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Free riders

Test traveller project as a soft policy measure for chancing travel behaviour. Empirical findings from the Swedish context

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Abstract

English

The present study examines a Mobility Management measure called “test traveller project”, which aims at increasing the public transport modal share by offering free public transport tickets to those who often use their car for their daily commuting and trips. The existing literature is characterised by a rather limited number of cases analysed, and they usually focus on specific aspects. Furthermore, literature is not unanimous in concluding that this measure can reduce car use. This work studies more than 50 cases in Sweden, and by employing the Theory of Planned Behaviour the effects of this project have been examined in an empirical case in the Swedish municipality of Botkyrka, located in the Stockholm metropolitan area. The findings underline that a test traveller project, despite its limitations, may be a valid and relatively simple tool available to public bodies and public transport companies for enticing a segment of car drivers to switch to public transport where it is a valid alternative. In fact, according to the literature, the major results achievable are around 20% of new public transport users among test travellers, whereas in Sweden 20% has been achieved by the first upper quartile of the projects. In particular, the effectiveness of a test traveller project is greater when combined or conducted in parallel with other measures such as improvements in the public transport offer and/or changes in the transport system aiming at disadvantaging car use. The case study of Botkyrka has confirmed that attitudes are the major influencing factor when making the transport mode choice. Further, it has confirmed that environmental concerns and the time passed from one’s residential relocation play an important role. Habits seem to be less important, thus adhering to that literature whose authors argue that an external event makes people reflect upon and rethink their travel habits. The case study in Botkyrka has empirically demonstrated how the project participants correct their beliefs and perceptions about public transport, sometimes in a positive way and sometimes in a negative way. An interesting finding is the existence of a new category of people living in the suburbs: individuals who have a suburban land use preference, but at the same time would like to use public transportation instead of their car and have high environmental concern.

Swedish

I den nuvarande studien undersöks en Mobility Management åtgärd kallad ”testresenärsprojekt” (”på engelska: test traveller project”), som syftar till att öka kollektivtrafikandelen genom att erbjuda gratis kollektivtrafikbiljetter till de som ofta använder bilen för deras dagliga pendling och resor. Den befintliga litteraturen karaktäriseras av ett ganska begränsat antal fall, och den fokuserar vanligen på specifika aspekter. Dessutom är litteraturen inte enig om att testresenärsprojekten kan minska bilanvändningen. I detta arbete studeras flera än 50 fall i Sverige, och genom att använda sig av ”Teorin om Planerat Beteende” (på engelska: ”Theory of Planned Behaviour”) analyseras projekts effekter i ett empiriskt fall i den svenska kommunen av Botkyrka, som ligger i Stockholms storstadsområde. Resultaten av denna studie understryker att ett testresenärsprojekt, trots dess begränsningar, kan vara ett meningsfullt och relativt enkelt verktyg tillgängligt för offentliga organ och kollektivtrafikmyndigheter för att locka ett segment av bilister att byta till kollektivtrafik när det utgör ett godtagbart alternativ. Förvisso, enligt litteraturen, är de större resultaten uppnåeliga ungefär 20% av nya kollektivtrafikåkare bland testresenärerna, medan i Sverige har 20% uppnåtts genom projektets första övre kvartil Särskilt är dess effektivitet större där testresenärsprojekt genomförs i samband med eller samtidigt som andra åtgärder som förbättringar i kollektivtrafikutbud och/eller förändringar till transportsystemet som syftar mot att hindra bilanvändningen. Botkyrka studiefall har bekräftat att ens inställningar är den mest påverkande faktorn när man väljer färdsättet. Dessutom har studiefallet bekräftat hur miljöoron och tiden sedan ens flyttning till en ny bostad spelar en viktig roll. Vanor verkar vara mindre viktiga, alltså i enlighet med denna litteratur vars författare bevisar att externa händelser gör personer reflektera över och tänka om sina resvanor. Botkyrka studiefall empiriskt bekräftat att projektdeltagare rättar deras övertygelser och uppfattning om kollektivtrafik, ibland positivt och ibland,

tyvärr, negativt. En intressant upptäckt är existensen av en ny kategori av personer som bor i villa-/radhusområde: individer som föredrar att bo i ett sådant område men vill samtidigt åka kollektivtrafik istället för att använda bilen och har höga miljöoro.

Italian

L'elaborato intende studiare una misura di Mobility Management chiamata "test traveller project", che si prefigge di incrementare la ripartizione modale del mezzo pubblico attraverso la distribuzione gratuita dei biglietti del trasporto pubblico a coloro che usano spesso la loro autovettura per gli spostamenti giornalieri. La letteratura esistente è caratterizzata da un numero abbastanza limitato di casi analizzati, che sono per lo più focalizzati su specifici aspetti. La letteratura, inoltre, non è unanime nel decretare che questa misura possa diminuire l'uso dell'automobile. Nel corso del presente studio vengono analizzati più di 50 casi in Svezia attraverso l'utilizzo della Theory of Planned Behaviour. Sono stati esaminati gli effetti di tale progetto in un caso sperimentale nel comune svedese di Botkyrka, situato nell'area metropolitana di Stoccolma. I risultati di questo studio sottolineano come questo tipo di progetto, seppur presentando delle limitazioni, può essere un valido e relativamente semplice strumento per enti pubblici e aziende di trasporto pubblico per convincere un segmento di automobilisti a convertirsi al mezzo pubblico come mezzo di trasporto laddove questi rappresentino una valida alternativa. Infatti, secondo la letteratura i maggiori risultati raggiungibili sono circa il 20% di nuovi utenti del trasporto pubblico, mentre in Svezia il 20% è stato raggiunto dal primo quartile superiore dei progetti. In particolare, l'efficacia è risultata essere maggiore dove tale progetto è accompagnato da altre misure, come miglioramenti nell'offerta di trasporto pubblico e cambiamenti nell'infrastruttura di trasporto volti a sfavorire l'automobile. Il caso studio di Botkyrka ha confermato che le disposizioni e attitudini personali sono il fattore che maggiormente influenza la scelta modale. Inoltre, è stato confermato che le preoccupazioni ambientali e il tempo trascorso dal trasloco in una nuova residenza hanno un ruolo importante. Le abitudini sembrano essere meno importanti, aderendo quindi a quella letteratura i cui autori sostengono che un evento esterno fa sì che le persone riflettano e ripensino le proprie abitudini riguardo alla scelta modale. Il caso studio di Botkyrka ha empiricamente dimostrato come i partecipanti al progetto correggano le loro convinzioni e le loro percezioni riguardo al trasporto pubblico, a volte positivamente e a volte, purtroppo, negativamente. Una scoperta interessante è l'esistenza di una nuova categoria di persone che vivono in aree suburbane: individui che hanno una preferenza per le aree suburbane, ma che vorrebbero allo stesso tempo usare il trasporto pubblico invece della macchina e che hanno alti livelli di preoccupazione ambientale.

Key words:

Test traveller, Travel behaviour, Car use habits, Public transport use, Economic incentive, Field experiment, Mobility Management, Travel Demand Management, Car use reduction, Effective policy instruments, Soft transport policy measures.

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Preface

This master thesis represents the conclusion to my course of studies in urban planning, started in 2011 at Politecnico di Torino and continued in the academic year 2015/2016 at the Royal Institute of Technology of Stockholm. This work is the result of an internship at Botkyrka municipality, which started at the end of October 2016 and ended in October 2017, and follows a test traveller project (in Swedish: testresenärsprojekt) in an area called Riksten.

Even though the internship started in the late October, the project itself started in April. The period in between was used to develop and prepare the project, because many aspects of it needed to be thoroughly organised. These aspects were research on the state of art in Sweden and on the literature (my task as a student), contacts with other actors involved within the municipalities (other departments, the politicians), the public transport authority of the Greater Stockholm (SLL Trafikförvaltningen) and the public transport provider of the area (Keolis Sverige).

In the thesis, the focus is on Sweden, hence a section that explains how Sweden is administratively speaking, in order to make the context more understandable for someone that does not know it. Further, given the fact that this work will be my final degree project in urban planning, I have included a section about the Riksten developing project.

This study constitutes not only the degree projects for the Royal Institute of Technology of Stockholm, but also for the Polytechnic University of Turin. Hence, the abstract is in English, Swedish and Italian, and the concluding part includes an analysis of feasibility of such type of project not only in the Swedish context (where there is already a vast knowledge) but also in the Italian context, besides a brief evaluation of the project feasibility in the other European countries.

Flottiljvägen, Riksten (Botkyrka, Sweden), September 2016

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1 Introduction

1.1 Presentation of the work

Widespread car use has proved to provoke significant negative effects (see for instance Mailbach et al., 2008). Car drivers pay for only a small share of these negative effects through the costs that they sustain (so called "internal costs"). The remaining costs and negative consequences such as pollution, congestion and car accidents are passed on to the rest of the society (so called "external costs") (idem).

There is an abundance of methods and practices that pursue a decrease in car use, as well as literature studies about them. This work analyses a campaign called "test traveller project", designed to increase public transport ridership and at the same time to decrease car use. It consists of providing free public transport tickets to selected citizens, typically habitual car drivers, during a trial period in the hope that they will continue to use public transport after the trial period.

Literature has not yet reached unanimous conclusion about its effectiveness, but in fact, as discussed later, some authors (for instance Tørnblad et al.m 2014) underline that the effects are smaller than how predicted by practitioners or suggested by other studies (for instance Thøgersen et al, 2014). Moreover, few studies (Fujii & Kitamura, 2003, Bamberg et al. (2003), Thøgersen, 2007 & 2009 and Abou-Zeid, 2009) have investigated why some car drivers continue using public transport after the trial period and how their attitudes towards public transport changed.

Due to the limited amount of literature and experiments, there is no defined term in English language for this type of project. In this work, term *test traveller project* will be used, as found in the European Commission co-founded MaxSumo tool explanation (Trivector Traffic & ILS Institut für Landes- und Stadtentwicklungsforschung gGmbH, 2009), part of the project "Maximise Mobility Management" (Welsch, 2009).

In the present study, after the presentation of international cases, there is a section where the focus is on the experiences in Sweden and a section that focuses on a specific test traveller project in Botkyrka municipality (in Sweden). Both sections address the research questions presented next.

1.2 Research questions

There is a lack of qualified practical research on the subject and it does not have an appropriate theoretical grounding (Friman et al., 2012; Richter et al., 2010). This study intends to answer the following questions:

- **How effective is the test traveller project in diminishing car use and why do some projects achieve better results than others?**

  Academic literature is not unanimous upon the real effectiveness of test traveller projects. Through the analysis of results obtained by real cases it is examined:
  - if and at what extent such projects may reduce car use and correspondingly increase public transport use;
  - what are the characteristics and conditions that enable a test traveller project to obtain better results.

  The analysis performed in chapter 3 upon more than 50 projects in Sweden aims at answering these questions.

- **How test traveller projects alter car drivers' beliefs and perceptions about public transport, and what are the mechanisms that lead habitual car drivers to switch to public transport?**

  Knowing the reasons behind drivers' decision to switch or not to switch to public transport after a test traveller project may provide an insight on why such measure may be or may not be effective in

reducing car use and increasing public transport use. The study performed in chapters 6 and 7 about a case study in Botkyrka municipality aims at answering these questions.

- **In what situations it is beneficial to implement a test traveller project to reduce car use? When is it better, instead, to use other methods and measures?**

  Literature is not unanimous regarding the usefulness of test traveller projects and, in particular, it does not address the issue of the different results obtained in different contexts, but it rather speaks in general terms about test traveller projects. This study aims at answering these questions by drawing on the results of the analysis performed upon both the various projects in Sweden (chapter 3) and the project in Botkyrka (chapter 7). The answer to these questions provides the ground for the transferability analysis performed in chapter 8.

1.3 Organisation of the work

Chapter 2 introduces the test traveller project concept.

The focus will then revolve around the Swedish experiences (chapter 3). This chapter will be useful for expanding the description of a test traveller project, showing how it may be used in its various forms and with various methods. In this section test traveller projects characteristics and the ways for carrying them out in the best form possible are deepened, thanks to an analysis of around 50 cases in Sweden.

Further on, the focus shifts towards Riksten, the area in the municipality of Botkyrka where a test traveller project has been carried out alongside this study. There is therefore a description of the characteristics of Riksten (chapter 5), proceeded by a digression about the urban planning process (plus the institutional background) and the public bodies involved in the test traveller project (chapter 4).

In order to understand how the empirical case in Botkyrka municipality has been studied, there is a description of the methodology used (chapter 6). The Theory of Planned Behaviour has been the theoretical basis for the analysis of the test traveller project effects on people's travel behaviour, and therefore the methodology explanation goes here in parallel with the Theory of Planned Behaviour presentation.

The following chapter (7) presents and discusses the results of the project in Botkyrka and evaluates both the effects on participants' travel behaviour and the efficacy of the project.

The last chapter (8) drawing on the international literature and the results of the various cases in Sweden, including the project in Botkyrka municipality, discusses upon the possibility of conducting similar projects elsewhere (in Sweden and in the rest of Europe, in particular in Italy and in the city of Turin).

At the end, there is the concluding chapter (9), which wraps up the work and summarises the main findings.

In order to provide a better understanding of the work structure and organisation, at the very beginning of each chapter there is a flow chart similar to the one in the following page (Figure 1), which highlights how the chapter is related to the other chapters. The reader is therefore facilitated and he/she can have a quick overview of the function of what it is about to be red.

1.4 How the study has been performed

In order to carry out the work here presented and to answer the research questions, different methods have been used. This mixing of methods and data is employed with the purpose of reaching a deeper understanding of the subject studied and contributing to validate and sustain the findings. This approach by which 'diverse viewpoints or standpoints cast light upon a topic' (Olsen, 2004, p.1) is named "triangulation"

in social science. In Figure 1 the methods used are indicated in the flow chart, where it is visible the triangulation.

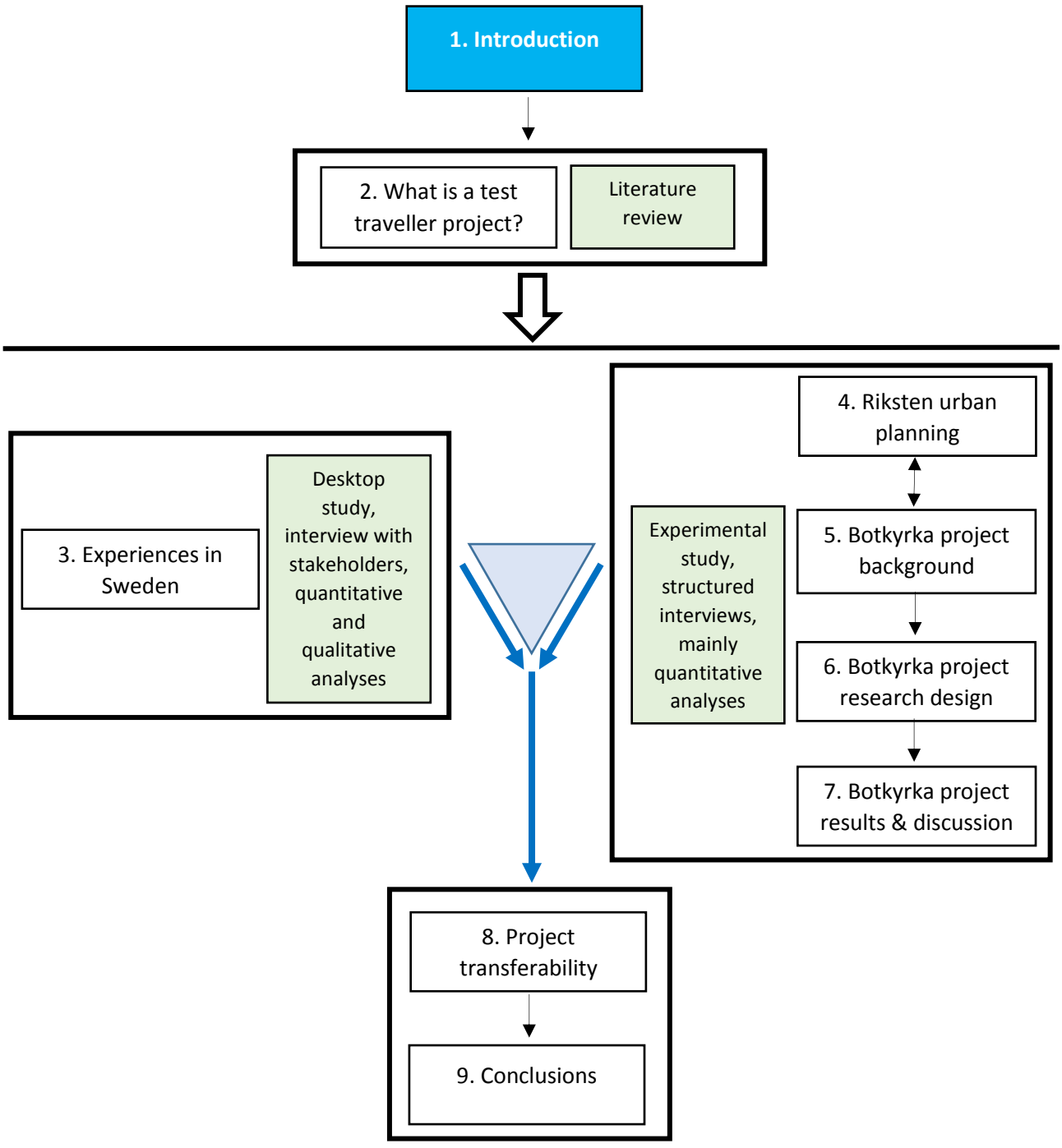
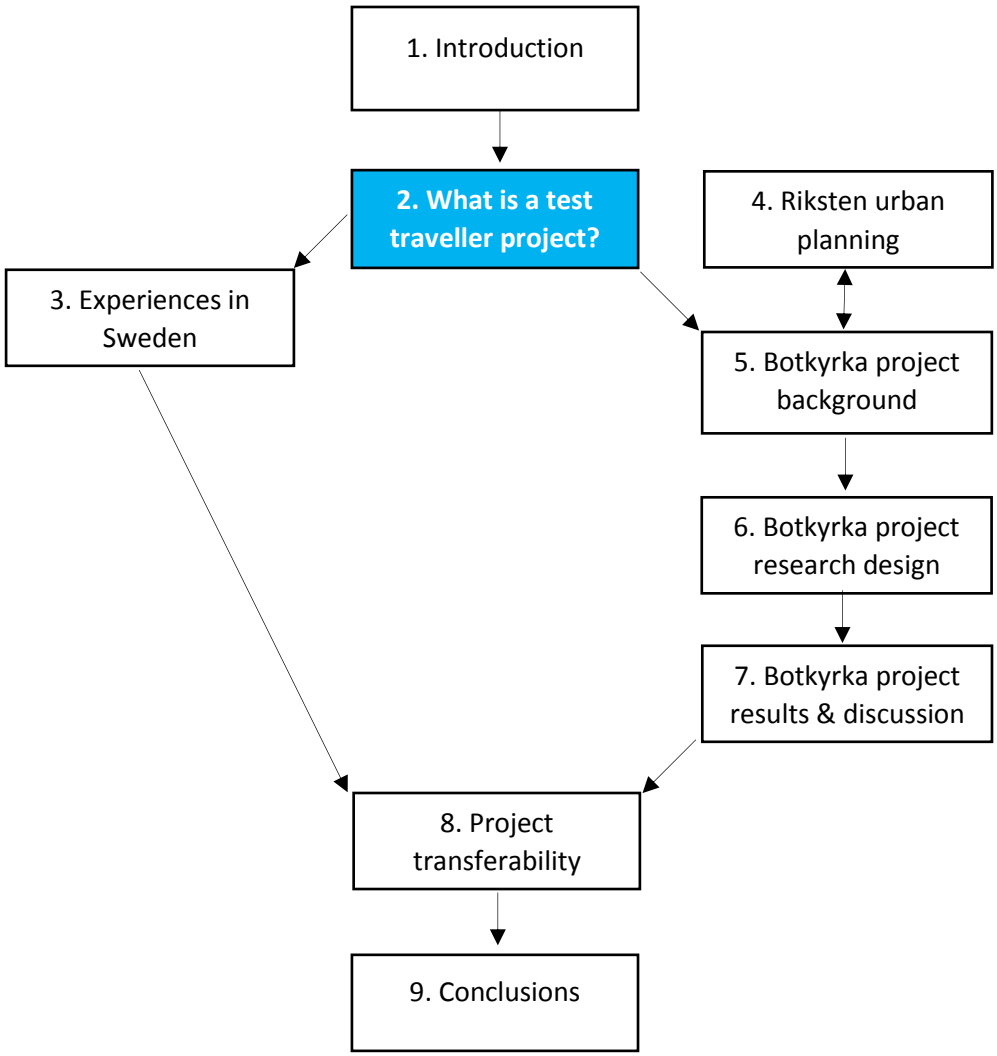


Figure 1: Flow chart of the present work. The introduction is highlighted in blue. In green, the methods used for that part. The blue triangle and arrows represent the triangulation.

2 What is a test traveller project?

In this chapter it is explained in details what a test traveller project is and what the expected outcomes are (2.1.). It is presented the state of art of the research on the effectiveness of such activity, from the first documented case where incentives to public transport where introduced, in the 60s in the USA, to the most recent, in 2012 in Norway (2.2.). The review of the projects studied by international literature is here reported in chronological order, with the purpose of describing how the test traveller projects idea and concepts has evolved and diversified during the years. In the last section of the chapter (2.3.) are presented the critiques to this type of intervention and a reasoned rebut to them.



2.1 Test traveller projects characteristics.

Explanation of the intervention

A Test Traveller Project (TTP) consists in giving free public transport tickets, which are valid for a certain period (for example two weeks). Generally, this intervention is directed towards people that regularly use their car for their trips. This approach may be considered similar to those subscription services, which offer reduce costs for some time or a free trial period in order to make people try out and get acquainted with that services/goods (Thøgersen, 2007). The main expected outcome therefore is that car drivers continue to use public transport after the trial period, even if they have to pay the full fare for it. These projects usually have some remarkable effects on the car drivers involved:

- Motorists that try out public transport may change their view of it, and may have a more positive opinion regarding it;
- They may judge it more convenient than their car (not only in economic terms);
- Car drivers may see that to travel by PT is it easier, more relaxing and/or not as much time-consuming than they expected;
- The people involved may become more aware of the problems caused by car use (for instance, because the project highlights the environmental aspects).

Therefore, it is to expect:

- An increase in public transport ridership and its revenues.
- An increase in traffic safety.
- A decrease in traffic congestion.
- A decrease in noise, air pollution. And resources use for transportation.

A soft policy measure

Test traveller projects may be classified among the numerous types of soft policy measures. Soft policy measures, contrary to hard policy measures, are not intended to physically change the transport infrastructure because they aim at increasing the use of alternative modes of transport by enticing people to voluntary change their behaviour (see for example Friman et al., 2010; Friman et al., 2012; Brög et al., 2009; Richter et al., 2011). Another classification of transport policy measures defines the measures directed at encourage alternative modes as “pull measures”, while the measures that aims at discouraging car use are defined “push measures” (see for example Loukopoulos, 2007 and Gärling et al., 2002). To implement at the same time both hard and soft policies and to use more types of measures gives the best results, but hard policy measures are costlier and may encounter public and political resistance, whereas soft policy measures aims at a voluntarily-based behavioural change not forced by external conditions. Regarding test traveller projects, they are pull measures. Research has shown how they may play an important role in breaking the habit of commuting by car, but its effects tend to be limited if not supported by other interventions, such as improving transport services and ad hoc activities and actions (Møller & Thøgersen, 2008; Bamberg, 2006; Matthies, 2003; Thøgersen, 2012).

A Social Marketing technique

In order to promote public transport, authorities have used various types of marketing techniques, already since the 1960s (Everett et al., 1978). However, when marketing techniques are employed not only for producing more profits but also for promoting social objectives, marketing is then named social marketing (Thøgersen, 2007). Social marketing is therefore “the adaptation of commercial marketing technologies to programmes designed to influence the voluntary behaviour of target audiences to improve their welfare and

that of the society of which they are part." Andreasen (1994, p. 110). Social marketing campaigns have as target social problems and their goal is to change people's behaviour through commercial promotions and campaigns, enticing costumers to use their product and services, which are meant to have positive effects for costumers themselves (in comparison to their previous behaviour) and for the society a whole (Thøgersen, 2007).

In light of this definition and explanation of social marketing, it is possible to classify test traveller projects as social marketing activities when public transport companies carry them out. In fact, these companies promote their service as it was a subscription service by offering free tickets, and if they succeed in attracting new customers and having them continuing to use their transport services, they achieve benefits for the company itself (more revenues) and for the society (less pollution and resource use).

Why do some motorists change their travel habits?

A test traveller project is intended to interrupt and break the driving habits. In fact, as for example Thøgersen (2007, 2009 and 2012), Bamberg et al. (2003) and Brög et al. (2003 and 2009) explain, motorists may have unjustified prejudices about public transport and/or they may not have a clear idea about how public transport is and how to utilise it.

Another reason may be that their driving habits prevent them to even consider the alternatives (for example, Møller & Thøgersen, 2008; Bamberg et al., 2003). In fact, 'even a relatively small cost in terms of time and effort needed to investigate and possibly test alternatives seems to be an insurmountable barrier' and thanks to a test traveller project 'some [motorists] would realize that for them using public transport is actually preferable to using the car'. (Thøgersen, 2012, p. 133)

People also might not have enough knowledge about the public transport services, regarding timetables and the actual time required for a trip using public transport, and they might expect using public transport as troublesome, cumbersome and difficult. Brög et al. (2003 and 2009) and numerous Swedish cases (see chapter 3) point out how after trying this mode of transport a significant proportion of car drivers state that they were lacking information about public transport (around 15% - 20% in Swedish cases and up to 50% in the Australian case of study of South Perth in Brög et al. 2003 and 2009). Further, in some Swedish cases it had been asked if the use of public transport was easier than expected, and a surprisingly high proportion of test traveller (from around 10% up to 50% of them) responded affirmatively.

Who may carry out a TTP? Why?

A test traveller project may be carried out by various actors, private and public, and at different scales, from a small part of a city or a small company, to bigger projects at a regional scale involving numerous public bodies and/or companies. The research here done have led to identify three particular actors and different forms of collaboration between them (see chapter 3).

It can be one of the solutions adopted in a Mobility Management plan of a private company in a broader context of other actions and activities. Research shows that Mobility Management actions produce benefits for a company that implement them, ranging from reduced costs (for example for parking areas) to an increased productivity and well-being of the employees (Senn & Ravasio, 2003).

It can be implemented by a municipality, which wants to reduce the share of travels made by car, and therefore reduce pollution and road congestion. Further, it might diminish the space occupied by parked car and it may increase the traffic safety. It can be a stand-alone activity, or it can be placed in a wider set of actions for reducing car traffic.

It can be implemented by a public transport authority/public transport company, which aims at increasing the ridership, therefore an increase of the annual revenues from the tickets. The campaign marketing (either

developed in-house or outsourced), the administrative work for organising, conducting and evaluating the project as well as the physical cards are the only expenses for the transport companies that carry out a test traveller project. It is costs-free for the transport companies/authorities to load the cards with tickets, their products (the transport services) are already available and the presence of new users do not impede the travels of those who already commute by public transport (unless if that provokes/worsen overcrowding on the vehicles). Further, the free tickets distributed do not produce a reduction of the total revenues from the tickets, because the people who receive the tickets are not costumers (or sporadic users in the worst case).

How TTPs are structured?

Every TTP necessitates a series of steps for its realization and competition. The redaction of the following summary has been made possible due to the personal involvement in the Botkyrka project and thanks to the thorough study of the Swedish context.

- Decide when to carry it out.
- Define the target of people to reach (employees, inhabitants) and who is going to be selected (everyone or only certain categories). They can be for instance young and/or students, only employed people or people that have never used the public transport in the last month.
- Decide the area where to implement the project. In the case of a municipality, it can be only a specific neighbourhood, the entire municipality or the areas along a specific bus line.
- Take contacts with other public bodies or companies that might be interested in a collaboration.
- Determine the trial period length, the conditions for the participants and the manner of evaluation (by phone, by online and/or postal surveys, the number of interviews and surveys and their timing).
- Design a captivating and effective communication, in order to boost people's engagement and involvement.

When to implement a TTP?

A test traveller project may be conducted any time, without a change in the transport offer, with the simple purpose of pursuing an increase in public transport ridership and what it implies. However, literature (Batty et al., 2014), along with the study of the Swedish cases (see chapter 3), have led to some findings.

The time of the year in which the test traveller project takes place does matter. It is advisable to avoid those time of the year when the climate conditions are not favourable, such as wintertime. It is also to avoid running a test traveller project during holiday periods (such as Easter and summer vacations) but is also desirable to not run them right before a holiday period. In that case the project participants would not have a sufficient time for becoming acquainted with the new travel behaviour in case they wanted to continue to use the public transport, and they would not have the possibility to buy a rather long-period ticket (valid for one month, for example).

Furthermore, the project may be conducted in connection with other soft policy activities but also simply as a stand-alone project and in absence of changes in the transport offer. However, better results may be achieved if combining the project with changes in the transport service. These may be:

- Improvement of a public transport service (one or more lines) (as in the Swedish municipality of Örnsköldsvik);
- After a prolonged disruption in the public transport service (Tetraplan, 2004);
- During a disruption of car traffic infrastructures, such as a temporary closure of a freeway or road works which slow-down car traffic (Fujii et al., 2001).

Other activities in connection with test traveller projects

Other activities may be conducted in connection to a TTP in order to increase its efficacy, which can be specifically directed towards promoting public transport or which can be in the general scope of promoting modes of transport alternative to the private motor vehicle and reducing car use. These activities may be both hard or soft policies[1] and may be oriented at increasing intermodality between car and public transport (i.e. new or improved parking facilities at the edges of the city) or between cycling and public transport (i.e. cycling workshops, introducing a bike sharing system or bikes parking spaces).

However, it might be arguable that access to information might not signify to actually be informed. In fact, if comparing this case with the Swedish cases, closer in time (same years) and as context (both Nordic country with similar indexes of economic and human development), in the Swedish cases where it was asked the participants if they received new information thanks to the letters sent them home, the percentage of yes was around 15% - 20%.

An issue raised by Strömberg et al. (2016) has been the unpredictability of the results of these projects, basing on the Abou-Zeid et al. (2012) work. Further, these authors refer also to the possible reinforcement of negative conceptions about public transport in those test travellers who did not switch to it, but instead became happier with their car commuting, making difficult for future interventions to reduce car use. However, Strömberg et al., again referring to the Abou-Zeid conclusions, highlight also positive effects of these type of projects, because some participants even if preferring to use the car may have had corrected misconceptions about public transport that they might have held before the trial period. Further, these projects render it possible to understand the causes and the motivations that prevent people from using public transport in that specific geographical area, facilitating future decisions about what changes to make in the transport service.

Variations of the project

The test traveller concept is flexible and malleable, because it may come in various typologies and modalities. In facts, in addition to the projects previously described, there are at least other two more variants. A typology of test traveller project rather used in the Swedish context consists in addressing **people that have recently moved to a new home**. Literature (see chapter 6) has shown that those people are more receptive and prone to changes in their habits when they change residence, therefore letting them become test traveller would be rather effective in fostering their use of public transport. Yet, there are variations of this variation; the project may be directed only towards people moving in from another city, towards all people that are changing their home, directed only towards certain categories of people, or even towards people moving in particular areas.

Another typology, which is partially different, is characterised by a public company or a public body giving to their employees discounts for buying public transport long-period tickets. Therefore, those who wants to benefit from this offer must pay part of the fare, making this method less attractive for habitual car drivers. However, it may show positive results, because once this financial incentive ceases to exist, the amount of people using public transport remains higher than previous the intervention (Città metropolitana di Torino 2015 & 2016).

Projects acceptance and problems

Besides the financial, organisational and marketing aspects of the projects, another element to take into consideration is the project acceptance among the public opinion, in particular among those who already use and pay for the public transport services. As it has been underlined by Thøgersen (2012) and by numerous practitioners in Sweden (see chapter 3) it is important to clarify the purpose of the project and the advantages

[1] See for example Friman et al., 2010 for the definition of hard and soft policies.

for the community. Further, as reported by the practitioners in Sweden, it happened that someone tried to sell the tickets online, handed them over to other family members, friends or acquaintances instead of using the tickets themselves. This could be illegal, because they signed a contract that prohibits selling and/or handing over the ticket, or simply immoral, because they promised they would not have done such things. Therefore, instead of being free riders on the public transport, in the sense of using it free of charge for the trial period, these specific car drivers become "free riders", because they and betray the initial ideal of the project[2] and they damage the collective interests by acting selfishly. In fact, their tickets are not going to enable any habitual car driver who genuinely would like to participate to the project and thus maybe change his/her travel behaviour (in the case of they went through a selection process) and the money used by the public bodies (or the company where they work) for providing those tickets would be wasted. However, there are methods for overcoming and minimise these problems and in the Swedish context it seems that the public is generally in favour to test traveller projects, considering it as innovative and interesting (see chapter 3).

2.2 History and international cases

This section is intended to describe the genesis of the test traveller concept, tracing back to its origin through the available literature on this topic. The main problem observed has been the paucity of literature on the topic, in particular for the period prior the new millennium. There might have been more applications of the TTP, but practitioners and transport authorities may lead this type of projects, not leaving easy traceable information in literature and in other sources of information. The test traveller project conducted in Sweden following the methods as described above and not used as a complementary and minor element of a project, are described later on in chapter 3. Figure 2 summarises the history of test traveller measures.

1960s and 1970s

The first traceable initiatives that aimed at promoting the use of public transport through methods that seems the ancestors of the TTPs where conceived by various cities transport authorities in the USA in the late 1960s (Everett et al., 1978). These projects consisted for example in offering free bus rides or passes for certain routes, times and/or periods; another method for attract passengers was to give free tokens or bonuses to spend for food or in local shops (idem). However, Everett et al. (1978) were the first to carry out an academically evaluated project, which took place between 1974 and 1975 in an USA university campus, testing the token method and concluding that it may be a concrete way to increase public transport ridership.

The first project that resembles a conventional TTP dates back to 1977, in the USA city of Portland (Bachman and Katzev, 1982). 83 people recruited door-to-door participated to the experiment, and they were divided into 4 groups: a control group (nothing given or asked), a group whose people were only required to commit to use public transport, a group that was given free 4-week tickets, and another group was both required to commit and given free 4-week tickets. The authors of the study found out that the last group had the best outcomes in terms of ridership after the treatment period (half of the participants), followed by the only commitment and the only free tickets group (1/3 of the participants).

These findings were an important contribution to the studies about travel behaviours, and they have more or less directly influenced the subsequent research.

[2] For more information about the "free rider problem", see for example Russel, 2013.

1980s and 1990s

After study of Bachman and Katzev, published in 1982, the scenario moves to Europe, in Germany. There, the company Socialdata GmbH developed a method called IndiMark®[3] (individualised marketing) and started to implement it from the late 1980s (Brög, 2009). Later on, Socialdata conducted their projects also in Australia (1998, South Perth), Sweden (in particular in Jönköping in 1997-98 and in Gothenburg in the early 2000s), Austria, USA and UK (idem). Briefly, their method is a combination of various soft policy measures, consisting in trying to reach all households in a specific area or city, and offering to the interested households individualised activities in order to help them to change their travel habits. The households interested could choose if receive information about cycling or about public transport. Among those interested in public transport were given personalised information about the public transport offer, support in forming their goal of not using the car and how to achieve the set goal. This method is different from the test traveller project, because only selected test candidates among these interested household received a free public transport pass valid for one month as an incentive (Brög 2003). This method in Australia (there and in UK called TravelSmart®[4]), enabled in the Australian city of South Perth a reduction of car use by 14%. In other cases, the results varied between 12% and 18% (Cairns et al., 2008).

In the second half of the 1990s, two test traveller projects, maybe inspired by the German cases, were conducted in Denmark, one in Copenhagen by the local transport authority (Copenhagen Transport HT) (Østergaard & Schougaard, 1997, in Thøgersen, 2009) and one in Aarhus (Lahrmann & Lohmann-Hansen, 1998, in Thøgersen, 2009).

2000s

Remaining in Denmark, between 2002 and 2003 around 800 car drivers living in the Greater Copenhagen area participated in a test traveller project researched by Thøgersen (2007 & 2009). Some of them were part of the control group (30%), while the others received a one-month travel card (70%). The outcomes of this study were rather positive, because the amount of commuting with public transport (among those who received the card) doubled in the short term, and it was still 40% after half a year. However, the author underlined that the initial levels of public transport use were significantly low (5%), and he pointed out that the people with the strongest car habit switched on average 30% less to public transport.

In the beginning of the 2000s (presumably, because the researcher do not indicate the years) Bamberg et al. (2003) conducted an experiment in the German city of Stuttgart. The researchers contacted around 600 people who were planning to move to Stuttgart in the following 6 months and divided them into an intervention group and a control group. After 6 months those who actually moved there received a free public transport ticket valid for one day. Of those 600 people, 169 participated to the experiment and completed two questionnaires (79 among the intervention group), one before their residential relocation and one after that those in the intervention group had received the public transport ticket. Public transport use in the control group went from 18.9% to 24.4%, whereas in the intervention group it went from 19.0% to 46.8%.

Again in Denmark, in 2004 the Danish public railroad company, DSB, gave to its customers a free month's travel card for travelling between the cities of Svenborg and Odense after a period of renovation works on the line, which provoked frequent disturbances (Tetraplan, 2004, in Thøgersen, 2009).

Meanwhile, in Japan two studies were conducted. One was addressed to students in Kyoto with around 40 participants, therefore not representing a heterogeneous group of people (Fujii, S. & Kitamura, R., 2003). In that experiment the authors investigated the role of past habit, concluding that it had not such high

[3] Indimark is registered in Germany as a trademark of Socialdata.

[4] TravelSmart is registered in the UK as a trademark of Sustrans.

importance as it was hypothesized, because many students who were using the car for travelling to university before the experiment and decided to participate, continued to use the public transport after the trial period. Hence, they had rationally processed the new information acquired and the perceptions experienced during the trial period.

Taniguchi and Fujii (2006), in the city of Ohibiro, in central Hokkaido, conducted the other Japanese project. They carried out Mobility Management activities, such as an information campaign, for promoting the public transport use and gave two free tickets to each household. 34% of the participants continued to use the public transport after one month.

Towards the end of the decade, in 2008 Abou-Zeid conducted two similar experiments, but in two different continents, one in Switzerland, in the Genève – Lausanne region, and one in the USA, in Boston (Abou-Zeid, 2009; Abou-Zeid et al., 2012). In both cases the participants were employees (of the MIT in Boston, the Genève airport and the Lausanne university). The samples of participants were rather small (67 people in the American one and 30 in the Swiss one), but the results were strikingly different: 30% of the MIT participants switched to public transport, whereas none of the Swiss experiments entirely did.

2010 - 2015

The most recent experiment found in the literature has been the one carried out by Tørnblad et al. (2014) during the end of 2011 and the end of May 2012 in Norway, in the small town of Lillestrøm, situated 20 km east of Oslo, with the collaboration of local companies and the regional public transport company. The target population consisted in the employees of such companies, around 2000, divided into three groups: a control group, a group that received tailored information and a group that received tailored information and a free public transport pass valid for 7 days.

The results of this experiment did not show an increase in public transport use, and the authors of the study suggested that these employees had already made a deliberate and rationale decision upon their mode of transport, and those who used the car had reasoned about its use. Further, they highlighted that in the area there is abundance of parking spaces, that it is very easy to get access to the public transport timetables, and that the harsh Norwegian winters may be a factor that deter people from standing outside and waiting for public transportation. The authors conclude that a test traveller project may not be useful for changing people's travel behaviour.

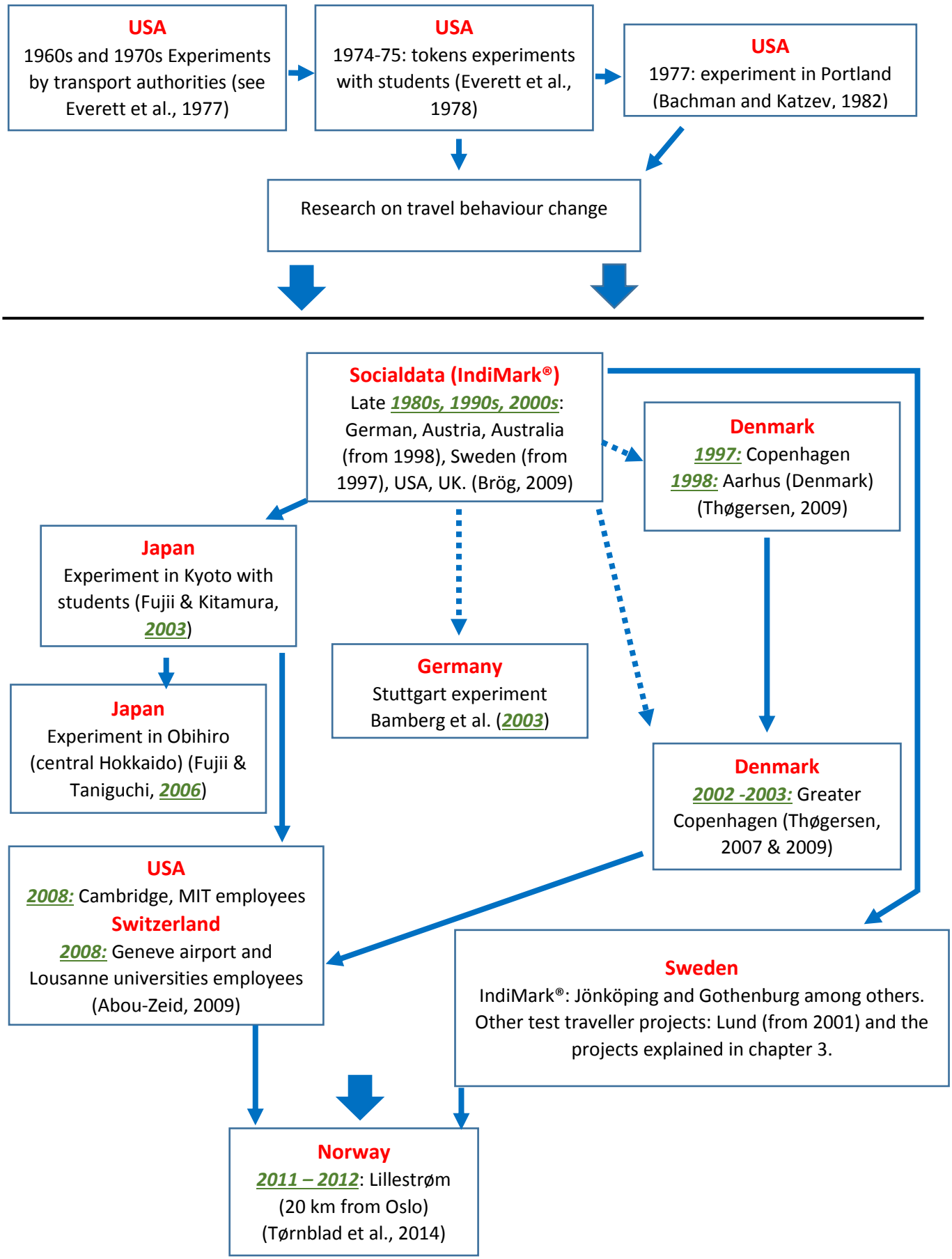


Figure 2: Summary of test traveller projects literature and connections among cases. Dashed arrows indicate a probable influence; solid arrows indicate a certain influence (references in the papers). Source: author's elaboration. The Norwegian case is based, directly or indirectly, on all the previous literature.

2.3 Critiques

In the literature there are some authors that criticise the efficacy and the utility of projects that aim at voluntarily change people's travel behaviour (see for example Chatterjee & Bonsall, 2009; Bonsall, 2009; Cohen, 2009), which however will not be addressed here. Instead, here it will be addressed criticism against test traveller projects by analysing the positions of Tørnblad et al. (2014) and Strömberg et al. (2016). Tørnblad et al., the authors of the Norwegian case study, they state that such type of project may not be effective, in particular in the Norwegian context. However, there are some aspects that it may be worthy examining, in particular due to the similarities with the Swedish cases and with the field study in Botkyrka municipality descripted and analysed in this work.

Tørnblad et al. indicate how the climate as an element that may hinder the use of public transport. Literature advises to avoid winter time to run such type of project (Batty et al., 2014), but their project took place exactly during the coldest months of the year. In the other Swedish cases analysed, the majority of the projects (around 70%) took place not in the wintertime, and around 50% during the spring, and yet, even the projects carried out during the wintertime had positive results. Further, in the Norwegian experiment participants were given 7-days tickets, which is a shorter than most of the other projects studied in the literature and shorter than most of the projects carried out in Sweden.

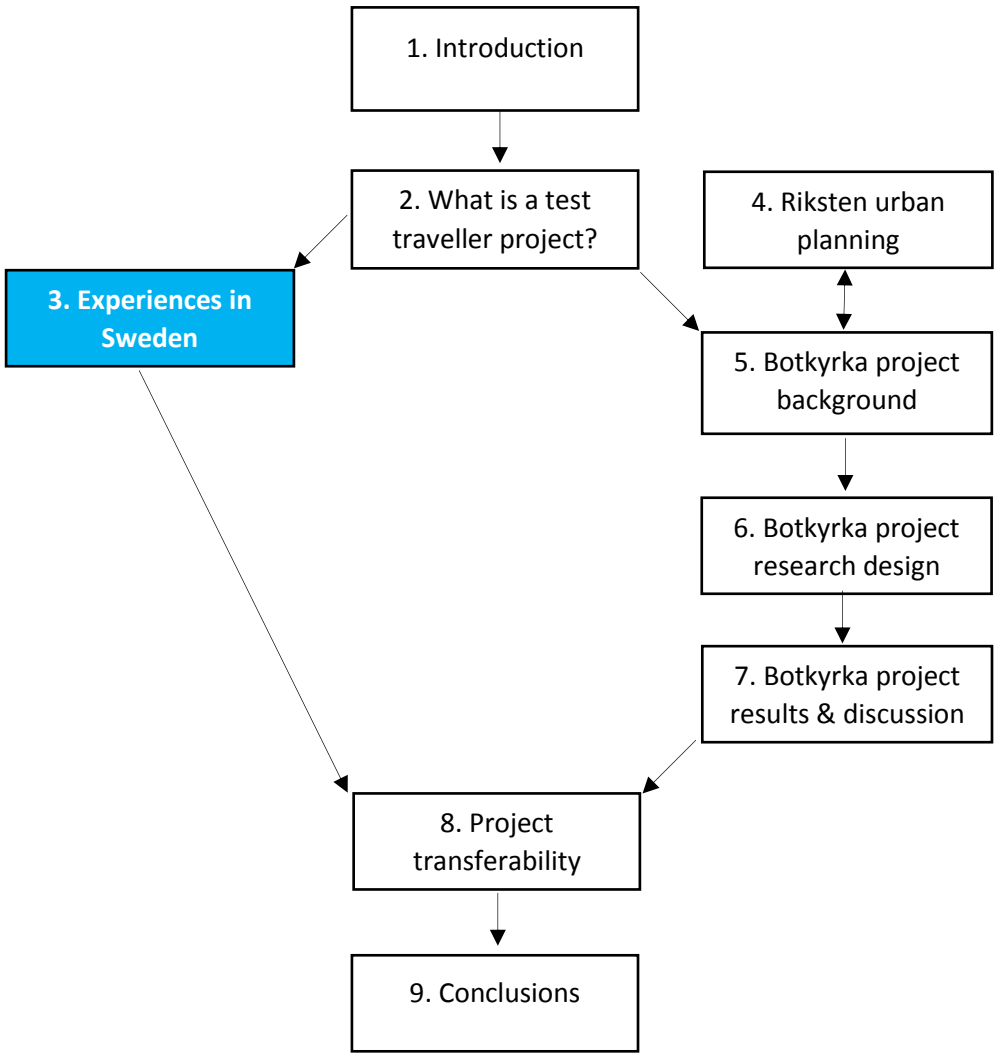
Tørnblad et al. reached out all the employees indiscriminately, including those already using the public transport. In all other case, however, participant had been selected basing on their willingness to participate. This fact may be seen as a bias against those studies, because one may argue that those who switched to public transport would have switched anyway. But "one of the benefits of the free trial is that it gives those who are predisposed to switch a chance to experiment further with public transportation and see if it works for them", serving "as a trigger for switching at least for some of those who switched, as they would be more convinced of switching after giving it a try" (Abou-Zeid et al., 2012, p. 58).

Another argument of Tørnblad et al. (2014) is that the participants to their study might have not switched to public transport because they already had made a rationale decision and compared the alternatives thanks to a high degree of access to information, but this issue is refuted by Brög et al. (2003) in the South Perth project and by the Swedish projects (see chapter 3 and chapter 7).

An issue raised by Strömberg et al. (2016) has been the unpredictability of the results of these projects, basing on the Abou-Zeid et al. (2012) work. Further, these authors refer also to the possible reinforcement of negative conceptions about public transport in those test travellers who did not switch to it, but instead became happier with their car commuting, making difficult for future interventions to reduce car use. However, Strömberg et al., again referring to the Abou-Zeid conclusions, highlight also positive effects of these type of projects, because some participants even if preferring to use the car may have had corrected misconceptions about public transport that they might have held before the trial period. Further, these projects render it possible to understand the causes and the motivations that prevent people from using public transport in that specific geographical area, facilitating future decisions about what changes to make in the transport service.

3 Experiences in Sweden

In this chapter it is presented not only a review of the Swedish projects, but also an analysis of around 50 cases in Sweden of test traveller projects, carried out in 27 different locations. The intent of this chapter is to answer the research question "How effective is a test traveller project in diminishing car use, and why do some projects achieve better results than others?" by examining the obtained results. Further, the study of the Swedish cases constitutes the ground for answering the questions "In what situations it is beneficial to implement a test traveller project to reduce car use? When is it better to use other methods and measures?", and the answers to these questions are presented in chapter 8. Hence, the examined projects are analysed both in a quantitative fashion, by comparing the results numerically, and in a qualitative fashion, by investigating the relation between results.



3.1 Cases in Sweden – research design

Data collection

The data collection took place during the period between December 2016 and February 2017. A web research has been conducted, with the key word "testresenärsprojekt" (the Swedish word for "test traveller project") and the key words "prova på kollektivtrafik" (meaning "try out public transport") plus the name of every Swedish municipality with more than 5,000 inhabitants and every Swedish transport authority. In case of no results, other combination of words (such as "testresenärskampanj" or "provåkarkampanj") have been used. Only projects with more than 20 test travellers have been considered for this study, smaller projects have been deemed as not meaningful for a general analysis of this type of intervention.

This research led to discover the existence of 61 projects with more than 20 test travellers had been found, in 35 different locations. In 24 of these locations, the data found online was not complete, therefore the correspondent municipalities and transport authorities have been contacted via e-mail. In the e-mail (see attachment 1), I presented myself as a master student at KTH writing on behalf of Botkyrka municipality, as I was building a theoretical background for their project and I was helping them to prepare and carry out a test traveller project. In the e-mail, I asked them for further information about their test traveller projects. 17 municipalities and the transport authorities answered the e-mail. The contacts proceeded most often only with an e-mail exchange and in some cases with a phone call. The information and the data asked were reflecting the aspects analysed below, but I also asked for suggestions and comments about the projects and the test traveller project concept. The framework of the questions followed during the phone calls and sent by e-mails is reported in attachment 2. If some data and information were already accessible to me, the questions related to that data and that information had been not posed. One project was still ongoing, while another project had not yet been evaluated. The final picture of the projects analysed in this chapter is the following:

- 52 projects
- 28 municipalities and/or transport authorities
- 17 out of 28 municipalities/transport authorities have been contacted

A summary table with all these experiences considered in this study can be consulted in the attachment 3[5].

How the analysis has been performed

This part of the study is constituted by three different sections. The first part (subchapter 3.2) presents the various methods and approaches used by municipalities and transport authorities for carrying out a test traveller project. In the second part (subchapters 3.3, 3.4 and 3.5) the data is analysed in a quantitative fashion, whereas in the third part (subchapters 3.6 and 3.7) the quantitative analysis previously performed is complemented by a qualitative analysis of the Swedish projects.

[5] In this research some very small projects were not considered (in the municipality of Ronneby, in the municipality of Boden, in the municipality of Vindeln and in the municipality of Ekerö). The cases where it has not been possible to find enough information and data are the projects carried out by Blekingetrafiken, the public transport authority of Blekinge County, by Kalmar länstrafik, the public transport authority of Kalmar County, by Jönköping municipality and by Gotland County and in Västernorrland county, whose data overlapped with one case in Sundsvall.

3.2 Different project designs used in Sweden

Brief introduction to the Swedish cases

A project of this kind, the idea of giving out free public transport tickets for a certain period (two weeks or one month) is not new in Sweden, where everything started in Lund in 2001 (proceeded by an IndiMark® experience in Jönköping in 1998 and in Gothenburg in the early 2000s). Between 2001 and 2008, 13 projects were carried out in Lund municipality, following a model that had already been used in Germany (Ecoplan, 2012). In that case, the municipality developed and took care of the projects and implemented them with the collaboration of the transport authority of the region (Skånetrafiken). During that period, the project slightly changed from an approach similar to the German model to an approach then used in the other projects in Sweden. However, it was not a stand-alone project, but it was integrated in a larger framework of Mobility Management actions. During the following years, many other municipalities and transport authorities have performed such type of projects, adapting them to the local contexts and learning from each other. In particular, Västrafik AB (the transport authority of Västra Götland region) has been looked at as an example by the numerous other municipalities and transport authorities in Sweden. Skånetrafiken (the transport authority of Scania region), Västtrafik AB and Värmlandstrafik (the transport authority for Värmland region) have carried out the biggest projects in Sweden.

Methods for reaching possible participants

Even if the projects have differences in methods, it is possible to compare their methodologies, which are often very similar to each other. In attachment 3 there is a map of Sweden with the localisation of the projects carried out in Sweden. In particular, in almost all cases the project managers tried, during the preparation phase, to foresee and predict the expected amount of test commuters that may have changed their travel behaviours. They have also explained to the public the objective of the projects: in the cases of Kollektivtrafikförvaltningen UL (the transport provider of Uppsala county) and Region Gävleborg, X-Trafik (the transport provider of Gävleborg County), they have explained it on their website amongst the FAQ. Further, in the case of Vännes – Umeå some free tickets were distributed through a lottery, also to people that were already using the public transport. Östgötatrafiken AB gave free tickets to some that were already public transport users. This strategy was intended to increase the acceptance of the projects and as a form of reward. Moreover, in the case in Skellefteå, the participants who achieved the best results received a little present.

The ways to reach people for the projects have been numerous and different. The most common way has been to send directly to people's home a letter and/or to contact by e-mail the employees of the companies operating in the region or the employee of the municipal body itself. These methods (letters and e-mails) resulted on average in a frequency of test travellers of 19.6% (not considering the projects where the amount of test people was fixed in advance or the cases where were used other methods than the letters and e-mails). Other ways to reach people have been for example to advertise the projects on buses and at bus stops, on mass media (newspapers, radio, TV) and on social networks. In one case (Kollektivtrafikförvaltningen UL), it has also been asked to those who were already using the public transport to suggest it to their friends and, basing on the number of friends that became test travellers, they were given a reward. For a more detailed list of method, see attachment 3. In some cases, letters and/or mails had been sent only to those who were not habitual customers of their transport services (leading to a higher percentage of test traveller in relation to the letters sent), and in some other cases a check regarding being a habitual transport user were made on the applications.

Aside from the purpose of contacting and communicating with people, these methods used for reaching possible test travellers and motorists in general most often contained information and advice about how and why to use public transport, its advantages, etc.

Those reached by these campaigns could apply online or fill in and return the received letter. However, in almost all cases not all of them took part to the projects. Usually the municipalities/authorities selected the people that applied based on some requirements by using the data provided by a short survey attached to the letter or to the online application. Usually it was required that participants must not have been regular public transport users or have not been costumer at all for at least a certain period; that they must not have been test commuters before and that they must not have a company car. Moreover, it was usually required that they must have a driving licence, have access to a good public transport, have a job in an area served by it, travel to work at least 2/3 days per week and to take part to some surveys and/or meetings (attachment 3). In some cases, the participants were also reminded to use the public transport and/or given information during the testing period (attachment 3). In some cases, the test traveller project was accompanied by other initiatives, such as activities for promoting cycling, information campaigns and public transport improvements.

Other projects differences

A difference that might hinder the analysis of the results of the numerous projects is the various times when these results have been measured: they vary, from right after the test period to 18 months later. For the following data analysis part, it has been used the latest measurement in case there is more than one measurement after the test period, and most of the cases have at least one measurement time that is not exactly after the project but after some time, mainly after 3 months, therefore this aspect has not biased the findings.

The cases analysed below have also other minor differences: besides the one already mentioned, (employees of local companies and/or inhabitants) the projects have had different forms of collaboration between municipalities and public transport authorities. In the case of Eskilstuna the municipality conducted the project and payed for the tickets, and in Sundsvall the municipality payed for the tickets although they collaborated with the local transport authority. In other cases, municipalities and public transport authorities have more or less equally contributed to the project (and the municipality did not have to pay for the tickets). Further, in some cases (as Örsnsköldsvik and Sudsvall) the projects received funds from the European Union, in the forms of regional development funds. Lastly, there are cases where the public transport authority has conceived and conducted the projects by itself, and the municipalities located in these areas interested in the project have marginally contributed, for example by helping to promote it. In some cases, more than one transport authority has collaborated, for example where were included in the project train and/or regional bus services, whose responsible authority was different than the one for the urban area. Regarding the municipalities, usually it has been the traffic planning department that took care of the project, in connection with the environmental department. Regarding the public transport authorities, it has been very often the marketing department that conceived and conducted these projects.

Furthermore, as a variation of the test traveller projects, in Örnsköldsvik municipality the two projects has revolved around one bus line each, whose frequencies were right then (permanently) increased. In another case, the public transport authority of Halland region (Hallandstrafiken AB) also run a project called “Fria resor” (free travels), which addressed the people that had not been satisfied by the public transport services during their free test period.

Moreover, in some cases there have been created online pages on the websites of the public transport authorities and/or municipalities/counties, besides the survey and the test traveller application form pages. There, it was possible to read about the project, to read its FAQ and to directly contact the responsible persons in case of further questions.

It is noteworthy the campaign conducted by Kollektivtrafikförvaltningen UL in 2013 called “Julklappskampanj i Uppland” (in English: Christmas gift campaign in Uppland). The campaign was intended to motivate people to donate a public transport card as a Christmas present. The goal was of course to promote the use of public

transport and to cultivate customers' loyalty. However, if someone who was not a habitual public transport user had received the special Christmas card, he/she could have tried to use it more often in order to take benefit of the present (and becoming a test traveller).

Another interesting campaign, which can be considered as a particular type of test traveller project, was the one carried out by the transport companies in the Mälardalen region and SJ (Swedish Railways) in 2015 (Kleppe, 2015). The campaign consisted in letting the employees of ten companies in that region to freely use the public transport during a two-month period for their business trips. The goal was to increase the amount of these companies' employees' business trips made by public transport instead of using cars and taxis.

Newly moved in packets

In Sweden, at a national level the intervention of giving free tickets for the newly moved in people is recommended for influencing people's travel habits (Ecoplan, 2012; Tafikverket, 2015; Statens Energimyndigheten, 2015). Their recommendations are in accordance with the research on travel behaviour (i.e Bamberg 2006; Verplanken et al., 2008), which describes the moment of a residential relocation (until six months after it) as particularly favourable for influencing one's travel behaviour.

In Sweden there have been carried out (and are currently ongoing) specific projects for people who had recently moved into a new house, but it is difficult to find information and evaluations about these activities. These projects are directed towards the new residents that move in the areas served by the public transport. The newly moved in people receive at home a letter, inviting them to try out the service and the possibility of requesting a free travel card. The projects that it was possible to find are presented in in attachment 3. There is only one project that has been evaluated: it is a Värmlandstrafik project, carried out in 2014, achieving the significant result of 34% of test travellers that continued to travel by public transport.

When implementing this type of projects, different approaches are possible: the difference consists in deciding the target groups to which to offer this opportunity. Namely, the discussion may be if to send it to all the new-moved-in people, regardless of where they come from and where they are moving (for example, one may decide not to send this offer to those moving within the same municipality or region) or to address this offer only to the people moving in certain areas. Another issue regards the typology of people and their travel behaviours, and hence to select only the people who always commute by car, or to send it to everyone, saving time (and money) for the selection process and reaching those who are non-regular public transport users but still sometimes utilise it.

3.3 Does the size matter?

After an extensive research on the Swedish experiences, it seems possible to perform a statistical analysis of the data collected[6]. The first step has consisted in considering the experiences of which it has been possible to find the number of testing people and the amount that continued to travel by public transport[7]. The mean and the median of people that continue to use the public transport[8] are respectively 39.6% and 32%. If looking at the upper quartiles, they are as follows: 20.0%, 30.5%, 52.25% and 92.0%. The data has been then

[6] Here is not considered the case of Lund, because the data found is not for a specific year, but for a range of years, and the methods used, since these were the first experiences in Sweden, are not the same over the period and partly differ from the other projects. However, the results obtained do not differ much from the averages of the characteristics analysed - and the findings to which I have came to - in this section.

[7] By "continuing to use public transport" is usually considered an use of public transport at least three days per week.

[8] People that use the public transport at least 3 days a week, while at the baseline where was no or sporadic public transport use.

plotted in a graph (Figure 3) and it has been run a linear regression analysis but no general pattern has been discovered. It seems however that small projects may have more success than bigger projects, but it is needed a more thorough analysis, as it is hereafter developed. Hence, the data have been divided into two subsets: one with cases smaller than 114 testing people and one with cases bigger than 320 testing people.

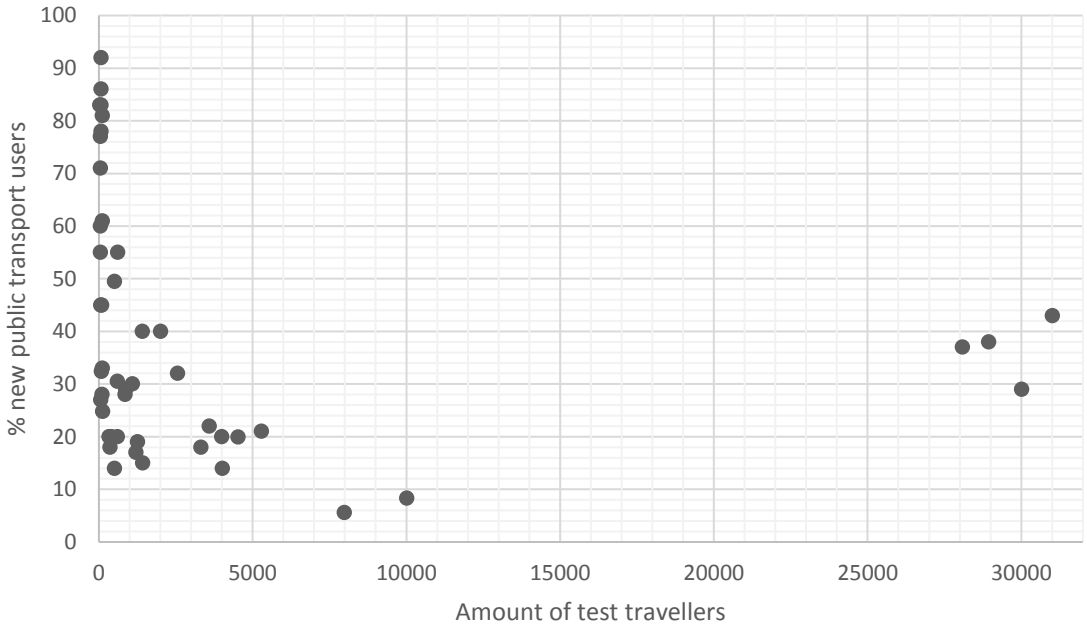


Figure 3: Experiences in Sweden, relationship between the number of new customers (x axis) and test travellers (y axis).

Both the smaller cases (figures 4 and 5) and the bigger cases seem not to have any type of pattern. However, the results obtained by the smaller projects are considerably higher than the bigger ones. After the small projects 59,0% (median of 60.5%) of test commuters have continued to commute by public transport, and most of them (14 of 15) have achieved a result that it is higher than the mean of the big projects, which is 26.0% (median of 21.0%).

In these graphs it is not possible to find a pattern that can explain the results achieved by the various projects, but this is not due to the number of observations. Different characteristics of the projects themselves and different contexts make each case partially diverse and unique, leading to results worth analysing qualitatively, besides the statistical comparisons, in order to understand more in depth the reasons for the success of these projects.

As can be seen in the data, in the least populated areas the percentage of people that continue to travel by public transport is not always significantly lower than the other cases, even if the service offered is not at the same level of other more densely populated areas in terms of frequency and times of the day when the service is available (i.e. evenings and late evenings). The reasons have been explained in interviews carried out with some project leaders and in the analysis of each project characteristics.

In some cases (i.e. Länstrafiken i Jämtlands Län AB, Värmlandstrafiken, Region Gävleborg, X-trafik) the people to whom to send the offer have been those living in the places with the best transport service or places along a certain bus line (Örnsköldsvik). Hence, due to the availability of a frequent service, the residents had a higher chance of testing it and finding it useful and comfortable in relation to their daily activities. In some other cases, the conditions for the participants included meetings (i.e. Skellefteå and Sundsvall) and/or events/occasions with the aim of explaining the project and its goals (i.e. Örnsköldsvik). Often, the participants were asked to commit to travel at least 3 times per week to and from work, as it is also

recommended in a document from Uppsala (Trivector, 2012)[9]. Further, in many cases the participants signed a contract in which they agreed that they would have answered to follow-up surveys, and meaning that they would have been monitored during the project. Hence, it can be supposed that the participants would have been more encouraged and incited to use the public transport by knowing about the monitoring done by the project managers, especially in small contexts ('The Hawthorne effect'. See McCambridge et al., 2014) and in the Skellefteå case the names of the participants were published online. Further, a personal contact with the people involved in the projects gives a higher outcome (Steer Davies Gleave, 2014, Brög et al., 2003), and in the Swedish context this have been achieved only by some small cases, whereas in the big projects the contacts with participants (and possible participants) have been more impersonal and made of standardised processes.

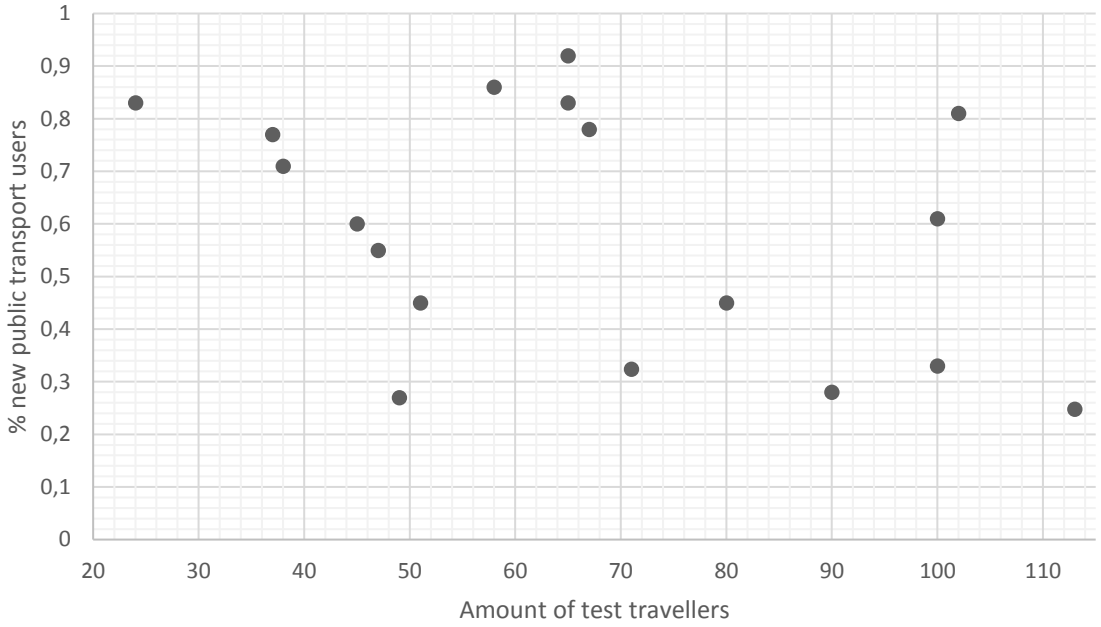


Figure 4: Experiences in Sweden – small projects (less than 114 test commuters), relationship between the number of new customers and test commuters.

Municipalities and transport authorities driven projects

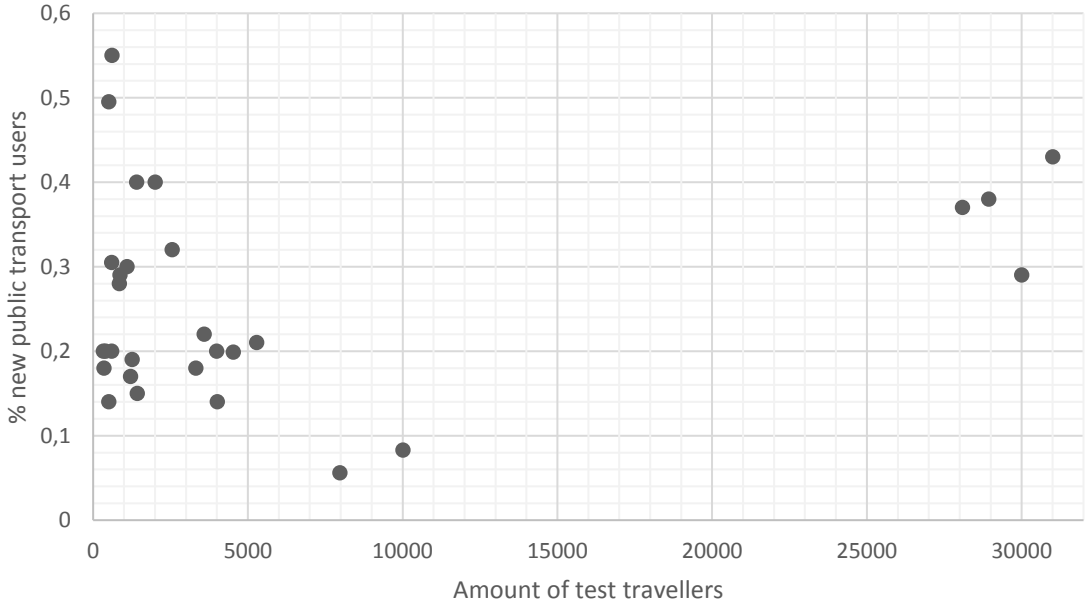
The difference between the results obtained by the projects run by the transport authorities or a collaboration between municipality and public transport authorities is not analysed, because this division mostly overlaps with the previous subdivision. Most of the small projects, indeed, involve directly the municipalities, whereas a public transport authority very often leads the bigger projects. The mean and the median of test travellers that continued to travel with the public transport services after a project led by a transport authority have been respectively 25.2% and 21.0%, whereas when the municipalities have been involved the mean is 52.9% and the median is 50.0%.

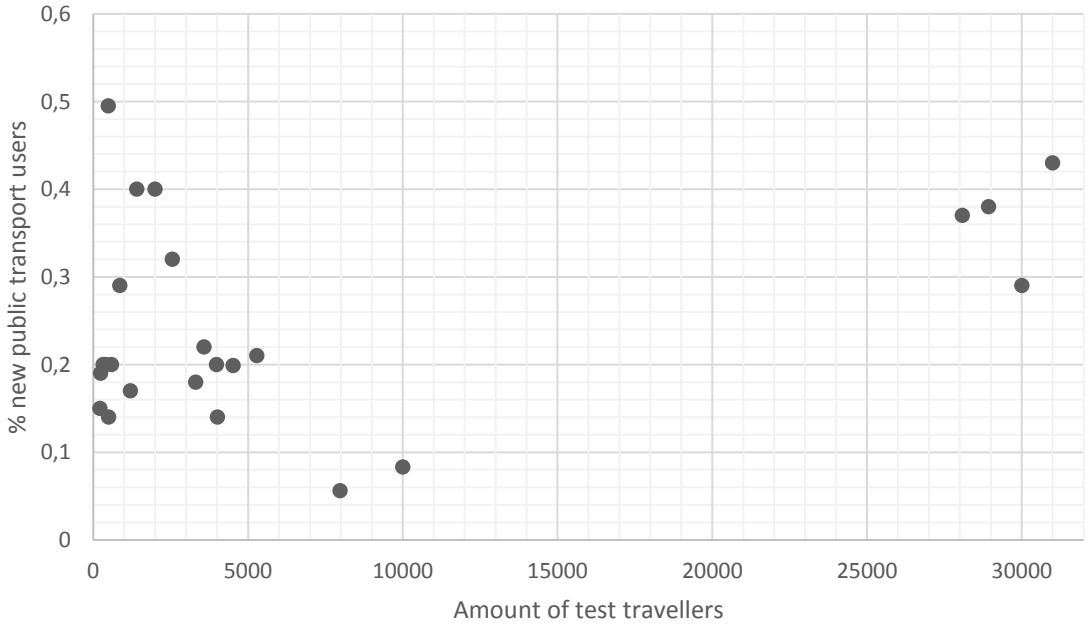
Projects addressed to local companies

The cases in Sweden studied in this research in which the beneficiaries of the projects were only the employees of local companies (or the employees of the municipal organisation) achieved a mean of 30.2% and a median of 28,0% of new customers. The cases studied here are only six, too few for undertaking any type of analysis. However, it is worth to underline that all the four big projects of this category have achieved

[9] "Previous test traveller projects show that the majority of participants, around 80%, travel with public transport at least 3 days per week during the test period and around 40% do that at least 3 days per week a year after the test period. That should be compared to the fact that none of the participants was travelling by public transport before the test period."

a result better than the average of the other big projects. In these cases, the employees are contacted via the local private companies. In an interview, the project leader of one of these cases stated that to address the employees through the companies might give better outcomes in terms of both the amount of test travellers and in the percentage of people that continue to use the public transport after the project. **T**he reason may be that the employees have a closer relation with the company, and may trust it more than a public body. In addition, the companies usually are genuinely interested in such type of projects, which fall within the scope of the Mobility Management activities. Companies are interested in Mobility Management activities, because they may ameliorate the workers' state of mind and increase their productivity as shown by research. Further, these activities may also improve the public image of the company, which can promote themselves as a more sustainable firm (for more on Mobility Management see for example: EPOMM (European Platform on Mobility Management), 2001 and Senn & Ravasio, 2003).





Figures 5 and 6: Big projects (more than 300 test commuters), relationship between the number of new customers and test commuters in all cases (upper figure), and by discarding the cases where the target were only the employees (here above).

3.4 Role of trial period length vs density of population

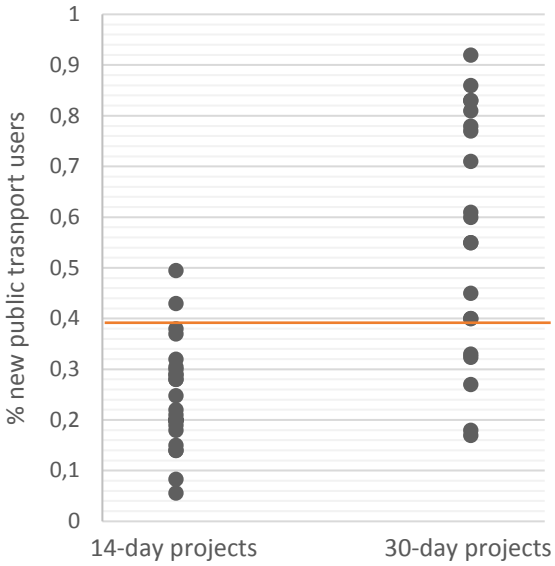
In some projects the test period has been 14 or 15 days, while in some other cases it has been of 30 days or 1 month. Only in one case whose data is available the duration has been of 2 months. In order to simplify the data, I have assimilated the 15-day projects to the 14-day-project and the 1-month projects to the 30-day projects. In some cases, the duration has been deliberately decided, even if there were not such time duration for a ticket, whereas in some other cases the time validity of the tickets has been decided after the duration of the existing ones. At a first glance, it may seem that the longer test period gives higher results (mean 57.3%; median 60.0%) than the shorter period (mean 24.3%; median 21%).

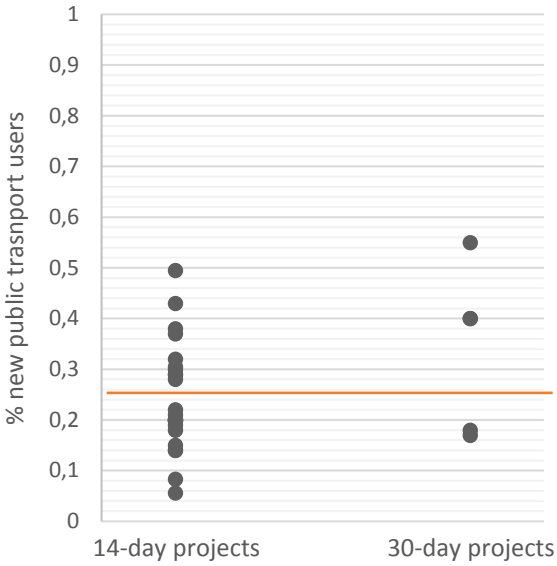
In order to confirm this hypothesis, it has been performed a t-test comparing the results obtained by 14-day projects and 30-day projects. Because only 2 out of 16 small projects lasted 14 days, and their results differ significantly from the result of the big projects, it seems meaningful to run a t-test analysis only between the big projects. 5 out of the 27 big projects (the 18.5% of them) lasted 30 days. The probability of the null hypothesis, namely that the test period duration is not a factor that affects the result obtained by a project, is 26.0%. This quantitative result shows that the different outcomes of the projects might be due to the longer test period, but the *p* is too high, and more research is needed. In the graphs below (figures 6 - 8) and in the tables below (tables 1 and 2) are reported the projects sorted out by test period duration.

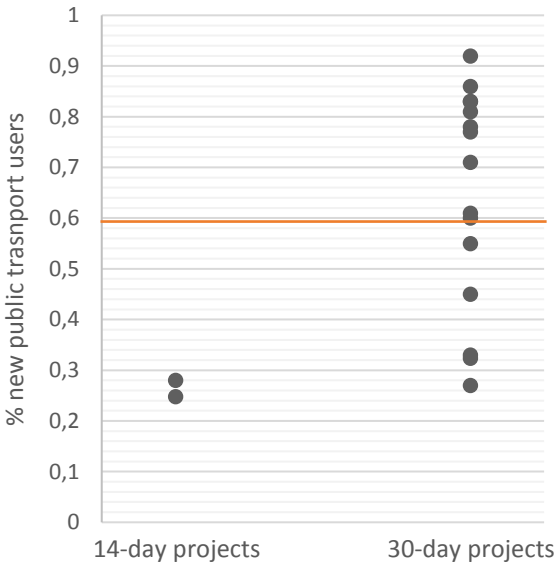
Due to the differences of the contexts and the not vast amount of observations, it may be interesting and relevant to examine the cases in their uniqueness, in order to understand better the quantitative results of the statistical analysis. When looking at the 30-day projects altogether, it can be noticed that only 2 out of 19 has achieved a result lower than the average. Amongst the highest 9 of these 18, in 7 cases there have been done other activities related to the project (i.e. increasing the frequency of the service, workshops). Regarding the 9 projects that achieved the least, 4 of them were conducted in a region very scarcely populated (Jämtland County, 2.6 ab/km^2, and Gävleborg County, 15 ab/km^2). When looking at the amongst the 9 14-day projects that achieved the least, 6 of them have been conducted in scarcely populated areas (Dalarna County, 9.55 ab/km^2, Värmland County, 15 ab/km^2, and Kronoberg County, 22 ab/km^2). Atop the 14-day projects there are mostly those carried out in densely populated areas (in the Stockholm and in the Gothenburg metropolitan area, Skåne County, 110 ab/km^2) and there have been used guerrilla marketing techniques (Östergötaland County, 44,5 ab/km^2). If running a correlation analysis between the amount of new users and the density among the project type with the most cases (14 day, big projects, only inhabitants, corresponding at 12 projects), the result is 56%, meaning a statistical significance higher than $\alpha = 0{,}05$ (which is 0.5324). If running a correlation analysis (same projects) between the percentage of test travellers and the density the results are similar: 62%, meaning a statistical significance close to $\alpha = 0{,}01$ =which is 0.6614)[10].

Hence, it is possible to say that the context does matter. If a project is carried out in a densely populated area, the public transport services are more developed and with a higher frequency in comparison to a scarcely populated area. Further, it matters in which modalities the participants have been reached and if there have been done other activities in addition to the distribution of free ticket. After that all these aspects have been taken into consideration, it is possible to say that the interpretation that a 30-day period could lead to better results might be correct, but it seems that the context is the major explanatory proxy. However, more research is needed, in order to understand at what extent a longer test period produces better results in terms of new public transport users.

[10] For both these correlations, the t-test analysis showed that the null-hypothesis had a probability lower than 0.01.







Figures 6 - 8: All projects (upper-left), only big projects (upper-right) and only small projects (lower-left), and their relationship between the number of new customers and the test period duration. In orange, the lines representing the mean values.

Tables 1 and 2: 14-day projects (on the left) and 30-day projects (on the right).

Municipality/Public transport authority	Test travellers	New costumers
Länstrafiken i Jämtlands län AB	1,200	17.0%
Region Gävleborg, X-trafik	350	18.0%
Östersund (Employees)	49	27.0%
Eskilstuna	71	32.4%
Söderköping	100	33.0%
Kollektivtrafikförvaltningen UL	1,402	40.0%
Kollektivtrafikförvaltningen UL	2,000	40.0%
Falun (Värmlandstrafik)	47	55.0%
Region Gävleborg, X-trafik	600	55.0%
Skellefteå	45	60.0%
Umeå & Länstrafken i Västerbotten AB	100	61.0%
Umeå & Länstrafken i Västerbotten AB	102	81%
Umeå & Länstrafken i Västerbotten AB	65	83%
Vännäs – Umeå (Länstrafken i Västerbotten AB)	38	71.0%
Örnsköldsvik	37	77.0%
Skellefteå	67	78.0%
Vännäs – Umeå (Länstrafken i Västerbotten AB)	102	81.0%
Vännäs (Umeåregionen) & Länstrafken i Västerbotten AB)	24	83.0%
Skellefteå	65	92.0%

Municipality/Public transport authority	Test travellers	New costumers
Hallandstrafiken AB	7,971	5.6%
Hallandstrafiken AB	10,000	8.3%
Hallandstrafiken AB	500	14.0%
Värmlandstrafik	4,010	14.0%
Länstrafiken Kronoberg	1,419	15.0%
Dalatrafik AB	3,313	18%
Länstrafiken Kronoberg	1,253	19.0%
Värmlandstrafik	900	19.9%
Värmlandstrafik	593	20.0%
Västtrafik AB	3,985	20.0%
Nyköping	400	20.0%
Värmlandstrafik	325	20.0%
Värmlandstrafik	5,282	21.0%
Dalatrafik AB	3,577	22%
Kollektivtrafikförvaltnigen UL (Employees)	113	24.8%
Nacka (Employees)	90	28.0%
SLL, Trafikförvaltningen (Employees)	840	28.0%
Skånetrafiken	30,000	29.0%
Tyresö	860	29.0%
Huddinge (Employees)	1,085	30.0%
Östgötatrafiken AB (Employees)	590	30.5%
Tyresö	2,552	32.0%
Västtrafik AB	28,080	37.0%
Västtrafik AB	28,930	38.0%
Skånetrafiken	31,000	43.0%
Östgötatrafiken AB	500	49.5%

3.5 Results in case of projects iteration

In numerous places, the so called “testresenärsprojekt” have been repeated over the years. For this reason, it may be interesting to analyse if in these cases the percentage of people switching to public transport increases over the years. For this analysis there have not been considered the cases in the same places but with too different characteristics. In the list below there have been indicated the differences of the percentage of new customers in relation to the testing people between similar projects. It is evident that in almost all the cases the projects have had better results after the first one, except for Värmlandstrafik third case, where nonetheless the percentage of new customers has still been considerably higher than the first case. For the complete table, see attachment 3.

When iterating the project, the table above (table 3) shows that the projects after the first one achieve a better result. It has not been possible to further investigate the reasons, but it is plausible that the residents in the areas involved have already had the possibility to get to know the project and see its effects, thanks to known people, mass media and social networks. Furthermore, the municipalities and/or the public transport

authorities can gain experience and new expertise by carrying out a project, thus they are more able to develop and carry out a second project, tailoring and adapting it for that specific context.

The participants may be the same, but not if the project has ended less than a year before, as Västtrafik: they admit only participants that have not been test travellers in the previous year. In some other project, however, a condition was not to have been a test traveller at all. This aspect has been directly asked to Västtrafik: they deem that a person may have had changes in his/her life, and therefore should not be refused the possibility to be a test traveller again.

Table 3: difference of the percentage of new customers in relation to the test travellers.

Municipality/ Public transport authority	**Years**	**Difference between projects**
Dalatrafik AB	2013 – 2015	+ 4%
Hallandstrafiken AB	2015 – 2016	+ 2.7%
Länstrafiken Kronoberg	2013 - 2015	+ 4%
Skellefteå	2010 – 2013	+ 18%;
Skellefteå	2013 – 2015	+ 14%
Skånetrafiken	2012 – 2013	+ 14%
Tyresö	2014 – 2015	+ 3%
Kollektivtrafik. UL	2014 - 2015	+ 0%
Umeå & Länstrafken i Västerbotten AB	2009 – 2010	+ 20%
Umeå & Länstrafken i Västerbotten AB	2010 – 2012	+ 2%
Vännes (Umeåregionen) & Länstrafken i Västerbotten AB)	2009 – 2013	+ 8%
Värmlandstrafik	2013 – 2014	+ 7%
Värmlandstrafik	2014 – 2015	- 1.1%
Västtrafik AB	2009 – 2010	+ 17%;
Västtrafik AB	2010 – 2014	+ 1%
Örnsköldsvik	2012 – 2013	+ 9%
Östgötatrafiken AB	2012 – 2016	+ 19%

3.6 Good practices and recommendations

After the analysis of the numerous cases in Sweden, it is possible to draw some considerations about what can be good practices and advice for a public body that wants to make use of a test traveller project.

More information

In numerous cases the organization leading the project has given information and advice to the car drivers, in particular to the test travellers, mostly by leaflets. This type of activity has been proven to be useful and appropriate, because in the cases where it has been asked the project participants if they received new information, around 15 – 20% answered yes. This fact disproves Tørnblad et al. (2014), who claimed that in an information technology society the information is already accessible. However, access to information might not signify to be informed. In fact, if comparing this case with the Swedish cases, closer in time (same years) and as context (both Nordic country with similar indexes of economic and human development), in the Swedish cases where it was asked the participants if they received new information thanks to the letters sent them home, the percentage of yes was around 15% - 20%.

Period length and a certain freedom to choose when to start the trial

Regarding the time validity of the tickets, the statistical analysis shows that a longer period, 30 days, seems to be more effective than a shorter period, 15 days. Moreover, by reading the project reports and by interviewing some civil servants in municipalities and public transport authorities, it has been discovered that both project participants (Nacka case) and project leaders (six projects) recommended a longer period, in order to break more effectively the old habit – use the car – and to give the opportunity to establish a new transport behaviour. A longer period, besides making a person more acquainted with the public transport, allows overcoming temporary problems or circumstances that could prevent a participant to use the public transport, such as an illness or a temporary different working location. A longer period, however, implies higher costs for the projects and might irritate the regular users. Therefore, it might be better to have a shorter period, and the test period should not be strictly fixed (i.e. from the 1st to the 14th of May) but the trial may be initiated in a given range of days (i.e. the card may be activated only from the 1st to the 10th of May, and it would be blocked automatically in case of non-activation after a certain day) and last two weeks thereafter. However, due to the limited number of projects analysed it is not possible to argue in favour of a shorter or a longer period in case of limited resources.

Accurately select the participants

In order to be more effective in selecting the project participants, invitation letters or mails should be sent only to non-public transport users, therefore, in case of a municipality, to check with the transport authority first and exclude those who have or have recently had, an active period ticket on their public transport card. The selection phase, during which the future participants are selected out of all the applications received, is important. If this step is executed correctly, only the right people will be chosen. Thus, the number of test travellers will be lesser, but the percentage of people that will continue to use the public transport services will be higher.

In the analysed cases it has not been possible to know about the methods used for further selecting the participants to the projects in case the applications exceeded the predetermined amount of places set by transport authorities and municipalities. Only in the case of Sundsvall this information has been explicitly mentioned. They selected mostly people that were seldom using the public transport, but still they choose also 14% of persons who were using it some times per week because of the limited number of applications that they had had. Interestingly, 65% of the participants were women (in Sundsvall women use public transport for 10% of their travels, men for 5% - Sundsvall kommun, 2017; in Sweden 60% of women's trips is made by public transport, compared to 40% of men's trips – Trafikanalys, 2015) and more than 40% of participants were aged between 36 and 45 years (Sundsvall kommun, 2017). It is however not possible to give advice about how to select the participants, in case of a fixed amount of participants and/or limited resources. A strategy may be to have a representative sample of population that corresponds to the travel habits of the residents. Another strategy may be to focus more on a particular group of people that do not use much public transport (for example men, whose public transport use has increased over the years in Sweden, but still is lower than women – Petersen, 2015). It has not been possible to find data about the outcomes of the projects among the women and men, as well as among the different age groups, probably because this aspect has not been investigated in the projects evaluation. More research is therefore needed, in order to know which strategy may give the best results.

Explain the purpose of the project to the public

By reading the reports and personally contacting the public bodies that carried out the projects here analysed, a question came out: how do citizens would react to this project? The issue regards the people that before the project implementation were already using the public transport, because they may feel it as unfair that other people, using a non-environmental friendly and potentially dangerous (in particular for cyclists and pedestrians) mode of transport, receive free tickets. It is therefore important to clearly explain to the

public that the free tickets are not a reward, and that the project aims at reducing the number of people using a car, thus generating positive effects for the community (more funds for the public transport, less traffic and therefore faster buses and increased road safety, etc.).

Prevent cheating

Some of the project leaders have mentioned the problem of people selling their free tickets online (see Carmbrant, 2015 and Ernerudh, 2016). In order to overcome this issue, there are different strategies. One of these consists in having a very short period in between the communication to the participants that they will be test travellers and the reception of the ticket, so that it would become more difficult to sell it. Another strategy is to use the code associated with the cards containing the tickets in order to be able to recognise the person who has received it, or to have special cards for the test travellers.

Crowding on public transport

An issue that has emerged by talking with some project managers has been the crowding that a test traveller project may cause. If some lines and/or if at specific times (i.e. peak hours) are already crowded or the problem might appear during the test period, the transport offer of those lines should be strengthened or it should be avoided to choose too many people that would probably use those lines.

Discounts to project participants for buying public transport tickets at the end of the trial period

Interesting has been the choice (made in some cases, as in Jämtland County) of making an additional offer to the test travellers at the end of the test period, to give further motivation for definitively change their travel behaviour. This offer consists in a discount for buying a monthly or a yearly ticket right after the test period.

Follow-up surveys and engage project participants

In order to obtain data about the effects of the test traveller projects, it is required to have follow-up surveys to be filled in by the projects participants. Interestingly, one transport authority that is currently thinking of repeating soon a test traveller project is planning to make it compulsory for the participants to answer the follow-up surveys, with the penalty of paying back to the transport authority the whole value of the ticket received. In this way, it will be possible to have a more accurate evaluation, and participants may feel more monitored and thus encouraged to perform better (see: Steer Davies Gleave, 2014; McCambridge et al., 2013). Botkyrka municipality in the project analysed later on has done the same. One municipality, Sundsvall in the 2010 project, wrote in the contract that had to be signed in order to take part to the project that participants had to answer follow-up surveys, but no penalties are indicated in case of not compliance to that.

In some cases, for example in Skelleftå and in Umeå, project participants have been encouraged to share their experiences online and on social media, on the municipality's or on the public transport authority's social media pages.

Avoid wintertime and holidays

The period in which the test traveller project is conducted may play a relevant role on the outcomes, as it has been suggested by the literature (Batty et al., 2014) and said by Sundsvall project manager. Hence, the project should be carried out in a period with favourable weather conditions, therefore not during wintertime, but also in period that does not precede a holiday time. Therefore, the best moments during the year seems to be the spring, from March/April (but being careful about Easter holidays) or right after the summer holidays, in August/September, before the cold months. Difficult weather conditions might discourage people from trying out the public transport service and/or to establish a new travel behaviour because of the walking and waiting times at the stops/stations, while a vacation period right after the test period may hinder the consolidation of the new behaviour.

3.7 Reflections about the Swedish context

After the study of the Swedish cases, it is possible to make some considerations and to observe how they have been carried out and what have been the results in comparison to the literature. It is significant, for example, that the results achieved have been quite high if compared to the results obtained by the other projects outside Sweden, even when the data refers to the long term (6 months or one year). In fact, the literature indicates 20% of new public transport users as the maximum, whereas in the Swedish cases analysed 20% represents the first upper quartile.

The material analysed lead to the conclusions that an information package for car drivers in general, and for test travellers in particular, is in any case helpful. Despite the critique that in a context where it is very easy to have access to all the relevant information about the alternatives to car driving thanks to the information technologies, the results of the Swedish projects depict a rather different scenario:

- 1 out of 5 or 6 car drivers lack some information about public transport.
- A proportion of car drivers, ranging from the 10 % up to the 50%, admitted that he/she was expecting the use of public transport more difficult than it was.

It is interesting to notice that in the vast majority of projects there have not been used intrusive methods for contacting possible test travellers, by phone or by a home visit. These methods have only been applied in some of the first cases, for example in Lund. Further, some projects managers warned not to ask the participants to write a travel book, but to ask them to fill in the questionnaires. Further, in many cases there have been a close cooperation between the municipalities and the public transport authorities, and the local media have written about the projects and hosted the advertisement.

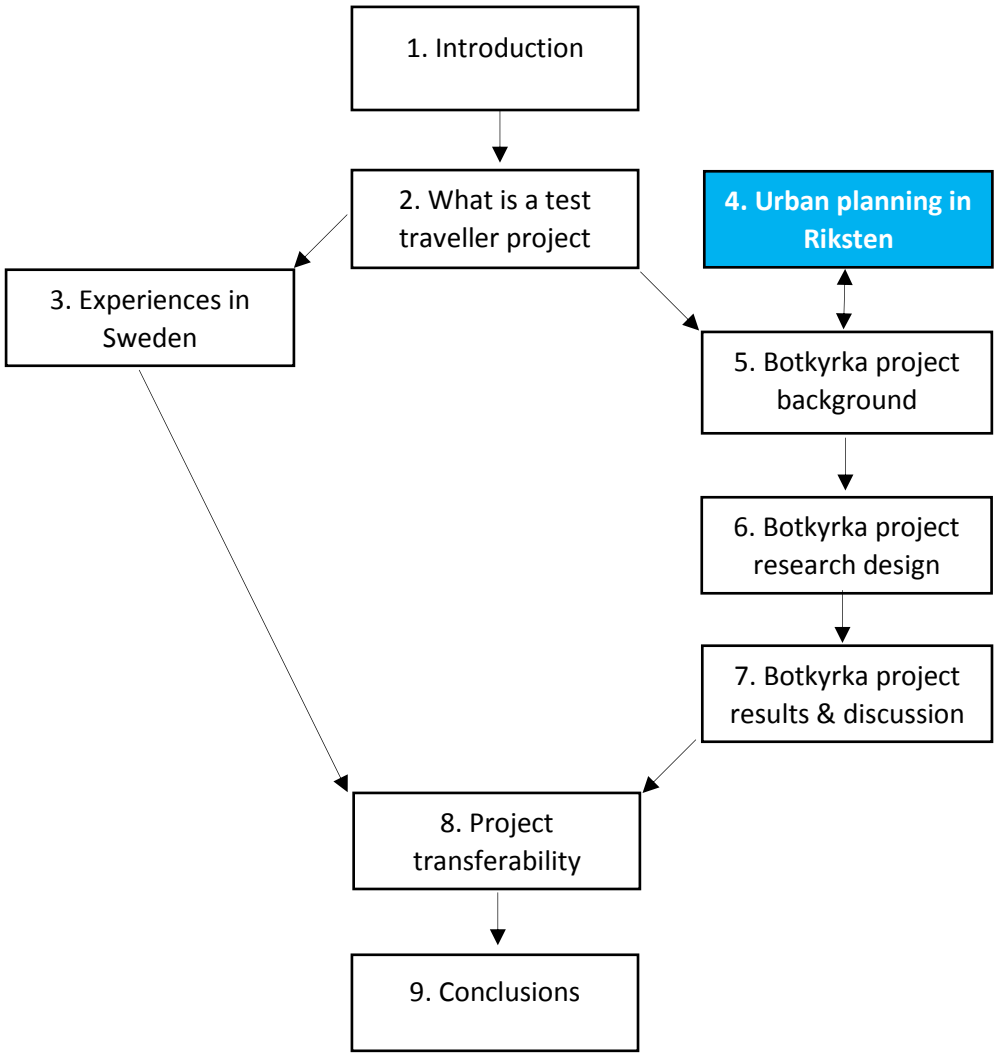
Another interesting aspect is that numerous Swedish test traveller projects, in particular the small ones, used techniques similar to the individualised marketing (see chapter 2). They added to the social marketing campaigns activities tailored for the participants, for example giving personalised information and advice. Further, in some cases the public transport service has been improved right before the project, therefore combining soft policy measures with hard measures. This combination of activities and actions was made in order to seek a better performance of the project, as suggested by the literature, and it gave positive and promising results.

In addition to the differences in methods and results, I deem that it is to recognise the efforts made by the civil servants engaged in this type of project, which have shown their support by helping in this research. In particular, the project managers contacted have a considerable knowledge of the topic, because when contacted they competently discussed about the choices made, referring to the theory and to other cases they had looked at as models and as an inspiration (especially the experiences of Västtrafik, the public transport authority of the county of Västra Götaland, where the city of Gothenburg is situated). These project responsible also brought up issues that are not mentioned in the literature, the relationship with the public above all. It is noteworthy that these projects have been possible thanks to a political will, that conceived the projects or that supported the departments and the persons that conducted them.

It is to remark that in Sweden is one of the countries with the highest ranking regarding the intellectual capital (Carol & Leif, 2008; Pirjo et al., 2015). The knowledge amongst the municipalities civil servants and the transport authorities' employees seems to be remarkable, because when contacted they have been able to explain the reasons and the implications of the projects carried out, making references to other experiences in Sweden and to some basic theoretical ground for the project. Moreover, there are currently numerous private companies in Sweden that have expertise in test traveller projects, from marketing solutions to more practical competences, and they offer consultancies and support to municipalities, counties and public transport authorities that want to implement such type of projects.

4 Urban planning in Riksten

This chapter describes the urban planning process in Riksten, the area where the test traveller project was carried out. In the first part of the chapter there is a digression about the institutional background in Sweden, followed by an explanation of the public bodies involved in the urban planning process and the organisation of the test traveller project in Riksten. After that, there is a section with comments upon the planning process.



4.1 Institutional background

Swedish planning system at national level

Sweden administrates the urban planning process at three levels: national, regional, and municipal. At the national level, Riksdagen (the Parliament) with Regeringen (the Government) enact laws and establish guidelines for development projects and planning practices.

Currently, the relevant laws in force are (Boverket website):

- Plan- och bygglagen (in English: Planning and Building Act) 2010:900.
- Plan- och byggförordning (in English: Planning and Building Regulation) 2011:338.
- Lag om allmänna vattentjänster. (in English: Law on public water services) 2006:412.
- Lag om riktlinjer för kommunala markanvisningar (in English: Law on guidelines for municipal terrain directives) (2014:899).

From 2002, the Ministry of the Environment (now Ministry of the Environment and Energy) carries the main responsibility for planning at a national level, supported by the Ministry of Enterprise and Innovation (Nordregio, 2004). Boverket (in English: National Board for Housing, Building, and Planning) is a government agency that cooperates with the Ministry of Environment by proposing laws and controlling general issues about spatial planning and sustainable development. Tillväxtverket (in English: Swedish Agency for Economic Growth and Regional Development), which has the task of managing the European Social Funds and the European Development Fund (Tillväxtverket website), also collaborates with the planning issues.

Länsstyrelsen (The County Administrative Board)

The national government nominates the County Administrative Board of each county. These administrative bodies represent the government and the national interests at the regional level (Regeringskansliet website).

The County Administrative Board can elaborate a regional plan, but it is not legal binding. Municipalities collaborate to address supra-municipal issues. One role of a County Administrative Board is to coordinate and control the planning activities of the municipalities in the county (Planning and Building Act (2010:900)).

The County Administrative Board collaborates with the municipalities, the county council, and numerous other actors regarding the planning processes. Examples include Regional cykelplan för Stockholms län 2014-2030 (in English: Regional cycling plan) (Trafikverket, 2014:041) and Regional Utvecklingsplan För Stockholmsregionen (RUFS) 2010 (in English: Regional Development Plan for the County of Stockholm, RUFS 2010). According to the Förordning (2007:713) om regionalt tillväxtarbete (in English: Regulation (2007:13) on the regional growth work), the various Swedish County Administrative Boards are responsible for the developing programs (in Swedish: Tillväxtprogram), and they have the role of mediator of the different interests, in order to produce a regional program or plan to be used for requesting that the central government release European funds.

Läns Landsting (in English: County Council)

The County Councils (Läns Landstingar) are the democratic counter-part to the County Administrative Boards (Länsstyrelserna), because they are elected by the citizens of the counties. They are responsible in particular for healthcare and local transport services (Socialtjänstlag (2001:453)).

For Stockholm County, however, there is a special law disposition in the Planning and Building Act (2010:900, chapter 7) that gives Stockholms läns landsting (Stockholm County Council) the power to draw up legal binding plans with a regional scope.

In Stockholm County, Trafikförvaltningen (Public transport administration), as part of the Stockholm County Council, is the responsible for the public transport services. Public transport on land is under the brand SL (Storstockholms Lokaltrafik – in English: Greater Stockholm local public transport), and the service is operated by different private companies (Arriva Sverige, Keolis Sverige, Nobina, MTR and Stockholms spårvägar). The transport operators have some room to manoeuvre in terms of deciding timetables and routes. Keolis Sverige operates the service in the study area, Riksten, among other areas of the Stockholm County (SLL website, section "verksamhet", subsection "kollektivtrafik", further subsection "Storstockholms Lokaltrafik, SL").

Swedish municipalities and local planning

In Sweden, a building permit is released only at the end of the planning process, as summarised in figure 9.

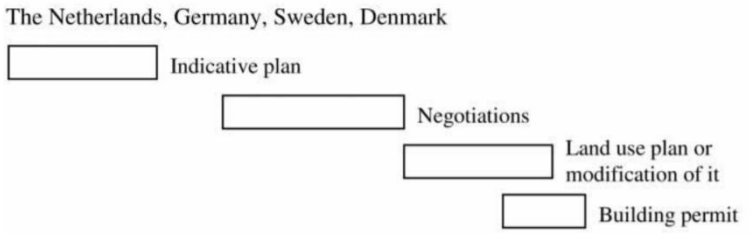


Figure 9: Municipal planning process in Sweden. Source: Muñoz Gielen & Tasan-Kok, 2010, p. 1101.

Swedish municipalities own the so-called "planning monopoly" since the promulgation of the "Town and Planning Act" in 1947 (COMMIN – The Baltic Spatial Concept share, 2007). This means that a municipality has a great power over the physical urban planning. However, the respective Administrative County Boards verify that the plans dispositions do not conflict with national interests (Länsstyrelsen Stockholm website), defence and communications (roads, railways, aviation, and shipping) among others. If the plans are not considerate enough of other aspects, such issues that concern other municipalities in the county and people's health and safety (Idem). In case of conflicts, the Administrative County Board has three months to reject the municipal plan (or only its conflicting parts if the municipality agrees with the decision).

1) Comprehensive plans (Översiktsplaner): These are non-binding documents that outline the strategies and the guidelines for the future development. They consider the national interests and create a vision towards which the municipality intends to direct its plans and policies. These documents are requested by the Plan- och bygglagen (Planning and Building Act, 2010:900), and introduced in 1987.

2) Negotiations, through which the municipalities discuss with private actors and make negations about the development of an area, often before the redaction of detailed plans. (Mattson et al., 1989; Newman & Thornley, 1996).

3) Detailed plans (Detaljplaner): These legally binding documents are the main planning instrument of a municipality. Their contents should respect the national guidelines and must comply with the binding rules set by the national (and the regional) level (Länsstyrelsen Stockholm website).

4) Exploitation contract and building permit (Exploateringsavtal and Bygglov): After the adoption of a detailed plan, the municipality and the developer(s) either sign one or more exploitation contracts, or the developer requests specific building permits (Planning and Building Act 2010:900, chapter 4).

4.2 The municipality of Botkyrka

Botkyrka is a Swedish municipality located in the Stockholm County, in the southwestern part of the Stockholm metropolitan area (Figure 10). At the end of 2016 its population exceeded 90,000 and has increased constantly over the previous years, by 17% in the last decade (data found on Statistiska Centralbyrån website). This trend reflects the Stockholm region population growth, which is the fastest growing region in Europe (Savage, 2015).

According to the last report by Trafikförvaltningen (2016) in Botkyrka, 52% of the trips are by car and 30% by public transport, which is a lower car use than the average of the outer suburbs (car 64%, public transport 23%). Botkyrka does even better than the inner suburbs, among which the average of car use is 54%, compared to the 29% share of public transport. However, car use in Botkyrka is still considered too high by the municipal civil servants because of the presence of a rapid and efficient transport system and its easy access in the three urbanised areas (two commuter train station and four subway stations – see Figures 11 - 13).

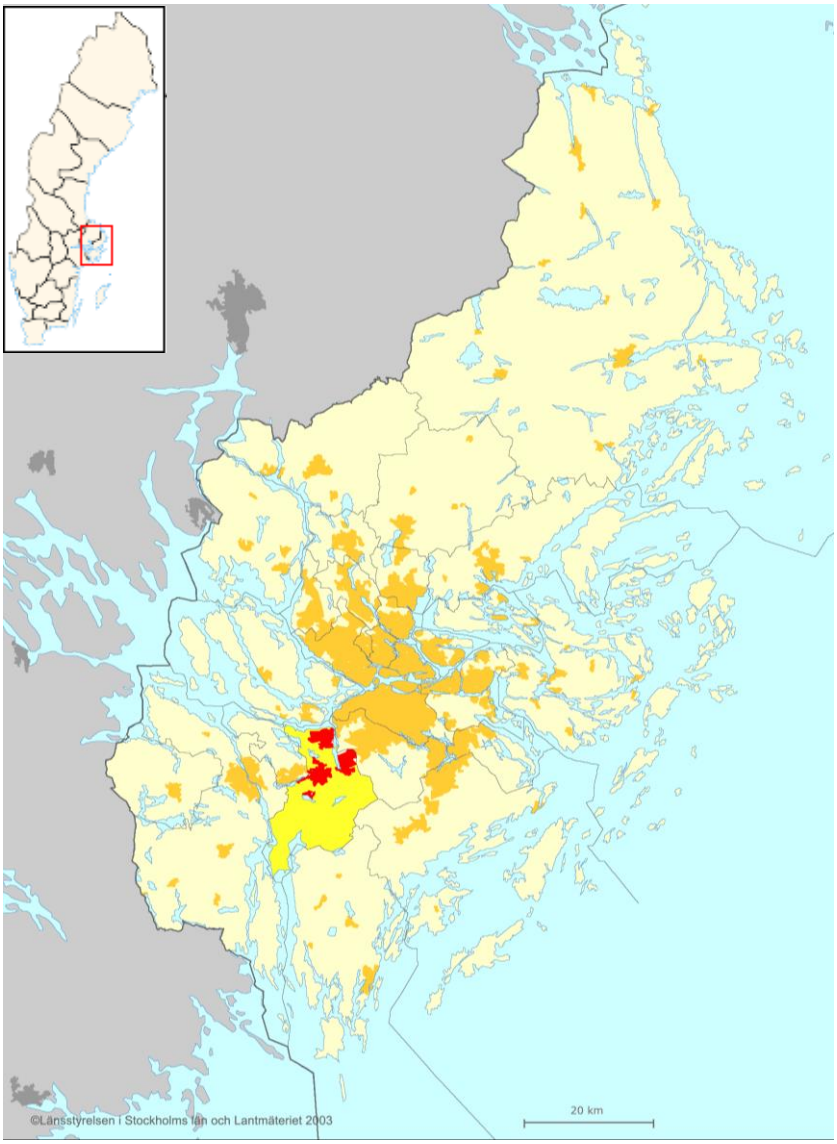


Figure 10: Localisation of Botkyrka in the Stockholm county (in dull yellow). In orange, the urbanised areas. Botkyrka municipality urbanised areas are in red, while the rest of its municipal territory is in bright yellow. Source: map of Sweden, author's elaboration. Stockholm County map: author's elaboration of a map on Länsstyrelsen Stockholm website.

Botkyrka municipality goals

In its document, Klimatstrategi för Botkyrka (in English: Climate strategy for Botkyrka), the municipality sets ambitious climate goals that envisage the municipality as free from fossil fuels in 2030 and climate neutral in 2040 (Botkyrka Kommun, 2009). The 2014 Comprehensive plan (Botkyrka Kommun, 2014) declares in its first goal the ambition of achieving a climate-smart living. Nowadays, around 80% of carbon emissions in the municipality comes from transportation (Botkyrka Kommun, 2009), and therefore a reduction of transport needs,a change of travel habits, or a switch to fossil-free fuels is required reach the 2030 goal.

4.3 The area – Riksten

A suburb of Stockholm

Riksten is an area located in the eastern part of Botkyrka municipality, in the southern part of Tullinge district (see Figures 11 – 13). The area may be defined in English as a "suburb", by using the definition of suburb given by the Cambridge Dictionary (Cambridge dictionary website) "an area on the edge of a large town or city where people who work in the town or city often live". Riksten is a rather homogeneous suburb characterised by townhouses, villas and small apartment buildings, and it is a residential area, because of the prevalence of this function over the others. According to the 2017 Swedish Association of Local Authorities and Regions (Sveriges Kommuner och Landsting, 2016) municipalities division, if a municipality has at least 40% of its commuting towards a big city or towards a municipality close to the big city, and at least 20% of the commuting outwards is directed towards only one of the big cities, that municipality is classified as "Commuting municipality close to the big city" (in Swedish: "Pendlingskommun nära storstad"). Botkyrka municipality falls within this category, because it has an outwards commuting that is 71%, of which 38% is directed towards Stockholm (Idem). If looking at the previous classification of municipalities from 2011 used in Sweden, Botkyrka was classified as "Suburban municipalities to the big cities" (in Swedish "Förortskommuner till storstäderna"). Riksten represents well the municipality figures, because its commuting outside the municipality is 80%, whose 35% is towards Stockholm (Burazor, 2015). In Figure 13 it is possible to see the distance between Stockholm and Riksten (around 15 km, 24 if considering Gamla Stan, the centre of Stockholm), and it is also visible the direct connections by train passing close to the area.

Furthermore, if looking at the position of Riksten in the aerial photo in the next page (Figure 12) it can be seen that Riksten is physically separated from the rest of Tullinge district by the tracks of the faster railway lines connecting Stockholm to southern and Sweden. From that photo it is also noticeable how the new area of Riksten is denser than the rest of the southern part of Tullinge (which is dominated by detached houses) and has a different urban structure.

History and controversies

A military airport was in operation in the area until 1994 and continued to be used for some minor civil purposes, sport and leisure activities, until 2004 (Luthander, 2004). Tullinge airport had received much attention from the state already from the late 1950s, because Tullinge was seen as an alternative for the growing overuse of Bromma airport (closer to the city centre). After the construction of the bigger Arlanda airport in the northern part of Stockholm County, Tullinge airport was seen as a viable alternative for closing Bromma airport (whose area could have been used for new residential purpose) due to its favourable position, close to Stockholm and to important transport corridors (route E4, the green metro line only some few kilometres away, the local and national railway lines passing at Flemingsberg station and connecting to Arlanda).

The municipality of Botkyrka was initially in favour of the project of the airport due to its positive economic returns, when the Social democratic party (Socialdemokraterna) was governing the municipality (Beckman-Petter, 1996). However, an opposition movement grew in Botkyrka. The party that was in favour of the airport lost all local elections after 1982, losing 9 of its representative in the municipal council (from 32 to 23), which is composed of 61 representatives. In the 1985 and 1988 elections, the "Aktionsgruppen mot flyg på F18", the action group against planes on F18 area, had respectively 3 and then 7 representatives elected (the third largest party in Botkyrka) (Statistiska Centralbyrån, website).

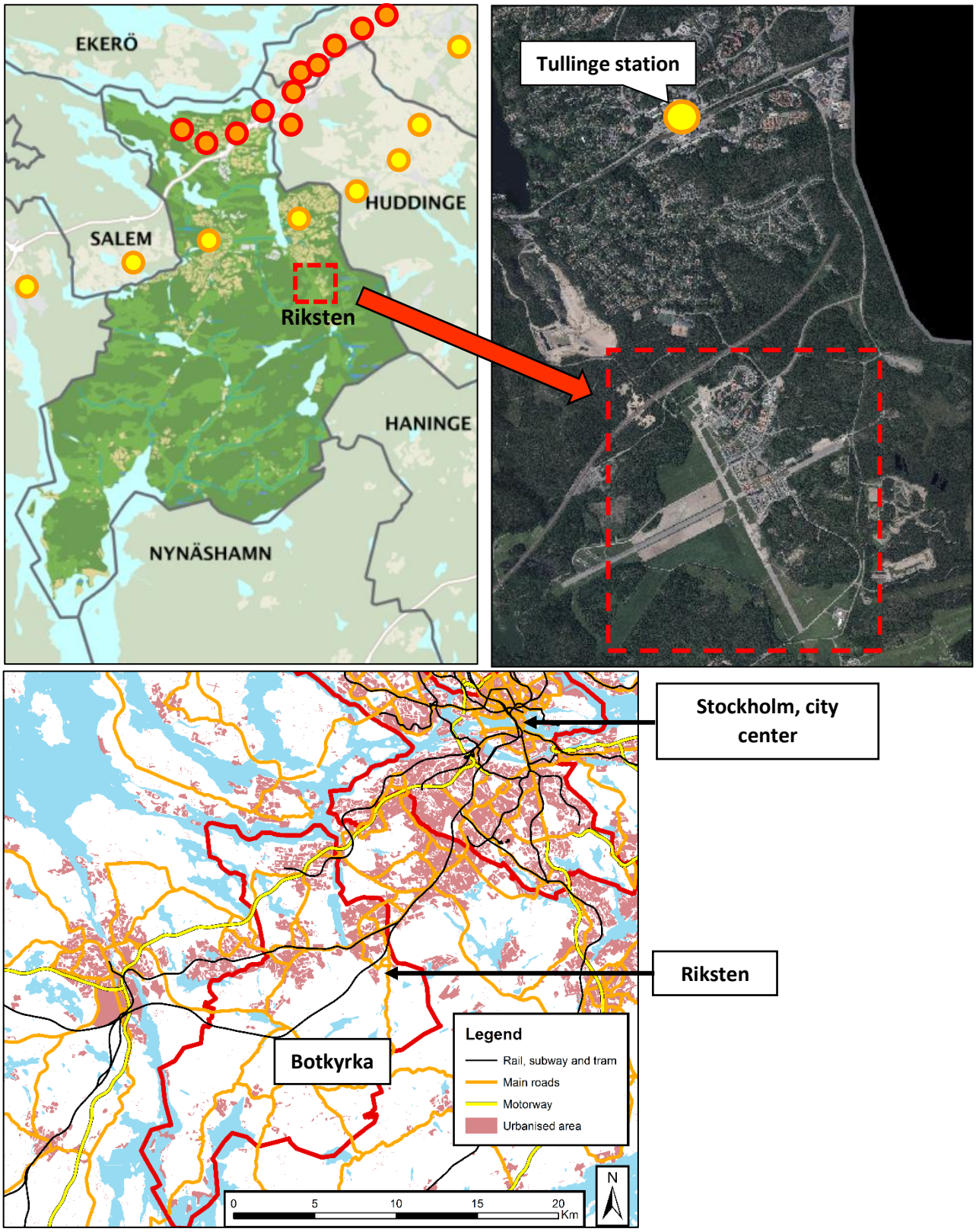


Figure 11 (upper left): Riksten position in southern Stockholm County. The yellow and orange circles represent the commuter train stations and the orange/red circles represent the subway stations. Source: author's elaboration of a map available on Botkyrka municipality website. Figure 12 (upper right): Riksten orthophoto. Tullinge station is in the upper part of the picture, Riksten area is clearly visible in the lower part of the image. Source: orthophoto Botkyrka municipality website (year of the picture: 2016). Figure 13 (lower): map representing the main infrastructure around Riksten. It is visible the fast train track, close to Riksten not stopping there, and the commuter train track, passing three km north of Riksten.

Therefore, the Botkyrka municipality started to think at a realistic alternative for the airport idea and, in 2000, the municipality asked a consulting company of Stockholm to evaluate the option of building residences and offices in the Tullinge airport area (Luthander, 2004). The outcomes were negative, stating that to build there would have been not profitable and convenient, due to low demand. However, one month after that Temaplan report was presented, the Swedish prime minister then in office, Göran Persson, made a keynote speech in which he pointed out that the area was appropriate for a new city district. The area was stated to be no more of national interest, and the airport hypothesis defectively abandoned. In January 2004, Vasallen AB, the state-owned real estate company that owns the closed properties of the Swedish Armed Forces, sold the area (250,000 m2 exploitable terrain and 30,000 m2 of existing buildings) for 80 million crowns (around what then corresponded to 8.6 million euros) to the company PEAB Sverige AB (Luthander, 2004).

In 2003, the municipality approved and signed a contract with the owner of the land (a state-owned real estate agency) defining the guidelines for the future development of Riksten (Botkyrka kommun, 2003), defining the area as Riksten Friluftsstad (in English: Riksten open-air /outdoor town). The construction has been carried out by the Riksten Friluftsstad AB company (the new owner of the land, which is a subsidiary company of PEAB Sverige AB).

In a 2004 interview (Luthander, 2004), Peter Andersson – the head of Moderaterna, Botkyrka second party – deemed that price was too low and also that it was not economical sustainable for the company to build there. He suspected that there must have been some kind of deal between the state and the developer company, which, allegedly, by building there in non-favourable conditions they obtained to build somewhere else.

The original project has been modified in 2006 and then again in 2012, when already 1/5 of the residences had been built (Botkyrka kommun, 2012). Riksten Friluftsstad AB delivers finished lots a little at time (around 100 homes per year), mostly single- or bi-familiar houses, but also small apartment buildings. Nowadays (at the beginning of 2017), about 2,000 people live there in 700 houses. As the expansion continues, by 2030 there will also be some high-tech industrial activities (for around 1000 new workplaces) and the number of residents in the area is planned to be between 8,000 and 10,000 in a total area of around 1,7km2 (Botkyrka kommun, 2003a; Botkyrka kommun, 2003b; Botkyrka kommun, 2012). As can be seen in Figure 14, the development project is classified as medium density.

However, as stated in the latest program for Riksten (Botkyrka kommun, 2012), the plan for the area may be revised again in the future, in light of new needs and on new regional projects, for example the Spårväg syd, a tramline for the south-eastern part of the Stockholm metropolitan area, which is currently undergoing the planning process (Botkyrka kommun, 2014). In the intentions of the municipality, therefore, Riksten will become a medium-density area, with good connections by public transport.

The closest areas with numerous services for the citizens are located close to the train stations of Tumba, Tullinge and Flemingsberg.

Currently, at a regional level the area is defined as “Other urban areas” (Övrig regional stadsbygd) (Regional Utvecklingsplan För Stockholmsregionen (RUFS) 2010, p. 156), as can be seen in Figure 15. Further, most of the areas that surround Riksten are classified as areas of “state interest for outdoor life” (Riksintresse för friluftsliv) (Figure 16), therefore no development can be planned there by the municipality.

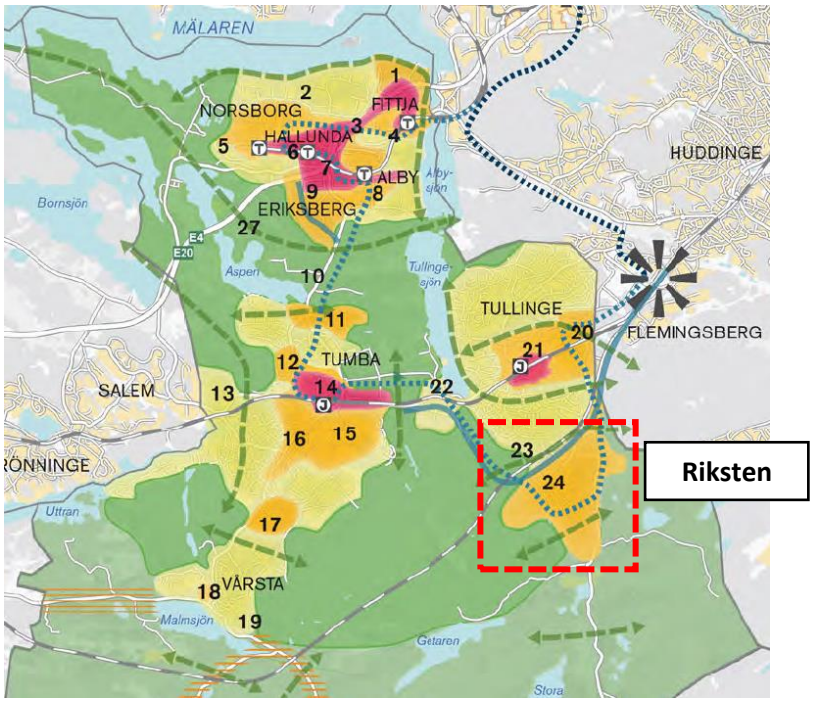


Figure 14: Clipping of the land use map of Botkyrka as planned in the 2014 Comprehensive Plan. The densest areas are coloured in red, the mid-dense areas in orange and the less dense areas in yellow. Riksten is indicated by number 24, and it is possible to see the hypothesis of the tramline, represented by the blue dotted line. Source: Botkyrka kommun, 2014, p.9.

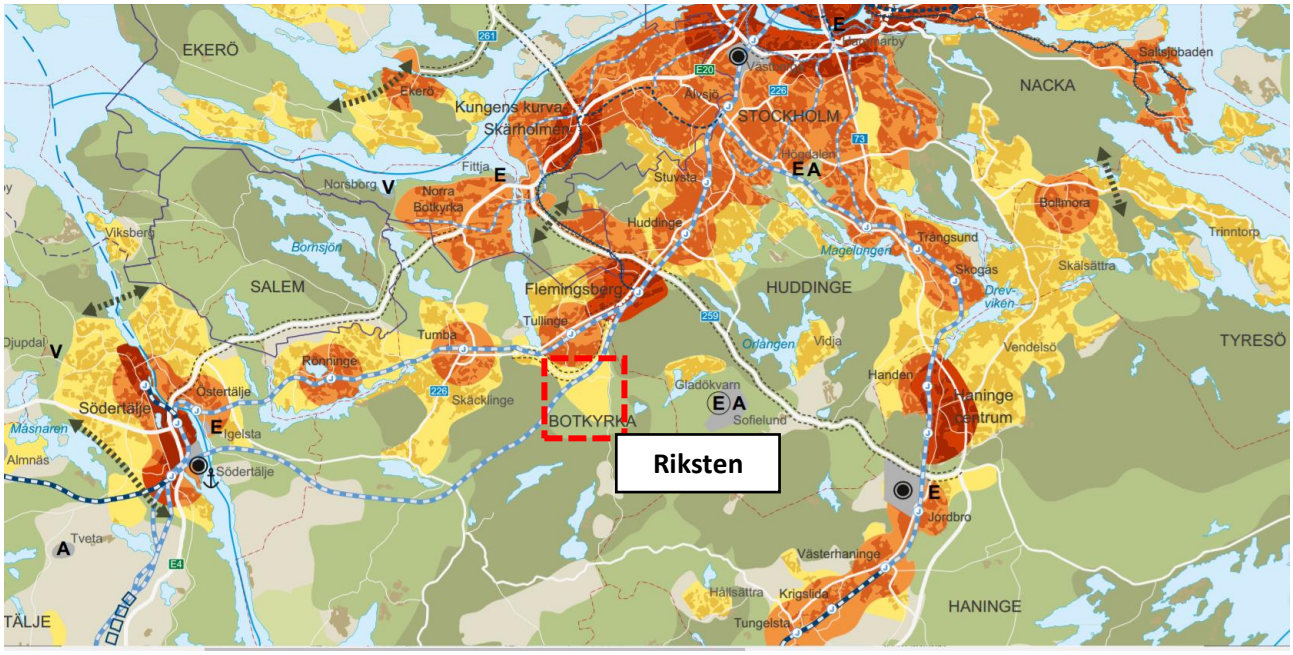


Figure 15: Regional Classification of the urban areas. In yellow: Other urban areas. In orange: Regional urban areas with developing potential. In red: Regional urban cores. Source: Regional Utvecklingsplan För Stockholmsregionen (RUFS) 2010, p. 154.

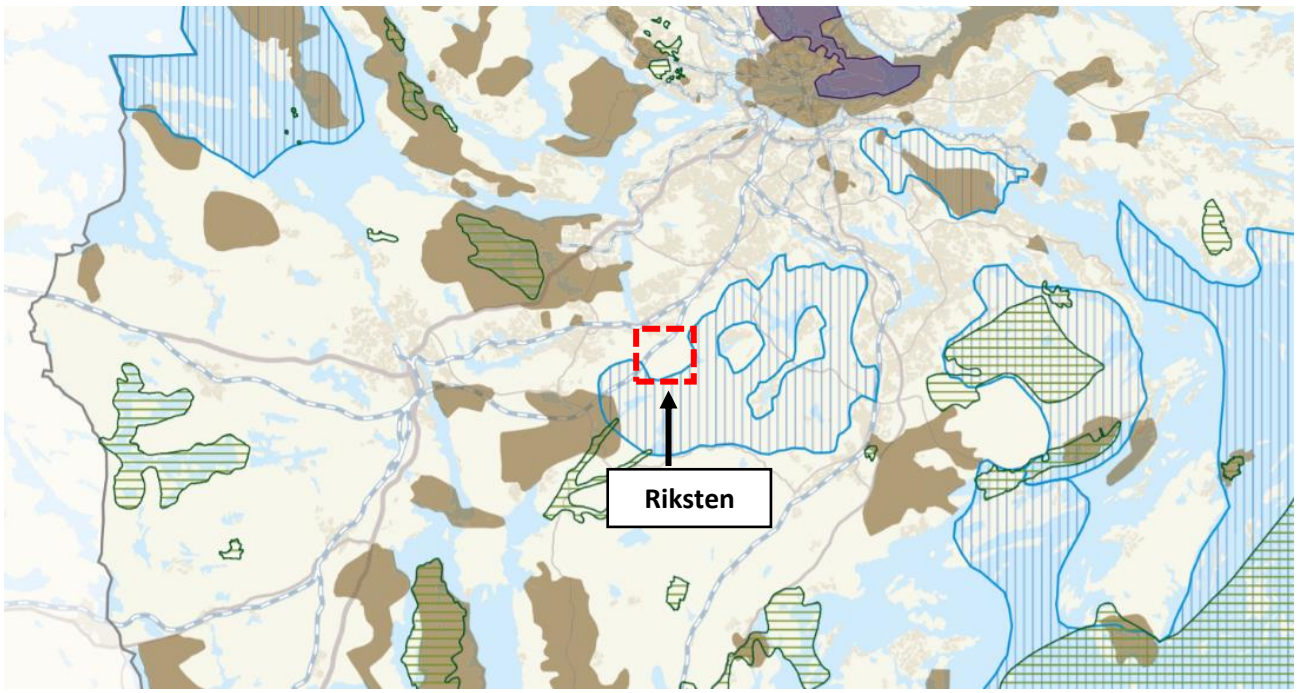


Figure 16: Classification of the areas of national interest for nature conservation (Green stripes), cultural heritage (Brown), and outdoor life (Blue stripes). Further, in violet: The national city park. Source: Regional Utvecklingsplan För Stockholmsregionen (RUFS) 2010, p. 213.

Historical buildings and role of Biografen Sländan

In Riksten the evidences of the military past reveal themselves not only in the local toponyms, but also physically. In fact, besides the old and still visible runways, which are gradually been covered by the residential developments, there are several military buildings whose functions have been transformed. For instance, some barracks have been transformed in student apartments, while in some others there are local companies or commercial activities (Botkyrka kommun, 2003). A particular role is now played by the former administration building (see Figure 17), now called "Biografen Sländan", which is a cinema and a meeting point for the local community, as emerged by a field visit11.

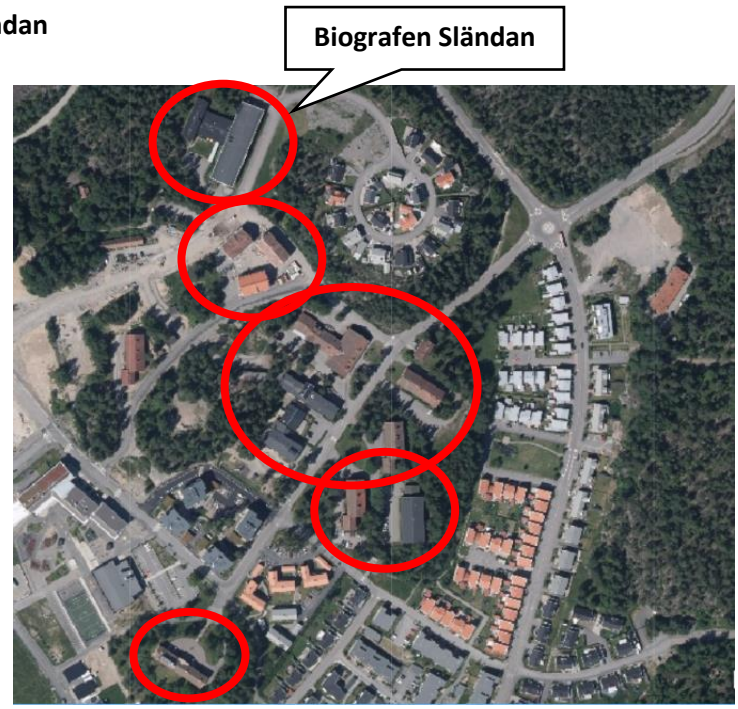


Figure 17: zoom on Riksten military buildings, in red circles.

[11] The 4th of May, in occasion of the planned meeting with the test traveller project participants.

4.4 Critique of the developing project

As emerged by a comparison between the detailed plans and the actual situation in Riksten and by talking with the civil servants working at the test traveller project in Botkyrka, there are some aspects about the physical planning of the area that currently need to be improved. In order to obtain an insight on these issues, I have conducted an interview with Åsa Hansson (project leader at the roads and parks unit) and Ebrahim Khajeh Zadeh (traffic planner) the 12th of June 2017.

Currently, the municipality is addressing some aspects of both the planned and the already existing parts of Riksten. For this reason, the detailed plans regarding the south-eastern areas have not yet been published online, and the municipality is currently working on their improvement.

The urban planning of the area took place at the beginning of the 2000s, when the standards considered where lower than the present ones, for example regarding the cycle paths. Therefore, the municipality has taken upon itself the responsibility of building the new roads and the infrastructure, in order to improve its quality. In fact, when the contracts were signed the demand for new housing in the area was low, and it was not very profitable for the developer to build there, and the municipality decided with them certain minimum requirements, which however are no longer actual.

Regarding the cycle paths, which are here taken as an example, it can be seen that the plans have always vague terms and descriptions when referring to them, like “generous cycle paths, integrated in the street space, simplify the everyday contact with schools and pre-schools” (Botkyrka kommun, 2010, p. 14), or “Overriding pedestrian and cycle sections should be separated as far as possible from the car traffic and organised in a green environment” (Botkyrka kommun, 2008a, p. 39) or even ”The overriding pedestrian and cycle paths lie as separate pedestrian and cycle ways in the ordinary road network” (Botkyrka kommun, 2008b, p. 5). As it can be seen in figure 19 the cycle paths are not recognisable, there are no signs (but they should be), and they look like usual sidewalks, with the presence of accesses to houses and garbage bins. When asking the civil servants interviewed about this issue, they acknowledge that without a precise description, the state of art of the cycle paths might be the correct interpretation of the plan.

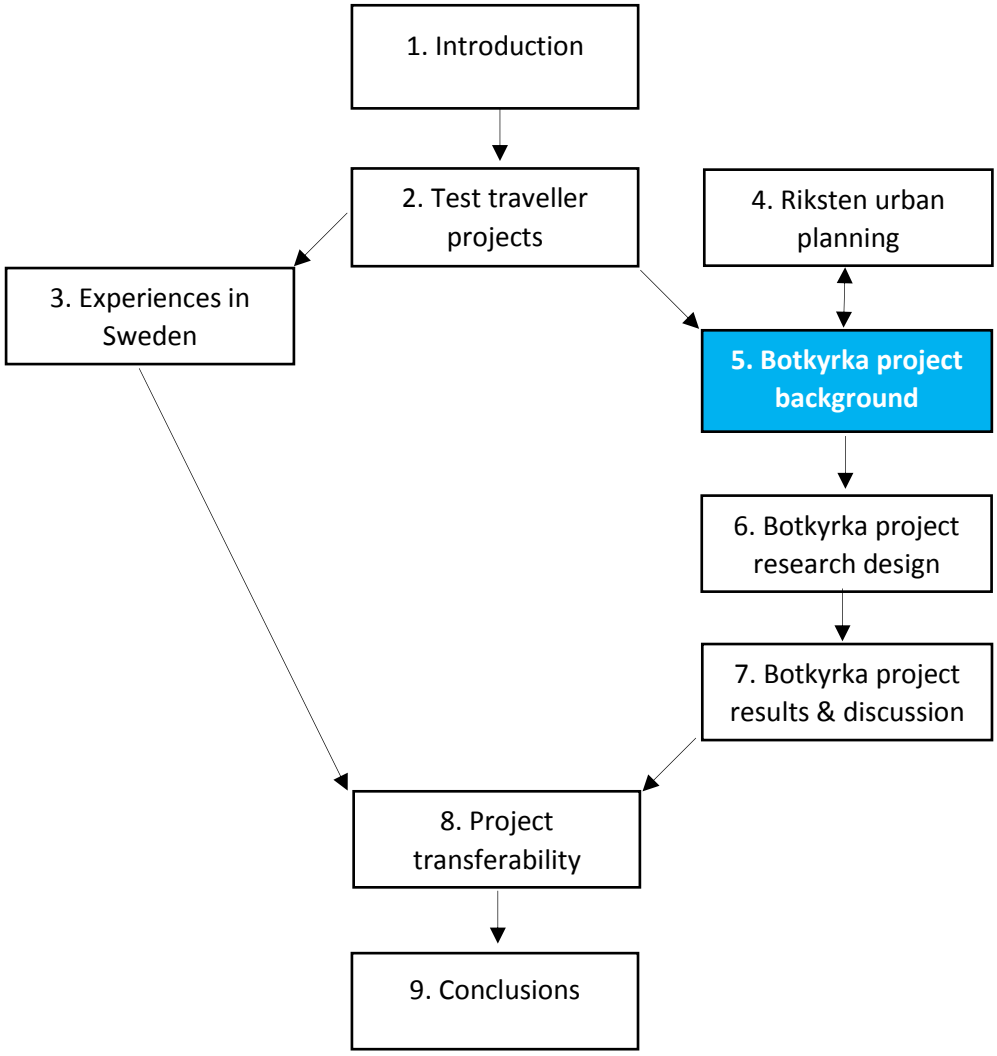
Figure 18: Flottiljvägen, in Riksten. The left side is considered a pedestrian and cycle path. Author’s photo.

Furthermore, the public transport network for the area has been planned (Figure 20), but there is not a time plan for its implementation during the developing process of the area. Riksten area has started to be transformed already more than 15 years ago, and its construction is planned to be completed in 2030. For example, there is an ongoing discussion about whether to build a temporary turnaround for the buses (the red circle in figure 19), or to wait until that street is completed and let the bus continue on it in order to reach Flemingsberg station (as it has been planned to be).

Figure 19: planned bus network in 2030 Line 711 is connecting the area to Tumba and Flemingsberg, in addition to line 721 connecting Riksten to Tullinge station. Source: Trafikförvaltningen Power Point, clip provided by Åsa Hansson (employee at Botkyrka municipality).

5 Botkyrka project background

This chapter provides a description of the context in which the test traveller project in Botkyrka municipality took place, and it presents the preconditions for enabling its implementation. There is therefore a description of the characteristics of Riksten (the project area in Botkyrka) and how the test traveller project has been organised.



5.1 Characteristics of the area

Work, leisure and activities

In Riksten there are only few leisure, shopping and work opportunities. There is a small cinema, a restaurant and a supermarket. There are no other shops. There are only two pre-schools and an elementary school. Right beyond the high-speed railway tracks, towards north, there is a sport centre. For all the other activities, services and work opportunities, nowadays residents have to travel at least some kilometres, to Tullinge station, for example.

Inhabitants' characteristics

The inhabitants of Riksten present particular characteristics, different from the rest of the municipality. Here after comes a short summary. This information and data has been found in the database of Sveriges lantbruksuniversitet (2016) and Botkyrka kommun website (statistic portal section).

- *Income:* In Tullinge income levels are around 25% higher than the municipality average.
- *Families*: in Riksten families are usually made of one or two adults with children. There are only few elderly and teenagers.
- *Foreign background*: Swedes are the vast majority of the inhabitants. In the rest of Botkyrka around 57% of people have a foreign background.
- *Education*: Riksten inhabitants have significantly higher education levels than the rest of Botkyrka.

Transportation options – alternatives to car use

Public transport

There is currently one bus line, line 721, connecting the area to Tullinge station, 3 km away, from which there are frequent commuter trains (up to every seven minutes) towards Stockholm (23 minutes to Stockholm Central) and other regional centres, and six other bus lines. Nowadays, only 27% of residents' commuting starts with bus line 721 (Burazor, 2016), which on an ordinary weekday has a frequency of 10 or 20 minutes during the peak hours and 30 minutes during the rest of the day, starting the service around 5:30 am and ending at around midnight (see attachment 4). There are two possible routes for bus line 721: a longer one, which goes throughout the area between Riksten and Tullinge station (16 minutes), and an express route, travelling on the most direct route towards the station (11 minutes). During off-peak hours the buses follow the longer route, whereas during peak hours departures of the two different paths alternate. Even if the timetable has a clock-face scheduling, it may be not intuitive or convenient to have an express bus 10 minutes after the longer route bus, and then 20 minutes without a departure. In figure 20 it is shown the public transport network in Riksten and its surroundings.

From the beginning of 2017 the prices of the public transportation in the Stockholm County increased (AB Storstockholm website). The best way for people who frequent travel, and especially for the recurrent trips such as the commuting, is to have a period ticket. In order to have a period ticket, one must own an SL access card (see figure 21).

Cycling

From Riksten, it is possible to reach some places of trips attraction in the surroundings (for leisure/shopping, study and work) and the distances are not excessive: Tullinge station 3 km, Södertörn university and Huddinge hospital 6 km, Tumba station 6.5 km. Nowadays, only 4% of Riksten residents use regularly the bike for commuting (data collected at the beginning of November 2015) (Burazor, 2016).

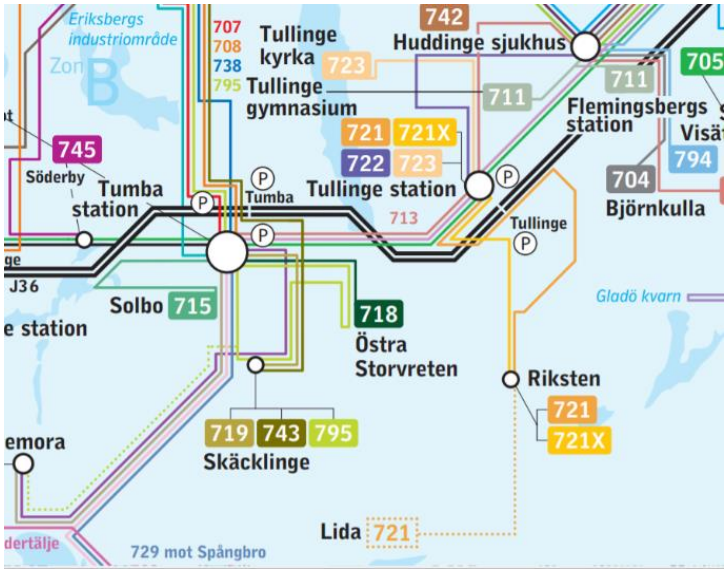


Figure 20: Public transport network in Riksten and in the immediate surroundings. Source: Cutting of the public transport map of Botkyrka Huddinge and Salem (Linjenätskarta Huddinge Botkyrka Salem), available on AB Storstockholm lokaltrafik.

Figure 21: An SL access card. Source: Sahlén, 2013

Combining modes of transport

Due to the distance between Riksten and Tullinge station, it is not feasible to walk to it as part of a normal trip to work or for other activities, but it is possible to cycle there. By the station there is a weather shelter for bicycles, which may be used by whoever would like to leave the bike there and continue the trip with a train or a bus.

By Tullinge station there are parking spaces for cars (270 places in total) (SL website), which however are fully utilised by commuters (Burazor, 2016; COWI, 2017).

5.2 Riksten pilot project

Why Riksten?

Riksten is not located close to a transportation hub (the nearest one, Tullinge station, is 3 km away), the transportation options alternative to the car use are limited, and literature shows that socio-economic characteristics as the one present in the area are imply a high propensity to car use. Hence, one may wonder why to choose this area, instead of other parts of the municipality. Hereafter the reasons are listed:

- Riksten is a developing area, with people that have recently moved-in, hence more open to a change of their travel behaviours, and maybe families there would not buy a second or even a third car. Further, the project leaders decided to focus on Riksten because they want the area to not have a high car use already at the beginning of its development and they will continue to make effort to keep car driving at a low level.
- The residents in Riksten present certain socio-economic characteristics (affluent, well-educated, etc.), and they are the ones that use the most their cars (only in other areas in the municipality tht are more isolated but with similar socio-economic characteristics the car is used more, i.e. Grödinge and Vårsta). Therefore, the municipality wants first of all to reduce their car use.

- If the project succeeds, it will prompt the municipal council to carry out a test traveller project on a larger scale in the rest of the municipality, where conditions are more favourable and suitable for a major reduction in car use.
- The percentage of people using the car in this area is higher than the municipal average, because the car is used in 67% of the cases. It is also higher by 8% if compared to the Tullinge district, where Riksten area is located. As explained later, there is a certain potential for making people change their travel habits, and this area turns out to be an interesting experimentation.

Actions and activities

The municipality tried to negotiate with Trafikförvaltningen and Keolis Sverige some changes and improvements to the existing local bus network and infrastructure. In order to make changes in the timetables, these changes must be approved at least 3 months before that they go into effect, therefore by the end of January at the latest in this case, and they have to go through a decisional process. Therefore, due to the relatively short notice given by the municipality (the first meeting with Trafikförvaltningen took place the 18th of October) it had not been possible to meet any of the municipality's demands by Trafikförvaltningen and Keolis.

Botkyrka municipality has also sought to obtain from Trafikförvaltningen of a certain amount of public transport free tickets to distribute to a selected group of Riksten residents, but neither this request was met. The reasons given were that at the time Trafikförvaltningen was undergoing some internal changes and that test traveller projects were not seen by some in the organisation as an effective method for increasing public transport use and decreasing car use.

The validity of the tickets was initially thought to be two weeks, but Trafikförvaltningen did not allow the municipality to buy two-week tickets. This news from Trafikförvaltningen came very late, after that the first letter was sent and after that the reminder letters were already printed.

The municipality managed to complete the installation of the traffic signs for cyclists along the fastest route between Riksten and Tullinge station at the beginning of April, resulting in having it ready before the test traveller project. However, these signs miss the names "Riksten" and "Tullinge station/centrum" and there is no indication of either the distances or the estimated time required.

Before the beginning of the trial period, the municipality sent to the participants information about the public transport services in southern Tullinge (where Riksten is located) in order to reduce a possible lack of knowledge. Further, along with this information, the municipality presented the advantages of using public transport and suggested trying out to cycle the distance between Riksten and Tullinge station as part of their commuting. This kind of information and communication may be considered as a technique of social marketing. Social marketing methods consist in giving general information to the public about alternative transport modes and the advantages for them and/or the environment (Thøgersen, 2007; Brög et al., 2003; Meloni et al., 2012; Richter et al., 2009a; Richter et al., 2009b, Bamberg et al., 2011).

In order to be able to conduct an evaluation of the project both in the short and in the medium run, it had been decided to have three surveys. One before the trial period, one right at the end of it, and one after three months. Further, in order to have an answer from all project participants, it was established that they would have to refund the card value and its period validity to the municipality.

Available data

Riksten mobility survey – 2015: A study about the residents' mobility patterns and behaviours were conducted by Botkyrka municipality in autumn 2015, almost at the same time as the County survey. 292 people (out of the 1010 contacted) completed the received survey. The data acquired gives the opportunity

to better understand residents' mobility patterns and their view on existing transport offer (Burazor, 2016). The main result about Riksten inhabitants' commuting is presented in Figure 22. Interestingly, the results of this survey have been similar to the results of the County survey for the Tullinge district, with the difference that in Riksten car use was higher (by around 8%) and cycling was lower (by around 3%), but it must be taken into account that the county survey took place in the period 12 September – 25 October, whereas Riksten survey in the period 30 October – 20 November. Other interesting finding is that around 72% of the commuting takes place during the peak hours (7 - 9 and 15 – 17) both by car and by public transport. Furthermore, it is to highlight that 53% of men commutes only by car, whereas only 29% of women do the same. Correspondently, women use public transport more than men (respectively 49% and 34%) (data from Burazor, 2016).

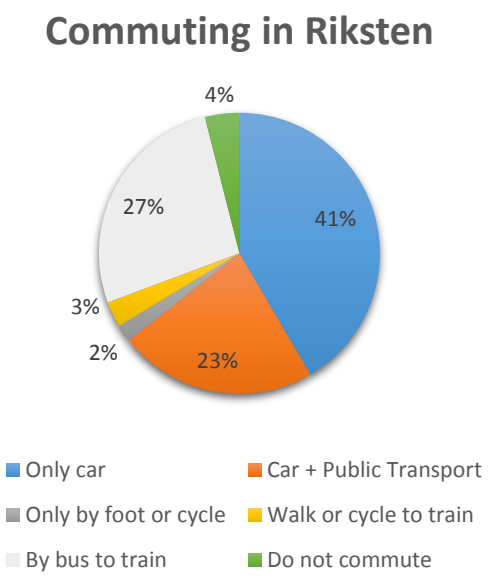


Figure 22: Commuting in Riksten – municipal survey (data from Burazor, 2016).

Residents' characteristics – 2013 - 2015**:** Data about Riksten inhabitants' characteristics of the years 2013, 2014 and 2015 (Sveriges lantbruksuniversitet, 2016), in particular, among others, age groups and income levels.

Potentialities

Regarding the potentiality of increasing public transport use in Riksten, the 2015 survey conducted by the municipality is of help. More than 42% of those who commute only by car and 36% of those who commute partly by car and partly by public transport stated that they would use bus line 721/721X if it had a higher frequency. Another question asked if drivers would use the public transport if there was a direct bus connection between Flemingsberg/Huddinge hospital and Riksten. In this case, the percentages of those who only use the car was 17%. Further, another question investigated the desire of more express buses (therefore line 721X, not 721), and among car drivers 34% said that they would use more the bus in this case. In total, around 80% of the car drivers who answered the survey stated that they would change their travel habits at a certain condition, therefore it was definitely not a complete rejection of public transport.

Project preparation

Before the actual conduction of the project, a careful preparation was needed and required. In facts, the first steps were undertaken already in October 2016, 6 months before the actual beginning of the project. Hereafter all the relevant stages are listed.

- *Literature background and information about other projects.* Starting from September 2016 the municipality started to gather information and theory background about test traveller project. This information has been provided mainly by the researcher, but they also succeeded in finding relevant material and data, in particular from the neighbouring municipality of Huddinge and from the municipality of Tyresö, which are other municipalities in the Stockholm County.
- *Contacts with Trafikförvaltningen (Stockholm public transport administration).* The 18th of October the project managers had a meeting with Trafikförvaltningen, in order to explain to them the motivations and possible advantages for carrying out a test traveller project. Unfortunately, Trafikförvaltningen did not show much interest in collaborating to the project. The project managers tried to further have contacts with the Stockholm public transport administration, but these attempts were not fruitful. People working at Trafikförvaltingen responded that an internal discussion would

have been commenced, but even in case of positive results, it would have not been possible to actively collaborate at the project due to the imminence of the project.

- *Contacts with marketing and promotion companies.* The project managers have contacted a private company that provides services for municipalities and transport authorities that want to carry out test traveller projects. These services include advertisement, organisational support, follow-ups and the realisation of a report after the project. After a meeting with them, it was decided not to use an external help for the project, due to the limited funds and to the limited size of it. It was then employed a company for the graphics of the letters the surveys.
- *Contacts with Keolis Sverige.* The project managers contacted the transport company that operates the public transport service in Riksten, bus line 721. The purpose was not only to inform them about the project, but also to ask for some changes in the rush hour timetable (a clock-face scheduling every quarter), but without adding new departures, and a lengthening of the route, with two new stops (in Friluftsvägen and in Hanvedens Allé).
- *Contacts with politicians and municipal council deliberation.* In the beginning of February, the municipal council was contacted and the politicians were given a short summary with a description and the purpose of the project. After around two weeks, they approved the project.
- *Preparation of the letter and the preliminary survey.* During February and March various meetings were held in order to decide how to structure the letters and the surveys to send to Riksten inhabitants. After that, this material was sent to the graphics company.
- *Sending of the letters* (7th of April) to all car inhabitants in Riksten aged 18 – 65, 1426 persons. The letters included a preliminary survey asking few questions about travel habits (attachments 5 - 7). The envelope sent contained: a letter explaining the purpose of the project. The preliminary survey to fill in, in which it was asked the applicants some information about their travel habits and about themselves, to be returned to the municipality. An empty envelope addressed to the municipality, with postage already paid, to be used for sending back to the municipality the filled-in application.
- *Order of the tickets* (11th of April).
- *Reminder* to prompt Riksten inhabitants was sent the 20th of April.
- *Selection of participants and sending of the letter* with all the necessary information and the SL Access card (21st – 22nd and 26th of April, plus 2nd and 3rd of May)

Requirements for becoming a test traveller

For becoming a test traveller, the applicant should have been a habitual driver. This means that he/she must not use the public transport as a main mode of transport for his/her travels, therefore all those who were using the public transport more than the car would have been excluded.

5.3 Problems encountered

During the preparation phase and during the implementation of the project numerous complications emerged, and they are hereafter briefly presented.

Trafikförvaltningen

Despite Trafikförvaltningen has the goal of increasing the share of public transportation in the Stockholm County (Trafikförvaltningen, 2017), they showed little interest in taking part to the project, despite the municipal efforts, and it has been difficult to identify the right person to whom to speak about the various issues connected to the project. This resulted in a delay of the meeting with Trafikförvaltingen. Further, the contacts with them have been difficult due to intermittent answers and slowness of their responses and their decisions. In fact, the municipality had to adapt to their decision to not to sell two-week tickets but only one-

month tickets, which costed more to the municipality. Moreover, no discount was granted, even if they are both public bodies and despite the purpose of the project and its positive outcomes for Trafikförvaltningen itself. Furthermore, because of this late decision, the first letters inviting people to participate and the reminder had written on a period length of 14 days instead of the actual 30 days. Further, in the contacts with other municipalities in the County that had already conducted a test traveller project, one of them has been intentioned to carry out another project, but they too hit the Trafikförvaltningen's disinterest wall. It is however peculiar that Trafikförvaltningen has been reluctant to engage and participate into new test traveller projects, because they have already carried out other successful projects in the County.

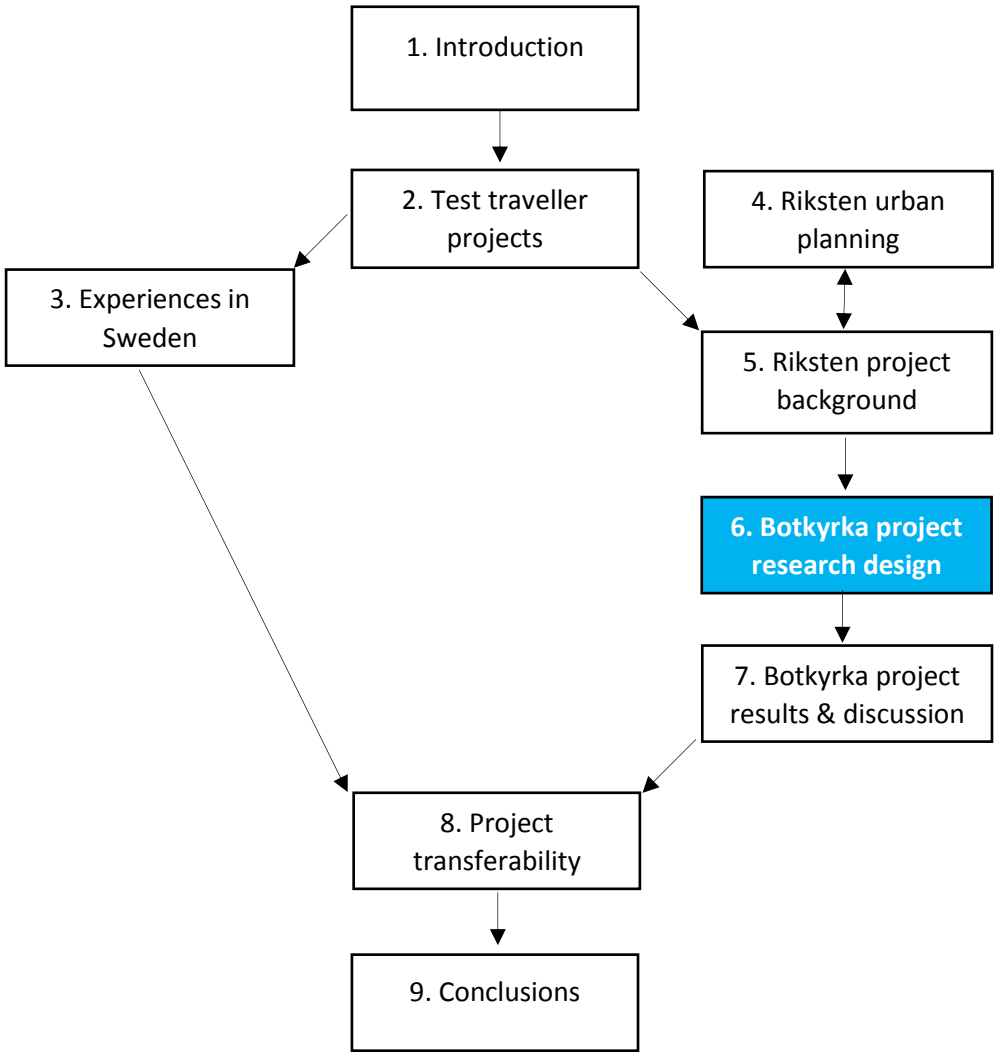
It was requested to Trafikförvaltningen that the SL Access cards bought would have been automatically blocked in case of non-activation within the end of May. This was not granted, because the cards would have been automatically blocked only after 60 days from the day of the order (the 18th of April) but in the letters sent it was however written that the cards would have expired after May if not used.

Keolis Sverige

Keolis Sverige demonstrated interest in Riksten project, but their contribution was not possible, due to the too short notice given to them. Therefore, the project did not benefit from nor the small adjustments to the route and the timetables Keolis Sverige had been demanded for, nor from some bigger changes at the service for which Trafikförfvaltningen had been demanded.

6 Botkyrka project research design

In this chapter is explained how the test traveller project in Botkyrka has been analysed. The chosen method for analysing travel behaviour has been the Theory of Planned Behaviour. In this chapter, the explanation of this theory goes in parallel with the methodology used and the explanation of the questions asked in the surveys. In the first part of this chapter is presented why it has been chosen the Theory of Planned Behaviour and the practical methodology. In the second part there is an explanation of the questions asked in the surveys.



6.1 How travel behaviour changes have been measured

What is the Theory of Planned Behaviour?

The theory of planned behaviour (TPB) has been developed in psychology by Ajzen (1985; 1991) in an attempt to produce a method that could be used for explaining and predicting people's behaviours and choices. TPB is a modification of the previous theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which was limited by the lack of accountability for conditions external to one's volitional control. This theory has had plentiful applications in numerous disciplines, and it has been largely used in the transport field, as opposed to discrete choice models for predicting one's transportation choices (Busch-Geertsema & Lanzendorf, 2016).

TPB, as well as the theory of reasoned action, assumes that one's decision are made in a rational way, even if one's beliefs are irrational and unfunded (Bamberg & Schmidt, 2003), and it assumes that there are several components that contribute to shape that decision. In figure 23, the main components of the theory are presented. Attitudes, SN and PBC had been recognised by Ajzen not to be the only factors that has a role on the formation of intentions and behaviours. Since the formulation of the theory (i.e. Ajzen 1991) the author has suggested that other components may exist, and has called for further research on the issue.

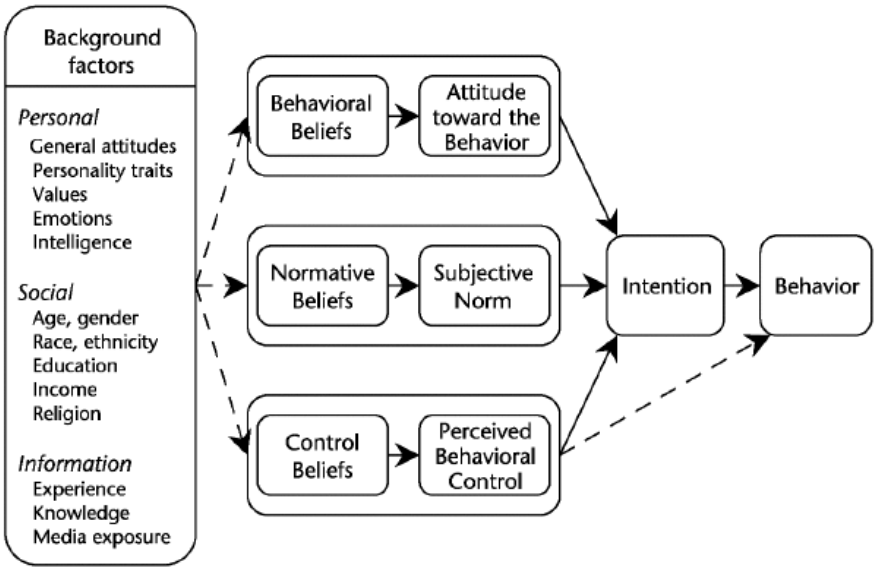


Figure 23: The role of background factors in the theory of planned behaviour. Source: Ajzen, 2005, p. 148.

Why TPB?

Theory of Planned Behaviour is being employed here for understanding reasons why some car drivers change travel habits and others do not, and how actually the trial period modifies perceptions and beliefs about public transport among project participants. Despite the range of theories available for understanding and explaining the processes and the underlining reasons that lead to a certain decision, TPB seems to be the most appropriate for the present work.

TPB is flexible

Ajzen, the proponent of the theory, in 1991 acknowledged that TPB could be extended if additional cognitions would have increase the theory predictive power. Hence, during the years several studies have contributed to better specify different components and have added new knowledge, such as the ROA model (Busch-Geertsema & Lanzendorf, 2016) and environmental concerns (Bamberg et al., (2011).

TPB is one of the most used theories for predicting a specific behaviour and it has a good predictive power.

TPB has been applied in a wide range of contexts. In particular, the aim has been to study the cognitive determinants that are assumed to contribute to travel behaviour and to study the effects of interventions on travel behaviour (Thøgersen, 2009; Mann & Abraham, 2012; Gardner, 2009; Egmond & Bruel, 2007; Ajzen, 2001). In fact, TPB "suggests that, faced with a new or unfamiliar choice situation, an actor will deliberate and form an intention to choose the most attractive goal-directed option, which will inform subsequent action" (Gardner, 2009, p. 68) Moreover, the theory's predictive power is generally quite high in comparison to other psychological models, up to more than 50% (Mann & Abraham., 2012).

TPB habit approach

TPB, with its further developments, takes into account habits and habitual behaviour, which usually are not considered in Motivation-Opportunity-Abilities models (Gardner, 2009). Several authors, for instance Bamberg & Schmidt (2003), Møller & Thøgersen (2008) and Thøgersen (2012), have addressed this issue in their works, investigating habits role in TPB framework.

Norm-activation theory and pro-environmental issues

Pro-environmental issues, habit discontinuity hypothesis and the self-activation hypothesis, which are all elements tackled by the Norm-activation models (Verplanken et al., 2008) are acknowledged and integrated in TPB framework used in the present work.

TPB allows quantitative measuments

TPB model is static. This is because in the model the formation of a behaviour follows a precise cognitive path. Further, the model considers the subject in a certain moment of time, while it does not consider the subject's life events as well as his/her experiences and learnings during the experiment. Other approaches consider the changes generated in the subject from a more dynamic perspective, as in panel studies (Lanzedorf, 2003).

A TPB approach considers people as aggregates and not in their individuality. It operates a decontextualisation, because it "assume[s] that people choose option or activity-travel pattern that provides the highest level of utility" (Dijst et al., 2008, p. 831).

TPB approach, thanks to its static nature and its considering people as aggregates, it is measurable. Therefore, it allows the quantification of the more psychological elements, which can be used for statistical analyses. TPB, however, does not consider the feedbacks given to the subject by the experience produced by performing a new behaviour and the adaptation of the subject to those feedbacks. In the study conducted in Botkyrka, this shortcoming has been partly addressed by specific questions in the follow-up surveys after the test traveller project.

External and internal factors

TPB is able to combine both internal factors, such as perceptions or beliefs, which is subject dependent, and external factors, on which the subject has no or limited control. The latter is an addition to the theory of Reasoned Action, as Ajzen (1991) explains, aiming at covering non-volitional behaviour. TPB has been nevertheless criticised for lack of accountability of background factors in its model, but with the addition proposed by Busch-Geertsema & Lanzendorf (2015), the ROA model, background factors are included.

Surveys: how and why

In order to obtain detailed information about residents' travel behaviour, it has been essential the use of three surveys, according to TPB method only through survey is possible to evaluate the effects on people's

behaviour Thøgersen, 2009). The surveys distributed were one before and two after the trial period[12]. The questions asked in the surveys are structured in order to reflect on the various components of travel behaviour, according to the Theory of Planned Behaviour.

The questions of the surveys that have been utilised for measuring TPB components have been replicated or inspired from the works of Thøgersen (2009), Bamberg & Schmidt (2003), Verplanken et al. (2008) and Verplanken & Orbell (2003). The question chosen were closed-ended questions. The section about the test period in the second and in the third survey has been inspired by reports written or commissioned by Swedish transport authorities and municipalities.

Attention has been payed to keep the questionnaires as short as possible, so to avoid stressing the respondents and maintaining as much as possible their attention when answering the surveys. For this reason, some questions that seemed very alike, but present in the works aforementioned, were not added. The process of selecting questions has been done with the help of the municipal civil servants.

Closed-ended questions used were mostly ordinal-scale questions, meaning that the respondents were asked to indicate where in their opinion they would fit the best in the continuum scale presented. The scale used for each item is been six-point, presented with a bipolar fashion (from a negative evaluation/statement or a disagreement to a positive evaluation/statement or an agreement). Regarding the elements of the scale, Ajzek's work (1991) suggests that an optimal scale should be made by six or seven elements, whereas Thøgersen (2007) in his work about the Copenhagen case used a five-point scale. The use six-point scale items – an even number – was intended to avoid a concentration of answers at the middle-point of the scale and to force the respondents to tend towards one of the two end points. Some questions in the second survey about the test period contain five alternatives, allowing for a middle value. This is because in those cases was useful to know if participants' point of view was neutral in regard to the trial experience.

At the beginning of the three surveys, project participants were thanked for their participation and reminded that their contribution with filling in the surveys was important for the project evaluation. The control group were also thanked for their voluntary contribution to the project. Participants have been also asked in the first and in the second survey to specify if they would have preferred to receive the subsequent questionnaires via e-mail instead of via mail. This has been done in order to reduce pollution and resources use and in order to make easier the data collection.

The control group

The surveys have been distributed not only to the project participants, but also other 400 inhabitants of Riksten who did not apply, who have been later adopted as control group. The control group had been chosen in order to resemble the age subdivision of the project participants. The purpose of the control group was to control for changes in the local conditions that may have influenced the project participants.

The control group received only the first and the third survey, in order to control for changes at the beginning of the project and after its conclusion, and in order to compare the control group results with the project participants results. In particular, the third survey can show if the effects of the test traveller projects are significant in comparison with results of the non-participants. It had been decided to not send also the second survey to the control group, first deeming that it would have been too difficult to ask people to voluntarily answer another survey, and second deeming that it was not essential for evaluating the project and checking for external variables as the third survey would have already performed that task.

[12] 26th April – 5th May the period for answering the first survey, 5th – 16th June the period for the answering the second, and 28th August – 4th September the period for answering the third.

The first survey sent contained a section with questions that had been asked to the project participants in the preliminary survey.

As an incentive and as a thank for their voluntarily contribution, in case they responded to both surveys they received a cinema ticket.

The control group has been then divided into car drivers, which use the car for the whole or a part of the trip to work, and public transport users, who do not use the car for reaching the workplace[13]. The analysis of the two groups has been conducted separately, in order to have the right comparison between car drivers only, participants and non-participants, and between public transport users only, participants and non-participants.

How biases and inaccuracies have been avoided

Voluntarily participation. Participants to the project decided to voluntarily take part, which implied a certain degree of commitment and interest, and it required a counter performance requested to them (answer the three surveys). Therefore, it is clear that such a project does not take into account all the other residents in the area who received the invitation to the project but did not show interest into participate. The same bias occurred for the other test traveller projects analysed in the literature and in the other cases in Sweden. Moreover, the fact that the project participation was voluntarily remarks the critique that this project alone is not a solution, because it does not have effects on the non-participants. For avoiding this bias occurring, the control group seemed a viable solution, as it makes possible to, indeed, control for behaviour, attitudes and beliefs of other people living in the area including those not interested in participating to the project. This makes possible to investigate reasons for non-participating and reasons for continuing to use the car.

Translation. One of the problem encountered has been the difficulty to find the right words and expressions to conveying to the surveys' respondents to what exactly was requested by the questions. This is because the literatures used was all in English, while the survey were in Swedish, so in some cases it has not been feasible or viable to literally translate questions, and in some cases the meanings might have slightly shifted.

Superlative and central value. Another aspect taken into account has been the Swedish culture, the concept of “lagom”, meaning “just the right amount”, “moderate, “average”, “neither too much nor too little” (Orange, 2017; Svenska Akademiens ordbok, 1939). In fact, in the questionnaires it has been as much as possible avoided to formulate questions containing superlative forms of adjectives. This fact has also been an element that contributed to the decision to use a six-point scale instead than a five or a seven-point scale for most of the questions. By this, it has been avoided to have a central value representing a neutral position.

6.2 Attitudes

$$A \propto \sum_{i=1}^{n} b_i e_i$$

Equation 1: Method for calculating attitudes

Attitudes “refers to the degree to which a person has a favorable or unfavourable evaluation or appraisal of the behavior in question” (Ajzen, 1991). Attitudes are formed by the aggregation of the various Behavioural Beliefs, which represent the beliefs about possible and expected consequences of that action under scrutiny. ‘The strength of each salient belief (b) is combined in a multiplicative fashion with the subjective evaluation (e) of the beliefs attribute, and the resulting products are summed over the n salient beliefs. A person’s attitude (A) is directly proportional (a) to this summative belief index.’ (Idem, p. 191).

[13] Less than 10 km per week by car for reaching the workplace/educational institution.

Recent additions to TPB: instrumental, affective and symbolic factors that form attitudes

Instrumental factors, considered by cognitive-reasoned behaviour models, encompass attributes like flexibility, speed, reliability, comfort, etc. (Steg et al., 2001). They can be short term, referring to a particular trip, or long-term, referring to factors as health or environment (Anable & Gatersleben 2005). Affective elements refer to the feelings that are evoked by travelling, which can be stress, pleasure, boredom, etc. (Anable & Gatersleben, 2005). Symbolic attributes are sometimes related to affective category (Bergstad et al., 2011), and refer to attributes such as 'autonomy, status, excitement and privacy, which 'depend strongly on processes of social interpretation' (Haustein & Hunecke, 2007, p. 1859)'. The 'independence' component has been included among symbolic attributes by Hunecke et al., 2007, but according to Bergstad et al. (2011) this can be included in the instrumental category.

Questions asked in the surveys

Types of questions: closed-ended questions, with a six-point scale of possible answer.

Question: **"How is your attitude towards public transport?"** Options of the scale: from "negative" to "positive". *Purpose*: this is a general and quick indicator of respondents' attitudes public transport. *Identifier*: "A1".

Question: **"I can be sufficiently alone/ I can have enough privacy when I travel by public transport".** Options of the scale: from "negative" to "positive". *Purpose*: to evaluate if respondent perceives enough privacy when using public transport, he/she can have enough privacy and be left alone in his/her private sphere (part of the symbolic attitudes). *Identifier*: "A2".

A table with as a heading **"To travel by transport is for you:"** made of six rows with a six-point scale from "agree" to "disagree" as end points, with an adjective per row: "**comfortable**", "**relaxing**", "**agile/easy to use**" and "**good**". *Purpose*: to evaluate how various aspect of travelling by public transport are perceived by a person, therefore how and in what ways the respondents consider positively or negatively some features of that (part of the instrumental and the affective attitudes). *Identifiers*: "A3", "A4", "A5" and "A6".

6.3 Subjective norm

Subjective norm refers to the social pressure exerted by other people, in particular from opinions and expectations of people that matter to individual and one's motivation to comply and conform to their opinions and expectations. 'The strength of each normative belief (n) is multiplied by the person's motivation to comply (m) with the referent in question, and the subjective norm (SN) is directly proportional to the sum of the resulting products across the number of salient referents.' (Idem, p. 195).

$$\mathrm{SN} \propto \sum_{i=1}^{n} n_i m_i.$$

Equation 2: Method for calculating Subjective Norms

Descriptive norms

As before mentioned, Ajzen left the theory open to further additions and/or modifications. TPB, in fact, presents a certain discrepancy between intentions, measured through attitudes, PBC and subjective norm, and the actual behaviour. Ajzen thought that this discrepancy might be partly explained by taking into consideration other factors, which could have been be disclosed by a future research, in order to obtain a more accurate prediction of the actual behaviour performed. Ajzen (2011) himself later theorised that the subjective norm may be formed not only by the injunctive norms, but also by descriptive norms. Descriptive norms refer to if and how people that are important to the individual engage in that behaviour. This addition to the theory has been proved to explain by 5% the variance in intention (Ajzen, 2012).

Questions asked in the surveys

Types of questions: closed-ended questions, with a six-point scale possible answer that have "disagree" and "agree" as end points.

Question: **"Most of my acquaintances expect that I use public transport for commuting if there is a choice between the car and public transport"**. *Purpose:* to measure the social pressure exerted on respondents by their acquaintances (part of the injunctive norms). *Identifier*: "SN1".

Question: **"Most of my acquaintances use themselves public transport for commuting if there is a choice between the car and public transport."** *Purpose*: to measure the social pressure indirectly exerted on respondents by their acquaintances (part of the descriptive norms). *Identifier*: "SN2".

Question: **"Most people who mean something to me expect that I use public transport for commuting if there is a choice between the car and public transport".** *Purpose:* to measure the social pressure exerted on respondents by those who the respondents consider meaningful to them (part of the injunctive norms). *Identifier*: "SN3".

Question: **"Most people who mean something to me use themselves public transport for commuting if there is a choice between the car and public transport".** *Purpose*: to measure the social pressure indirectly exerted on respondents by those who the respondents consider meaningful to them (part of the descriptive norms). *Identifier*: "SN4".

6.4 Perceived behavioural control

This refers to those beliefs that one may have in relation to external factors (control beliefs) that may hinder to perform a certain behaviour (equation 3). 'each control belief (c) is multiplied by the perceived power (p) of the particular control factor to facilitate or inhibit performance of the behavior, and the resulting products are summed across the n salient control beliefs to produce the perception of behavioral control (PBC).' (Idem, pp. 196-197).

$$\mathrm{PBC} \propto \sum_{i=1}^{n} c_i p_i$$

Equation 3: Method for calculating Perceived Behavioural Control

Perceived controllability and perceived self-efficacy

Ajzen (2002) showed that perceived behavioural control may be intended as two separate components. These are perceived controllability and perceived self-efficacy. The first comprises the "beliefs about the extent to which performing the behavior is up to the actor" (idem, p. 672), and therefore at what extent the person can actively make something happen or actualise a behaviour. The second involves the "ease or difficulty of performing a behaviour" (idem, p.672), therefore at what extent the person is able to do something, relatively for example to his own abilities and skills.

Questions asked in the surveys

Types of questions: closed-ended questions, with a six-point scale possible answer. All questions, except the second and last one, have as options at the two end points of the scale "disagree" and "agree". The second one has "bad" good", and the last one has "easy" and "difficult".

Question: "**If I wanted to I could easily travel by public transport to the workplace/education institution"**. *Purpose*: to know if the surveyed person perceives it easy or difficult to use public transport for the daily commuting. This question also represents an opportunity to actively reflect upon the public transport an alternative (part of the perceived controllability). *Identifier*: "PBC1".

Question: **"I think that the public transport offer in Riksten is:"**. *Purpose*: to obtain an evaluation of the perceived quality of public transport offer in the project area (part of the perceived controllability). *Identifier*: "PBC2".

Question: **"It takes much more time to travel by public transport than by car"**. *Purpose*: to obtain an evaluation of the perceived travel times in case of using the public transport (part of the perceived controllability). *Identifier*: "PBC3".

Question: "**I save money when I use public transport instead of the car**". *Purpose*: to know if the respondents deem that to use public transport it is economically convenient. This question might exclude, at least partially, the costs of public transport as an element that influences travel choice, as it had been shown by the recent project done in Copenhagen (Thøgersen, 2009). However, in that case this question was classified differently, whereas here it is included in the perceived control (part of the perceived controllability). *Identifier*: "PBC4".

Question: **"I know how to travel by public transport (I know the transport offer, I am able to read timetables, find information about disruptions or changes in the service, buy tickets, etc.)".** *Purpose:* to know if respondents believe that they are able to use public transport, and if they are able to minimise and avoid encountering problems that might occur. Car drivers might not be able to use public transport, as some research has shown (Brög, 2003), and therefore this may be a contributing factor for continuing to use the car (representing the self-efficacy). *Identifier*: "PBC5".

Question: **"How easy would be for you to travel mostly by public transport to/from the workplace/education institution during the next month?"** *Purpose*: to know if the surveyed person perceives it easy or difficult to use public transport for the daily commuting in the following month. This question might be seen as a control question for the first one of this section, but its difference resides in the different reasoning behind it. This question, in fact, asks the respondent to reflect upon a realistic circumstance, it is not hypothetical as the other one (part of the perceived controllability). *Identifier*: "PBC6".

6.5 Self-identity

Another factor that contribute to the prediction of the actual behaviour is the self-identity, which refers 'to salient and enduring aspects of one's self-perception' (Rise et al., 2010). The social identity theory, developed in the social psychology studies, describes the 'self' as able to categorise not only the material and tangible world but also itself, and this process is defined 'self-categorisation'. (Burke & Stets 2000). Accordingly, a person depicts itself as belonging 'to a social category or group' (idem, p. 2), thus perceiving himself/herself as a certain type of person. In TPB theory has been discussed whether this aspect should be considered as already included in attitudes or as something apart from it (Fishbein & Ajzen, 2010). It seems that self-identity is able to explain up to 9% of the variance in intention (Rise et al, 2010)

Questions asked in the surveys

Question: "**At what extent do you think of yourself as a motorist?"** and **"At what extent do you think of yourself as an environmentally friendly person?"** *Type of questions:* closed-ended question (options: a six-point scale from "low" to "high"). *Purpose*: to measure the view of the self in relation to car driving and environmental issues. *Identifier*: "SI1" and "SI3".

Question: **"To drive a car is part of my identity".** Options of the scale: from "disagree" to "agree". *Purpose:* to measure how to drive the car may be a way to express one's self, one's personality. *Identifier*: "SI2".

6.6 The ROA (Requirements, Opportunities, Abilities) model

One of criticism of TPB has revolved around the fact it does not fully acknowledge situational elements, related to one's life situation (married/single, employed/unemployed, etc.) and related to the place of residence (i.e. rural or urban), which play a certain role in non-psychological disciplines, such as transportation. For this reason, Harms (2003, in Busch-Geertsema & Martin Lanzendorf 2015), inspired by studies on consumers, which had developed the NOA model (Needs, Opportunities, Abilities), conceived the ROA model (Figure 24) by combining the NOA with TPB model, changing the first letter in R, which stands for 'Requirements'. As Busch-Geertsema and Martin Lanzendorf (2015) explained, this first letter has shifted during the years from Motivation, to Needs and finally Requirements, because researchers had been debating over the reason of mobility demand. The word requirements designates the "the subjectively perceived demand of mobility on the individual's level" (Harms, 2003, in Busch-Geertsema & Martin Lanzendorf 2015, p. 8), hence influencing the attitudes towards the different modes of transport. Mobility opportunities represent environmental-related factors (idem) that influence the access to services, leisure,

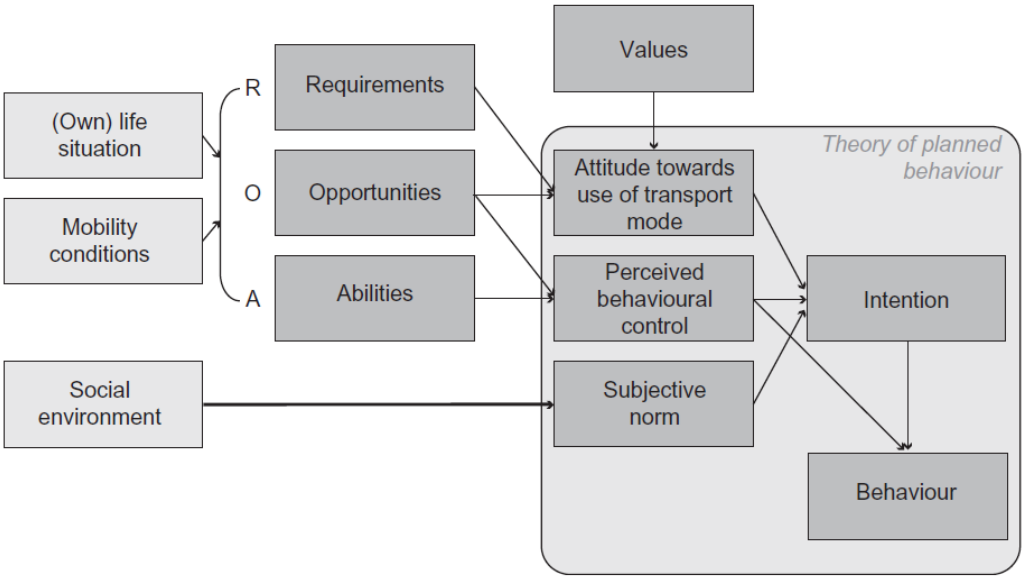


Figure 24: The ROA Model. Source: Busch-Geertsema & Martin Lanzendorf (2015, p. 28), modification of graph in Harms (2003, p. 193).

jobs, shopping, etc., and therefore mobility opportunities depend on the built environment structure, the transport system (the road network, the public transport, the availability of means of transport) and the land-use of the district or neighbourhood, and they and have impacts on both the attitudes and the PBC. Mobility abilities define one's personal skills necessary for performing a behaviour (for example the possession of a driving licence, or the financial availability), having consequences on the PBC (Busch-Geertsema & Martin Lanzendorf 2015). The ROA model takes into account also the social environment as a factor that shapes the subjective norm, and it views one's attitudes as a mediation of personal values.

As Ajzen explains (Ajzen, 2005, pp. 147-149), **background factors** contribute to the formation process of one's beliefs, influencing at a certain degree the way in which a person perceives the beliefs identified by TPB theory. Furthermore, according to Bergstad et al. (2011), socio-demographic factors (such as age, sex, education, income, etc.) have a direct influence on attitudes, and therefore on the travel behaviour. Their study was focused on the car choice, and they found out that socio-demographic factors accounted for from 7% up to 13% of the variance in car use. Hence, background factors and socio-demographic factors may be considered in Figure 24 partly as "(Own) life conditions" and partly as "values".

Questions asked in the preliminary survey:

Question: **"How many cars do you usually have access to in your household?"** Answer options: "1", "2", "3". *Purpose*: Only one car might mean that it is may not be always available, maybe because another family member uses it or because, or it might mean that the other family members use alternative transport modes *Identifier*: "tot cars" (opportunities).

Question: **"How many persons in your household are 14 years old or younger?", "How many persons in your household are 15, 16 or 17 years old?"** and "**How many persons in your household are 18 year-old or older?"** Answer options: indicate a number. *Purpose*: as the question before, in case of only one car available, it might not be always available and it might be use to drop off/pick up the children at school. *Identifier*: "pp14", "pp17" and "pp18" (Own life situation).

Question: **"Do you have you a driving licence?"** Answer options: "Yes" and "No". *Purpose*: for choosing test traveller participants, because only car drivers have been selected (abilities). *Identifier*: "licence".

Question: **"Do you use the car for your work?"** Answer options: "Yes" and "No". *Purpose*: to evaluate the need of mobility of a person I*dentifier*: "car work" (Requirements).

Question: **"Age"** Answer options: ". *Purpose*: it might be an aspect that influences car use and possible changes in travel habits produced by the test traveller project. *Identifier*: age (Own life situation and background factors).

Questions asked in the first survey (Section 1 – General questions)

At the beginning of the first survey, some further general information about the participants has been asked, in order to complete the information already given in the preliminary survey. These *questions type* have been closed-ended questions.

Question: **"How many bikes do you have access to?"** Answer options: "1", "2", "3 or more". *Purpose*: to verify if there may be a concrete hinder from using the bike and if in that household the bike is used. *Identifier*: "bikes" (opportunities).

Question: **"Sex"** Answer options: "woman", "man", "other/I do not want to say". *Purpose:* to observe if the project affects differently men and women. *Identifier*: "sex" (own life situation and background factors).

Question: **"Education"** Answer options: compulsory education, secondary education, post-secondary education, postgraduate education. *Purpose:* to observe if the project affects differently people with different levels of education (background factors). *Identifier*: "education".

Question: **"I am a person who need to travel to several different places during a day"** (Answer options: a six-point scale from "Incorrect/Untrue" to "Correct/true"[14]) and **"I can choose at what time to travel to work"** (Answer options: a six-point scale from "Incorrect/Untrue" to "Correct/true"[14]). *Purpose*: to investigate the perceived mobility requirements of the person, both in general (first question) and focused on the working hours (a fixed time or if it is more flexible, in the second question) (requirements). *Identifiers*: "travel need" and "work time".

It has not been posed a question regarding the income levels of the participant. Even if it would have been beneficial for the analysis to know if the changes triggered and caused by the trial period and the project have been more substantial among those with a lower or a higher income, the municipality objected what this question would have been too personal and intrusive (even if giving a range of income levels, and with the option: "I do not want to say").

[14] In the Swedish survey sent to the participants, there have been used the terms "Stämmer inte" and "Stämmer".

Aspects of the ROA Model not investigated

Regarding the components that constitutes the core of TPB, these will all be investigated. On the other hand, the components present in the ROA model are more difficult to evaluate and take into consideration.

- *Social environment*: For this component, it has not been viable to ask questions on how the social environment in general might have influenced the respondents' subjective norm components, because it would have required to have questions about how society in general view car use and public transport use, perhaps seemingly out of scope to the respondents.
- *Mobility conditions*: it stands for all the external conditions (Busch-Geertsema & Lanzendorf, 2015), therefore it indicates the transport system and its quality, the land-use structure, and the localisation of activities and functions. Mobility conditions is a too broad definition for being analysed singularly and its aspects are already investigated in other sub-categories. Hence, no questions have been asked regarding it.
- *Values*: In the ROA model values is a too broad concept, which includes background factors of a person. The components of the "values" cell, however, may be partly represented by the environmental concerns (hereafter explained) and by the self-identity questions section.

6.7 Environmental concerns

Bamberg et al., (2011) have also given their contribution the theory of planned behaviour by analysing the correlations and the connections between the different components, and introducing in TPB components regarding pro-environmental behaviour. They therefore added 'problem awareness', 'perceived responsibility' and 'feeling of guilt', which all contributes to one's attitudes, SN and PBC. According to the definitions of values given before and their role, these components are influenced by them and differ among people. In the summary figure (Figure 25) values are connected to these components. Further, the awareness of the problem directly influences the perceived responsibility and the feeling of guilt, and the perceived responsibility directly affects the feeling of guilt. Bamberg et al. (2011) also hypothesized the self-regulatory theory in their analysis of the process of the behaviour formation, but it will not be considered here because it entails that people form specific goals and plans, which are not explicitly requested by test traveller projects, and no questions will be posed to the participants in the Botkyrka project.

Question asked in the surveys (Section 9 – Environmental awareness and concerns)

Types of questions: closed-ended questions, with a six-point scale possible answer that have "disagree" and "agree" (the first six questions) and little and much (the last two questions) as end points.

Question: **"Car driving is harmful for the environment."** *Purpose:* to measure the repondents' awarness of the environmental damages provoked by the use of motor vehicles (problem awareness). *Identifier*: "EC1".

Question: **"People should use cars less."** *Purpose:* another indicator for measuring the respondents' awarness of the negative consequences of car use, pointing at a reduction of it in general by the society (problem awareness). *Identifier*: "EC2".

Question: **"I think that my travel habits contributes to worsen the quality of the air of my neighbourhood."** and **"I think that my travel behaviour contributes to climate change."** *Purpose:* to measure the degree of individual responsibility for the negative consequences of car driving, both at the local level and a higher scale (perceived responsibility). *Identifiers*: "EC3" and "EC4".

Question: **"I think that I should use my car less."** *Purpose:* to measure if the respondents deem that he/she should use less his car. It is different from the previous one ("people should use car less), because here the

focus is on the individual, and it may be interesting to compare the two answers (perceived responsibility). *Identifier*: "EC5".

Question: **"I am concerned about climate change."** *Purpose:* to measure at what extent the respondents are concerned about climate change. They may be aware of the pollution and the resources consumption caused by car use, as previously asked, but they may not be much concerned for that (environmental concern). *Identifier*: "EC6".

Question: **"I feel guilty because I travel by car."** *Purpose:* to know if and at what extent the respondents feel a sense of guilt provoked by the fact that they use the car. If they do, it would be interesting to compare it to other aspects of this study, from the effects of the test traveller project to the reasons for using anyhow the car (feeling of guilt). *Identifier*: "EC7".

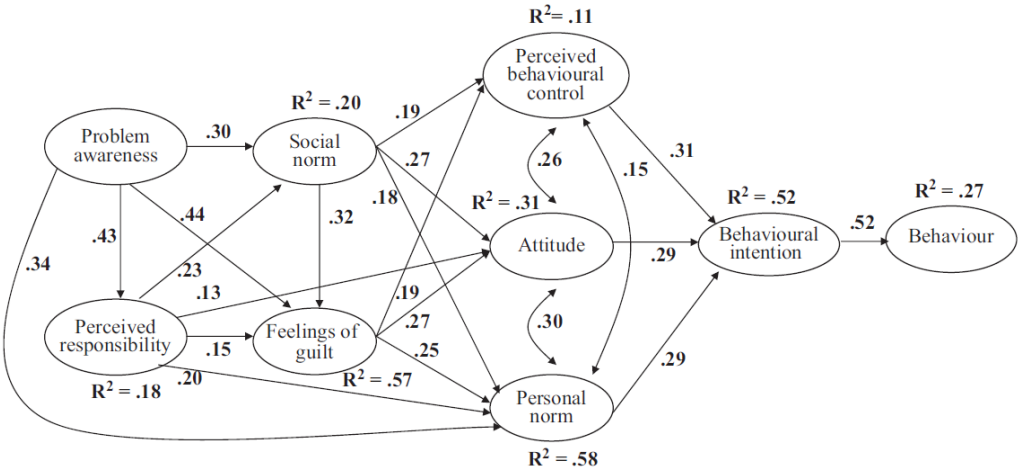


Figure 25: Problem awareness, perceived responsibility and feelings of guilt. Source: Bamberg et al., 2011, p. 231: 'Results of path analysis of meta-analytically pooled correlations. (single-headed arrows represent causal paths, double-headed arrows represent correlations; standardized path coefficients and explained variance are shown; adapted from Bamberg and Möser, 2007).'

6.8 Habits role

In the travel behaviour discourse it has emerged the importance of the habit. The debate has revolved around the role of the past behaviour and how it could influence a future decision. For example, Thøgersen (2009) demonstrated that the effect of free public transport tickets on intentions and behaviour is weaker among those with strong car habits, and among those who continued to travel by car their perceptions of and attitudes towards public transport went back to their original levels.

Basing on psychology studies, literature on travel behaviour (Bamberg et al., 2002; Fujii & Kitamura, 2003) presents habits as facilitators for one's everyday life decisions, because they enable us not to continuously think about our actions. Albeit human behaviour, as TBP theory assumes, is driven by reasoning (which may be biased by misperceptions or prejudices) repeated "behaviors gradually become habitual and are later performed without deliberation as to which goals are promoted or obstructed" (Dahlstrand & Biel, 1997, p. 589). Hence, as Thøgersen (2012, p. 131) says, "habits moderate the influence of behavioural intentions on behaviour" and they reduce one's awareness of the behaviour.

However, **external factors** can unfreeze the driving habit by inducing the individual to rationally think of his current travel choices and to evaluate the alternatives (Fujii et al., 2001). Therefore, human behaviour indeed

incorporates aspects derived from habit, generating automatisms in our lives, but these automatisms may be interrupted. Literature (Thøgersen, 2012; Bamberg, 2006; Busch-Geertsema & Martin Lanzendorf 2015; Verplanken et al., 2008; Klinger & Lanzendorf, 2015; Thomas et al., 2016, Lanzendorf, 2010; Kley, 2011; de Groot et al., 2011; Scheiner & Holz-Rau, 2013) has demonstrated how key events in one's life, such a residential relocation or the birth of a child, can disrupt one's habits, making people reconsider their travel behaviours. In fact, Bamberg et al. (2003) conclude their paper by claiming that past behaviour may be "a good predictor of future behavior" only "when circumstances remain relatively stable" (p. 13).

A test traveller project may be considered as one of those external factors, because one is given the opportunity to try the existing alternatives at no cost. In fact, as Thøgersen (2012 p. 131) says, 'in order to be noticed at all, persuasive information needs to be obtrusive and to be perceived as personally relevant one

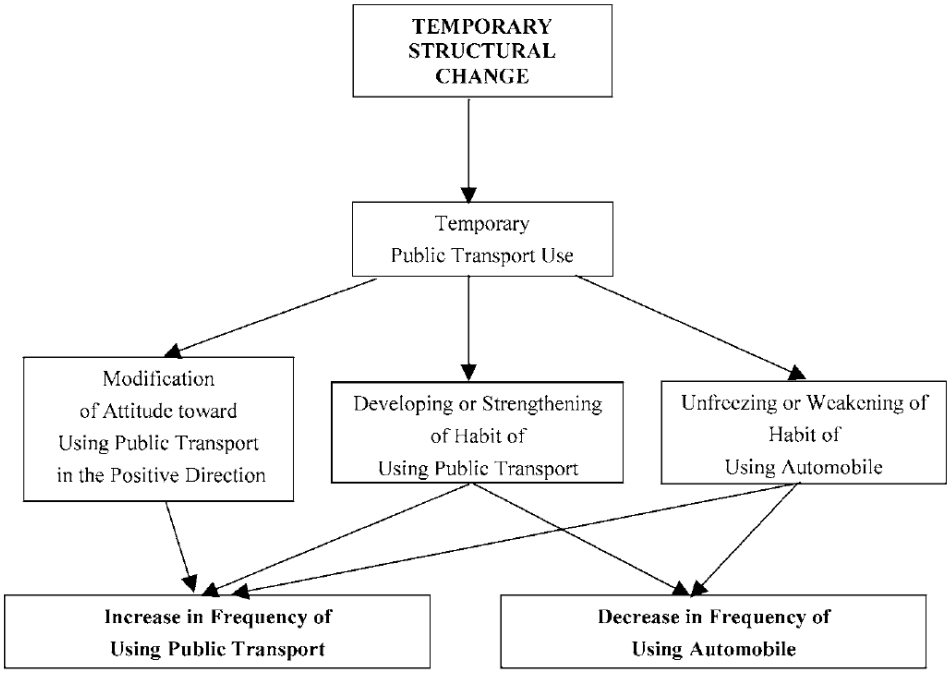


Figure 26: 'The process of changing to public transport use due to a temporary structural change.' Source: Fujii & Kitamura, 2003, p.83.

has to consider if taking part to the project may be convenient for him/her'. The offer given to car drivers by a test traveller project is personally relevant, because induce people to consider trying out the public transport option and disrupting their habits, creating conditions that "make the automatic execution of the habit impossible or at least unattractive and which give individuals sufficient motivation and ability to make a deliberate choice" (Thøgersen, 2012, p. 132). Of course not all car drivers would consider this opportunity alluring, or at least interesting, for example because, there is not a suitable public transport connection between their residence and the workplace (PBC) or simply because they might have deeply rooted prejudices against public transport (attitudes). The test period interrupts and unfreezes the car driving habit it activates the reasoning over one's travel behaviour, and Figure 26 represents what happens when a test traveller project succeeds. Thøgersen (2009), Bamberg (2006), Fujii & Kitamura (2003), Bamberg et al. (2003) and Brög et al. (2003) have demonstrated that after the test period participants showed a different attitudes and perceptions towards public transport. Hence, "the negative beliefs were corrected by actual experiences of using public transport. Due to this correction, attitudes towards public transport were modified in a positive direction" (Fujii & Kitamura, 2003, p.84). These negative beliefs along with a car driving habit were preventing motorists who participated to the experiments to use the public transport. As it concerns the other participants, after the test period their attitudes and perceptions did not sufficiently change to trigger a modification in their travel behaviour, and therefore more actions are needed, which may be improvements

to the public transit network, constraints to car use (road pricing, parking fees, etc.) and campaigns promoting sustainable travel modes. An issue that still needs research is the period span needed for establishing a new behaviour, in this case travel behaviour. During past years, it has been erroneously believed that 21 days were the period needed for establishing the new behaviour. However, research (Lally et al., 2009 and Gardner et al., 2012) has demonstrated how this is not true, and in order to render a new behaviour a habit the amount of time needed varies considerably and heavily depends on each individual, ranging from 18 days to more than 250 days. Hence, the test traveller project main role is to break a habit, as underlined by authors as Thøgersen & Møller (2008) and Bamberg & Schmidt (2003), and it helps people to reconsider their travel behaviour. However, it is not said anywhere in the literature how long it should be or what is it minimum duration, and the projects that have made hitherto have had various period lengths and various result.

Questions asked in the surveys (Section 3 – Habits)

Question: "How many trips do you do during a usual week (go and return trips = 2 trips)

- **To/from workplace/education institution with public transport?**
- **To/for free time activities with public transport?**
- **To/from workplace/education institution by car?**
- **To/for free time activities by car?**
- **To/from workplace/education institution by bicycle?**
- **To/for free time activities by bicycle?"**

Type of questions: closed-ended questions, to fill in with a number. If the respondents use more than one of these modes of transports for their trips, they are asked to mark the trip in all the correspondent categories. *Purpose:* To investigate respondents' habits and their actual behaviour. *Identifiers*: "trips PT work, trips PT leisure"," trips car work", "trips car leisure", "trips bike work" and "trips bike leisure".

The *type of* the following *questions* is closed-ended question, with a six-point scale from "disagree" to "agree" as options.

Question: **"I choose to take the car for the home-workplace/education institution trip without considering the other alternatives."** and **"To use the car is one of my routines."** *Purpose:* to measure if and at what extent the respondents consciously take the car instead of using other means of transport, and hence to know if and at what extent car driving is a habitual act. *Identifiers*: "H1" and "H2".

Question: **"To take the car is typical of me."** *Purpose:* to measure at what extent the respondents believe that their taking the car is something that characterises them, hence measuring the strength of this habit. *Identifier*: "H3".

Question: **"To take the car for the trips to/from workplace/education institution is something that I have done for long time."** *Purpose:* to find out for how long the car driving has constituted their travel behaviour. *Identifier*: "H4".

6.9 Residential self-selection

In Moktarian & Cao (2008), Cao et al. (2009), Schwanen & Mokhtarian (2004 and 2005), the issues of residential self-selection and the built environment have been brought up to attention and discussed. In Schwanen & Mokhtarian (2005, p.3) residents of three neighbourhood in the San Francisco Bay area had been classified into four different categories defined as follows:

• True urbanites: urban residents with urban land use preferences.

• Mismatched or dissonant urban dwellers: urban residents with suburban land use preferences.

• Mismatched or dissonant suburban dwellers: suburban residents with urban land use preferences.

• True suburbanites: suburban residents with suburban land use preferences.

This study has shown that when people that prefer to live in a suburban environment live in an area considered as urban (higher density, short-distances between home and services, leisure and shopping), they tend to use the car more than people classified as true urbanites (83% versus 59%, in the case studied by Schwanen & Mokhtarian (2004)). On the other hand, true suburbanites' car use levels are not much higher than mismatched or dissonant suburban dwellers (93% versus 87%) (idem). It has emerged that mismatched or dissonant suburban dwellers tend to travel more with public transport if there are viable options, and in the long run attitudes (called "preferences" by Mokhtarian & Cao, 2008) may be influenced by the travel behaviour performed.

More recent studies have tried to understand the role of the built environment and land use as a component separated from the residential self-selection. The research on this topic, however, has still not come to a conclusion, because the authors has used different methods, and research on the issue is still in its early stage. Up until now, it is not clear if the major effects on travel behaviours are provoked by the built environment or by residential choice per se (Mokhtarian & Herick, 2014).

Residential self-selection has been considered in the analysis of the Botkyrka case, because it has been considered interesting to compare and to examine the results of the test traveller projects on different categories of people, in these cases "Mismatched or dissonant suburban dwellers" and "True suburbanites" (Riksten has been considered a suburban environment, as explained in chapter 4).

Questions asked in the surveys (Section 8 - Residential self-selection)

Types of the questions: closed-ended questions, with a six-point scale possible answer that have "disagree" and "agree" as end points.

Question: **"I prefer to live in a suburban environment rather than in a central/denser populated area."** *Purpose:* to be able to appreciate the level of residential mismatch of the inhabitants in more general terms. *Identifier*: "RSS1".

Question: **"To live in Riksten implies having longer commuting / travel times."** *Purpose:* to find out if the participants' choice to live in Riksten may have been, at least partially, motivated for a shortening of their commuting, or if it actually means that they have to travel longer distances. *Identifier*: "RSS2".

Question: **"I can tolerate travelling longer distances as long I live in such type of neighbourhood."** *Purpose:* another indicator of the level of mismatching, which may occur in case respondents remark that to live in Riksten is a burden for them in terms of distances travelled. *Identifier*: "RSS3".

Question: **"I would prefer to live closer (walking or cycling distance) to services (school, medical centres, etc.) and leisure/shopping."** *Purpose:* another indicator for measuring if there is some mismatch between the residents' residential preferences and the actual place of residence, in this case focused on the services offer. *Identifier*: "RSS4".

Question: **"I considered the public transport offer as an important factor to me when I chose to move to Riksten."** and **"I consider important to have a good public transport service in the area where I live."** *Purpose:* to measure if the public transport offer in Riksten has been an important factor or not. In case they answer no, consider the public transport offer in Riksten/southern Tullinge as bad, and at the same time they have a negative attitude towards using public transport, that reinforce the probability that they are true

suburbanites (as defined by Schwanen and Moktharian, 2005). In case they answer yes, consider the public transport offer in Riksten/southern Tullinge as bad, but at the same time they hold positive attitudes towards public transport, that would reinforce the probability that they are mismatched or dissonant suburban dwellers. *Identifiers*: "RSS5" and "RSS6".

Questions not asked in the surveys

Built environment and land use: There are no questions related to this element, because the literature about its influence does not agree about the strength of its role and how to measure it. Parts of this element are already embedded in the residential self-selection questions (for example the question "To live in Riksten implies having longer commuting / travel times").

6.10 Intention

All the components presented hitherto contribute to form one's **intention** to perform a behaviour. It remains not clear, however, what happens in the step between the intention and the behaviour. One reason has been identified in the "Actual Behaviour Control", and therefore in the actual hindrance of the external factors. The discrepancy between intentions and the behaviour performed may also be due to the time interval between the intention measure and the performing of the behaviour, time in which the conditions may have changed (Ajzen, 2011). It should also be noticed that TPB is based on surveys, in which people might not completely or honestly speak their mind and answer in a way that they may not exactly express their opinions and beliefs, but what they think the interviewer is expecting or what themselves hope or desire to appear (Verplanken & Orbell, 2003).

In the case examined in Botkyrka, the actual behaviour control, when speaking about public transport, is the discrepancy between how people perceive and think of it as easy or difficult to use, and how it actually is for them, while the actual behaviour is how they actually decide to travel after that they have taken in consideration all aspects.

Questions asked in the surveys

Type of questions: closed-ended questions, with a number from 1 to 10 for the first two questions, and with a six-point scale possible answer that has "Never" and "Always" as end points.

"**How many of the next 10 the trip to/from work/educational institution do you plan to use public transport (or a combination of other means of transport and PT)?"** and "**How many of the next 10 the trip for leisure/other activities institution do you plan to use public transport (or a combination of other means of transport and PT)?**" *Purpose*: to have a close look at the intentions for the coming trips. *Identifier*: "PT work next 10 and PT leisure next 10.

"If you look at the next month, how often do you think you will use public transport (or a combination of other means of transport and PT) for the trips to/from work/educational institution?" and "**If you look at the next month, how often do you think you will use public transport (or a combination of other means of transport and PT) for the trips for leisure/other activities?**" *Purpose*: to have a look at the intentions in the longer run. *Identifier*: "How often PT work" and "How often PT leisure".

6.11 Cognitive dissonance: a window of opportunity

Literature in the psychological studies has coined the expression 'cognitive dissonance' to designate the conditions of those people whose behaviours are in contrast with their attitudes (Festinger, 1957). 'People prefer to adjust their attitudes with actual behaviour' (Busch-Geertsema & Martin Lanzendorf 2015, p. 12) and, in case of conflicts between actual behaviour and attitudes, people tend to add new cognitions or to change them (Festinger, 1957) in order to try to harmonise existing behaviours with one's attitudes and values.

Besides the work done by Shwanen, Moktharian, Cao and Herick, which have focused more on the influence of the built environment and residential self-selection on travel behaviour, other authors have directly addressed the cognitive dissonance issue in relation to travel behaviour. Bamberg (2006) and Scheiner & Holz-Rau (2013) have analysed the effect that a residential relocation has on people's travel behaviour, underlining how it may be a moment when changes are likely to happen.

In particular, a study conducted by Verplanken et al. (2008) among the employees of a small English town university, is explicative of this concept. The participants were questioned about their travel behaviours, and then divided by the authors in four categories accordingly to their environmental concerns (low or high) and if they had recently moved. The authors also asked the travel modes of the participants and if they had recently moved. In the survey there were also other questions related to their environmental concerns, in order to understand if, in case they changed their travel behaviour, it could have been related to their pro-environmental behaviour.

Table 4: 'Proportions of car use as a function of context change and environmental concern'. Source: Verplanken et al., 2008, p. 125.

Proportions of car use as a function of context change and environmental concern

Context change	Environmental concern	
	Low	High
Recently moved	0.73a	0.37b
Not recently moved	0.54a	0.64a

Note. Cell means that do not share a common letter differ at $p<0.05$.

The results show that those who had recently moved and were environmentally concerned were using significantly less the car than those who were environmentally concerned but had not recently moved. This study demonstrates the **self-activation hypothesises**, which states that 'values influence choices and behavior only when two conditions are met; a value should be part of a person's self-concept, and a value should be cognitively activated.' (Verplanken et al., 2008 p. 122). This process of self-activation and deliberate reflections upon one's behaviour takes place in case of events that change and disrupt one's habit, opening a so-called 'window of opportunity' (Verkplanken & Wood, 2006), that for a residential relocation may be considered no longer than 6 months (Verplanken 2008). Therefore, in case of cognitive dissonance, it is to "expect adjustment processes in both directions, towards the attitude or towards the behaviour, and therefore less appearance of cognitive dissonances after the key event." (Busch-Geertsema & Martin Lanzendorf, 2015, p. 16).

In order to assess if cognitive dissonance has had a role in making some people change travel behaviour after the test traveller project, since the studied neighbourhood, Riksten, has been recently built, part of the residents have very recently moved. Further, cognitive dissonance might also be present in those who have not recently moved, because their values might be in contrast with their actual behaviour. Only one question have been specifically asked for investigating this aspect, but the other questions asked in the survey in the questionnaires. Therefore, if a project participant would have changed its travel behaviour after the project, it may mean that the 'value should be part of a person's self-concept,' (Verplanken et al., 2008, p. 122) and this is verifiable by looking at the answers given to other questions, 'and a value should be cognitively

activated' (idem), in this case by the choice of participating to the project and actively trying out public transport.

Questions asked in the surveys

Question: **"When did you move to Riksten?"** Answer options: "Less than 6 months", "between 6 months and 1 year", "between 1 and 2 years", "more than 2 years". *Purpose*: to observe if the project has a stronger effect on those who moved more recently. *Identifier*: "how long".

6.12 Distance travelled

In order to understand if there are difference s among project participants and the control group, or if there are differences among project participants who decided to continue to use public transport after the trial period and project participants who did not, the following questions have been asked.

Questions asked in the first survey

Question: "**What is the major type of fuel in the car that you usually drive?"** (Answer options: "petrol", "diesel", "biogas", "ethanol", "electricity", "Hybrid"), **"For how many km do you usually drive for going to/from work/education institution?"** (Answer options: an estimated number) and "**For how many km per week do you drive for your leisure/shopping activities?"** (Answer options: an estimated number). *Purpose*: Discover the weekly distance driven and appreciate its environmental impact. *Identifiers*: fuel, km work and km leisure.

6.13 Summary

After the presentation of the questions posed, in relation to TPB, its additions and the related studies, it may be useful to make a summary. In Figure 27 there are all the components presented. However, in green colours there are the aspects that have not been analysed through the questions posed. Regarding the external factors, in this case the test traveller project is the external factor studied, which may trigger changes.

Most part of Figure 27 is a result of other graphs, or pieces of graphs, realised by other authors, as it may be easily noticed by comparing this figures to the other previous figures in this chapter. However, some components in the figure below had not been put in a direct relation by the authors that have been referenced to before. These components are cognitive dissonance, residential self-selection and built environment and land-use.

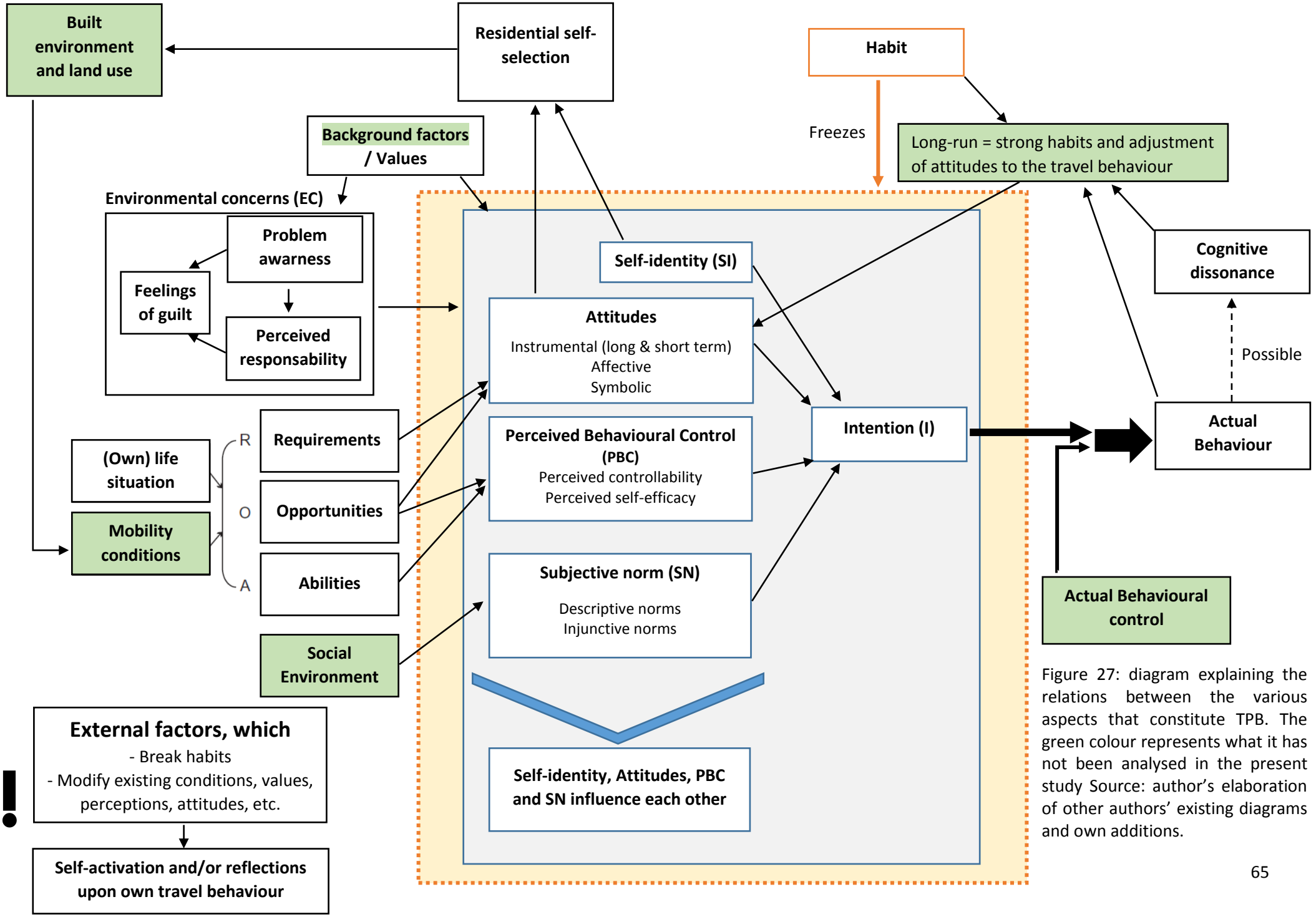


Figure 27: diagram explaining the relations between the various aspects that constitute TPB. The green colour represents what it has not been analysed in the present study Source: author's elaboration of other authors' existing diagrams and own additions.

6.14 Follow-up surveys

In the two follow-up surveys there are not present the questions in section 1 of the first survey, whereas the other sections are entirely repeated in order to compare the answers given.

Second survey

In the second survey there is a set of questions regarding the trial period and what it entailed, which representing the external factor in the travel behaviour graph. There are some contingency questions[15] and some open questions, which help in providing a better insight into the respondents' choices. Here below there is the complete description of the questions. Regarding the control group, see the last part of this section about the second survey.

Question: "**How do you think that it has been to travel by public transport during the trial period?**" *Type of question*: Closed-ended question, six-point scale with "negative" and "positive" as end points. *Purpose*: to measure the appreciation of travelling by public transport during the trial period. *Identifier*: "how was".

Question: **"Have you received some pieces of information in the letters you received that you did not know before? If yes, what?"** *Type of question*: Closed-ended question (yes, no or don't know options), plus open question. *Purpose*: in some Swedish cases it was asked this question, and it emerged that between 15% and 20% of the participants got to know new pieces of information in the letters sent. It may be useful to investigate this aspect, in order to understand if there is some lack of knowledge among habitual car drivers, which in turn might prevent them to use public transport. *Identifier*: "new info".

Question: **"Was it easier or more complicated to travel by public transport compared to what you expected?"** *Type of question*: Bipolar scale (Much more complicated, more complicated, as expected, easier and much easier as options). *Purpose:* it is related to the previous question, but here the focus is on the perceptions, which can be mismatched from the reality. In some Swedish cases it was asked this question, and it emerged that a variable number of participants from only 10% up to 50% found using mass transit easier than expected. This aspect is interesting to examine too, because it might be a factor that hinders car drivers to use public transport. *Identifier*: "how easier".

Question: **"Did the test period affected your view of the public transport? Why and how?"** *Type of question*: the first part bipolar scale (Yes, very positively, Yes, positively, No, Yes, negatively and Yes, very negatively as options) the second part open question. *Purpose:* to know if the test period has changed the view about public transport that the participants previously held. This question could be seen as quick and direct way to examine if there have been changes due to the trial period, which can be however discovered by comparing the results of the attitudes sections of the first and the second survey. *Identifier*: "affected".

Question: **"How many times have you travelled by public transport during the test period?"** Type of question: Close question (5 - 7 days/week, 3 - 4 days/week, 1 - 2 days/week and never as options). Purpose: to know if and at what extent the participant answering has used the 2-week ticket, and hence to understand if his/her answer may be considered relevant for evaluating the trial period effect. *Identifier*: "times travelled".

[15] Questions that should be answered only in case it has been given a certain answer in a previous question.

Question: "**Will you travel more or less with public transport today after that you got the opportunity to try it out, compared to before the test period? Why?"** *Type of question*: the first part closed-ended bipolar scale question (Much more, more, same as before, little less and much less as options), the second part open question. *Purpose:* This question could be seen as quick and direct way to examine if the trial period enticed participants to use more public transport, which can be however discovered by comparing the results of the intentions and habits sections of the first and the second survey. *Identifier*: "travel more".

Question: **"Would you basing on your experience recommend to family members, friends and/or acquaintances to use public transport?"** *Type of question*: Closed-ended question (Yes, definitely, Yes, probably, Maybe, No, probably, No, definitely as options). *Purpose:* In other Swedish cases it has been posed this question, which reveals if their view of the public transport services is positive enough for recommending it to other people. *Identifier*: "recommend".

Question: **"Have you tried to cycle to Tullinge station during the test period as part of your commuting/travelling? If yes, how often? If yes, how have you experienced that? If yes, will you continue to cycle to the station as part of your commuting/travelling?"** *Type of question*: multiple question. Closed-ended question (yes or no options), closed-ended question (5 - 7 days/week, 3 - 4 days/week, 1 - 2 days/week and never as options), open question, closed-ended question (yes, very often, yes often, sometimes, seldom, very seldom and never as options). *Purpose:* to know if the participants have tried and started to use the bicycle as part of their commuting or as part of some of their trips. In the letters sent, participants were encouraged to cycle and were given some information about this possibility. *Identifier*: "cycling".

The questions about the test period, indeed, are needed for clarifying in what way the test period have changed the participants' opinions and perceptions and focused on the test period per se, but they do not specifically address the participants' components of the theory of planned behaviour.

Second survey control group

Regarding the control group, they do have been asked about the test traveller project, aiming at providing an insight in case of the mere fact that a test traveller project was proposed and taking place could have influenced their behaviours, attitudes and beliefs. These questions are reported and explained here below.

Question: **"Although you have not taken part into the test traveller project, do you think that it may have had some kind of influence on you and/or your travel habits? If yes, how?**" *Type of questions*: Closed-ended question ("yes" or "no" as alternatives) and open question. *Purpose*: to know if and how a non-participant might have been influenced by the test traveller project. *Identifier*: "control affected".

Question: **"Do you think that this project should be carried out in several places in the municipalities?"** *Type of question:* closed-ended question with "yes", "no" and "I don't know" as options. *Purpose:* to know the acceptance of the project among the non-participants. *Identifier*: "project".

Third survey

The third survey does not have the section about the test period, as the second survey, except for the *question* "travel more".

It seems however not appropriate to ask again the other about the test period experience, because it had taken place more than three months before; because the opinions about the test period have already been asked in the second survey; because it is observable in the other sections of the survey if the project participants have changed their travel habits, their attitudes and/or other measured components of the theory of planned behaviour in comparison to the second survey.

This survey has the further *question* "project", as the control group in the second survey.

6.15 Data analysis methods

Comparisons between and within groups

The first analysis performed has been a comparison between and within respondents' groups (control group and project participants), basing on the data of the first survey (the baseline). All the variables of the first survey previously presented in this chapter have been here considered. The comparisons are represented by the difference between the means of each variable.

It is to remind that all project participants are at the beginning habitual car users, and therefore they have been compared with those in the control group who use the car for commuting to work. Three main characteristics have been in depth explored: sex, age and education in order to observe if there are relevant differences depending on these characteristics. It is to point out that these two groups (project participants and control group) are composed by a different amount of people, which present different proportions regarding the characteristics studied. For this reason, car drivers of the control group have been weighted so that they reflect the composition of the project participants. After running a T-test analysis, non-significant results have excluded from the results presentation and discussion. When analysing the results of the first survey, a value of $p < 0.05$ has been considered as significant, while sometimes a $p < 0.10$ has been considered only if other results of the same group (for example attitudes or environmental concern) had a $p < 0.05$. When analysing the results of the second and the third survey, results with $p < 0.10$ has been considered, but it has been indicated if p is between 0.10 and 0.05.

The answers of project participants who switched to public transport after the test period have been compared with the answers of those in the control group not using the car, and in parallel the answers of the project participants who did not switched to public transport has been compared with the car users of the control group.

The answers of the second control group survey have not been used for a comparison with the third project participants' survey, but only for verifying that the differences with the results of the first control group survey would have been similar (and therefore the findings of the study more valid).

The purpose of these analyses is to find out:

- if and how the control group and the project participants differ in attitudes, beliefs and behaviours;
- how people with different personal characteristics, in particular age, sex and level of education might determine a certain mind-set and a certain beliefs and attitudes;
- the differences between the same variables measured among the project participants before and after the test period (second and third survey), divided into the two subgroups of new public transport users and car drivers.

Correlation matrix

A correlation matrix with the data from the project participants of the first survey has been built and employed for discovering general patterns and to find out possible interesting or unexpected parallelisms between the various elements asked in the surveys. In addition, this correlation matrix contains the data from the first section of the second survey (with questions about the test period), in order to discover patterns and characteristics not found in the previous analyses which might have led project participants to use public transport more after the trial period. In case of a correlation of at least 0.3% the result has been reported. A $p < 0.05$ has been considered as significant.

Further analysis about Residential Self selection

Thanks to the results of the questions regarding the residential choice, project participants and control group have been respectively divided into two groups, according to the RSS index with data of the first survey,

hence the half presenting higher values and the half presenting the lower values. Then, the results of the groups have been compared by using the same method employed for the comparisons between and within groups.

The same analysis above has also been performed by dividing the groups according to the item RSS1, which directly addresses the preference between a suburb and a central/dense area.

Structural equation modelling

The structural equation modelling employed in this work has been the "Lavaan" package for the R system for statistical computing, thanks to its SEM models tool.

Since the variables measured are 63 and the number of observations of car drivers are 39 (who answered the first and the second survey), it has been necessary to reduce the number of variables in order to make it possible to create a functioning and decent model. For this reason the variables explaining an aspect of TPB have been summed together, in order to form an indexes, considering them to have an equal strength (therefore, using Ajzek formula, the multiplicative factor is 1 for every item). The items within Attitudes are highly correlated, hence it seems correct to assume that the items behave similarly and consider them altogether as one index. The same method and the same explanation apply to Habits, Subjective Norms and Environmental Concerns. Self-identity is an exception, since SI1 and SI2 ("At what extent do you think of yourself as a motorist?" and "To drive a car is part of my identity") measure a completely different part of the self-identity than SI3 does. Regarding Perceived Behavioural Control and Residential Self Selection, only few items correlate. Nevertheless, PBC items as well as RSS items have been respectively summed, because their items represent different aspects of PBC and RSS.

The problem derived by the aggregation of items is that in the results it will not be possible to distinguish which variables in the indexes has had the strongest influence, but they will appear as all the same. It has not been viable to consider every single item separately due to the limited number of observations, which does not allow to deepen the analysis (the model would not be specified). However, it is possible to partially overcome this problem by looking at the correlations among items.

Since all items that have been used in order to form an index are values that range from 0 to 5 (or 0 to 10, then dividing by two the scale is the same) it has been possible to aggregate them. An exception is the distance travelled for reaching work and leisure activities (items "km work" and "km leisure"), where respondents answered with the number of km driven. In this case, the two items are still expressed in the same way and in a comparable amount, so they may be aggregated to form an index.

The values of the variable RSS3 have been inverted, because the question that represents ("I can tolerate travelling longer distances as long I live in such type of neighbourhood") implies that at a high value corresponds appreciation of the suburban environment, whereas it is the opposite for the other variables named RSS. Following the same reasoning, also RSS1 values have been inverted. ("I prefer to live in a suburban environment rather than in a central/denser populated area"). Regarding Perceived Behavioural Control, PBC1 and PBC 5 have been inverted ("If I wanted to I could easily travel by public transport to the workplace/education institution" and "I know how to travel by public transport […]"), because higher values in these questions imply a lower PBC, while higher values in the other questions imply the opposite.

The software package employed enables to run multiple regression equations. Further, the Lavaan package allows to use a variable that is independent in one equation as a dependent variable in another equation (Rosseel, 2012). Moreover, in SEM models it is possible to include continuous latent variables (Intention, in this cse), as dependent and/or as independent variables (idem). Through these steps the structural part is defined. The syntax below (equation 4) mathematically represents the diagram in Figure 27 , and it has been used as a starting point for the construction of a working model. The fundamental part, the original TPB model developed by Ajzek, has been maintained unaltered during the process of find the right model specifications. The item "travel more" has been included in the model below and not considered as a result of the items' values of the second survey, because it is researched the connection of the item "travel more" with the answers given before the trial period. The estimated values for I, A, PBC, SN, SI1and2, SI3, RSS, H, will have a maximum value of 5[16], while "Travel more" and "How many" have a maximum value of 4[17].

```
MYMODEL.MODEL <- ' # measurement model
I =~ A + PBC + SN + SI1and2 + SI3
R =~ sex + age + pp14 + pp17 + pp18 + work time + travel need + distance travelled
# regressions
I ~ H + EC + R
RSS ~ A + SI1and2 + SI3
Travel more ~ H + I
How many ~ I + H
# residual correlation
SI1and2 ~~ H
'
fit <- sem(MYMODEL.MODEL, data = mydata, std.lv = TRUE)
Summary(fit)
```

Equation 4: Model syntax, starting point corresponding to all items in the surveys.

In an attempt to understand the importance of each single item in the formation of the intention, a further analysis have been performed, by using the syntaxes as in equations 5 - 8 and 9. These syntaxes are **not** methodologically correct, because some items are placed at the same level as indexes, in the first case, and all the items at the same level in the second case, while the correct formula for I (intention) would be as in equation 10. However, by using this procedure it would be possible to roughly discover in which proportion each item contributes to the formation of the main TPB aspects (Attitudes, Perceived Behavioural Control, Subjective Norms, plus the later-added Self-Identity). If the proportion of the items in relation to the other items explaining one aspect of TPB are similar, both in the results obtained by using equations 5 – 8 and by using equation 9, then it would seem fair to assume that the proportion in which items contribute discovered by employing this method, are actually fairly true. As an example: if by using equation 9, as a result item A1 contributes for 0.500 to the total estimate value of a hypothetical total estimate of all the other attitudes items of 4.0 (where 4.0 is ∑A), it means that A1 would contribute to the overall aspect Attitudes by 12.5% (where ∑A% = 100%).

[16] The possible answers range from 0 to 5.

[17] The possible answers range from 0 to 4.

Equations 5 – 8: Items respectively for Attitudes, Perceived Behavioural Control, Subjective Norm and Self-Identity are at the same level as the other main aspects of TPB. The writing "[..]" means that the rest of the syntax is the same as Equation 4.

```
MYMODEL.MODEL <- ' # measurement model
I =~ A1 + A2 + A3 + A4 + A5 + A6 + PBC + SN + SI + SI3
[…]
```

Alternatively

```
MYMODEL.MODEL <- ' # measurement model
I =~ A + PBC1 + PBC2 + PBC3 + PBC4 + PBC5 + PBC6 + SN + SI + SI3
[…]
```

Alternatively

```
MYMODEL.MODEL <- ' # measurement model
I =~ A + PBC + SN1 + SN2 + SN3 + SN4 + SI + SI3
[…]
```

Alternatively

```
MYMODEL.MODEL <- ' # measurement model
I =~ A + PBC + SN + SI1 + SI2 + SI3
[…]
```

Equation 9: All items that form Intention are at the same level, there is not latent variable.

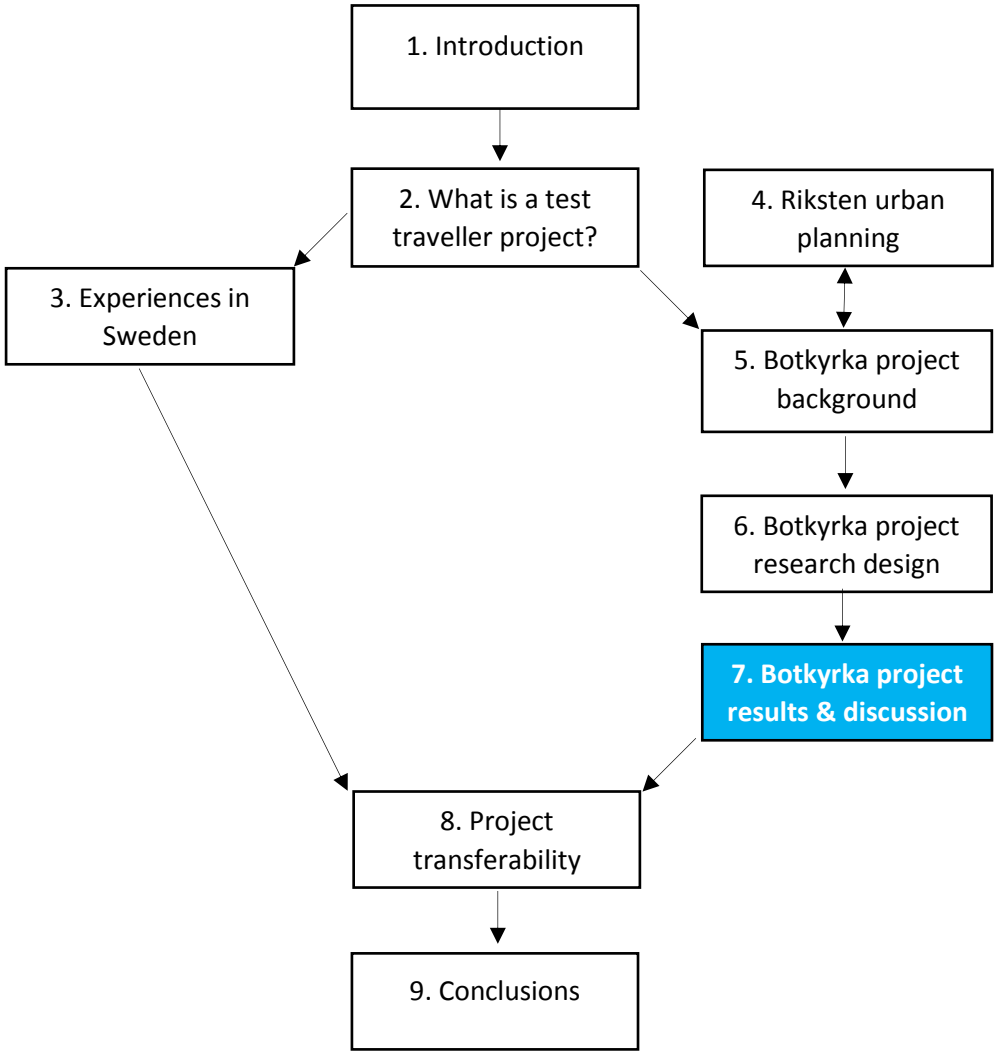
```
MYMODEL.MODEL <- ' # measurement model
I =~ A1 + A2 + A3 + A4 + A5 + A6 + PBC1 + PBC2 + PBC3 + PBC4 + PBC5 + PBC6 + SN1 +
SN2 + SN3 + SN4 + SI1 + SI2 + SI3
[…]
```

Equation 10: Model syntax with all items included in the formula.

```
MYMODEL.MODEL <- ' # measurement model
I =~ A + PBC + SN + SI + SI3
A =~ A1 + A2 + A3 + A4 + A5 + A6
PBC =~ PBC1 + PBC2 + PBC3 + PBC4 + PBC5 + PBC6
SN =~ SN1 + SN2 + SN3 + SN4
SI1and2 =~ SI1 + SI2
RSS =~ RSS1 + RSS2 + RSS3 + RSS4 + RSS5 + RSS6
R =~ sex + age + pp14 + pp17 + pp18 + work time + travel need + distance travelled
# regressions
I ~ H + EC + R
RSS ~ A + SI + SI3
How_many ~ I + H
Travel_more ~ H + I
# residual correlation
SI1and2 ~~ H
'
fit <- sem(MYMODEL.MODEL, data = mydata, std.lv = TRUE)
Summary(fit)
```

7 Results and discussion - Botkyrka project

In this chapter the results of the project in Botkyrka municipality are analysed in the way explained in chapter 6. In the first place, it is reported who answered the questionnaires, both among project participants and among the control group. After that, there are the main results of the analyses performed on the three surveys. These main analyses are the groups' comparisons, the correlation matrixes and the structural equation model. In the last part of this chapter there is the discussion part, where the intent is to answer in particular the research questions "How test traveller projects alter or may alter car drivers' beliefs and perceptions about public transport?" and "What are the mechanisms that lead habitual car drivers to switch to public transport?". This chapter also contributes at answering the research questions "In what situations it is beneficial to implement a test traveller project to reduce car use? When is it better, instead, to use other methods and measures?" and the answers to these questions are used in chapter in chapter 8 (project transferability). The complete tables with the comparisons between groups and with correlations among items can be found in attachment 11.16.



7.1 Who answered?

Project participants

Considering an average of eligible applicants of 11% (as in the other comparable cases in the Stockholm region), it was expected that around 150 out of the 1423 people contacted would have answered. However, due to the condition set in the contract - that is to refund the card value in case of the participants would have not answered all three questionnaires – and due to the absence of an initial removal of the registered public transport users from the addresses list, the expected number of applicants was around 100. Because of the limited funds for the project, the maximum number of participants had been set at 50. However, only 66 people applied, of which 37 were compatible with the requirements. One application, even if the person was eligible, arrived too late. Other five people did not complete carefully their application (signature missing or cross on the box regarding the conditions for being test travellers), but eligible concerning all the other elements of the application, hence they were asked to finalise it. Four of them completed the missing part of the application, bringing the total number of participants to 41, resulting in the 2.9% of those who received the application letter at home.

The participants' age subdivision was[18]:

- 6 (14.7%) aged between 18 – 30 (all Riksten: 35.2%).
- 21 (51.2%) aged between 31 – 40 (all Riksten: 38.2%).
- 13 (31.7%) aged between 41 – 50 (all Riksten: 18.9%).
- 1 (2.4%) aged between 51 – 60 (all Riksten: 6.5%).
- 0 more than 60 years old (all Riksten: 1.2%).

Sex subdivision: Riksten inhabitants are nearly 50% men and 50% women, and the project participants correspond to these figures (20 men and 21 women).

Education level: 39% (16) have a high school education or less and 61% (25) have an education level higher than high school.

The particular socio-economic conditions, wealthy families with small children, might have contributed to reduce the number of people requesting to participate.

Two participants did not answer the second survey, therefore only the subchapter 7.2 takes into account all 41 project participants. Regarding the third survey, 35 participants answered.

Control group

For the control group, 407 people were contacted, 53 answered only one survey. However, only 45 answers were taken into account, because one was missing the name of the respondent, and other 7 did not have a car or did not have a driving license. Of these 45, 37 answered both surveys. Among those who responded to the first survey, 31 were considered as habitual car drivers, and therefore comparable with the project participants. Regarding habitual car drivers, the age subdivision is 45% (14) between 18 and 40 years old and 55% (17) older than 40, the sex subdivision is 52% (16) women and 48% (15) men and the education level subdivision is 16% (5) with a high school education or less and 84% (26) with an education level higher than high school.

[18] The percentage of Riksten inhabitants' age subdivisions has been calculated without counting the minors (aged less than 18 years old).

7.2 Results of the first survey

The results are here below presented with the following order:

- Differences between project participants and control group
- Differences between men and women;
- Differences between the age group 18 – 40 and the age group 40+;
- Difference between people with a level of education not higher than high school and people with an education level higher than high school.
- Comments from participants
- Correlations

All the differences presented are on a scale 0 to 5, except for the distance travelled. All the comparisons in this section do not take into account those in the control group who are not habitual car drivers.

Differences between project participants and control group - habitual car drivers

In general, the majority of the respondents, both among project participants and among those in the control group, has access to only 1 car (1.44 and 1.46) and in their household there are 1 or two children. Project participants have moved to Riksten on average slightly more recently (0.37[19]) than those in the control group, and furthermore they are younger (0.35[20]). Project participants, moreover, drive longer distances, in particular for leisure activities (6 km for work, 35 km for free time activities), and the median values highlight this difference. A remarkable difference regards the possibility of choosing at what time to go to work, because project participants' average answer has been 3.5, 1.4 higher than the control group. The intention part is not comparable between the two groups, because the project participants had received the monthly ticket together with the first survey, therefore this data is distorted. Project participants, before the trial period, were not using public transport more than those in the control group for commuting to work, but they were for their free-time trips. Consequently, among project participants car use is not lesser for car trips to work, but it is for car trips to free time activities. Cycling among project participants resulted much higher, in particular as part of the daily commuting, but still the average is very low, 0.5 trips per week (only 4 people used to do it for more than 3 trips per week). In the questions regarding car use habits (from H1 to H4) the answers given by project participants contain values higher than the control group, in particular in question H2 ("To use the car is one of my routines") and H3 ("To take the car is typical of me"), where values were respectively 0.68 and 0.98 higher (4.0 and 3.2). Answers to SI2 ("To drive a car is part of my identity") has received a value 1.25 higher among the project participants (2.9). Answers regarding Attitudes do not present significant differences between the two groups, and values are mostly around 2 and 3. In the Perceived Behavioural Control section, answers to questions PBC4 ("I save money when I use public transport instead of the car") and PBC6 ("How difficult would be for you to travel mostly by public transport to/from the workplace/education institution during the next month?) show differences between project participants and control group, with values respectively 1.3 higher in question PBC4 (4.0) and 0.7 lower in question PBC6 (2.2). In the questions about Subjective Norms, all answers given by project participants present higher values (0.6, 0.2, 0.4 and 0.3), but only SN1 has $p < 0.10$. Regarding the Residential Self-Selection, question RSS3 ("I can tolerate travelling longer distances as long I live in such type of neighbourhood") project participants have given a value that is 1.7 lower than the control group (which is however low, 2.5). Lastly, in the Environmental Concerns section, the only significant difference is in question EC7 ("I feel guilty because I travel by car"), where project participants' given value is 2.9, 0.9 higher than the control group's average.

[19] Coding here has been from 0 (less than 1 month) to 3 (more than 2 years).
[20] Coding here has been from 0 (18 – 30) to 4 (61 – 70).

Differences according to respondents' sex

Among the project participants, at the time of the first survey women were using public transport much more than men were (respectively 3.2 and 1.3 single trips to/from work per week), while in the control group there is almost no difference. Among the control group, women define themselves as motorists 1.3 points more than men (SI1), even if they use public transport almost at often as men. Moreover, women among project participants deem that public transport is less comfortable and relaxing (1.0 and 0.9) than men do, and they are more concerned about climate change (1 point). If considering both project participants and the control group, it emerges that women think that their travel behaviour contributes to climate change (EC4) more than men (0.8 more) and that they feel guiltier (2.9, which is 0.8 more) than men for using the car (EC7).

Differences according to respondents' age

Among project participants, young people need to travel less during the day than older people do (1.6 less). In both groups people who are older than 40 years have a more fixed working time than younger respondents do (1.9, which means 1.6 less flexible). Older respondents also expressed a higher intention of using public transport for leisure, but it might be caused by an already higher public transport use for that purpose. It is interesting that young people, in both groups, perceive public transport as more relaxing (0.9) and in general the other Attitudes indicators, although p is not <0.05, indicate a more positive attitude of young people towards public transport.

Among project participants younger respondents gave lower values (but still as high as 3.7 and 4.2 out of 5) than older respondents did to the items PBC4 ("I save money when using public transport") and PBC5 ("I know how to travel by public transport"), respectively 0.8 and 0.6 lower. Both age groups among project participants respondents seem not to tolerate well to travel longer distances just in order to live in a suburban area, but younger respondents gave values 0.8 higher than older people, but still low (1.2 on average).

Among project participants, younger respondents' answers to question E2 denote that car use is seen as less harmful to the environment than older respondents, but still they valued it on average 4 out of 5 points.

Regarding environmental issues, all groups' (younger and older) answers have been rather similar, both in the control group and among project participants. There is a slight difference among the project participants at the question EC2 ("people should use their cars less"), where those aged 18 – 40 gave a lower value (0.6 lower) than those aged 40+. However, the major difference emerges in question E7 (I feel guilty because I travel by car) when considering both groups together, where those aged 18 – 40 reveal that they feel more guilty for using their car (0.9 more) than those aged 40+.

Differences according to respondents' education

People with a higher level of education (more than high school) has given on average a value 0.6 higher at question "work time" ("I can choose at what time to travel to work"). Regarding the intention to use public transport in the following month and for the following 10 trips, all answers indicated a prominence of public transport use among less educated respondents, especially among project participants. In particular, public transport intention is higher regarding leisure travels, and this is mirrored by a higher current use of public transport for leisure among them.

In the control group, people with a lower level of education have given higher values in all questions in the Attitudes section than those with a higher level of education, from 0.5 to 1.8 higher. Among project participants the values follow the same pattern, yet they are not as high and p is not <0.05. In the control group, less educated people know better how to use public transport (PBC5 is 0.5 higher), while this does not happen in among project participants. Further, regarding the difference in the Environmental Concerns

section, people with a lower level of education have indicated higher values in question EC2 ("People should use cars less") (0.5), in particular in the control group (0.8).

Comments section

In the comment section of the project participant questionnaire, respondents expressed the need for more buses (3 people) and a more departures of bus 721X (1) as well as a direct connection with Huddinge hospital/Flemingsberg (1). In the control group, among those considered as habitual car drivers, respondents requested more departures (5 people), a direct connection to Huddinge hospital (1)[21] and that the bus await the train when late. Among those not considered as car drivers, 4 want more buses, 1 wants more bus 721X departures, 2 want a direct connection to Huddinge hospital, and of them one complains about the disturbances in the train service and one complains that the bus should wait for the train when late.

Correlations

Correlations based on sex, age and education level are here not described, since the role of these aspects of the respondents has already been described in the previous section of the present chapter.

Regarding the intention of using the public transport for the following 10 trips to work and for the trips for going to work during the coming month, the correlation between these two elements is high, i.e. among project participants it is 85%. Something similar happens for the elements describing the intention to use public transport for the trips to leisure activities (63% correlation among project participants), but correlation between the intention to use public transport for the purpose of going to work and the purpose of going to leisure activities is lower (the maximum value is 41%).

Regarding the habits, there are negative correlations between car use and public transport use, between public transport use and car habits. Correlations between car use and car habits (H1 to H4) are low among project participants, but are around 30% and 50 % in the control group. Moreover, there are negative correlations between both the use and the intention to use public transport with car habits and SI1 and SI2. For example, "trips car work" correlates negatively with both "How often PT work" (the intention of using public transport in the following month) and "How often PT leisure respectively, -54%, and -42%, while car use for going to leisure activities ("trips car leisure") seems to be slightly less negatively correlated with the intention of using public transport, showing correlations with "trips PT work" and "trips PT leisure" are respectively -23% and -33%.

Among project participants, there is a negative correlation (up to -43%) between the time that they have been living in Riksten and the intention to use public transport.

Habits items and SI1 and SI2 correlate with each other, among project participants in 11 out of 15 cases they correlate more than 30% and in 6 cases more than 50%, while they correlate much more in the control group. Among project participants, this group of items (in particular SI1) correlates negatively with Attitudes and PBC4 ("I save money with public transport"), while in the control group it correlates negatively with PBC1 ("I could easily travel by PT to work") and PBC4, but positively with PBC3 ("more time") and PBC6 (how difficult PT in the next month). H1 ("choose the car without considering the alternatives") correlates negatively with all Environmental Concerns items and for both groups.

Among project participants, H1 correlates negatively (-38%) with RSS1 ("prefer to live in suburban area), while Habits and SI1 and SI2 correlates positively with RSS4 ("distance to services") and, further, answers of those who consider themselves as motorists (SI1) negatively correlate (-46%) with RSS5 ("considered PT as important when moved"). Among project participants, SI1 and SI2 correlate with RSS2 ("judgment about

[21] Part of the 5 people that requested more departures.

public transport in Riksten) and SI2 correlate negatively with RSS questions, in particular RSS6 (good PT in the area where I live is important to me).

Regarding Attitudes, besides the correlations already described above, they correlate with each other rather strongly, in particular in the control group. Attitudes also correlate positively with PBC2 (judgment about PT in Riksten), in particular in among project participants. Further, a positive general attitude towards public transport (A1) correlates with PBC4 ("save money"). Moreover, in both groups Attitudes correlate positively with RSS5, but slightly negative with RSS6.

Regarding Perceive Behavioural Control, among project participants they do not significantly correlate with each other, only PBC4 with PBC5 ("know how to use PT") by 53% and PBC2 with PBC5 by 31%, while PBC1 and PBC5 correlate negatively by 46%. RSS2 (judgment about PT in Riksten) negatively correlate with RSS2 ("to live in Riksten implies long commuting times"), RSS4 ("prefer to live closer to services") and RSS6 ("considered PT as important when moved"). Among project participants, PBC4 and PBC5 correlate positively with RSS1 ("prefer to live in suburban area") while only PBC5 correlates with RSS6. Among project participants, all PBC items but PBC2 correlate positively with EC items (PBC2 correlates negatively, in particular in the control group).

Subjective Norms strongly correlate with each other and slightly correlate with Attitudes. Among project participants, they also negatively correlate with H2 ("car is a routine"), RSS3 ("I can tolerate to travel longer distances in order to live in a villa/townhouse area") and positively with RSS5. Among control group's respondents, SN negatively correlates with "work time" and "km work" and positively with Environmental Concerns.

Regarding Residential Self Selection, among project participants RSS1 ("prefer suburban area") and RSS2 correlate positively with EC items, and RSS3 correlates negatively with EC1 ("car driving is harmful for the environment"). Among project participants, RSS1 and RSS3, RSS2 and RSS3 as well as RSS3 and RSS6 negatively correlate, while RSS1 positively correlate with RSS1. In the control group, Residential self-selection items do not correlate with Environmental Concerns items, RSS4 negatively correlates with RSS1, and positively correlate with RSS3.

7.3 Results second survey and comparison with the first

The results are here below presented with the following order:

- Answers given to questions regarding the test period per se.
- Comparison between after and before trial period.
- Comparison between participants who switched and who did not switch to public transport.
- Comparison between project participants and control group.
- Correlation matrixes of the first survey, including and focusing on the test period questions.

All questions that are the same as the first survey are on a scale from 0 to 5.

Test period questions

In the second survey, section 1 is dedicated to gather information about how project participants experienced the test period. The number of people here considered in 39, not all 41 project participants, because 2 test travellers did not answer to the second survey. For 69% (27 persons) of the participants to travel by public transport had been a positive experience, while for 31% (12 persons) it had been a negative

experience[22]. 18% (7 persons) answered that to travel by public transport during the test period has negatively affected their view about public transport, while 36% (14 persons) deemed their view about it had been positively affected. 15% (6) reported that to travel by public transport had been easier than how thy had expected it to be, while 33% (13) thought that it had been more complicated. 49% (19 persons) indicated that they would recommend travelling by public transport, while 13% (5 persons) would not do it.

The majority of project participants (72%, 28 persons) complied with their previously declared commitment to travel at least 3 times per week by public transport during the trial period, while the other 11 people travelled only 1 or 2 times per week. Of these 11 people, only 1 person said that is had been easier to travel by public transport and only two of them reported that they would have travelled more with it than how they used to before the trial period. Further, of these 11 participants only 2 said that their view about public transport had improved, and for only 3 of them it has been a positive experience to travel by public transport.

Almost half of the respondents (19 out of 39) said that they would have travelled more by public transport in the future, compared to before the trial period, but only two of them said that they would have travelled much more. 16 respondents (41%) said that they would have travelled by public transport as much as before, and only 4 (10%) said that they would have used public transport less, and among them only 2 answered that they would have travelled much less by public transport. The answers given to the other characteristics of the test period measured in section 2 and divided according to the resolution of travelling more, less or the same compared to previous the test period, are summarised in table 5.

Table 5: Answers regarding the test period (second survey).

Characteristic	Travel more (19)	Travel same (16)	Travel less (4)
Positive experience	17	10	0
Negative experience	2	6	4
Easier	6	0	0
Neither easier or difficult	11	5	1
More difficult	2	11	3
Positively affected view	12	0	2
Neither positive or negative	5	13	0
Negative affected view	2	3	2
Travelled 2-3 times/w.	16	11	1
Travelled 1-2 times/w.	3	5	3
Would recommend	14	4	1
Neither would or would not	2	10	1
Would not recommend	1	2	2

13 people (33%) cycled during the test period as part of the daily commuting: 4 did it 3 – 4 days per week, 6 did it 1 – 2 days per week and 3 people cycled less times. Only 1 person who cycled 1 – 2 days per week was already doing the same before the trial period, and also other 3 people were already seldom cycling before. Regarding the intention for the future, 1 person expressed that he/she would continue to cycle often, 10 said sometimes and 2 answered seldom.

Men and women answered almost equally to the question about an increased use of public transport. Regarding age, among the 15 people between 18 – 40 years old, 5 (33%) said that they would travel more and 10 (67%) less or the same, while among the 24 respondents older than 40, 14 (58%) said that they would

[22] This question did not have an intermediate and neutral value as a possible answer, while the other questions of section 1 did have.

travel more, while 9 (42%) said that they would travel the same or less. Regarding the education level, among the 23 people with a higher level of education, 9 (39%) said that they would travel more and 14 (61%) less or the same, while among the 16 respondents with a lower level of education, 10 (63%) said that they would travel more, while 6 (37%) said that they would travel the same or less. Moreover, only among those with a higher education level there are as answers "less" and "much less", and only among those with a lower education level there are as answers "much more".

From the comment fields of section 1 and at the end of the questionnaire it is possible to obtain additional data and information. Although nobody answered "yes" to the question "new info", 4 respondents said that they know better how to use public transport after the test period. Furthermore, 2 participants particularly appreciated the project and 9 people who said that they would not use more the public transport expressed dissatisfaction regarding the train service, because of the too frequent delays and disruptions[23], and in addiction 4 people said that there are too few bus departures.

In this survey other 2 people, in addition to the first survey, expressed in the comments section that they want more bus departures, and one person even said that he/she was thinking about moving out from Riksten due to the "incredibly bad communications" in order to into an area served by the subway. 3 persons said that they learned, thanks to the test period, how to use in a better way the public transport.

Comparison after and before trial period

Since the groups of people are small, hereafter are reported also the cases where $p < 0.10$.

Project participants who use public transport more. -0.89 of public transport use for commuting to work/educational institution in the following month[24] (to 2.7) and – 0.9 for trips to free time activities (to 1.3). Regarding habits, H2 decreased by 1.1 (to 2.5), H3 by 0.53[25] and SI1 decreased by 1.1. A5 ("agile/easy to use") increased by 0.8 and A6 ("relaxing") by 0.7, but PBC4 ("I save money") decreased by -0.6. RSS1 ("Prefer to live in suburb") decreased by 0.42, and EC2, EC3 and EC5 decreased by respectively 0.79, 0.74 and 0.32[26].

Project participants who do not use public transport more. - 2.10 intention of using public transport for commuting to work/education institution in the following month (to 1.25) and - 0.90 regarding the trips for reaching leisure activities (to 1.5). To use public transport is good (A6) – 0.45[27]. I save money when using public transport - 0.95[28], I know how to use public transport + 0.50 (to 4.9), SN1 - 0.7. EC all slightly negative, but $p > 0.10$.

Comparison between participants who use more public transport and project participants who do not

Since the groups of people are small, hereafter are reported also the cases where $p < 0.10$. The difference has been calculated as follows: the mean of those who switched – the mean of those who did not switch.

Comparison with data before the trial period. H1 ("I choose to take the car without considering other alternatives") - 1.06 and H2 ("to use the car is one of my routines") – 0.57[29]. The other indicators for habits are some positive and some negative, but none with significance $p < 0.10$. Among those who switched, A3

[23] between the 1st of May and the 16th of June there have been 7 times disruptions in the commuter train line 36 in the stretch between Södertälje and Stockholm Central (where Tullinge station is located) (SL, 2017).

[24] $p = 0.056$.
[25] $p = 0.076$.
[26] $p = 0.055$.
[27] $p = 0.070$.
[28] $p = 0\ 064$.
[29] $p = 0.078$.

("comfortable") was 1.75 higher. Regarding SN, *p* is never < 0.10, but all 4 indicators show that among those who switched the values are between 1.5 and 2.1 higher. RSS4 ("I would prefer to live closer to services") is 1.45 lower among those who continued to use public transport. All EC items are higher among those who switched, but since the values were already high for both groups and the differences are limited, the resulting figures are not significant.

Comparison with data after the trial period. H1, H2 and H3 are lower among those who switched (-0.97, -1.48 and -0.83), an accentuated difference than before the test period. Values given to Attitudes are all higher among those who continue to use public transport and for $p < 0.05$ are A3, A4, A5 and A6 (comfortable, relaxing, agile/easy to use and good), which are respectively + 1.15, + 0.98, +1.54, +1.12 (previously only A3 was significant for $p < 0.10$). PBC1 ("could easily use PT to work") and PBC2 (judgment of PT offer in Riksten) present higher values among those who switched to public transport (+ 0.98 and + 1.05), while PBC5 ("know how to use PT") and PBC6 ("difficult to use PT in the next month to go to work") present lower values (- 0.37 and - 0.95[30]). Subjective Norm items are in all cases higher among those who continue to use PT, but only SN1 is significant for $p < 0.10$[31]. Regarding Environmental Concerns items, also in this case there are no results with $p < 0.10$, but all values are higher among those who continued to use PT.

Comparison between project participants and control group

Project participants who use public transport more and control group non-habitual car drivers. Among this group of project participants the travel need is much higher than those in the control group who do not commute by car (1.8). Car habits are significantly higher among project participants before the test period (between 1.8 and 3.9 higher) as well as SI1 and SI2 (2.2 and 2.1) and, despite a one third decrease, they remain much higher after test period. Regarding Attitudes, project participants have given lower values to all items before the test period, in particular A2 (- 1.3) and A6 (-1.0), while after the test period they are more similar to non-habitual car drivers in the control group (slightly lower). Regarding the Perceived Behavioural Control, among project participants PBC1 ("could easily use PT to work") shows a value 1.7 lower before the test period and 1.6 lower after it, PBC3 ("it takes much more time to travel by PT to work) 1.4 higher (only before the test, after it it's still 0.8 higher but $p = 0.18$) and PBC6 ("How difficult would be for you to travel mostly by PT to work?") shows a value much higher +1.5 (before the test) and 1.7 (after the test). Among the RSS indicators, only RSS6 is significant because project participants consider less important a good public transport where they live (- 0.5). Before the test period in the Environmental Concern section EC3 ("My travel habits worsen the air quality of my neighbourhood"), EC4 ("I contribute to climate change"), EC5 ("I should use my car less") and EC7 ("Feeling of guilt") are higher among project participants than among non-habitual drivers in the control group (+ 1.2[32], + 1.3, + 2.5 + 2.1), while EC1 ("Car driving is harmful for the environment), EC2 ("People should use cars less") and EC6 ("Concerned about climate change") present almost identical values. After the test period project participants values decrease but EC5 and EC7 remain higher (+ 2.1 and + 1.8), while EC1 ("Car driving is harmful for the environment") is lower (- 0.6[33]).

Project participants who do not use public transport more and control group - habitual car drivers. These project participants have a higher need to travel during the day than the habitual car drivers in the control group + 0.9[34]. Yet, these project participants after the trial period indicated that they would have used public transport more than the habitual car drivers in the control group do (+ 1.4 in the following month). This group of project participants stated to have a stronger car habits (H1, H2 and H3), but slightly higher values have been indicated before the trial period (H1 + 1.0, H2 + 0.9 and H3 + 1.0). SI2 ("to drive the car is part of my

[30] $p = 0.066$.
[31] $p = 0.77$.
[32] $p = 0.053$.
[33] $p = 0.059$.
[34] $p = 0.085$.

identity") is higher among these project participants (after the trial: + 0.7[35]) especially before the test period (+ 0.9). All indicator of Attitudes but one (A4, "relaxing") among project participants were lower than the control group before the trial period, but none with $p < 0.10$, while after the test period they are all lower, in particular A1 – general attitude towards PT –, A5 – "agile/easy to use" – and A6 – "good" – (- 0.9, - 0.7 and - 0.7[36]). PBC 4 (judgment about the PT service in Riksten) was higher before the test period (+1.2) but almost the same as the habitual drivers in the control group after it. PBC5 ("I know how to travel by public transport") from being lower before the trial period has become higher among project participants (+ 0.3). Regarding item RSS3 ("I can tolerate to travel longer distances in order to live in a villa/townhouse area") it is higher than the control group, but the difference decreases after the test period (from + 1.6 to + 1.3). RSS4 is still lower among these project participants after the trial period, but it decreased (from 0.7 to 0.4[37]). RSS6 ("I consider important to have a good public transport in the area where I live") is 0.6 lower than the control group after the test period. EC1 ("car driving is harmful for the environment") was already slightly lower than the control group before the test period, but after that it reached -0.7. Similar trend for EC2 and EC3 ("people should drive car less" and "I think that I contribute to worsen the air quality in my neighbourhood") but not significant per $p < 0.10$. EC7 ("I feel guilty because I travel by car") is still higher among project participants, even if it decreased, but both before and after the test period p is < 0.10.

Project participants who switched and control group - habitual car drivers.

Apart from the intentions of using the PT and the actual use, which are higher among these project participants, both before and after the test period, some other items differ from the habitual car users in the control group. Car habits as well as SI and SI2 among these project participants were stronger before the test period, and SI decreased to slightly less than the control group while SI2 ("car driving is part of my identity") decreased from 1.5 higher to 0.9 higher. Attitudes towards PT were similar if compared before the test period and improved after it, although this is only faintly visible in the data ($p < 0.10$, except for A3 + 0.5 and A5 + 0.6[38]). Regarding Perceived Behavioural Control items, before the test period only PBC4 ("save money") was higher (+1.4) among project participants and significant per $p < 0.05$. After the test period PBC1 ("I could easily travel by PT to work"), PBC2 (judgment about PT in Riksten") and PBC4 are higher among project participants (respectively + 1.1[39], + 0.8 and + 1.0[40]), while PBC3 ("it takes much more time with PT") and PBC6 ("How difficult would it be to travel mostly by PT to work in the following month?") are lower (- 0.73 and – 0.9[41]). Regarding Residential Self Selection, RSS3 ("I can tolerate travelling longer distances as long I live in such type of neighbourhood") was 1.85 higher before the test period among project participants, and it stayed higher after it (+ 1.4). RSS1 ("I prefer to live in a suburban area rather than in a central/denser populated area") has become similar to the control group after the test period (from 0.5 higher) and RSS4 ("I would prefer to live closer to services") from a value lower than the non-habitual car drivers in the control group (- 0.8) increased (to - 0.4, not significant per $p < 0.10$) but still remained a little lower. Environmental Concerns items were all higher before the test period (but EC1 "car driving is harmful to the environment"), in particular EC5 ("I think that I should use my car less") (0.85) and EC7 (I feel guilty because I travel by car") (1.2). After the trial period all items decreased and EC1 has become -0.6[42], while EC7 remained higher (+ 0.9[26]).

[35] $p = 0.051$.
[36] $p = 0.094$, $p = 0.068$ and $p = 0.072$.
[37] $p = 0.08$ and $p < 0.10$.
[38] Respectively $p = 0.92$ and $p = 0.85$.
[39] $p = 0.057$.
[40] $p = 0.077$.
[41] Respectively $p = 0.064$ and $p = 0.052$.
[42] $p = 0.051$.

Correlations

When test travellers find that to travel by public transport is easier than expected, they are more prone to travel more (0.60 correlation) and to recommend it (0.68). Those who has been more positively affected by the test period stated that they would travel more (0.36), and those who tried out cycling and they continued to do it indicated that they will travel more (0.74). A positive experience during the test period positively correlates with "easier" (0.60), "affected" (0.31), times travelled (0.38), "travel more" (0.58) and "recommend" (0.35). "Travel more" and "times travelled" do not correlate with intention.

The number of cars available as well as the use of a car at work have a negative correlation (respectively - 0.46 and - 0.33) with the number of times when the test travellers used the public transport during the test period. The higher the level the education, the lesser test travellers continued to use public transport (- 0.31), and men tried it for more times than women did (0.34). The item "travel need" correlates negatively (- 0.37) with the effect of the test period, and those with stated that they were already considering other alternatives while choosing the car (H1) said that they travel more after the trial (0.41). Further, H2 ("to take the car is one of my routines") correlates negatively with the items "easier" (- 0.41) and "recommend" (-0.50), and at a lesser degree (- 0.29) with "how was". Attitudes correlate in particular with "recommend" (average: 0.36) and "how was" (0.34), but also with "easier" (0.30), while the times when PT has been used during the test correlates only 0.2 on average. PBC1 and PBC6 correlate respectively positively and negatively with "easier", PBC4 correlates quite much with "recommend" (0.55), but also with "easier" (0.38) and "how was" (0.32), and PBC2 correlates with "recommend" (0.38), "how was" (0.37) and a bit less with "easier" (0.29). Those who stated that it would have been difficult to mostly use PT during the trial period (PBC6) tend not to travel more (- 0.34 correlation). Subjective Norms correlate positively with "recommend", "easier", "affected", "travel more" and "times travelled", SN1 and SN2 (referring to acquaintances) on average less then SN3 and SN4 (referring to people who mean something to the respondent), and in particular SN3 and SN4 correlate with "recommend" (0.39 and 0.41) and SN3 with "easier" (0.31). Regarding Residential Self Selection, RSS4 correlates negatively (0.34) with "travel more", and RSS5 with "easier" (0.32) and "recommend" (0.36). Lastly, "easier" correlates with Environmental Concerns on average more than the other items about the test period, in particular with EC2 (0.33) and EC4 (0.31). "travel more" and "recommend" correlates in a weaker way with EC items (EC2, respectively 0.25 and 0.20, is the highest correlation found), and the only exception is "affected" with a correlation of 0.37 with EC2.

Further analysis about Residential Self selection

Regarding RSS5 ("consider public transport in the dwelling area as important") it has been higher (0.6) among project participants, but not significant for $p < 0.10$, and this same difference has been registered between the two groups of project participants (travel more – travel same or less), but not significant for $p < 0.10$. This difference is very limited (0.2) between the group of project participants "travel same or less" and the control group – habitual car drivers, but it is 0.8 and significant for $p < 0.10$ between the group "travel more" and the control group – habitual car drivers.

Both the project participants and the control group, and for both the analysis of RSS index and RSS1, they have been divided in two groups as follows.

Regarding project participants, for RSS index the values have been from 9 to 18 (mean 15.5) and from 19 to 25 (mean 20.1). A lower value means a preference for suburban area. The difference between these two groups (group with lower RSS - group with higher RSS) that have $p < 0.05$ are the presence of children under 14 years old (- 0.6)[43], A6 (+ 0.9), SN2 (0.8), PBC6 (1.0) and the presence of children in the household (respectively 1.60 and 2.15 children), while H1 have $p < 0.10$ (0.08). When using RSS1 instead of RSS index, one group is made of people who gave a value from 1 to 4 (mean 3.3), including 11 people, and the other

[43] Also the presence of teenagers, but the answers are too few for draw any conclusion.

group is made of those who answered 5 (28 people). A lower value means a preference for a central/dense area. The differences (prefer suburb, high RSS1, - prefer central/dense area, low RSS1) where $p > 0.05$ are EC2 (+ 1.0) and EC5 (+0.9) (while the others EC are higher among those who prefer suburbs, but not significant for $p < 0.10$), while where for $p < 0.10$ there are travel more (- 0.5), travel need (- 1.0) and RSS3 (+ 0.6). Attitudes and the presence of children under 14 years old are all higher among those who prefer a suburban area, but p does not reach 0.10.

Regarding the control group – habitual car drivers, RSS index values have been from 7 to 15 (mean 15.6) and from 16 to 22 (mean 19.0). Here are reported the differences between those with a lower RSS (preference for suburbs) and those with a higher RSS. Only RSS4 (- 1.2) and RSS5 (- 0.9) have $p < 0.05$, while only SN2 (- 0.5) and RSS6 (- 0.2) have $0.05 > p < 0.10$. When using RSS1, values have been from 0 to 4 (2.9 mean) and 5. For $p > 0.05$ there are A1 (1.1), A2 (1.7) and A3 (1.4) (the other A, which show the same pattern, do not reach $p > 0.10$) and RSS4 (1.3). For p between 0.10 and 0.05, there are the use of public transport and the car to work (respectively - 0.7 and + 2.4) and H4 (1.0).

The same analysis but conducted with RSS3 showed very similar results, because RSS1 and RSS3 are correlate with each other.

7.4 Results of the third survey and comparison with the second

Among the 35 people who answered the third survey, around 50% (18) answered that they will travel more by public transport. 27 (77%) answered that they think that the municipality should implement such project elsewhere, 5 do not know if the municipality should do that and 3 (who also do not travel more) think that the municipality should not do it again somewhere else. 4 people (12%) who were not travelling more after the second survey now answered that they do it.

Among those who use public transport more, Environmental Concerns have raised, by up to 0.9 (all means have become higher than 4 except for EC7 – feeling of guilt- that has become 3.4), while among the other project participants they further decreased (means of all items but EC7 are between 2.8 and 3.9), in particular EC7 (feeling of guilt) that has become 1.5 (from 2.3). Subjective Norm present higher values for all project participants, in particular for those who use public transport more.

In the control group (habitual and non-habitual car drivers) values have stayed constant, except for:

- The number of trips, both by car and public transport, which both have increased of 1.2 per week.
- A3 (comfortable), which increased of almost 0.5 (to 3.2)
- RSS1 ("prefer to live in suburban area"), PBC1 ("easy to reach work by public transport") and H3 ("to use the car is typical of me") increased (respectively by 0.3[44], 0.5 and 0.3).

7.5 The model

By using the 39 observations after the second survey, departing from the syntax in Equation 4, numerous attempts have been made. The elements "travel need", members of the household ("pp14", "pp17" and "pp18") and "distance travelled" do not have a notable effect, because their p is always high and their estimated effect low. The element SI3 does not have an appreciable effect on the intention (> 0.1 on a scale to 5, meaning less than 1%) and its p is higher than 0.5, but it might have an effect on Residential Self-Selection, but due to the small amount of observation it is not possible to draw conclusions about it (p higher

[44] p is respectively 0.09, 0.07 and 0.09.

than 0.5). The working model specification (Chi-square = 0,004) is as follows (Equation 11). The complete output table with the results of this model is in attachment 11.16, while in table 6 are presented the main results. The maximum value in "Estimate" could have been 5.

```
MYMODEL.MODEL <- ' # measurement model
I =~ A + PBC + SN + SI1and2
#regressions
I ~ H + sex + age + work_time + EC
RSS ~ SI1and2 + A
How_many ~ I + H
Travel_more. ~ H + I
# residual correlation
SI1and2 ~~ H
'
fit <- sem(MYMODEL.MODEL, data = mydata, std.lv = TRUE)
summary(fit)
```

Equation 11: working model specification

Table 6: main results obtained from equation 11. The maximum value in "Estimate" could have been 5.

Latent Variables:

	Estimate	Std.Err	z-value	P(>|z|)
I =~				
A	2.659	0.912	2.914	0.004
PBC	1.581	0.518	3.053	0.002
SN	1.558	0.660	2.363	0.018
SI1and2	-0.811	0.357	-2.271	0.023

Regressions:

	Estimate	Std.Err	z-value	P(>|z|)
I ~				
H	-0.080	0.044	-1.814	0.070
sex	1.092	0.564	1.935	0.053
age	0.862	0.399	2.159	0.031
work time	0.336	0.177	1.901	0.057
EC	-0.011	0.034	-0.330	0.741
RSS ~				
SI1and2	0.483	0.194	2.482	0.013
A	0.014	0.078	0.177	0.860
How many ~				
I	-0.022	0.083	-0.262	0.793
H	-0.034	0.016	-2.135	0.033
Travel more. ~				
H	-0.018	0.023	-0.787	0.431
I	-0.065	0.122	-0.535	0.593

Intention is strongly defined by Attitudes, which constitute the 46% of the factors that motivate it. The remaining percentage is equally divided between Perceived Behavioural Control and Subjective Norms. SI1 and SI2 ("At what extent do you think of yourself as a motorist?" and "To drive a car is part of my identity") diminish the strength of intentions (-14%). Intentions is little influenced by habits (- 0.08045) and not influenced by Environmental Concerns. Sex is the major factor influencing intentions (1.092), meaning that men have stronger intentions[46], followed by age (0.862), meaning that people who are more than 40 years

[45] $p = 0.070$

[46] In the coding, women were coded with the number 0 and men with the number 1

old have stronger intentions47. In case of a more flexible work time, intentions are also positively influenced (0.336). Residential Self-Selection seems to be influenced by Self-Identity 1 and 2 (0.483), but p is not low enough (0.13). Intentions and habits do not influence the number of time travelled during the test period nor a higher use of public transport after the trial.

When trying the model above with RSS1 instead of the RSS index, the model is not identified.

Role of items in forming the latent variable "intention". If using the results of equations 5 – 8 and equation 9, the results are as follows:[48]

- As it concerns Attitudes, from A1 to A4 they all similarly contribute to forming "Intention", and the difference between methods is minimal, with a proportion of contribution to intention ranging from 17.8% to 19.6%, while A5 and A6 contribute respectively around 13.5% and 12%.
- Regarding Perceived Behavioural Control, PBC2 and PBC4 contribute overall to PBC between 80% (using equation 9) and 95% (using equation 6). PBC 3 contributes for around 13% with both methods, while PBC1 and PBC6 contribute very little (toghether, around 7 and 5 %). PBC5 negatively contributes using both methdods, - 1% (equation 9) or -14% (using equation 6).
- For Subjective Norm, the fact that acquaintances expect project participants to use public transport (SN1) or the fact that they use it themselves (SN2) is lower than if people meaning something to the project participants expect them to use public transport (SN3) or use it themselves (SN4). The results by using equation 7 and 9 are respectively 19% and 25% (SN1), 23.5% and 18% (SN2), 29.5% and 31% (SN3), 28% and 25% (SN4).
- Regarding Self-Identity, only SI1 and SI2 are considered, because SI3 measures another characteristic of self-identity and it is part of the model employed (see equation 10). SI1 makes up alternatively 60.5% or almost 57% (respectively by using equation 9 or equation 8), while SI2 makes up alternatively 39.5% or 43% (by using equation 9 or equation 8).

In all cases the Chi-square value of the equation is lower than 0.001. Regarding the single values, for Attitudes *p* is always ≤ 0.001. For Subjective Norm and Self-Identity p is always < 0.05 except for one value each. For Perceived Behavioural Control *p* is always < 0.001 by using equation 9, while by using equation 6 *p* is ≤ 0.001 for PBC2 and PBC4 (the highest values, which constitute most of PBC), while the other PBC items have *p* > 0.10 (but their contribution to PBC is marginal).

7.6 Discussion of the results

Why to choose to be a test traveller?

Project participants' car habits are perceived as rather stronger than the habitual car users control group's, even if the number of times the car is used is similar, with the only difference of the length of these trips that are slightly longer. This is marked by the fact that project participants see themselves more than the control group - habitual car drivers as motorists and that they feel that the car is part of who they are. Project

[47] In the coding, people between 18 and 40 years old were coded with the number 0, those older that 40 with the number 1.

[48] N.B. the proportions here presented refer to the summation of the items of each aspect of the core of the TPB. Therefore, when presenting Attitudes, it is to keep in mind that ∑A = 100%. When presenting the proportions of each item contribution for Perceived Behavioural Control, it is to keep I mind that ∑PBC = 100%. The same applies for Subjective Norm.

participants are therefore willing to reconsider their habits, maybe because they feel as sort of overpowered by them.

As literature shows (Bamberg, 2006; Thøgersen 2012, Thomas, 2010; Kley, 2011; de Groot et al., 2011; Scheiner & Holz-Rau, 2013), those who most recently moved are more willing to try out new ways of travelling, because there is an appreciable difference between the time of relocation among project participants and control group - habitual car drivers and because project participants that have lived for longer in Riksten have indicated a lower intention to use public transport. Therefore, when people are moving in a new home it is the right moment to make them rethink their car habits, in particular for those who have higher Environmental Concerns, where the key item in Environmental Concerns seems to EC7 ("I feel guilty because I travel by car").

Attitudes and environmental concerns present significant differences between project participants and control group - habitual car drivers. Subjective Norm seems not be a discriminating factor between project participants and the control group - habitual car drivers. Instead it seems rather important the difficulty to reach the workplace by public transport and the belief that public transport would make the person save money.

It seems also meaningful the difference between project participants and control group - habitual car drivers in question RSS3 because project participants seem tolerate less than the control group - habitual car drivers to travel longer distances only for the sake of living in a suburb[49]. However, project participants Attitudes towards public transport correlate positively with PBC2 (the judgment of its offer in Riksten), but this does not occur in the control group - habitual car drivers.

Even if women were already using public transport more than men (Burazor, 2016), respectively 49% and 34%, women and men are equal in numbers among project participants. In the whole Stockholm County men travel more by car than women (Trafikförvaltningen, 2016), therefore these figures were expected. Further, women present higher Environmental Concerns, also in the control group - habitual car drivers.

Project participants are in general younger, and it might depend on the fact that younger people have higher Environmental Concerns, and albeit they see that the car is less a problem than older people do, they feel guiltier for using it. Further, as literature confirms (Stave et al., 2017; TNS Political & Social, 2014) youngers have a more positive attitude towards public transport and they have a more moderate view about PBC4 (money saved) and PBC5 (to know how to use public transport). Younger people have also more freedom regarding their work time, and this is also a characteristic of the project participants, and they interestingly indicated a lower travel need.

Interestingly, 39% of the project participants do not have an education level higher than high school, more than double the control group - habitual car drivers' proportion, which though reflects more the actual proportion of those living in the area. This might depend on the fact that hose with a lower education level have a more positive attitude towards public transport, especially in the control group - habitual car drivers, hence they expressed higher values of intention, and this finding is supported by European Union research (TNS Political & Social, 2014).

Effect of the test period

Although between the 1st of May and the 16th of June there have been 7 times disruptions in the commuter train line 36 in the stretch between Södertälje Centrum and Stockholm Central (where Tullinge station is located) (SL, 2017), almost half of the project participants continued to use public transport. However, it is to notice that 9 respondents (22%) brought it as a reason for not continuing to commute with public transport. In Figure 28 and Figure 29 it is possible to see the amount of disturbances and disruptions on all

[49] Translated as villa/radhusområde (villa/townhouse area) in Swedish.

train lines and specifically on line 36 from October 2016 to September 2017, which have been the most numerous since December 2016 and they increased during May.

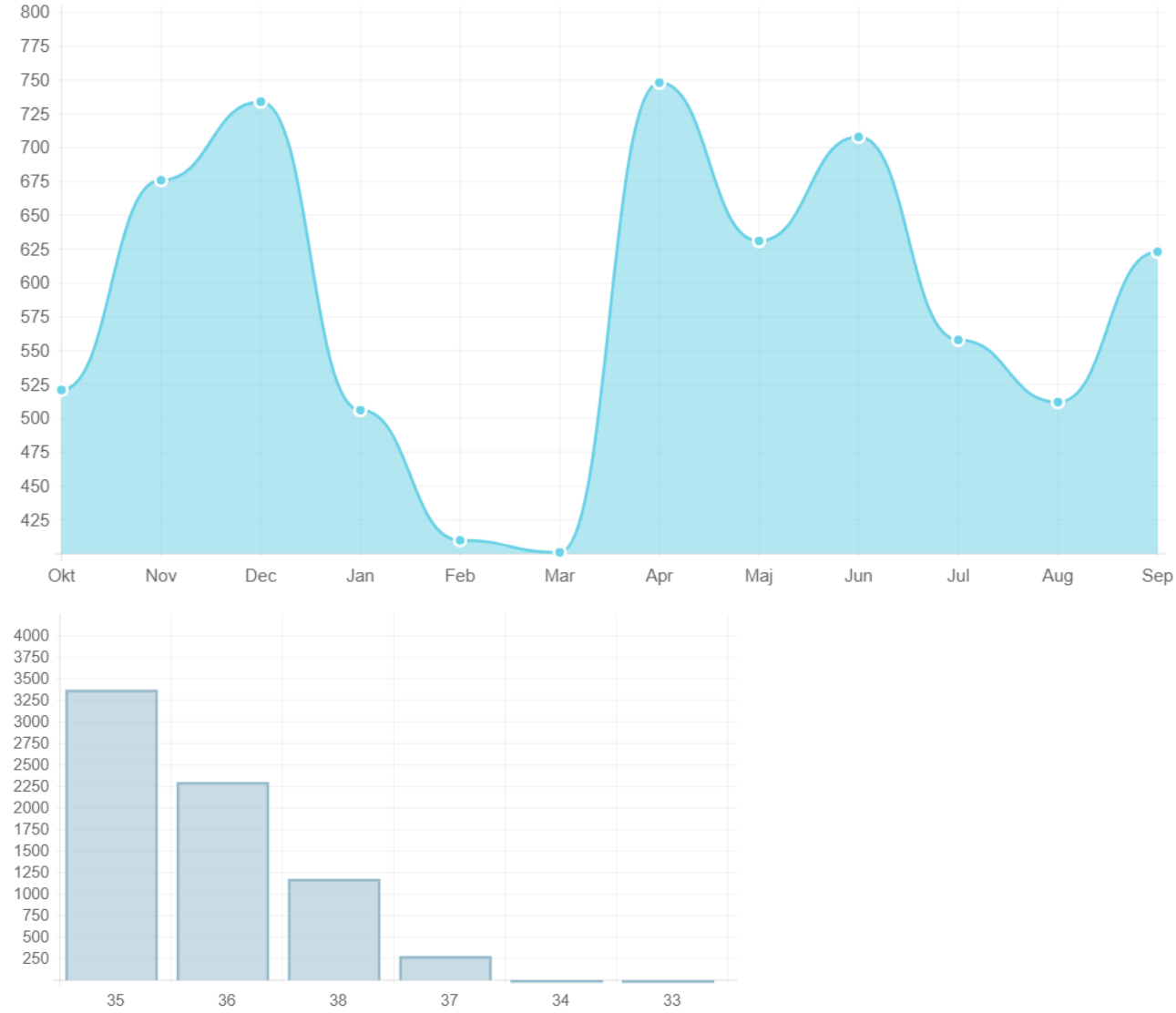


Figure 28 and 29: Disturbances and disruptions on all commuter train lines in Stockholm County (upper figure) and disturbances and disruptions per line (lower figure). Period: October 2016 – September 2017. Source: SLstats, 2017.

From table 5 and from the correlations, it is evident that those who had a positive experience during the trial period indicated that they would recommend others to use public transport and that they travelled at least 2 or 3 times per week. Further, they reported that their view about public transport had been positively affected but, interestingly, only for 6 of those who stated that they would travel by public transport more (out of 19) found it easier to use that expected, and the majority found it nor easier nor more difficult. Correspondently, those who answered that they would travel by public transport as much as before expressed a more neutral opinion, while those who would travel less (4) marked negative answers. These answers are reflected in the other sections of the second survey, where those who would use public transport more have given higher values to Attitudes and lower values of habits than in the first survey, and correspondently the opposite for the other group of project participants. Lower values for Attitudes is a negative outcome of the project, against which Strömberg et al. (2016) and Abou-Zeid and Ben-Akiva (2012) warn, because this would make it more cumbersome to persuade these people to use public transport

instead of their car. Another negative outcome are the decreased values given in the Environmental Concerns among all project participants regarding car use, arguably because they realised that it might be necessary and/or difficult to quit driving than they expected. Interestingly, both in groups after the trial participants have given lower values to PBC4, meaning that they do not deem as strongly as before that public transport would make them save money, therefore they might have a more correct perspective about it and it may not be something to be considered negative. Surprisingly, after the test period especially the project participants who said to travel the same or less reported that they have learnt something new about public transport during the test period (new ways for moving around and how to face problems when travelling), and they now feel more confident when using it. Hence, the mean of PBC5 after the test period is almost 5 out of 5 (while in the other group of project participants this value slightly decreased, to 4.5 from 4.7). This result might be considered as positive, because this would facilitate them in case they would be to decide to choose public transport more often as they currently do, which is more than the control group – habitual car drivers. Interestingly, RSS3 decreased among all project participants, slightly more among those who do not use public transport more (respectively 0.4 and 0.5), but values still show that project participants prefer to live in a suburban area (around 3.8 after the trial).

When analysing the answers of those project participants who answered that they would not use public transport more and comparing their answers with the control group of habitual drivers, it emerges that they had stronger habits (1 point out of 5) before the test period, which however slightly decreased after the test period, and the same applies for Self-Identity 1 and 2. Attitudes were instead already slightly lower and, due to the unfortunate experience (as half of them underlined), these values decreased up to almost 1 point. Accordingly, the values given regarding the judgment about the public transport offer in Riksten decreased, reaching the same level as the control group – habitual car drivers (+1.4). Regarding Environmental Concerns, even if values among these project participants have decreased, they are not significantly higher or lower than the control group – habitual car drivers.

Among project participants who indicated that they would use public transport more, the travel need is much higher than those in the control group – non-habitual car drivers, as well as Habits and Self-identity question 1 and 2. This is because these project participants still use the car for commuting more than those in the control group who do not. Interestingly, Attitudes values of these two groups are now similar. Yet, these project participants perceive that it is more difficult to reach the workplace by public transport, however not as much as before the trial. Regarding Environmental Concerns, EC5 and EC7 are higher among these project participants, meaning that they still think that they should use less the car and that they feel guilty for using it.

It is interesting that project participants in the first survey had positive correlations between both SI1 and SI2 with PBC2, and not the control group – habitual car drivers. Arguably, some project participants did not have a clear idea about how was the public transport offer in Riksten, hence after the trial period RSS2 values decreased.

As Tørnblad et al. (2014) showed in their study, project participants did not receive new pieces of information from the municipality's leaflets.

PBC4 (I know how to travel by public transport […]) is substantially higher after the test period among all project participants. Further, even among those who indicated a not higher use of public transport after the trial there have been comments expressing an improved knowledge about the transit system and an increased self-confidence when travelling by it. This is something in contrast with Tørnblad et al. (2014) paper, because they underlined how the test traveller project is not providing new information to project participants, and that they already know and/or have the means for getting to know how to use public transport. However, this experiment, as well as the projects in Sweden described in chapter 3, shows that

test traveller projects are helpful for project participants and that that access to information might not signify to actually be informed[50].

Who are the project participants who use public transport more?

Regarding the participants' intention, no significant *p* has been found. Maybe in this particular case, where people voluntarily participated, the intention might not be a predictor of future behaviour. As it has been observed, those who experienced problems or difficulties to travel with public transport have travelled less times during the test period, regardless of the initial intention, and consequently they have indicated that they are not going to travel more after the trial.

By comparing the stated values for habits, they are stronger among those who do no travel more by public transport after the trial, but not in a great way, and in the model they do not appear to have a role. Literature is not unanimous about the role of past behaviour. Some (i.e. Bamberg et al., 2003) found that past behaviour is highly mediated by the new information and experience, others (i.e. Thøgersen 2009 and 2012) found that, albeit less than other factors, it does influence the intention to use public transport (33%) and decision after a test traveller project (10%). The conditions in the present experiment are however similar to Bamberg et al.'s experiment, because participants have voluntarily taken part at the trial, while in Thøgersen's study case people were randomly selected. Further Riskten area is relatively new-built (ten years old) and project participants have been living there for a shorter period (less than the control group). Therefore, habits might play a more limited role when participants free willingly choose to become test travellers, because they themselves want to change their habits, in comparison to when people are randomly selected and, as Bamberg et al (2006) demonstrated, previous behaviour is not a predictor in case of residential relocation.

One's attitude towards public transport is the best predictor of who is going to use more public transport after the test period. All items have a similar importance in defining the intention, and it seems that "comfort" is the most important when deciding if to travel more after the trial.

Subjective Norm seems also to have a role, in particular the expectations and the behaviour of the people mean something to the individual. Interestingly, in the second survey Subjective Norm correlates with a more positive perception that project participants had during the test period and, when Subjective Norm values are high, test travellers will tend to recommend public transport to other people. Its weight in defining intention is almost half as Attitudes.

Perceived Behavioural Control seems to have the same weight as Subjective Norm in defining intention, but one's intention seem to be influenced the most by how bad or good that person perceive the public transport offer in the dwelling area and how much that person deems that by travelling by public transport he/she will save money (which both positively correlates with Attitudes). The finding regarding the saving of money is however not supported by the literature, because in Thøgersen (2009) he indicates that it did not have any effect in his research. It might be argued that this item could have a different importance in different contexts, depending on the costs of car owning and car driving compared to public transport.

Those who know better how to use public transport present a lower value of intention, and this might mean that they already know, or at least have more than a clue, about how it is going to be to use it, and their view might be closer to how it really is than the other project participants. Further, the difficulty of reaching the workplace by public transport seems not to be important in forming the intention, because probably for those who knew that it would have been high did not become project participants in the first place. As expected, those who stated that it would have been difficult to mostly use PT during the trial period (PBC6) tend not to travel more.

[50] In some comments participants have demonstrated gratitude for taking part to the project, because they learned something new and had the opportunity to try out, which would have never have happened spontaneously.

Environmental Concerns were higher among those who answered in the second survey that they would use public transport more, but the difference is small, and this means that the major difference regarding Environmental Concerns is between control group and project participants.

As expected (TNS Political & Social, 2014), young age and a lower education level seem also to be factors that lead to a higher public transport use after the test period and, as expected, those with more cars available in the household and those who use the car at work tend not to travel more after the test period.

From this analysis it emerges that the project participants, and in particular those who use more public transport, present a certain degree of "cognitive dissonance" (Festinger, 1957), because their behaviour before the trial period seems to have been in contrast with their Attitudes and personal values. They therefore decided to participate to the test traveller project in order to adjust their behaviour (Busch-Geertsema & Martin Lanzendorf 2015), to make it consonant with their very own self-concept (Verplanken et al., 2008). When deciding to participate to the test traveller project, they "cognitively activated" (idem, p.122) their set of values and, interestingly, few participants even expressed gratitude, in the second and in the third survey, because they had this opportunity.

Residential Self-Selection

Surprisingly, among project participants RSS1 ("prefer suburban area") and RSS2 correlate positively with Environmental Concerns items, and H1 ("choose to take the car without considering the other alternatives") correlates negatively with RSS1. These correlations, however, do not occur in the control group – habitual car drivers. These results suggest that project participants prefer a suburban environment, but have higher Environmental Concerns and are well inclined to use public transport. Further, project participants really dislike spending more time travelling. Therefore, they also want a good public transport service but they also want to live in a suburban area.

Regarding only RSS1, those who gave 5 as value could be considered true suburbanites, suburban residents with suburban land use preferences (as defined by Schwanen & Mokhtarian, 2005). Those who prefer to live in a suburban area seems to have better Attitudes towards public transport, maybe because they expect it to be more incommodious to use and that implies longer commuting times. Further, among project participants, true suburbanites have higher Environmental Concerns, more children[51], and maybe they chose to live in such a neighbourhood in order to be in a cleaner area, but this does not happen in the control group – habitual drivers. In the control group – habitual drivers car use is much higher among suburbanites and public transport use is lower. Among project participants, true suburbanites seem to have a higher travel need and it seems that they tend to increase to a lesser degree their public transport use after the test period than the mismatched suburbanites.

This result is consistent with what Schwanen & Mokhtarian (2004 and 2005) and Moktharian and Cao (2008) works, who described true suburbanites as prone to car use, while mismatched suburban dwellers tend to use public transport. However, in this particular case the "hierarchy constraint" (Hägerstrand, 1970), does not apply, because the people living in Riksten are rather affluent, therefore they chose this place for dwelling without, or at least limited, constraints related to the price of housing in more central areas. However, values given by both project participants and control group – habitual car drivers regarding RSS are rather similar, and there is an evident preference for a suburban dwelling, even among project participants (72% have given the maximum value, 5, and 15% have given the value 4). Hence, those who travel more by public transport and present urban land use preferences are only 3 (out of 19, the total who travel more). It is therefore here proposed a new categorisation of suburbanites:

[51] In particular when considering the RSS index as a whole

- Transit-oriented true suburbanites or Eco-friendly true suburbanites: They have suburban land use preferences but still want to use public transport (maybe for their higher Environmental Concerns and/or the presence of children).
- Car-oriented true suburbanites: they have suburban land use preferences and they are indifferent to the public transport options in the area where they live.

Third survey

The small differences in the control group's answers might be explained by the opening of the "citybanan" (Trafikverket, ND. and 2017), which has slightly improved accessibility to Stockholm central areas for commuter train users. The results regarding the project participants confirm the findings. Interestingly, the proportion of those who travel more has not decreased. However, the five people who did not answer the third survey do not travel more by public transport, hence the proportion of those who use public transport more might be slightly lower than the second survey, as literature suggests.

Interestingly, 4 people who were not travelling more after the second survey now travel more by public transport, but It is not possible to know why this happened. It can be a lagged effect of the project, or due to changes in these participants' lives or changes in the external conditions (the opening of the citybanan), or a combination of these two, but "These effects could only be investigated by panel data but not with cross-sectional data" (Lanzedorf, 2003).

If considering only the project participants who answered in both the second and the third survey that they travel more by public transport, the result is 11 people, which is the 27% of the initial number of project participants (41), which is still a meaningful and positive result.

7.7 Summary of the findings

This project seems to have both created an interference, a disruption in the habits of the project participants, and it has taken advantage of the "window of opportunity" created by itself and by the cognitive dissonance of some of the project participants, which would have never tried out a regular commuting by transport spontaneously. The project outcome is undoubtedly positive, due to an increased use of public transport by almost half of the participants, higher than the international literature experiments (34% the highest, Taniguchi and Fujii (2006)) and the mean of the other projects in Sweden (40%), but not higher than the mean of the small projects carried out in Sweden (59%). The project is however flawed by the worsening of some project participants' view upon public transport, due to their negative experience by trying out commuting by public transport. For almost half of the participants who reported to have had a negative experience, and therefore a worsened view about public transport, the cause has been the numerous problems regarding the train line.

This project has confirmed much of the literature findings, but it also has opened new questions. Here follows a summary.

- It contributed to the debate upon the habits role. In this project it seems that those who decided to participate (perceive to) have stronger car driving habits but would like to make a change, and the test traveller project could have such effect. It might also be that project participants, in particular those who are more willing to rethink their travel habits, overestimate their travel habits. However, as literature suggests, previous behaviour still has a role, because participants who are not travelling more by public transport after the trial had previously even stronger habits than the other project participants. However, their role is minimal in this case, where people "self-selected" themselves by voluntarily participating. Therefore, in case of a non-self-selection habits might play a more

important role. The same reasoning applies also for Environmental Concerns, because the major difference is between participants and control group, hence they already selected themselves.

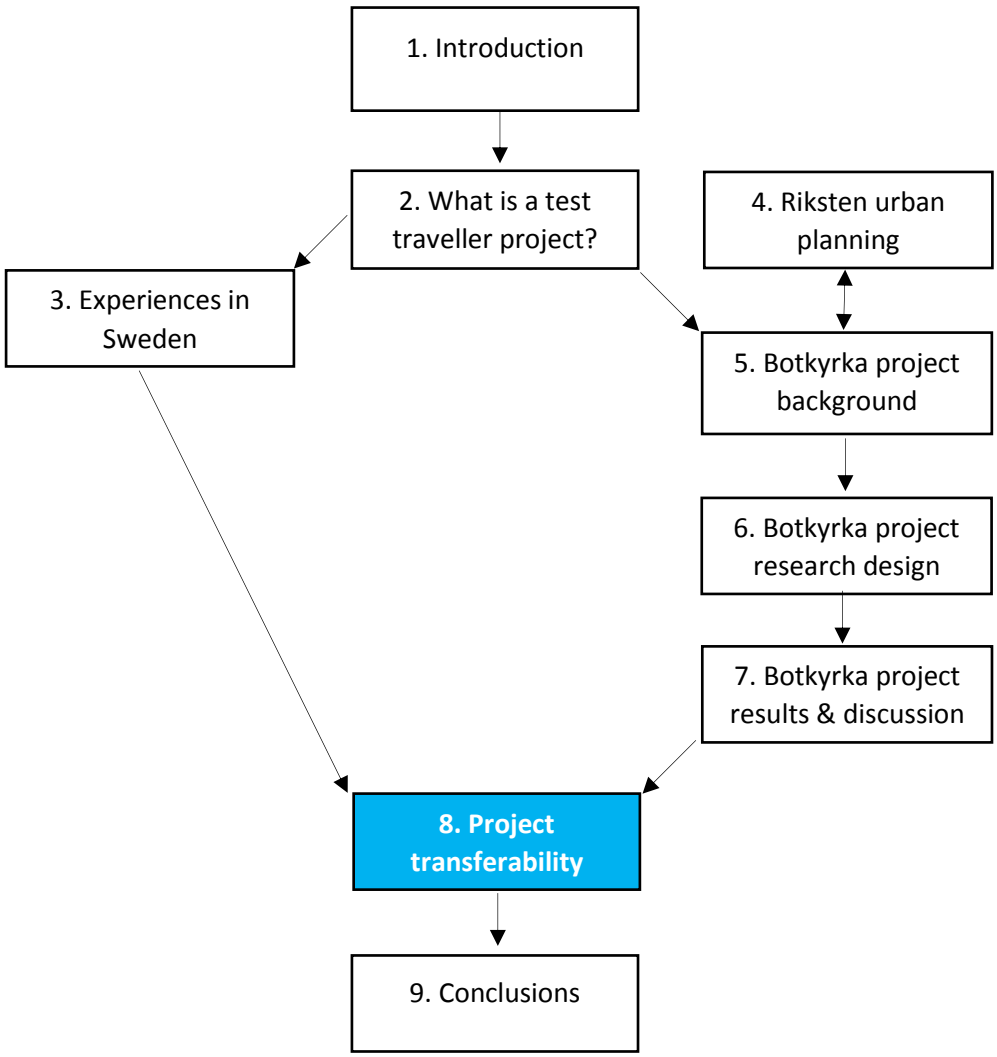
- It has confirmed literature warnings about worsening of the view of public transport if the test travellers encounter problems and/or bad travel conditions during the trial. Participants corrected misconceptions they previously had, as the costs of using public transport, and part of them learned something new about how to use public transportation and feel more self-confident when travelling by it, even among those who do not travel more as before the trial period.
- Attitudes, as also literature suggests, are the major defining factor for deciding to use public transport or the car, followed by Subjective Norm, and in particular the persons who mean something to the respondent are the ones with the greatest influence.
- Regarding Perceived Behavioural Control, in the present study the difficulty to reach the workplace by public means seems not to be a determining factor for the project participants in order to predict who will use public transport more[52], but rather the perceived level of the transport offer in the dwelling area and the perception to save money.
- While sex is not a decisive factor at all, it seems to have a certain role the education level, where high educated people tend to have more negative Attitudes and to use public transport less.
- Residential Self-Selection has a more complex role. The previous literature findings are valid, but when working with a test traveller project in a suburban context there seems to be a category of people who have suburban land use preferences and have as well both positive Attitudes towards public transport and higher Environmental Concerns.

It is not possible to know a priori how are people's beliefs and which education level they have, a survey is indispensable. Yet, young people and people who moved to the area more recently demonstrated to use public transport more after the test period, and literature confirms it. Hence these groups may be chosen as a target for a test traveller project even without a previous survey, eliminating costs and times for preparing, sending and analyse it.

[52] Again, it should be kept in mind that project participants already self-selected themselves before the test period, they have not been randomly selected. Notably, one person called the project organisers and expressed sorrow for not participating (and therefore not applying for the project) because of the difficulty of reaching the workplace by public transport.

8 Project transferability

In the previous chapters are presented good practices, recommendations, how to organize and conduct a test traveller project and there is an analysis of how and at what extent a test traveller project can make car drivers switch to public transport. This chapter is dedicated to a more complete and broader analysis of feasibility of the project, by briefly evaluating the feasibility in the European Union countries, and using a comparison between Sweden and Italy, which despite being both European Union countries, present significant differences. For this purpose, it is analysed if the project is further applicable in Sweden, and if it is feasible in Italy, in particular in the city of Turin by comparing it with the Swedish city of Gothenburg – the capital city of a region where the local transport authority (Västtrafik) has conducted (and still conducts) numerous test traveller projects. Turin and Gothenburg have a comparable size and some common characteristics, making a comparison interesting.



8.1 Overall feasibility of the project

Social acceptance of public transport investments

In Sweden, the citizens are generally in favour of using public transport and in favour of public investment in public transportation as shown by the following studies:

- In the Stockholm central region (Stokcholm, Solna and Sundyberg municipalities) around 46% of trips are made by public transport (Trafikförvaltningen, 2016);
- the travel habits survey of Riksten (Burazor, 2016) where around 80% of the car drivers stated that they would use the public transport instead of their car;
- In Västra Götaland region (whose capital city is Gothenburg) 71% of inhabitants are in favour of investments in public transport, more than those in favour of other road infrastructures (Elmquist, 2012)
- Political efforts and goals set at the various level, from national to local, targeting a better environment, a decrease in car use and a higher public transport ridership. For example, Gothenburg municipality targets for 2035 to have only 29% of trips made by car (Göteborgs stad, 2016), Stockholm County goal of increasing public transport share from 49% in 2015 up to 51.5% in 2020 and 54% in 2030 (Trafikförvaltningen, 2017) and the Swedish government's and agencies' goal of doubling the public transport share in 2030, compared to the 2006 levels (Järnvägs- och kollektivtrafikfrågor, Parliament act 2014/15:108).

Political and administrative issues

As it has been explained in the case of Botkyrka municipality, the collaboration between the various political and administrative actors involved is important for achieving better results and being more effective. When all politics and administrative sides agree on conducting a test traveller project it is easier and more cost effective to organise and carry out a test traveller project, because:

- there is no need of seeking for an agreement between the parts;
- it is more cost-effective (costs split between the agencies and the body involved, the public transport company provides the transport cards for a minor price – the cost for the physical card);
- all actor involved are interested in promoting the initiative among the population.

8.2 In the European Union

Test traveller projects have generally succeeded in attracting and captivate new customers to public transport in Sweden. But could such type of project be used in Italy and in the rest of the European Union?

Regarding European Union countries, a research commissioned by the European Commission may be of help. The results of this study (TNS Political & Social, 2014) describe European Union citizens' satisfaction with urban transports in their countries. The study is limited to the urban transports, but since the majority of European Union citizens (75%) live in cities, that data may be used as an indicator for the all local transport services used for the daily travels and commuting.

As presented in this work, a person is going to change his/her travel behaviour if he/she deem that this mode of transport responds overall for himself/herself better than another transport mode to a series of criteria, which can be for example the ease to use it, its availability and other people's opinions about it. Therefore, it is important that the people's satisfaction with public transport, and its (perceived) quality is good.

As it can be seen in the TNS Political & Social report, the majority of people in the 28 EU state members is overall satisfied by the public transport (Figure 30). Sweden achieved the 11th position, with 71% of

satisfaction, while Italy is 26th with a meagre 53%. In the first three positions there are Luxemburg (88%), Latvia (83%) and Finland (82%). When looking at the other indexes, such as provision of information and timetables, routes, amenities for passengers at stops and stations, frequency, and punctuality & reliability, Sweden has achieved quite high positions (6th, 10th, 5th, 7th and 12th), while Italy is at the bottom of this ranking (25th, 20th, 27th, 25th and 26th). It is pertinent here to underline that this data refers to people's opinion, and therefore a service that may be perceived as good or bad in a country might be not seen as such in another country with the same level and quality of service. However, it is appropriate to adopt such type of data because the mode choice is not something completely objective but, as the Theory of Planned Behaviour says, it actually depends on the individuals and on how they perceive the context in which they are.

The sample of people used for the TNS Political & Social report is sufficient for taking the data as valid (28,000 people interviewed, 1,000 per country), and it represents a variety of individuals with different levels of use of public transport. Given the data above, it is arguable that a test traveller project might have less success in a country where the overall (perceived) quality of the public transport is low, because less people would be satisfied by their experience, thus they would return to drive their car and maybe positively reinforce their view of the previous travel habit (Strömberg et al., 2016). On the other hand, it is arguable that where the public transport is perceived of good quality and satisfying, a greater share of test travellers would stick to it. Further, a test traveller project might have even better results in those countries where, in addition to good quality transport, the average ridership is modest compared to the rest of the EU (see Figure 31). It may be the case of Finland, UK, Ireland, Belgium, Spain and France, where - as an additional aspect - in recent years the demand of transport has increased (International Association of Public Transport, 2016).

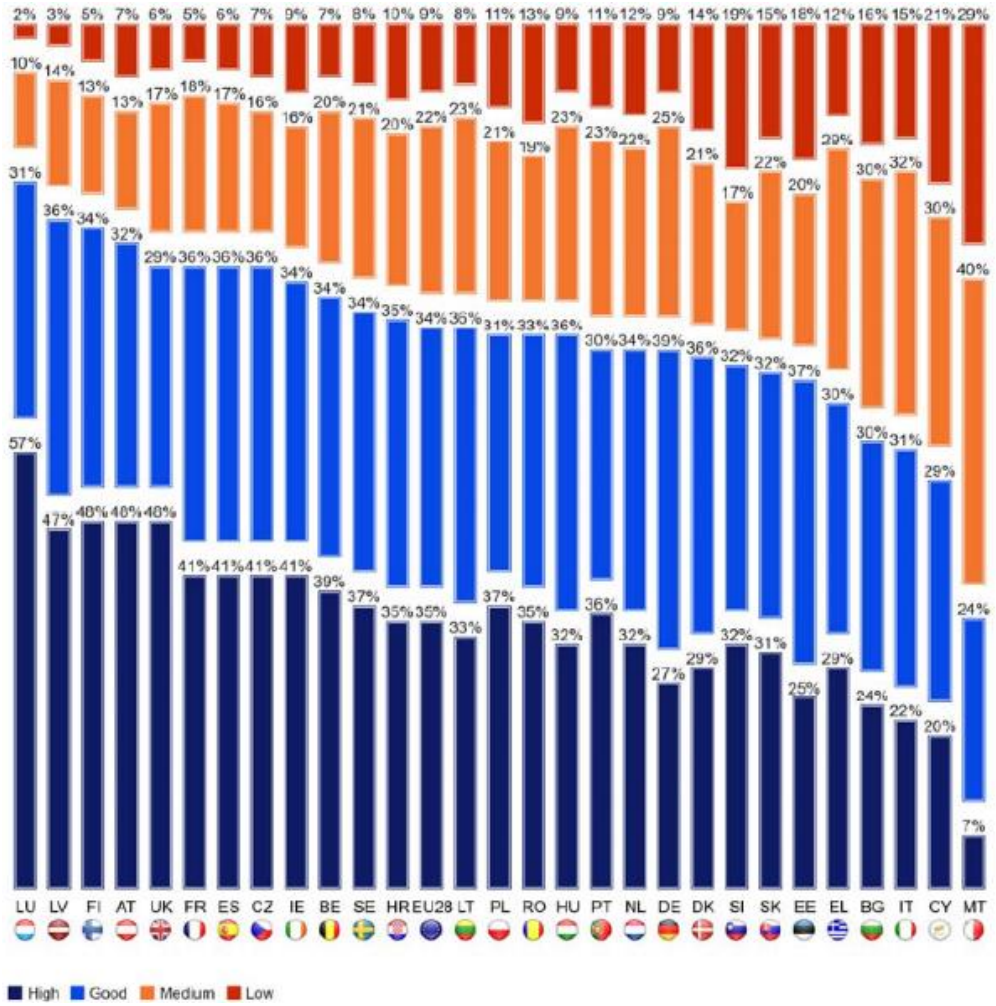


Figure 30: Overall public transport satisfaction in the European Union per country. Source: TNS Political & Social, 2014.

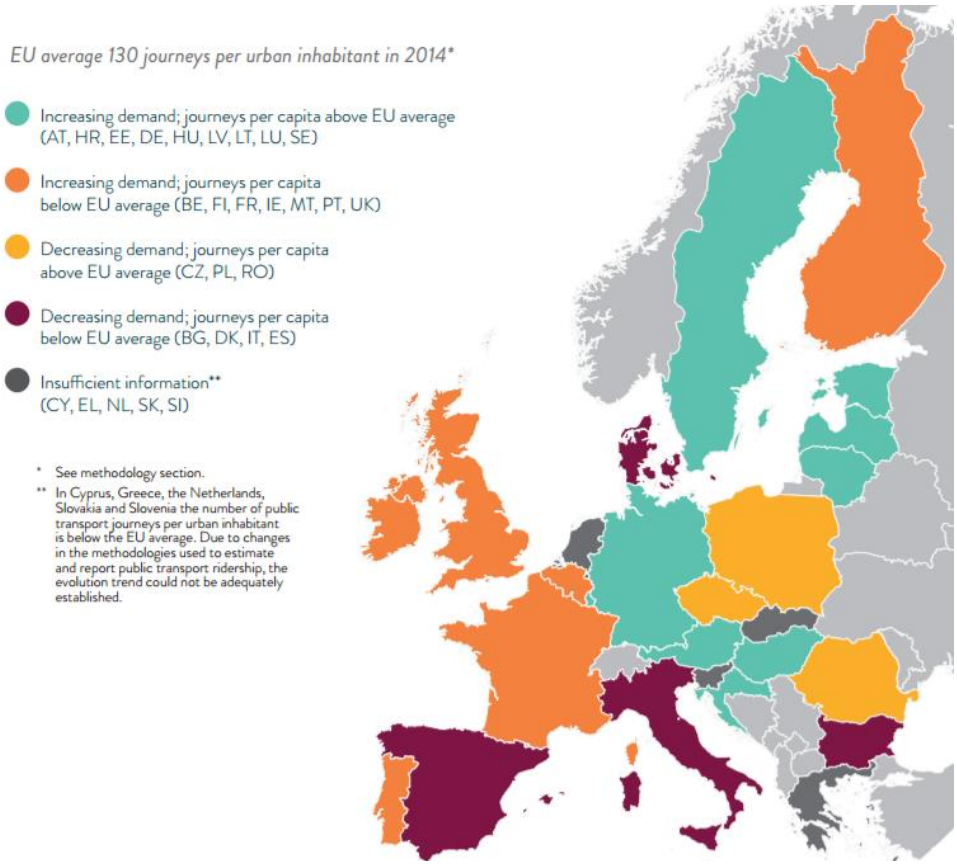


Figure 31: EU public transport journeys by bus, tram and metro per urban inhabitant in 2014 and evolution trend in the previous five years. Source: International Association of Public Transport, 2016.

8.3 In Sweden

In Stockholm County

Three test traveller projects have already been carried out (one in Huddinge, two in Tyresö, one in Nacka and one very small in Ekerö), which involved more than 4700 test travellers and resulting in an average of 30% of them continuing to travel rather regularly with public transport (see attachment 3).

In Stockholm County there are around 480 bus and tram lines, 7 metro lines and 7 railway lines, with numerous bus services running also during weekdays nights, and the public transport services are planned to be further expanded. In particular, at the beginning of 2018 the rail services will be intensified thanks to the opening of the Citybanan, a project aimed at increasing the capacity of the tracks in central Stockholm (Trafikverket, ND. and 2017). This increased capacity will be utilised for improving and intensifying the commuter train services of lines J35, J36 and J38, hence the numerous municipalities located along the railway lines (including Botkyrka) will be interested in this change. Test traveller projects in Stockholm County might therefore be more successful in light of this improvement, and they could be directed towards those commuters who nowadays use their car for travels that overlap with train routes.

Currently, in the central Stockholm region (constituted by the municipalities of Stockholm, Solna, Sundyberg) the proportion trips made by car is 24%, whereas the public transport represents the 46% of the modal share (Trafikförvaltningen, 2016). In the area called the inner suburbs – in Swedish “inre förort” - (consisting of the municipalities of Danderyd, Järfälla, Lidingö, Sollentuna, Täby, Huddinge, Nacka and Tyresö), the proportions are 54% versus 29% (idem). Moving outwards towards the areas less densely populated and farther from Stockholm, the outer suburbs - yttre förort” - (consisting of the other 15 municipalities of the County,

including Botkyrka), the car is used for the 64% of the trips, whereas public transport accounts only for the 23% (idem). When considering the whole County, the car turns out to be used less than public transport, respectively 37% and 39% (idem) (see Figure 32).

In Stockholm County there is on average one car every 2.5 persons, therefore 15% less than the national Swedish average (author's elaboration of 2016 data found on Statistiska Centralbyrån website). This fact is

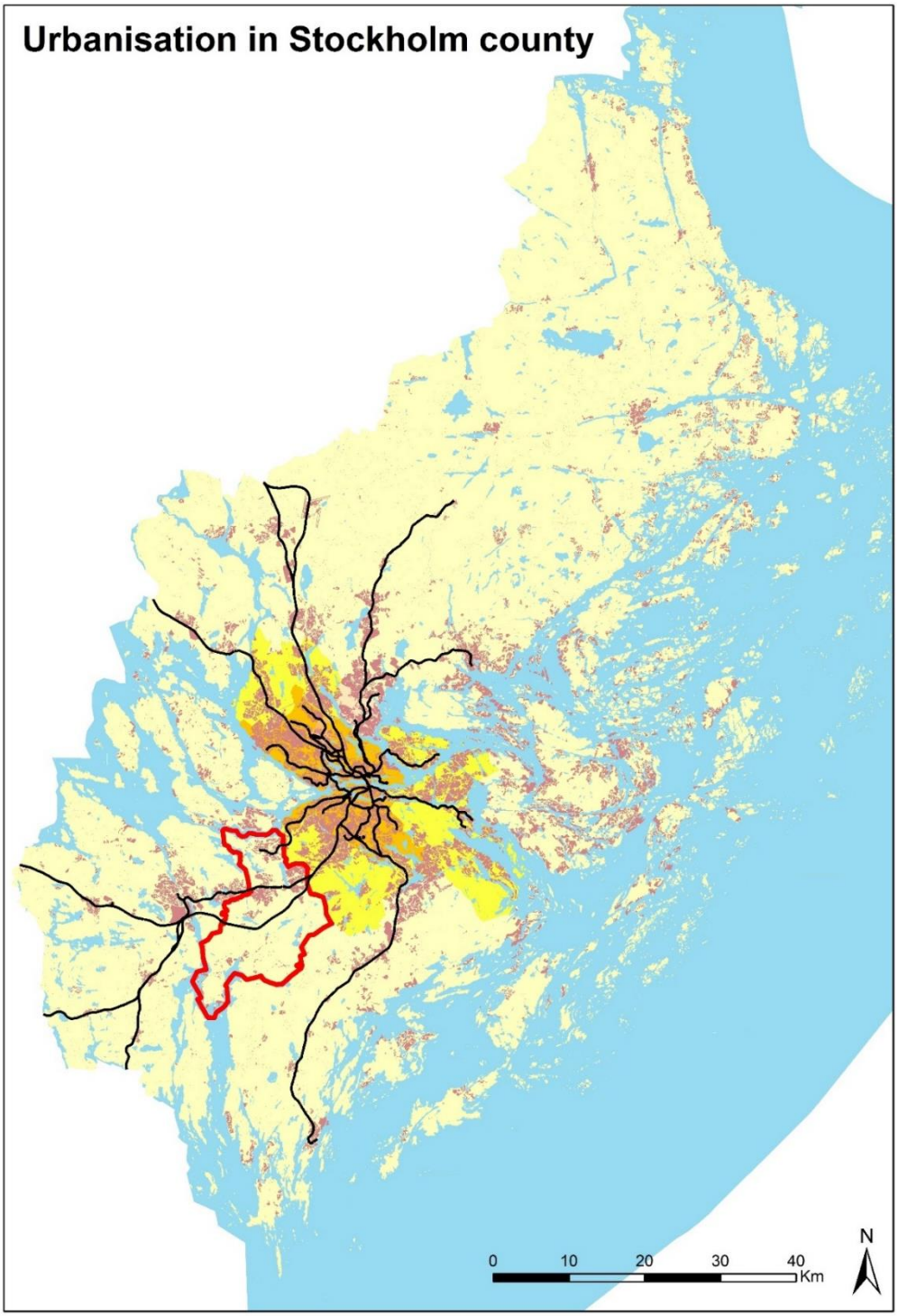


Figure 32: Map showing the three classifications used in Resvanor i Stockholms län 2015 (Trafikförvaltningen, 2016) for the municipalities in the Stockholm metropolitan area. In black, the railway tracks (train, subway, tramlines). In orange, the region centre, in bright yellow the inner suburbs and in dull yellow the outer suburbs. Source: Author's elaboration.

remarkable, because if related to the context of an extensive public transport service, the Stockholm region seems to have potential for further reducing car use.

Further, Keolis Sverige has expressed in their communications with Botkyrka municipality to initiate in 2018 a project directed towards all those who moved in a new house in the areas in Stockholm County where Keolis operates, who will be given the possibility to apply for becoming test travellers. This project might have a certain significance, due to the high rate of population increase in the region (Savage, 2015).

The example of Nacka municipality

Another relevant project regards the construction of new metro tracks and stations (Stockholms läns landsting website), which will take from 6 to 8 years to be completed. It could be interesting therefore to conduct test traveller projects in the areas surrounding the new stations once the new metro lines will be operative. Nacka municipality, where there will be built three new metro stations, proposed a similar but innovative idea during autumn 2016. Around the new metro stations, the municipality has planned the construction of 15,000 new houses. However, they want to keep as low as possible the amount of car use of the residents that will move in. Hence, because the new buildings will be ready when the metro stations will be already completed and in service, it has been proposed that the developers can choose between some measures, among them to offer a free card for public transport valid for 6 months or to pay the fixed costs of a car sharing service for 10 years (Nacka kommun, 2016). The idea behind it, is that the developer would save money by not building a large number of parking spaces and they would be able to sell the apartments at a slightly lower price. Thus, the constructors could still have the same revenue by selling their apartments and, also due to the high demand for houses in the Stockholm region (see for example Savage, 2016), they ought not to have difficulties in selling apartments even though they have limited parking spaces.

Rest of Sweden

As it has been stated by the Swedish Transport Administration in 2012 and again in 2015 (Ecoplan, 2012; Trafikverket, 2015), test traveller projects represent a good practice for increasing the public transport use and thus reduce car use. As explained in chapter 3, in the rest of Sweden there have been conducted a great number of test traveller projects. However, it seems that there is room for other test traveller projects because there are some cities and areas where such type of projects has never been tested[53]:

- Norbotten County. In Luleå region the public bodies are planning to carry out a test traveller project in the future (Widmark & Ahnlund, 2016). Municipalities with a frequent[54] city bus service: Luleå, Kiruna, Piteå, Boden - only a small project in Boden in 2006 – and Gällivare.
- Västmanland County. Municipalities with a frequent[54] city bus service: Västerås and Arboga.
- Jönköping County. Municipalities with a frequent[54] city bus service: Nässjö and Jönköping - in Jönköping the test traveller project has been already tested as a part of IndiMark©, but not recently and only some parts of the city).
- Södermanland County. Municipalities with a frequent[54] city bus service: Katrineholm, Strängnäs*, Eskilstuna (where the project done was small) and in Visby.
- Kalmar County (only two small projects done). Municipalities with a frequent[54] city bus service: Kalmar, Västervik and Oskarshamn*.
- Blekinge County (only a small project done in Ronneby). Municipalities with a frequent[54] city bus service: Karlskrona, Karlshamn, Ronneby.

As it has been demonstrated by the experience in Sweden, when test traveller projects are repeated, even for some years in a row, they continue to produce good results, even better than the previous ones.

[53] See Chapter 10.3 for references about public transport offer in these cities.

[54] 30 minutes or less between departures (including when two or more lines overlap for long extent, marked with the symbol*).

Therefore, this type of projects may still play a significant role in promoting public transport services in Sweden. Clearly, these projects cannot be implemented in those cases where the public transport is free of charge, because the idea is to temporarily remove the price aspect for enticing people to test public transport. Hence, in those cases other methods must be utilised.

Test traveller projects may also be used in order to boost the use of a new or an improved transport line, as said earlier for the Nacka municipality case. A possible use of the test traveller concept might be for example in Värnamo municipality (in Jönköping County), where from August 2017 the departures of the bus line existing will be doubled, in order to a departure every 30 minutes (from 6:00 to 22:00) (Svensson Andersson, 2016). A test traveller project may help in their goal of increasing the number of trips and meeting the ridership objectives set.

8.4 In Italy: Turin vs Gothenburg

Gothenburg vs Turin

Both Turin's and Gothenburg's economies have been characterised by a prosperous car and duty vehicle manufacturing industry, respectively FIAT and Volvo, and both have recently seen a production decrease in the local factories (Griseri, 2016 and Västra Götalandsregionen, 2016). Turin population is around 880,000 inhabitants, 1,740,000 including the metropolitan area (Osservatorio Demografico Territoriale del Piemonte website) and Gothenburg population is 557,000, 998,000 including the urban area (Statistiska Centralbyrån, 2017). Due to these two characteristics, the comparable size and the car manufacturing industry, it may be interesting to analyse how test traveller projects, which have been successfully carried out in Gothenburg, could be applied in a fruitful way in Turin.

The presence of a car-manufacturing industry is visible in the figures of car ownership and car use in these cities. The share of the car for the trips in Turin in 2013 was 48.3%, whereas the public transport share was 18.0% (Agenzia della mobilità metropolitana e regionale, 2015). In Gothenburg, car use in 2013 was 41%, whereas public transport use was 28%. Regarding the car ownership, the difference between the two cities is around 26%. In Turin in 2016 there was one car every 1.59 inhabitants (3% cars more than the Italian average, 1.64) (Città di Torino, 2016), whereas in Gothenburg there was one car every 2.16 inhabitants (Statistiska Centralbyrån website), almost 3% less than the Swedish average and more than 24% of Turin.

Despite the fact that Turin is bigger city, almost double the size, the public transport offer in Gothenburg is much greater. The seats-kilometres per capita for the whole Västra Götaland region (23 942 km^2, 1,672,000 inhabitants, 69.8 inhabitants/km^2 (SCB website) were 5,613 in 2015 and 5,534 in 2014 (Trafikanalys, 2015). In Turin province[55] (6,827 km2, 2,291,719 inhabitants, 335,7 inhabitants/km2 (ISTAT website and Osservatorio Demografico Territoriale del Piemonte website)) they were 552 in 2009 (Conto Nazionale Trasporti, 2009), and only in Turin municipality (130 km^2, 6,814 inhabitants/km^2 (ISTAT website and Osservatorio Demografico Territoriale del Piemonte website) the seats-kilometres per capita were 5,917 in 2014 (ISTAT, 2016). In this data about Italy, commuter trains offer is not taken into account. However, in Turin municipality there are only 13 km of railways, and the seats-kilometres per capita of Turin province are an order of magnitude smaller. As a comparison (Table 10) data of other areas of Sweden where the railway services are fewer (northern regions, as Jämtland County, Norbotten County and Västernorrland County) or non-existent (the insular County of Gotland) the seats-kilometres per capita are at least 3 and half times more.

[55] Since 2015 called "Città Metropolitana di Torino" ("Metropolitan City of Turin").

Furthermore, in Gothenburg the public transport service in the evenings ends at the same time as Turin and in some cases even one hour and a half later, and it starts at the same time or 30 minutes earlier (comparison of the main public transport lines, timetables consulted on Gruppo Torinese Trasporti website and Västtrafik AB website).

The case of Gothenburg

In the region of Goteborg, Västra Götaland, the automotive industry has a great importance. In Gothenburg was founded the car manufacturer Volvo, where there is still part of its production. According to a report of Västra Götalandsregionen (2016), in 2014 were around 32,500 people working in this sector (4.1% of the employees in the region), representing around the 42.3% of the total of the employees in Sweden in this sector. Nevertheless, there is one car every 2.16 persons, almost 3% less cars than the national average of 2.10 (author's elaboration of 2016 data found on Statistiska Centralbyrån website). This data is noteworthy, because it means that even in a city that has had and still has significant proportion of its economy and history bounded with the car industry, it is currently one of the region with the biggest and the most numerous test traveller projects, which have had a considerable success over the years. Further, the regional transport authority is planning to continue with this measure for reducing the share of trips made by car, which currently represents the 63% of the motorised trips, compared to the 37% of public transport (Göteborgs stad, 2016).

Regarding the case of Gothenburg, during the years the share of public transport has slightly increased. It is interesting to examine what happened during the years, because the transport authority carried out numerous projects in Västra Götaland region, which may have contributed to the increase in public transport use in Gothenburg. Here there are considered the years of the test traveller projects taken into account in the previous analysis of the Swedish cases (presented in chapter 3). Between 2009 and 2010, when it was conducted "the big commuting experiment" (in Swedish: "Det stora pendlarexperimentet"), involving more than 28,000 car drivers, it increased from 25% to 26% (Göteborgs stad, 2013). Between 2012 and 2013 it increased from 26% to 28% (Göteborgs stad, 2016), but it must be taken into account that year was introduced the congestion charge (Göteborgs stad website). Between 2013 and 2015 the public transport share remained stable at 28%, and it increased to 29% in the year 2016 (Göteborgs stad, 2016). In Figure 33 it is possible to see the modal share trends in Gothenburg. It is not possible to assert the impact of the test traveller projects on these figures, but from the data collected after these campaigns evince that they contributed (+10,000 new users in Västa Götaland region in 2010 and 11,000 new users in the region in 2014, and around 60% of the region's population lives in the Gothenburg metropolitan area (data from SCB website)).

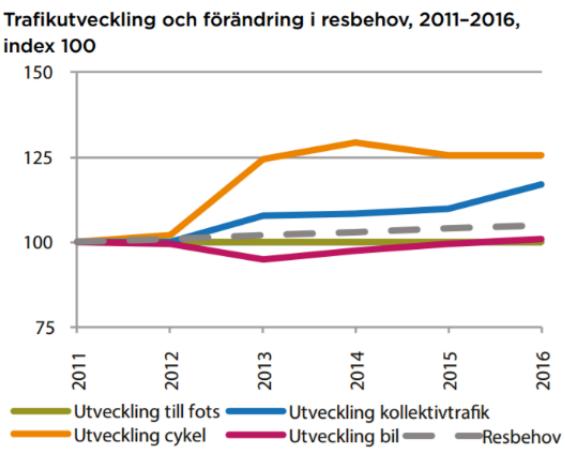


Figure 33: Traffic development and changes in travel needs, 2011 – 2016, index 100. Orange: bicycle; green: on foot; blue: public transport; purple: car use; dotted line: travel needs. Source: Göteborgs Stad, 2016, p.5.

In the case of Gothenburg there is a strong political will, because the regional transport authority (Västtrafik), which is entirely owned by the Västra Götaland region, has carried out numerous projects and deems test traveller project as an effective tool for increasing ridership.

Turin

The main public transport company that operates in the whole Turin province and numerous lines that run from the other provinces of the region to Turin (excluding Novara province and operating only one of the

railway lines in the region) is Gruppo Torinese Trasporti (GTT), entirely owned by Turin municipality. In order to use all the tickets with a period validity of 1 week or more it is mandatory to have a personal registered card, and only the owner is allowed to use it. It is therefore easy to avoid misuses of the card, in case a test traveller project would be carried out (in Figure 34 there is an example of this card).

Because the area served by GTT is broad, the public transport company could start with one or several small projects (for example in one or several of the municipalities surrounding Turin, or in one or more parts of Turin municipality), and only after becoming acquainted with the project (how to organise it, how to manage it, etc.) GTT could carry out a bigger project in all the areas where it operates.

Figure 34: An example of the card for travelling on the public transport network within Piedmont region. Source: Gruppo Torinese Transporti website.

As presented previously, public transport quality is perceived as quite high in Sweden and very low in Italy. The European Union report "Quality of life in European cities"[56] (European Commission, Directorate-General for Regional and Urban Policy, 2016) sets Turin as second among the six Italian cities analysed, but in the European Union ranking it is at the 60th position, out of 83. In Sweden, only Malmö and Stockholm were analysed (see Table 6 for Italian and Swedish cities). One of the questions posed to the surveyed people was: "Generally speaking, please tell me if you are very satisfied, rather satisfied, rather unsatisfied or not at all satisfied with public transport, for example the bus, tram or metro in [CITY NAME]?". In Stockholm (which is 28th) 79% of people are satisfied (31% very satisfied and 48% rather satisfied), in Malmö (which is 45th) 72% of people are satisfied (27% very satisfied and 45% rather satisfied), whereas in Turin 63% of people are satisfied (18% very satisfied and 45% rather satisfied).

Table 6: Transport satisfaction in the Swedish and Italian cities analysed in the report "Quality of life in European cities". Source: European Commission, Directorate-General for Regional and Urban Policy, 2016, p. 25.

City	Ranking	Very satisfied	Rather satisfied	Total satisfied
Stockholm	28th	31%	48%	79%
Malmö	45th	27%	45%	72%
Bologna	59th	21%	44%	65%
Turin	60th	18%	45%	63%
Verona	67th	14%	42%	56%
Naples	81th	5%	28%	33%
Rome	82th	4%	26%	30%
Palermo	83th	1%	13%	14%

Possible obstacles

One of the main obstacles to the project might be how public transport is perceived, in particular in those countries like Italy, where in all the issues analysed in the TNS Political & Social report (2014) Italy lays at the lowest positions of the rankings. Hence, people might not be willing to participate in a test traveller project and/or it might not have the expected positive outcomes. However, In Italy a test traveller project may be conducted in cities and areas where public transport is considered as rather good. For example, in Turin more

[56] Around 500 citizens for each city had been interviewed.

than 60% of people are satisfied by the service. This figure is not very high, but it might be enough for having a positive outcome of a test traveller project. In particular, such project should be promoted in the areas where the service is perceived better (for example the areas served by the subway, which received a grade of 8.4 out of 10 (Agenzia della mobilità metropolitana e regionale, 2015) and where there is enough spare capacity on the vehicles.

Another hindrance to the project may come from the political side. In fact, due to the fact that the GTT (as many other public-owned public transport companies in Italy) is owned by the municipality of Turin, in case that the transport company wanted to implement such project but the municipal politician opposed it, it would be problematic, if not impossible, to carry out the test traveller project. It would be therefore fundamental to convince them that a test traveller project does not reduce the revenues from the existing customers, because the project is directed towards those who do not use the public transport (and who are not costumers) and that the costs of the projects would be minor, because the only expenses would be the purchase of the cards, some promotion activities, and the administrative work for organising, conducting and evaluating the project.

Regarding the project acceptance, the Swedish cases showed that the public opinion and those already using the public transport accepted generally well the project, because it has been very clear what were the projects purposes. However, where the public transport satisfaction is not high, the users might complain, bringing the argument that it should be better to focus on increasing the service quality instead of spending resources in attracting new customers.

The frequency of strikes called for by the public transport companies employees is a further problem that may occur and that represents an additional hindrance to the efforts for increasing public transport ridership. In Sweden the last strike in the public transport sector took place at a national level in June 2013 (SVT/ TT Nyhetsbyrån, 2013; Ogelid, L., 2013). In Italy, on the contrary, strikes are rather frequent (Ministero delle Infrastrutture e dei Trasporti website). If looking only at the strikes that affected the city of Turin, 7 took place in a period of 15 months (from March 2016 to May 2017 included) (Google news, 2017). Public transport strikes create annoyances to the customers, because the service for which the costumers expect and has paid for might not be effectuated. Consequently, the users have to use alternative mode of transports or renounce to travel, such as the car. If the strike happens during a trial period, or in the months that follow it, the test traveller would probably see returning to drive his/her car as the best option, and/or consider the car as a more reliable mode of transport.

Lastly, as it may be seen in Table 8, public transport service in the Turin has been progressively shrinking, year by year, therefore people might not find it as an alternative on the long run if looking at this trend.

Italy – a shrinking service – vs Sweden – an expanding service

Regarding national policies and strategies, in Sweden had been set in 2015 a national goal for 2030, which is the doubling public transport modal share compared to 2006 levels, and the government role is to contribute to reach this goal by providing financial resources (Järnvägs- och kollektivtrafikfrågor, Parliament act 2014/15:108). All Swedish municipalities and counties have signed this agreement, and for this purpose there is a dedicated association (Partnersamverkan för en förbättrad kollektivtrafik – in English: Partnership for an improved public transport) and a dedicated website for sharing and learning from each other (Svensk kollektivtrafik website), besides official publications from Trafikverket, the Swedish Transports administration, giving suggestions and recommendations (Plentiful material available on Trafikverket website).

In Italy there is no a national strategy or national policies regarding public transportation as in Sweden. The most similar document can be the national general transport plan. However the last one (Ministero dei Trasporti e della Navigazione, 2001) was not setting goals or targets to reach regarding public transport,

whereas the new plan that is currently under development has general indications of moving towards a more sustainable transport sector, where public transport and modern sharing services in the cities should play a more important role, and car use should diminish. However, these provisions are too vague, except for the goal of increasing by 20% the offer of trams and subways until 2030 (Ministero delle infrastrutture e dei trasporti, 2016).

Regarding Piedmont region, at a regional level there is the Regional Transports Plan. Currently, a new plan is under development, and it sets rather ambitious goals (Regione Piemonte, 2016). Among others, to increase public transport accessibility and make it at the same performance level as the car; to fully satisfy the public transport demands for all the recurrent trips; to reach a zero-emission urban mobility, with a 30% or lesser car modal share, at least 30% of public transport share and at least 15% of bike modal share. However, these goals refer to a faraway point in the future, the year 2050, without really describing how to reach them. Regarding Turin municipality, the SUMP (Sustainable Urban Mobility Plan) currently in effect, concerning public transport it sets goals that aim to increase public transport efficacy and at ameliorating the service (Città di Torino, 2010). However, since the plan has been in force, 2010, the regional government has executed recurrent cuts to the public transport budget (see f~~or example~~ Longhini, 2013; Tropeano, 2015; Guccione, 2016), making it hard for the municipality to comply with its own goals.

At a national level, as it can be seen in Tables 9 and 10, in Sweden both public transport offer and public transport use has generally increased over the years 2011 – 2015, and users' satisfaction is everywhere high or very high, between 75% and 90% (see Table 7) (Svensk kollektivtrafik, 2017). On the contrary, in Italy the transport offer has been shrinking (see Table 8 and attachment 11.17) as well as the public transport use (see for example Balotta, 2017).

In light of the state of art of the public transport in Italy, it seems that implementing a test traveller project would not be an appropriate measure in most cities, because if the service quality is low and the transport offer is diminishing, a test traveller project might be non-effective, or at worse counterproductive. However, there are some cities (attachment 11.17) where public transport service has increased (for example Verona, see Table 8) and cities and region where public transport is perceived as quite good (see Table 6 and Figure 35) (i.e. in Bologna (European Commission, Directorate-General for Regional and Urban Policy, 2016), and in Trentino-South Tyrol region (Regione Emilia-Romagna, 2016)). In the other Italian context, the priority should be first to improve the service and to implement other policies, and then implement a test traveller project only once public transport is reliable and of good quality, representing a practical and viable alternative to car use.

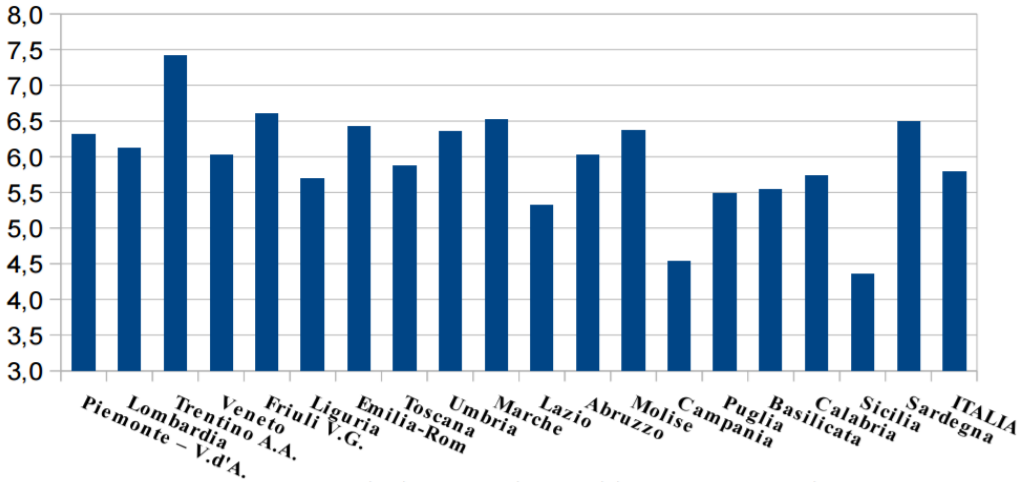


Figure 35: Transport satisfaction among users in the Italian regions. Source: Regione Emilia-Romagna, 2016,

Table 7: Transport satisfaction among users for the transport services of the Swedish transport companies (except for Stockholm county, Södermanland county and Östergötland county). Source: Svensk kollektivtrafik, 2017, p.65.

Sammanfattande nöjdhet, kollektivtrafikresenärer	2012	2013	2014	2015	2016
Blekingetrafiken, Region Blekinge	90%	77%	91%	84%	76%
Dalatrafik, AB	78%	75%	72%	55%	57%
Hallandstrafiken AB	74%	80%	82%	70%	81%
Jönköpings Länstrafik	74%	79%	79%	82%	72%
Kalmar Länstrafik	75%	75%	65%	61%	68%
Karlstadsbuss	83%	86%	92%	86%	82%
Landstinget i Uppsala län, Kollektivtrafikförvaltningen UL	75%	73%	64%	75%	73%
Region Gävleborg, X-trafik	86%	72%	80%	76%	78%
Kollektivtrafikmyndigheten i Västernorrlands län	75%	75%	61%	63%	75%
Landstinget Västmanland, Kollektivtrafikförvaltningen	76%	84%	79%	82%	83%
Luleå Lokaltrafik AB	87%	89%	85%	80%	84%
Länstrafiken i Jämtlands Län AB	-	-	-	73%	72%
Länstrafiken i Norrbotten AB	90%	91%	83%	84%	72%
Länstrafiken i Västerbotten AB	71%	78%	75%	79%	72%
Länstrafiken Kronoberg	69%	80%	70%	78%	76%
Region Gotland Kollektivtrafikenheten	81%	71%	81%	57%	53%
Region Örebro län, Länstrafiken	79%	64%	74%	80%	75%
Skånetrafiken	72%	70%	68%	69%	64%*
Värmlandstrafik	69%	78%	75%	88%	78%
Västtrafik AB	61%	63%	65%	62%	73%*

Table 8: Author's elaboration of seat-km per capita data in the years between 2011 and 2014 of the 15 biggest Italian municipalities. Source: ISTAT, 2016 and 2017.

Municipalities	Seat-kilometre per capita					
	2011	**2012**	**2013**	**2014**	**2015**	**Variation seat-km per capita 2011 - 2015**
Milan	15,141	15,351	15,005	14,722	16,218	+7.1%
Venice	11,241	11,698	11,407	11,129	10,895	-3.1%
Rome	8,145	8,339	7,965	6,940	6,823	-16.2%
Turin	**7,529**	**7,145**	**6,052**	**5,917**	**6,016**	**-20.1%**
Trieste	6,186	6,192	5,903	5,856	5,735	-7.3%
Florence	6,112	5,797	5,560	5,446	5,541	-9.3%
Genoa	5,134	4,916	4,677	4,608	4,675	-8.9%
Bologna	4,062	4,030	3,899	3,808	3,742	-7.9%
Padua	3,413	3,289	3,353	3,236	3,268	-4.3%
Catania	3,340	3,281	2,774	2,744	2,308	-30.9%
Bari	3,220	3,242	2,949	2,854	2,882	-10.5%
Naples	2,934	2,791	2,333	2,594	2,403	-18.1%
Verona	2,629	2,577	2,747	3,157	3,180	+21.0%
Palermo	2,414	2,232	2,124	2,030	2,034	-15.8%
Messina	857	764	755	901	1,225	+43.0%
Italy	**4,787**	**4,770**	**4,577**	**4,423**	**4,503**	**-5.93%**

Table 9: Number of boardings, vehicle kilometres available and passenger kilometres, per county and per year 2012-2015 (in thousands). Source: Trafikanalys, 2016, p.60.

Län *County*	**Resor per år** *Boardings per year*				**Utbudskilometer per år** *Vehicle kilometers available per year*				**Personkilometer per år** *Passenger kilometers per year*			
	2012	2013	2014	2015	2012	2013	2014	2015	2012	2013	2014	2015
Stockholm	742 396	764 093	775 144	800 131	241 783	253 512	255 826	253 661	5 241 000	5 558 142	5 652 000	5 714 000
Uppsala	30 200	32 600	34 100	38 170	40 350	45 667	33 542	34 500	575 000	565 000	550 000	625 000
Södermanland	9 943	9 827	12 557	13 012	14 272	15 880	15 661	15 104	212 535	210 157	273 943	282 047
Östergötland	26 590	27 487	27 815	28 508	30 449	29 536	28 430 [k]	27 137	352 600	374 202	377 820 [k]	390 780
Jönköping	17 519	18 507	18 747	20 725	20 070 [k]	21 750 [k]	20 961 [k]	28 532	237 354	241 808	250 612	281 397
Kronoberg	7 579	8 236	8 793	9 190	12 272	12 982	13 705	14 231	211 254	227 753	242 899	253 290
Kalmar	7 529	7 694	8 374	9 384	17 026	18 111	20 316	19 738	151 253	190 954	200 820	238 966
Gotland	1 051	898	902	854	2 535	2 535	2 589	2 589	26 275	12 976	12 628	12 628
Blekinge	8 169	8 465	8 252	8 217	12 603	13 120	9 564 [k]	9 767	135 820	159 831	180 457	172 686
Skåne	148 541	152 499	151 871	158 860	96 738	92 784	92 300	96 610	2 259 495	2 361 664	2 755 425	2 880 839
Halland	15 689	16 077	16 358	16 846	17 114	18 198	18 103	19 168	490 335	519 830	535 437	550 360
Västra Götaland	259 295	281 800	276 578	280 096	142 788	132 895	144 842	147 835	2 985 573	2 342 175	2 384 544	2 423 721
Värmland	13 121	12 175	12 299	12 407	21 096	20 847	20 827	21 314	291 358	262 723	267 184	266 496
Örebro	12 751	12 377	12 654	11 403	13 240	13 159	13 584	13 629	123 000	121 601	125 100	106 906
Västmanland	9 392	9 533	11 210	14 101	8 093	9 163	11 216	14 411	122 096	123 929	127 908	143 412
Dalarna	10 121	9 855	9 374	10 118	15 700	15 900	16 300	19 511	345 455	349 792	356 215	407 824
Gävleborg	14 265	13 913	13 887	14 167	21 418	22 530	21 905	19 450	219 982	217 954	217 239	228 462
Västernorrland	10 589	10 100	9 886	9 709	13 498	13 597	20 374 [k]	15 337	116 731	107 837	172 789	172 461
Jämtland	5 226	5 254	5 692	5 893	11 420	10 825	11 678 [k]	11 931	79 174	79 598	112 124	129 719
Västerbotten	10 529	11 314	11 654	11 913	18 187	22 312	19 650 [k]	23 888	189 519	239 332	260 973	294 205
Norrbotten	8 113	8 212	8 510	8 723	16 037	16 434	19 741	17 563	126 600	123 521	141 609	140 649
Riket - *Total*	1 368 608	1 420 916	1 434 656 [k]	1 482 427	786 689 [k]	801 737 [k]	811 114 [k]	825 906	14 492 409	14 390 779	15 197 726 [k]	15 715 848

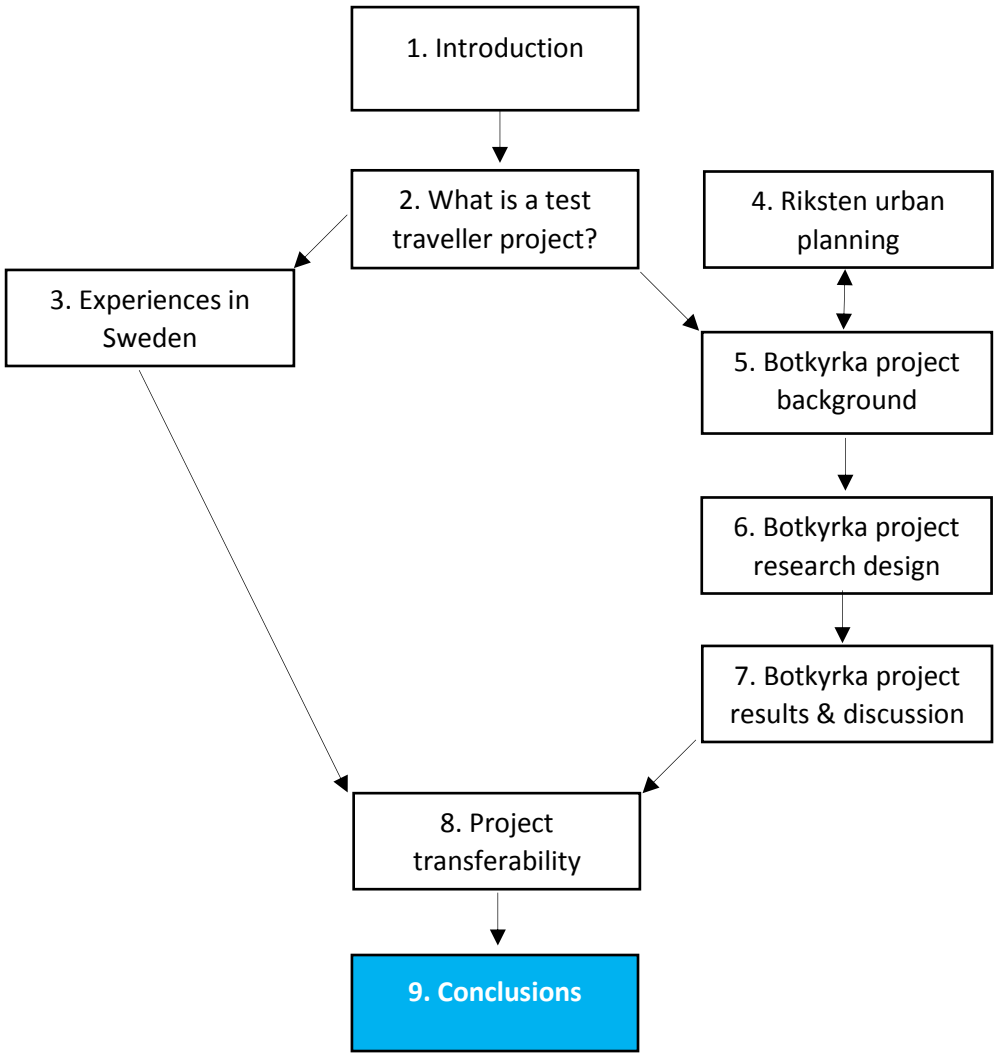
Table 10: Data and key indicators of public transport per county in 2015. Source: Trafikanalys, 2016, p.50.

Tabell 2. Nyckeltal för trafikuppgifter efter län år 2015.
Table 2. Data and key indicators of public transport per county in 2015.

Län *County*	**Invånare**[1] (1 000-tal) *Inhabitants (thousands)*	**Antal bilar**[2] *Number of cars*	**Resor/ invånare** *Boardings per capita*	**Utbuds-kilometer/ invånare** *Vehicle kilometers available per capita*	**Sittplats-kilometer/in vånare**[3] *Seat kilometers per capita*	**Person-kilometer/ invånare** *Passenger kilometers per capita*	**Bilar/1000 invånare** *Cars per thousands inhabitants*	**Medel-reslängd** *Average trip length*	**Genomsnittligt antal sittplatser**[4] *Average number of seats*	**Resor/ utbuds-kilometer** *Boardings per Vehicle kilometers available*	**Personkilometer/ utbudskilometer** *Passenger kilometers/Vehicle kilometers available*
Stockholm	2 215	887 057	361	115	8 266	2 580	401	7,14	72,17	3,15	22,53
Uppsala	352	157 021	109	98	7 168	1 778	447	16,37	73,04	1,11	18,12
Södermanland	282	140 155	46	54	5 170	999	497	21,68	96,60	0,86	18,67
Östergötland	444	211 198	64	61	4 664	880	476	13,71	76,29	1,05	14,40
Jönköping	346	179 099	60	82	4 353	813	518	13,58	52,79	0,73	9,86
Kronoberg	190	98 639	48	75	..	1 331	518	27,56	..	0,65	17,80
Kalmar	237	128 253	40	83	4 889	1 010	542	25,47	58,61	0,48	12,11
Gotland	57	34 490	15	45	2 103	220	602	14,79	46,55	0,33	4,88
Blekinge	155	82 300	53	63	4 778	1 113	530	21,02	75,93	0,84	17,68
Skåne	1 296	614 845	123	75	6 520	2 222	474	18,13	87,48	1,64	29,82
Halland	313	166 759	54	61	..	1 760	533	32,67	..	0,88	28,71
Västra Götaland	1 640	756 139	171	90	5 613	1 478	461	8,65	62,28	1,89	16,39
Värmland	275	150 789	45	77	4 433	968	548	21,48	57,25	0,58	12,50
Örebro	290	143 710	39	47	2 448	369	496	9,38	52,02	0,84	7,84
Västmanland	263	130 844	54	55	2 690	545	498	10,17	49,10	0,98	9,95
Dalarna	280	161 059	36	70	4 133	1 457	575	40,31	59,31	0,52	20,90
Gävleborg	281	147 370	50	69	4 718	813	525	16,13	68,13	0,73	11,75
Västernorrland	243	131 940	40	63	4 189	708	542	17,76	66,50	0,63	11,24
Jämtland	127	71 345	46	94	1 322	1 021	561	22,01	14,08	0,49	10,87
Västerbotten	263	131 778	45	91	4 973	1 119	501	24,70	54,72	0,50	12,32
Norrbotten	250	141 078	35	70	3 238	563	565	16,12	46,07	0,50	8,01
Riket - *Total*	9 799	4 665 868	151	84	5 507	1 604	476	10,60	65,34	1,79	19,03

9 Conclusions

In this chapter there are the conclusions for this master thesis work. There is therefore expressed the scientific contribution of the work and a summary of the findings. After that, it is explicated what are aspects that need further research and some final remarks.



9.1 Summary of the findings

Scientific contribution of the work

As seen in chapter 3 by analysing 52 projects in Sweden, this type of project may achieve a noteworthy success in convincing car drivers to use public transport, with average results in Sweden better than the ones reported by the literature. In Sweden, car drivers who use public transport after a test traveller project range from around 25%, in projects at a city or regional level, up to 60% in small scale projects.

From the study performed in chapter 3, it seems possible to make some generalisations and identify common traits that render the projects more effective, which are summarised in table 10. A limitation to the generalisation of the findings might be that the projects studied in this work took all place in Sweden and they are 52, not a small number but still a limited sample. Despite this, it is interesting that the results are mostly positive or very positive, even though the heterogeneity of methods and contexts of the projects analysed.

Another aspect that has appeared to play a role is the category of people targeted by the projects. If selectively contacting those who are employed (especially if through the company where they work), the percentage of people that will continue to use public transport will be higher than a usual test traveller project directed towards all citizens. Further, the literature points out that when targeting newly moved in people, the projects are more effective.

Table 11: list of favourable and adverse conditions for a test traveller project.

Favourable conditions	Adverse conditions
People's willingness and/or openness to switch to public transport	Public transport seen not as a viable and reliable alternative/ prejudices towards using public transport
Good public transport quality	Bad public transport quality
Extensive and frequent public transport services	Limited and infrequent public transport services
Political efforts and agreement upon the project implementation	Opposition or disinterest of some important actors
Project promotion (on newspapers, on social media and institutional websites, meetings with participants, etc.)	
Test traveller project combined with/conducted in parallel to other initiatives or campaigns.	
Project conducted during a warm/sunny period of the year and not close vacation periods.	Project conducted during a cold/rainy period of the year or close vacation periods.
	Frequent public transport employees' strikes
	Disturbances/disruptions during the trial period

Furthermore, by analysing the project in Botkyrka municipality in chapter 7, it emerged that when project participants voluntarily participate to a test traveller project car habits do not seem a good predictor of intention. Further, their predictive role of future travel behaviour is not as important as literature has shown, maybe due to an overestimation of project participants' own car habits. In line with literature findings, the predictive elements are:

- Attitudes, the most important.
- Perceived good public transport offer in the dwelling area and perception of saving money by using public transport.

- Higher subjective norm, in particular the expectations of those who mean something to the project participant.
- Young age.
- Lower education.
- Higher environmental Concerns, in particular the feeling of guilt for using the car.
- Recently relocated.
- Mismatched suburban dwellers (who would prefer to live in an area with an urban land use).

The Botkyrka project supports the findings of Abou-Zeid and Ben-Akiva (2012), namely that the project might reinforce the car preference among those who have tested public transport, in particular when project participants do not have a positive experience during the trial.

This work proposes the introduction of a new categorisation for suburban dwellers and amend the one formulated by Schwanen & Mokhtarian (2005), by further diving suburban dwellers into "Transit-oriented true suburbanites" and "Car-oriented true suburbanites". This new categorisation is proposed because it has been discovered that, regarding Residential Self-Selection, there hardly any differences among project participants and control group, and that in both groups the preference for a suburban area is predominant (even among those who use public transport more after the trial).

Opportunities

Test traveller projects attract car drivers into using public transport thanks to the free trial offer. Thanks to the free tickets, test traveller projects are able to be appealing to that car drivers segment who might not consider the public transport options even in case of implementation of other policies (such as awareness and information campaigns) because the cost barrier is removed (Thøgersen, 2009).

Further, a test traveller project has low costs, especially if the transport companies provide the tickets, and they can be implemented also in case of no improvements of the service.

Limitations

Test traveller projects are of course not meant to be the solution for reducing car use. Test traveller projects are one of the existing policy measures for diminishing car use, and they can be implemented only if there is a decent transit system, which enables the inhabitants of the interested area to easily reach their workplace and the major points of interests (such as medical services and shopping), otherwise such projects might be counter-productive. A low quality public transport would be a certain hinder to the success of a project of this kind, and it may even be counterproductive, therefore other measures should be applied first.

Another limitation may be a weak collaboration between the various political and administrative bodies. When a municipality conducts a test traveller project, it is needed a certain degree of collaboration by the transport authority, in particular to obtain free tickets in order to be able to run the project at big scale.

9.2 Future research needed

Test traveller projects are still a topic that needs further studies and research because, despite its application particularly widespread in Sweden, there is a certain paucity of literature. Further, there is not a unanimous consensus in academic literature because some authors raise doubts about test traveller campaigns real usefulness or efficacy. Further research should attempt to dispel doubts of about test traveller projects, by exploring the contexts and the situations where such projects may be successfully conducted and where it is not convenient, useful and/or effective to implement them, and therefore to employ other measures.

Another aspect of test traveller project that needs to be further researched regards the duration of the trial period. As it has been studied in this work (in chapter 3), it seems that a longer period gives better results in terms of people that continue to use the public transport. However, the projects analysed are too few for determining with statistical significance ($p < 0.05$) if a longer period really makes a difference. If demonstrated, this aspect would be of help in case of limited resources, especially if the transport authority does not provide free of charge the tickets to the project organisers.

Further research is needed in order to better understand the role played by habits. When participants voluntarily take part in the project it seems that habits role is minimal and that those who choose to participate perceive their car habits as stronger. The belief of saving money by using public transport needs also to be additionally studied, because it might change along with the contexts. In the present study it seems to be a rather important item of Perceived Behavioural Control, but Thøgersen (2009) present it as non-influential.

Further research is also needed in order to support the new categorisation of suburban dwellers here proposed. It would contribute to the current discussion about the roles of residential choice, built environment and land use in shaping and conditioning one's travel behaviour and one's travel mode choice.

9.3 Final remarks

As show in this work, test traveller projects represent a feasible way for increasing public transport ridership and diminish car use. More research is still needed but test traveller projects, if intelligently employed, might be an important tool available for municipalities and local transport authorities. Sweden has proven to have gone rather far in employing this method, but there is still room for manoeuvre in places where test traveller projects have been implemented but also where this concept has been already used.

This study does not only add to the existing literature, but it contains guidelines, information and advice for those municipalities and transport authorities that are thinking of implementing a test traveller project, and for those in search of alternative methods for enticing citizens to diminish their car use in context where public transport is an existing and valid alternative.

It is important to remark here that a test traveller project is not and should not be seen as the definitive solution for resolving the problems that it intends to tackle. A test traveller project is only one single measure, which might work better when used in combination with other interventions.

10 References

First (10.1), there are the references regarding the bibliography that can be found in the main body of the work. After that (10.2) there are listed the sources for the data analysis of the Swedish cases (of chapter 3). At last (10.3) there are listed the sources for the data about the other Swedish cities where it may be possible to conduct a test traveller project.

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10.3 Local transport authorities and public transport companies in the rest of Sweden, where it may be possible to conduct a test traveller project

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