Passenger waiting strategies on railway platforms - Effects of information and platform facilities -

Case study: Sweden and Japan

PIERRE PETTERSSON

Master of Science Thesis
Stockholm, Sweden 2011
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Preface

The idea for this study was born during the fall of 2009 when I just had come back to Sweden from an exchange year in Japan. One day, when a train I was waiting for arrived, I noticed that many passengers, including myself, did not stand where the train doors they entered stopped. Crowding and movements appeared on the platform and I thought to myself that I must investigate why this happened.

The work on this master thesis started in August 2010. The work has been carried out under the supervision of Professor Bo-Lennart Nelldal and Anders Lindahl at the KTH Railway Group, at the Division of Transportation and Logistics, at the Royal Institute of Technology (KTH) in Stockholm, Sweden.

I would like to express my deepest gratitude to my supervisors and all students and staff at the KTH Railway Group, and the Division of Transportation and Logistics, for all their help and support and without whom this work would have been very difficult to carry out. I would also like to take the opportunity to thank all the people in Japan that have supported me during the Japanese part of the study. I am specially thinking of the Moriya family, the Kikuno family and Hippo Family Club.

I further hope that the reader of this master thesis will enjoy it and find the subject interesting and meaningful.

Stockholm, March 2011

Pierre Pettersson Traba
Abstract

The Swedish railway has during many years received low customer satisfaction scores. Reasons for this are reliability, service and information concerns. The focus of this master thesis lies on the railway platform. The platform is an important part to the factors above as its information and facilities, which constitute a part of the service before the trip, could contribute in causing delays and reliability issues. This study investigates the behaviour of passengers on railway platforms and the effect that information, seats and entrances along the platform has on that behaviour. The goal is to find advantages and disadvantages and propose improvements in a Swedish setting. Platforms and trains that have been studied are in Stockholm, Sweden and Tokyo, Japan. Platform distributions and individual behaviour on the platforms are recorded with three different and relatively easy methods.

Results of the Swedish study show aggregate trends where passengers tend to cluster around entrances and seats. Many Swedish passengers do not believe themselves to have enough information to know where their car will stop. These passengers do mostly not know that information exist and on average stand much further away from their closest door, when the train arrives, compared to passengers that believe themselves to know where their car will stop along the platform. The results of the Japanese study show that almost all passengers stand close to their door.

From the findings in not only this, but also other studies, four aggregate properties in order to get better railway platforms are finally presented. These properties are reliability, clarity and availability of information and good location of seats and other facilities. Suggestions for tangible improvements for the Swedish railway platforms are finally given. Among these improvements are new information screens and standardized information and stopping position of trains.

Keywords:
Railway platforms, Passengers distributions, Passenger behaviour, Dwell times, Boarding, Train, Railway, X2000, Shinkansen, Sweden, Japan
Sammanfattning

Resandet med tåg i Sverige har ökat de senaste åren och därmed också trängslen på plattformarna liksom förseningarna samtidigt som kundnöjdheten har minskat. Fokus i detta examensarbete ligger på järnvägsplattformen. Den är en viktig del i resan eftersom dess utformning och information tillgänglig på den är en del i servicen som ges före resan. Utformningen av plattformen och informationen som är tillgänglig på den kan även påverka ombord- och avstigningsprocessen vilket i sin tur påverkar både tillförlitligheten och uppehållstider. Denna studie analyserar hur resenärer beter sig på järnvägsplattformar samt hur information, sittplatser och ingångar utefter plattformen påverkar detta beteende. Information i fokus är information om vart utefter plattformen tåget och dess vagnar stannar. Målet är att hitta för- och nackdelar med dagens lösningar samt att ge råd och förslag till förbättringar. Passagerare, tåg och plattformar på Stockholms centralstation samt i Tokyo, Japan har studerats med tre relativt enkla metoder.

Resultaten av den svenska studien visar att passagerare tenderar att klumpa ihop sig runt sittplatser och ingångar på plattformen. Många väntande passagerare anser sig inte veta var utefter plattformen deras vagn kommer att stanna. Dessa passagerare vet ofta inte heller att information finns. De står även i genomsnitt mycket längre bort från deras dörr när tåget ankommer än passagerare som genom information eller erfarenhet säger sig veta var deras vagn stannar. Studier av passagerare på japanska plattformar visar att de oftast står och väntar väldigt nära den dörr de använder för att stiga på tåget troligen eftersom det finns mycket bra information.

Genom analys och diskussion av resultat, inte enbart från denna studie, men också från tidigare studier, ges fyra förslag till övergripande egenskaper som är viktiga för information och utformning av järnvägsplattformar. Dessa egenskaper är tillförlitlighet, tillgänglighet och klarhet av information samt bra placering av säten på plattformen. Slutligen ge förslag till konkreta lösningar för de svenska järnvägsplattformarna. Bland dessa är nya informationstavlor samt standardisering av information och tågens stopp position.
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1. Introduction

1.1 Background

A regional or interregional train journey consists of many steps for the common train traveller. First the traveller plans the journey. He or she may buy the ticket only minutes or up to several days or even months before boarding the train. On the day of the journey, the traveller has to travel from his or her home or origin to the railway station. At the station, he or she might want to buy a newspaper or a snack for the trip. The traveller may also need to pick up or buy the ticket at a ticket office or machine. Finally the traveller must find his or her way through the station building to the correct platform and wait for the train. When the train arrives the traveller boards the train together with other passengers and needs to find his or her seat. The train then takes the traveller to another station in another place, where the traveller either has to transfer to another train or prefers to stay and continue to his or her final destination. In either case the traveller must leave his or her seat and alight the train. The traveller must then find his or her way through yet another station, either to find the transfer platform or to exit the station.

Figure 1.1, Example of different parts included in a train journey
As seen above, travelling by train can be much more than just riding the train. Besides riding the actual train, the journey is a composition of one or several shorter local trips to and from the stations. The traveller has to make a number of actions, choices and movements during the journey, especially inside the station. Besides reliability, frequency, comfort and total travel time of the train itself and other local transports to and from the station building it is important for the traveller to get good information throughout the whole trip. The traveller needs to know when the train departs, how and when to get to the station, where to pick up the ticket, at which platform the train arrives, how to get to that platform, in which car his or her seat is located and much more. The traveller might also need a variety of facilities such as seats, wind shelters, shops and restaurants conveniently located at the station.

In the past decades, governments in many countries have tried to promote more environmentally friendly modes of transportation. As a part of this promotion Sweden as well as many other countries has invested highly in allowing higher speeds on their railway networks. Both infrastructure and vehicles have been modified for this reason. Scholars, professionals as well as politicians hope that higher speeds, thus also shorter travel times on long distance rail lines will increase the demand for rail while reducing the demand of car and flight, which are seen as less environmentally friendly modes of passenger transport. The market share of rail compared to flight between the two Swedish cities Stockholm and Gothenburg increased from around 40% in 1990 to around 60% in 1996 largely due to the introduction of the Swedish high speed rail service X2000 in the beginning of the 1990’s, allowing speeds up to 200 km/h instead of the old maximum speed of 160 km/h and thus reducing the travel time between the two cities from 4 to around 3 hours. Figure 1.2 illustrates the relationship between travel time and the market share of the railway compared to air travel. A clear trend towards higher market share can be seen as the travel time for train decreases.
Figure 1.2, The relationship between train travel time and the market share of train and air travel (Modified from original, KTH Railway Group, 2010)

As seen in the example above the tactic seems to have worked well, increasing the train travel on lines with shorter travel times while reducing air travel on the same destinations. In the Sweden however, the railway in many parts of the country is reaching its maximum capacity, which in recent years has caused trouble with delays and reliability. The Swedish railway is constantly getting bad press due to this matter and it is not uncommon to see articles or reports in newspapers, magazines or even on TV, criticising the situation of the Swedish railway. Adding to this the railway sector is getting the lowest customer satisfaction scores among the different personal transport sectors in the country for the fifth year in a row. The main Swedish railway operator SJ AB gets the lowest score in 8 years in 2010. The main reasons for this are due to bad reliability and bad customer services before and after the trip (SKI, 2011). According to the Swedish rail agency’s own sector report, the traffic/passenger information is getting bad customer satisfaction scores as well. The general score of traffic/passenger information has between 2007 and 2009 been around 50 out of 100. Passengers are especially dissatisfied with the reliability of information, especially when the train is delayed. Passengers are also dissatisfied with the clarity or simplicity of the information given. (Banverket, 2010)
For the railway to become a really attractive mode it is not enough for the railway services to just be fast. As have seen a train journey includes much more than just riding the train. In the past and still continuing today railway enforcements has largely been done through big investments in new infrastructure and vehicles. The author sees a general disregard in the Swedish railway industry for smaller and continuing investments improving all the small problems the railway has today. The industry seems to promote big changes like building new tracks and designing new trains rather than promoting better and reliable maintenance, upgrades and development today’s infrastructure and vehicles. Of course big changes are important and often lead to increased ridership as have been seen above, but small changes cannot be disregarded as an effect of those changes. As seen above smaller problems still exist and there is a need for them to be addressed in order to get a truly attractive railway service. It is a necessity for the train services to increase their reliability by improving and maintaining today’s infrastructure and vehicles at the same time as building new tracks and vehicles. All related infrastructure such as station buildings need to be well designed for the travellers needs. Good information and excellent customer service must be offered during the whole trip. This means before, during and after the actual train ride.

Much research has and is being done in making the trains themselves more comfortable, reliable, efficient, environmentally friendly and cheap, both for the operator and the traveller. A good example of such recent research in a Swedish context is called Gröna Tåget (Fröidh, 2010), which presents new concepts and ideas for future trains. Currently, research is also being done related to railway capacity, reliability and operations. An example of the increased popularity in this field is a new PhD position, focusing on reducing delays and making robust timetables offered at the University of Linköping. Recent research in a Swedish context includes a doctoral thesis called Railway Operation Analysis (Lindfeldt, O., 2010), which shows examples of analyses of complex traffic situations through simulation experiments. Other contributions can be seen in Lindfeldt, A. (2010) and Sipilä (2010).
This study will focus on some parts of the services offered to the traveller before the actual train ride, which have not yet been studied to a great extent and seems to have been forgotten in the Swedish context. This report will study how passengers behave on railway platforms and how different information and platform facilities such as seats and entrances effect their position to wait for the train. As we will see this subject is interesting and important not only from a passenger perspective but also from a reliability, capacity and travel time perspective.

1.2 Purpose, Objectives and Goals

1.2.1 Purpose and Focus

The purpose of this master thesis is to study how information on and design of railway platforms effects the passenger distribution and the behaviour of passengers on the platform. The information that primarily is on focus in this study is information about where the train and its cars stop along the platform. The design in focus will be positions of entrances and seats. The behaviour in focus will be were passengers choose to wait along the platform.

1.2.2 Main questions to be answered and analysed

- How do the passengers distribute themselves along the platform while waiting for their train
- Can aggregate patterns related to information and location of entrances or seats be observed in the passenger distribution
- How far away from their seat-reserved car do passengers wait when the train arrives
- Do passengers with different information and experience locate themselves differently
- Does it seem like the information available on the platform today is well used and well designed
- What advantages and disadvantages can be observed with today's solutions
1.2.3 Objectives

Results and analysis of this report are meant to deepen the understanding of the role of information on the platform and the location of different facilities. Results, discussion and final conclusions are also meant to serve as material for discussion for decision makers, planners and professionals working with these matters.

The objective of the study is also to give ideas and insights for future more advanced studies in the area. The methodology is therefore to be written very detailed and include suggestions for future studies. The study will hopefully also open up an interest for the field.

1.2.4 Goals

The main goal is to be able to suggest improvements for information on and design of Swedish railway platforms.

1.3 Study area

The study area will be platforms 10 and 11 at the Stockholm Central Station. Some studies will also be performed on platforms in Tokyo, mainly in Tokyo Station and Ueno Station but also in Shinagawa Station. Platforms in Sweden are chosen mainly because they have different layout which will allow analysis of differences in behaviour due to the specific layout. The platforms in Tokyo and Japan are primarily chosen is to give examples of the influence of different information than what is available in Sweden and to get ideas for improvements.

Trains that will be studied will primarily have seat-reservation. Departures studied will be X2000 departures in Sweden and Shinkansen departures in Japan. The X2000 and Shinkansen train services were chosen because they have similar properties which thus make it easier to compare them to each other. Both train services are high speed train services with quite long distance between the stops. Both are also quite expensive and seem to have a similar kind of customers/passengers.
1.4 Methodology
In this study three different survey methods will be used, one method to collect data of the platform distribution and two different methods to collect personal and behavioural information from the passengers. The platform distribution will be analysed through photo surveying while the personal information will be conducted through a questionnaire survey on the platforms in Sweden and a video survey in Japan. The Japanese studies will be more observational with the focus to give examples and will not be as comprehensive as the studies done in Stockholm. The methodology will be discussed more in detail in Chapter 4.

1.5 Limitations
Due to the limited time, manpower and financial resources of a master thesis, this study will be restricted to using simple methods and a relatively small data size. This will give the study some important limitations. The study only studies a very limited number of platforms. This study is further only being carried out in Sweden and Japan. Due to this fact it is unknown whether conclusions on especially behavioural aspects might or might not be transferable to other countries. They could differ due to the different cultural setting in the particular country. This could also be true in the comparison between Sweden and Japan but will be discussed and analysed as much as possible in the study. The limitations will be discussed more extensively in Chapter 4

1.6 Relevance
Keeping the background in mind it is remembered that a train journey is more than the time inside of the train. For the train to become a really attractive alternative to other passenger transport modes it is not enough with only improving the train; its speed, comfort and other vehicle and rail specific properties. The author is not saying that these properties are not important; on the other hand he strongly believes that they are of great importance but think that more is needed for the train to be a really attractive mode of personal transportation. The whole railway industry and especially operators must also offer their customers state of the art services already before the customer even buys his or her ticket and all the way until he or she reaches his or her final destination. As seen, the Swedish railway services are getting low customer
satisfaction scores, lower than any other passenger transport mode in the country. One of the reasons for this is said to be the service before and after the trip. Passenger information has also been seen to get low scores in many aspects, especially because of bad reliability. This tells us that the Swedish railway industry must begin to improve and invest in its services and passenger information.

This study tries to evaluate the information and location of entrances and seats on railway platforms and their effect on where passengers wait for their train. The platform is the only place where all passengers must pass in order to get into their train. It is therefore only natural that the platform becomes a place where passengers cluster and wait for their train. The fact that all passengers of a specific train must pass the platform before they enter their train makes the platform the obvious and most suitable location for train specific information. The platform is an important service hub where passengers should be able to wait comfortably and get relevant information before their trip. So even though the platform is just one of many places where passengers pass during their trip, it is by the author still believed to be of great importance. Improvements to facilities and information at the platform level should contribute much to the improvement of the overall service of the trip.

Good information about where the train and its cars stop along the platform help passengers to find their seats easier. Stress that might appear due to standing very far away from a seat-reserved car when the train enters the platform will be reduced with good information. This can be especially important for passengers with much or large luggage, passengers with disabilities or elderly that might feel higher discomfort and stress if standing/waiting very far away from their car when it arrives. Good information about where the train stops is thus a part of a good service to the customers.

Good information is also required on trains that depart as one from the origin station but later separate towards several destinations. Such trains do not yet exist to a great extent in Sweden however exists in countries like Denmark and Japan. An advantage with such a train departure is that two departures can
depart as one and thus save time slots for other trains and the capacity of the
overall network. If information on such a departure is not well designed there is
a big chance for misunderstandings and that passengers board the wrong train.

As will be seen in the literature review the boarding and alighting time is an
important part of the dwell time at a particular station. The author believes that
information about where the train stops along the platform is needed to avoid
higher dwell times than needed. This is for example important when the train is
already delayed and the dwell time should be as short as possible to be able to
reduce the delay. Higher dwell times than needed might especially appear on
seat-reserved trains and thus the reason for studying these types of trains in this
study. One or several passengers standing far away from a seat-reserved car
could at least in theory increase the whole dwell time by his/her or their own
and thus affect the total travel time. This is probably most likely when the load of
boarding and alighting passengers is medium or high and or the platforms and
trains are long.

If there are few passengers boarding and alighting, the passengers standing far
away from their door could enter any door and then walk inside of the train until
they reach their seat.

In situations with a medium load of boarding passengers there is no or very low
possibility to board any door and walk inside of the train to the correct seat due
to queue build-up inside of the train. Instead the traveller must board a door at
the correct car. The time for boarding and alighting passengers waiting close to
their doors might in these situations be lower than the time it takes for
passengers standing far away from their closest door to reach their door. The
dwell time can in these circumstances become longer than what was really
needed in case everyone waited close to their seat-reserved cars already when
the train arrived to the platform.

When there are many passengers boarding or and alighting the train, the time it
takes to board passengers standing close to the doors could be longer than the
time it take for passengers who stand far away to walk to their car. This even
though they might have much luggage or standing very far away. However, if
many passengers are standing far away from their cars, this could lead to crowding and queue building along the platform which also could lead to longer dwell times than needed.

1.7 Outline of the report

This report consists of eight chapters. Chapter 1 above constituted an introduction. Chapter 2 will present and summarise previous research in related fields. In Chapter 3 the study areas will be introduced in detail. Chapter 4 then continues with presenting the methodology and data of the study. Chapter 4 will also introduce possible limitations of this study and discuss suitable methodologies for future similar studies. Chapter 5 will then present the results of this study. Chapter 6 will finally summarise, discuss and analyse the findings. Chapter 7 will conclude the study and give suggestions and examples of improvements. Chapter 8 will finally propose future research topics.

The goal of the report is that it should be possible to read it and get a general basic understanding of the study, its results and conclusions just by reading Chapters 1, 6 and 7. Chapters 2 to 5 and 8 present deeper and more detailed information and are meant for readers with special interest and who want to get more detailed information about the study as a whole or about one particular topic such as for example the results or the methodology of the study. The different chapters of the report do because of the above mentioned reasons include some repetitions but this is done intentionally.
2. Literature review

There are quite an extensive body of literature describing and analysing the behaviour and preferences of train travellers. Most of these studies focus on the relationship between vehicle and passenger or the passengers aggregated behaviour or preferences during the whole trip.

There has however until recently not been many studies focusing on the behaviour of passengers inside of the station. The vast majority of these relatively fresh studies in the English or in the Swedish literature are focusing on pedestrian modelling inside the stations building or other public transportation hubs. Pedestrian modelling mainly focuses on movements of people and their interactions with other people and facilities as they move through an area such as a station or a platform. Contributions in the field can for example be seen in Hoogendoorn and Bovy (2005), Helbing et al. (2007) and Zhang et al. (2007). Many pedestrian modelling software have also been developed to help planners and designers choose for example the best platform or station building layout; allowing good passenger flows. Examples of such software are SimWalk and Vissim. These studies, models and software are very useful for their purposes. They are however more mathematical movement models than the behavioural analysis and theory relevant for this study. The availability of English or Swedish literature describing similar topics to this study was scarce. Significant effort was therefore made in order to sort out relevant and related literature for this study.

In this chapter five relevant and to this study related reports or papers will be introduced and briefly summarized. Among the five studies which all cover rather different topics there are two important Swedish studies. The first is a licentiate thesis (Heinz, 2003) giving a review of dwell time and passenger flow theory. The second Swedish study is a master thesis (Sund and Thurfjell, 2009), which studies passenger information on railway stations, mainly in a Swedish setting but also with some examples from other countries. The other three studies are taken from other countries, the first one being a Dutch study (Wiggenraad, 2001), studying alighting and boarding times at Dutch Railway stations. The study also includes a section about passenger distribution. The final
studies that will be summarized are two Chinese studies (Cheng et al., 2009; Lam et al., 1998) studying station capacity and crowding effects on platforms.

**Passenger service times on trains: Theory, measurements and models**

*Heinz, 2003*

The first report summarized is a licentiate thesis, which gives a review of dwell time and passenger flow theory. One section of the report also includes information about passenger distributions in coaches and platforms. The dwell time review and information about passenger distributions are of particular interest for our study and will be summarized below.

**Dwell time**

The total dwell time and the total running time are together the main parts of the total travel time of a train. The dwell time and the running time are opposite to each other. The running time is the time when the train is moving while the dwell time is the time when the train is standing still. The dwell time exist due to the necessity for the train to stop and exchange passengers. The total dwell time is the sum of all dwell times at particular stations.

\[
Dwell\ time_{Total} = \sum Dwell\ time_{Particular\ station}
\]

The dwell time at a particular station consists of the following elements:

1. Train stop
2. Checking procedures (Entire train check etc.)
3. Doors opening
4. Alighting and boarding
5. Waiting for the timetable departure time
6. Check procedures (No blocked doors check etc.)
7. Doors closing
8. Final clearance and departure

Of the components above number 1-3 and 6-8 can be seen as system constants that depend on the technical systems and equipment. The time it takes for these components to happen can be seen as a technical time which is more or less the same every time for a particular case, therefore called constant in this study. To
explain the alighting and boarding part of the dwell time on a particular station. Heinz introduces an important term called *the dimensioning door*. “The dimensioning door is the single entrance door of the train that needs the most time to alight and board its passengers”. The dwell time on a particular station thus becomes the system constant time plus the time it takes for *the dimensioning door* to exchange all its assigned passengers and all left time until scheduled departure time after that.

*Figure 2.1, Summary of different parts of the total travel time (Heinz, 2005)*

*Passenger behaviour on platforms:*

The number of boarding and alighting passengers is mentioned as an important part of the boarding and alighting process but it is also mentioned that it is really important to remember how the passengers are distributed in the coach and on the platform. Heinz points out that one easy mistake when calculating dwell times is to assume that the load on every door is equal and that passengers spread out evenly which in most cases are not true. Passengers tend to cluster.
Heinz summarises three different observed clustering behaviours:

- **Knowledge basis;** Passengers who know where they should stand, place themselves accordingly.
- **Clustering close to entrances, stairways, rain shelters and other platform infrastructure and facilities.** Often done by passengers who do not know their way.
- **Standing where others stand.** Often done by passengers who do not know their way.

Theoretically the behaviours above can lead to any passenger distribution but the four most common distributions that cover most of the cases are said to be: the uniform distribution, the bell shaped distribution, the unilateral skewed distribution or the bilateral skewed distribution. They are shown in Figure 2.2 below.

![Figure 2.2, The four most common passengers distributions (Heinz, 2005)](image-url)
In this paper, Wiggenraad (2001) studies dwell times of trains on platforms at seven Dutch railway stations with different location of platform entrances. The study tries to answer the following main four questions:

- What is the length of the dwell time and of the different components, also in case of delays?
- What is the distribution of the passengers over the platform related to the location of the platform accesses?
- What is the typical length of the alighting and boarding times (per passengers) according to the vehicle/platform characteristics?
- What is the influence of the type of station, the type of train service, the vehicle characteristics and the period of day in the Dutch situation?

Dwell time is as in the previous report pointed out as being an important aspect of speed and reliability in public transportation networks. Several factors are identified which determine the dwell time. As these components have been summarized in Heinz (2003) they will not be summarized here again.

Among the conclusions made in this study are that the dwell times are longer than scheduled, especially for intercity trains. The study also concludes that a train generally arrives late at the platform. The both facts put together results in an even more delayed train departure than arrival.

There is also a clear concentration of passengers waiting around platform entrances. Entrances at the end of the platforms lead to higher concentrations than entrances on the middle of the platform. It is stated in the report that the passengers do not have information about the stop location of the train. It is however unclear if the trains have seat-reservation or not. The paper also mentions that further research is needed to analyse if a more uniform distribution of passengers along the platform would lead to shorter dwell times.
In this article Cheng et al. (2009) aims to identify the practical passenger passing flow capacity of metro station facilities. Stations studied are located along the Beijing subway line 1 and the research focuses on the passengers’ whole way through the station from the security check to the platform.

The article concludes that there are many facilities that do not meet the demanded flows during peak hours or the demanded design values. This sometimes leads to very severe queuing development in some parts of the station such as at the automatic escalators or at the security check.

An important notice made by this article, which can be of great relevance for our study and that has been seen in earlier studies is that the platform passenger distribution has been noted to be very affected by the location of the entrances. People seem to stand close to the entrances. Another notice is that the platform distribution seems to be more uniform during peak hours.

This paper investigates attributes related to crowding effects at the light rail transit stations in Hong Kong. The paper studies different crowding effects and the relationship between the dwell time of trains and the crowding situation.

A regression model is made for the dwell time delays of trains. The models will not be discussed here but the dwell time was higher as more passengers boarded and alighted at a station, which could be expected. What is interesting for the study at hand is that different sections of the platform were utilised differently. Stations exemplified in the study both have entrances located at one side of the platform and vending machines located close to the entrances. What is very easy to see is that crowding appears around the entrances and at the vending machines. The authors point out that a bottleneck appeared to be built up around the entrances and around the vending machines further hindering passengers to go to sections located further away. This gives us an indication
that the planning of entrances and facilities has a great impact on the passenger
distribution along the platform. The authors recommend also having vending
machines located further away from the entrances as a solution to get a more
even utilisation of the platform.

*Passenger information at the railway station*
*Sund and Thurfjell, 2009*

So far we have looked at studies focusing on dwell time and passenger
behaviour. As information is one of the main parts of our study it is time to see
contributions studying informational aspects of the railway as well. In this
master thesis the authors aim to highlight the passengers’ need for information
and to identify deficiencies in the informational system in the Swedish railway
sector. In the end of their report they make proposals on how these deficiencies
could be addressed. The focus of this report is on a Swedish setting and the
whole aggregate information system process. Policies, coordination between
different actors and more is in focus rather than the exact information needed at
stations or platforms even though this is briefly investigated as well.

As in our report, this report also points out that the passenger information gets
very low grading in a number of investigations. A downward trend in the score is
pointed out as seen in investigations that are performed on annual basis. Sund
and Thurfjell conclude a general dissatisfaction with the passenger information
in Sweden.

To highlight the passengers’ need for information a focus group study is
performed. The group consisted of 3 persons, which makes it a deep interview
rather than a focus group. Participants were commuters and workers in the
railway sector. Some of the result from this deep interview is of particular
relevance for our study and are summarised below.

- The most important requirement was that the information should be
correct, relevant and be given at the right moment.
- Technical information should be suited for the passengers, not too
  complicated as the average passenger does not have any knowledge about
  the railway system.
• The passengers want/need to know where trains separate, where different parts of the train go and where the trains cars stop along the platform (*Vagnlägen* in Swedish)
• Information should be given in other languages than just Swedish
• Information on signs and displays should be hard to misunderstand. The signs should highlight important information more pedagogically.
• Signs and displays should also be flexible and should be able to be used for different information. One example mentioned is that information about changed tracks should be displayed on signs on the platform.

Through their study the authors further find three main deficiencies in the information system/process. These are communication, responsibility and resources and will be explained briefly below.

**Communication:**
Communication to passengers but also within the sector needs to improve. There seem to be few or no plans for communication between responsible actors within the sector. The passengers do not seem to trust the information they get. There are no good plans or policies on what should be done in special cases such as disturbances, delays and more.

**Responsibility:**
Responsibility is divided among different organizations. A problem that arises due to this is a difficulty to know who is responsible for what, which leads to mistakes and communication difficulties.

**Resources:**
There is not enough resources and manpower. People working with passenger information have other assignments as well and passenger information comes second to those assignments.

The report ends with proposing seven measures to overcome the problems and deficiencies that were found in the research. The first five of these measures are aimed at the whole sector including organisations and traffic operators while the
two last measures are aimed for the responsible railway agency, Banverket or as it is called today, Trafikverket.

1. Benchmarking
2. Audit, adjust and follow up internal routines
3. Motivate personnel to follow internal routines
4. Education of personnel about the passenger information system
5. Experience-sharing
6. Education of communication and target groups
7. Passenger suited information standards
3. Study area
The previous chapter introduced previous studies in related fields. This chapter will present the platforms and vehicles that will be studied. In Sweden two platforms will be studied. They were chosen because they have different layouts which will allow studies of different behaviours due to the layout. In Japan three different platforms will be studied. They were chosen because different information is available compared to what is available in Sweden. Trains with primarily seat reservation will be studied. X2000 trains, in Sweden, and Shinkansen trains, in Japan, will as they primarily have seat reservation therefore be on focus.

This chapter will introduce the general layout of these platforms and the information and facilities available on them. It will also briefly introduce the vehicles used on departures which will be studied. The platforms and trains in the Swedish case will be introduced first, followed by the platforms and trains in the Japanese case.

3.1 Case Study: Sweden
On Swedish platforms there are generally four types of signs or displays that give different information to passengers. These signs all show information only in Swedish. The first type is a display showing information about the next train arriving to the platform. This display has information about departure or arrival time of the next train, type of service, main destinations and car order. It also shows an estimated new time in case of delay. Figure 3.1 shows an example of such a display.

Figure 3.1, Type 1 Information display on Swedish platforms
The second type of display or screen shows departure information of the several next trains departing from the station (from any platform of the station). This display shows departure time, destination, type of service and platform number of the trains. It also shows an estimated new times when a delay occurs. The display sometimes also shows general traffic information. Figure 3.2 below shows this display as it looks on a platform.

![Figure 3.2, Type 2 Information display on Swedish platforms](image)

Figure 3.2, Type 2 Information display on Swedish platforms
The third type of information is about where the train and its cars will stop along the platform, which is the type of information that is in focus in this study. This information is typically indicated by a car-location poster showing lists with models of the trains for each specific departure on the particular platform, and the position of the cars of these trains in relation to letters A to E. This brings us to the fourth and final sign giving passengers information. On Swedish platforms there are often but not always so called “vagnlägeskyltar” which directly translated to English would be “car-positioning signs”. These signs are positioned along the platform either hanging down from a roof or on a pole (around 50 metres from each other) and indicated with a letter A to E. With help of the poster showing the train in relation to these signs the passenger is supposed to be able to find where his or her car stops along the platform. Both the poster and the signs can be seen in Figures 3.3 and 3.4 below.

*Figure 3.3, Car-location poster indicating the car-stopping positions*
As mentioned earlier two different platforms will be analysed in the Swedish part of the study, these platforms are platforms 10 and 11 on the Stockholm Central Station. Both platforms are opposed to each other. Stockholm Central Station will be the origin station for the departures studied. Because of this, trains will arrive several minutes before the departure time. This is different than on normal intermediate stations where the train normally arrives 1-2 minutes before departure. The choice of Stockholm Central Station as the study areas is mainly due to location aspects; it is closely located. Another reason is that the load of passengers is higher at Stockholm Central Station compared to other stations, which make it easier to observe the passenger distribution.

To be able to conduct the study, the platforms were measured and divided into small parts, called subsections in this study. Each subsection was decided by the pillars holding up the roof of the platforms, which happened to be located at about more or less the same distance from each other. The pillars where used as borders between the subsections. Figure 3.5 shows a part of a platform with subsections indicated with pillars as the border.
Figure 3.5, Pillars on the platform are used as boarders of the subsections

The distance of the platform was measured by a measuring wheel and by adding the distance of each measured subsection. As the platforms in reality are a little bent but the measurements are done on a straight line the calculated length will include a couple of metres of measurement error, which is important to remember.

Below the actual platforms will be introduced. It is important to notice that all maps, drawings and illustrations of the platforms are aggregated visualisations of the actual platform and not real detailed plans. The distances, placement of facilities and entrances and the layout of the actual platform might differ from what is shown in the figures. The level of detail is however estimated as sufficient enough for this study. One example is as mentioned above that the platform in reality is bent but showed as straight in the figures and calculations of this study.
3.1.1 Platform 10

Figure 3.6 below shows an illustration of platform 10. Appendix A shows a more detailed illustration with length of each subsection.

![Figure 3.6, Illustration of platform 10 showing location of seats, entrances, poster and car-positioning signs](image)

The surveyed part of platform 10 is 168 metres long and consists of 20 subsections. As the Figure 3.6 above illustrates the subsections are more or less of the same distance. The only exception is subsection 1 which is larger. The subsections are around 7-9 metres. Subsection 1 is 13 metres.

There are two major entrances. The main entrance is located on subsection 14. Another, smaller entrance exists and is between subsection 19 and 20. There is also an elevator on subsection 18, which is not indicated on the illustration above. As seen in Figure 3.6 the platform is equipped with car-positioning signs indicated A to D. The platform also has a poster, indicating the stop position of the cars, located in subsection 12 and several seats on subsections, 1, 7, 8, 10, 12, and 13. The platform has a roof along the whole platform to protect against rain and snow. Informational displays about the next train and other departures from the stations do also exist on the platform.
3.1.2 Platform 11

Figure 3.7 below shows an illustration of platform 11. Appendix B shows a more detailed illustration with length of each subsection. Platform 11 is an island platform and actually a platform for both track 11 and 12. Only the bottom part of the platform is actually platform 11.

The surveyed part of platform 11 is 181 metres long and consists of 19 subsections. As the Figure 3.7 above illustrates, the subsections are more or less of the same distance. The subsections are around 9-10 metres.

There are three major entrances on platform 11. The main entrance is a staircase leading to subsections 10 and 12, while other entrances can be found at subsection 13/14 and 18. As platform 10, platform 11 is also equipped with car-positioning signs and a poster to locate the stop positions of the train and its cars. The poster is located at subsection 12. There are also several seats located on subsection 5, 8, 9 and 18. Seats on subsection 9 and 18 are also equipped with wind shelters. In opposite to platform 10, platform 11 has several staircases directly located on the platform which makes several areas of the platform narrower than others as the staircases occupy available space. Platform 11 has a roof along the whole platform, which protects against rain and snow. As Platform 11 however is an island platform it is less protected from wind compared to platform 10, which has a wall on one side.
3.1.3 Trains
In the Swedish study only X2000 departures will be surveyed. X2000 services have mandatory seat-reservation; this means that all cars need seat-reservation. An X2000 trains normally consist of one control car, 4-5 intermediate cars and an X2 locomotive. This makes a total of 6-5 cars most often numbered 1-6 or 2-6 and a locomotive. The intermediate cars are 24 990 mm long while the control car is 22 500 mm. The X2 locomotive is 17 500 mm long. (Jarnvag.net, 2011)

All doors are located in the end of the cars. Car number 6, which is a control car has only one door. Car number 4, which is a restaurant car, has two doors on some departures but only one door on some others. The rest of the cars have two doors. Doors are normally indicated with seat numbers. The meaning of this indication is probably that passengers with those seat numbers should enter through that door. Figure 3.8 show a simplified illustration of a normal X2000 train with length used in the calculations of this study.

![Figure 3.8, Illustration of a normal length X2000 train and distances between doors used in the calculations of this study](image)

3.2 Case Study: Japan
Shinkansen trains normally depart from special platforms, separated from other platforms on a Japanese station. To enter these platforms a Shinkansen ticket is normally needed. The only way to enter the platform besides holding a Shinkansen ticket is by a platform ticket, which allows two hours on a platform. The Shinkansen platforms include more information than normal Japanese platforms. There are very much information on the platforms and all will not be described here. As in the Swedish case there are four main types of information on the platform.
The first type of information is a display showing information about the three next train departures on the particular platform. Information about type of service, destinations, departure time, train number and number of cars are shown here for all of the three next-coming departures. There is no information about departures on other platforms like there is in the Swedish case. That information can be found in the departure hall inside of the station.

![Figure 3.9, Type 1 Information display on Japanese platforms](image)

The three additional types of information all have to do with the position of the train along the platform. At first there is as in the Swedish case, signs showing where the train and its car will stop along the platforms. This is shown with a model of the train in relations to staircases and the current location of the sign. This information is showed on both dynamic displays just before entering the platform (Figure 3.10) or by static signs on the platform itself.

![Figure 3.10, Car-positioning display type 1 on Japanese platforms](image)
In addition to this there are indications where each door of each car will stop along the platform located on the platform. Two types of information indicate this and are located at the stopping position of each door. The first one is a dynamic display hanging down from the roof showing train type, departure time and car number that will stop here. This information exists for all doors. The second information showing the doors stop position are signs on the floor of the platform. This shows static information about the particular car that stop here depending on train type or number of cars of the train.

![Figure 3.11, Dynamic car and door-positioning display type 2 on Japanese platforms](image1)

![Figure 3.12, Static door and car-positioning signs on Japanese platforms](image2)

Most of the Japanese information is displayed in both Japanese and English. The Japanese platforms also include some facilities, which do not exist on the Swedish platforms. Such facilities can be small restaurants, kiosks, vending machines, smoking rooms and waiting rooms.

As the study conducted on the Japanese platforms will be less comprehensive than the on the Swedish ones the Japanese platforms will not be measured as the Swedish ones were. Displays showing stop position of the train will serve as indications on where passengers stand instead.
3.2.1 Platforms
The Japanese studies will be conducted on two main stations, Tokyo Station and Ueno Station. Some data will also be collected at Shinagawa Station, mainly to confirm results of the two previous stations. Tokyo Station is an origin station while Ueno and Shinagawa Station are intermediate stations. As the stations are of different types they have different properties. Exactly as discussed in the Swedish case the trains arrive several minutes before the departure time on origin stations. At intermediate stations trains arrive only one or two minutes before the departure time.

Figure 3.13 and 3.14 below show the position of entrances and seats on platform 20 and 21 on Tokyo Station and platform 19 and 20 on Ueno Station in relation to a 17-car train, which is around 400 metres. At Tokyo Station there is only one waiting room with seats. Ueno Station, which is an underground station, has more seats spread out over the platform. A roof protects both platforms exactly like in the Swedish cases. As Ueno Station is an underground station, it has more protection against wind and strong weather. Shinagawa Station will just be studied during one day as an example and no detailed description will therefore be done of that station. Some surveys will also be done on platforms 22 and 23 on Tokyo Station but the layout of these platforms are very similar to the layout of platforms 20 and 21 why it is not further described here.

![Figure 3.13](image1.png)
*Figure 3.13, Illustration of platform 20 and 21 at Tokyo Station showing the location of seats and entrances in relation to car-stopping positions*

![Figure 3.14](image2.png)
*Figure 3.14, Illustration of platform 19 and 20 at Ueno Station showing the location of seats and entrances in relation to car-stopping positions*
3.2.2 Trains
Only Shinkansen trains have been observed in the Japanese study. Shinkansen departures mostly require seat-reservation. On some departures all cars have seat-reservation but it is also common that some cars of each train are unreserved. These cars are then normally located next to each other in one of the ends of the train. The departures include between 8 and 17 cars were two of them always are control/end cars. There are several Shinkansen train types but no further explanation of differences between the different types will be given here. The intermediate cars are, on almost all types that will be studied, 25000 mm long. They also have one door located more or less in each end of the car. End cars can be both longer and shorter but they normally have two doors in each end as well. Doors do not display seat numbers as they do on the Swedish X2000 trains. Some intermediate cars on some train types are shorter than 25000 mm. The car is then between 20 070 and 23 070 mm long. The distance in the Japanese study will be roughly estimated using these lengths and the calculations will be much more imprecise than in the Swedish study.

Figure 3.15, Two different Shinkansen types
4. Methodology, descriptive data and limitations

The study area was presented in detail in the previous chapter. This chapter will first discuss the methodology of the study in more detail than was done in Chapter 1. In the second section of the chapter the data gathered through the different surveys will be described. Finally limitations and recommendations for future studies will be summarized in sections 4.3 and 4.4.

4.1 Methodology

4.1.1 General methodology

There are many ways to study behaviour and thoughts of passengers and there are also various ways of recording passenger distributions. Some ways are better and some are worse than others. As mentioned before, this study will have very limited resources. This is due to the fact that it is a master thesis without any financial support and restricted time. The study will besides this only be conducted by one person. This study will because of these reasons be restricted to using easy methods.

General for all methodologies are that the study time will be short, which will make the data size relatively small. Whether the data is a good estimate of the population is therefore questionable. Passengers who arrived after the train will be missed both in the passenger distribution and behavioural studies. This is one major exclusion bias that the data will have and which to a small part is due to the methodology used. This is however mainly due to the choice of studying origin stations where trains arrive several minutes before they depart.

The study will as mentioned be done in two different countries. The general methodology will be different in the both countries due to the purpose, time restrictions, different permissions and different infrastructure. In Sweden the platforms are open for everyone to enter without paying. In Sweden the studies were therefore conducted on as many departures as possible on weekdays between 10 and 16 o’clock.
In Japan the situation is different. It is only allowed to enter the railway platforms of Shinkansen tracks when holding a Shinkansen ticket or a special platform ticket, which costs money. Platform tickets only allow a maximum of two hours stay on the platform. Because of economic reasons the study in Japan will be limited to two hours per day. The time of the study was a different two-hour interval between 10 and 16 every day.

The study in Sweden was conducted in September and October 2010. The Japanese study was conducted in October and November 2010. Weather conditions were similar in both countries. The temperature was between 10-20°C. On most days it was not raining but cloudy. Sometimes some light rain appeared. The platform distribution and passenger behaviours could be affected by the weather. A passenger could for example be more likely to wait inside of a waiting room in winter than in summer because of the cold. As the weather in the both countries was quite similar during the studies the comparability is seen as good. Some findings in this study might however due to differences in weather conditions not be transferable to other days or seasons of the year, especially days or seasons with extreme weather.

Below the methodology used in this study will be presented. Theoretical advantages and disadvantages due to the chosen methodology will then be summarized and discussed. This is followed by a presentation of empirical problems that appeared during the data collections for each of the methods.

Three different methods were used in this study; one photo survey, one video survey and one questionnaire survey.

The photo survey was used to answer the following main questions in both countries:

- How do the passengers distribute themselves along the platform while waiting for their train
- Can aggregate patterns related to information and location of entrances or seats be observed in the passenger distribution
A questionnaire (See Appendix C; Swedish original and D; English translation) was developed to survey the following main questions in the Swedish case.

- How far away from their seat-reserved car do passengers wait when the train arrives
- Do passengers with different information and experience locate themselves differently
- Does it seem like the information available on the platform today is well used

The Japanese part of the study only got the permission to conduct video/photo surveys; this means that no questionnaire survey was allowed. A video survey will therefore be used in the Japanese case to answer the following questions.

- How far away from their seat-reserved car do passengers wait when the train arrives
- Does it seem like the information available on the platform today is well used

As seen above the Japanese study will answer fewer questions than the Swedish study.

In order to draw conclusion and make discussions, answers from the photo and the questionnaire in the Swedish study the surveys will be combined to try to simply model the situation on the platform. Below we will present the different methods more extensively.

4.1.1 Photo survey
A photo survey was performed to be able to count people standing on the platform. Various methods of taking photos were tested during a pilot study at Stockholm Central Station; both taking photos on the actual platform and higher grounds were tested. The method that gave the best result was to taking photos from the opposite platform. The photo survey was therefore finally performed using a camera and taking photos from an opposing platform. To capture overall
dynamics and changes of the platform distribution pictures were taken every 5 minutes from around 30 minutes before the scheduled departure time of the train. The photos were then used to count passengers standing in the different sections on the platform. The count was done manually.

Figure 4.1, Illustration of the methodology of the first video survey

In Sweden the survey was conducted during 8 days plus one pilot study on as many departures as possible on weekdays between 10 and 16.

In Japan the survey was conducted during 4 days. Due to problems that appeared good data were not collected. Discussions of observations will be done instead. Read more about the problems below.

Theoretical advantages and disadvantages
The main advantage with this methodology is that it is easy to conduct for one person. If the camera is equipped with enough zoom, the platform is straight enough and not too long, it is possible to stand on one spot on the opposing platform and take pictures of the whole platform.

There are three major theoretical disadvantages with the method. Firstly, depending on the angle from where the photo is taken and the load of people on the platform it is possible to miss passengers standing behind one another. Taking pictures from different angles when there is time enough to move to different spots on the opposite platform can battle this disadvantage.
Figure 4.2, Some passengers might be missed because they stand behind other passengers

The second disadvantage has to do with the mix of passengers to different trains that are using the platform at the same time. If there are many departures close to each other, passengers from different departure will mix on the platform, making it impossible to know which passenger distribution is caused by a specific departure.

The third and probably largest disadvantage if it occurs is that a train that enters the opposing platform track will block the view of the relevant platform, making it impossible to take photos and thus recording the passenger distribution. The only way to reduce the impact of this disadvantage is to study the timetable and plan the photo shooting thereafter. Even doing so there is randomness due to delays and changed tracks, which could make a train block the platform anyway.

Figure 4.3, Impossible to conduct the study if trains are blocking the view

Empirical problems: Sweden

When conducting the study, it soon became clear that the third disadvantage presented above would become the biggest problem. It was especially hard to find unblocked departures on platform 11. A train that arrived earlier to platform 10 would often block the sight of platform 11. This fact led to yet
another problem. The problem was that the blocking train at platform 10 often was another X2000 train. It seemed like X2000 departures from platform 10 and 11 on Stockholm Central Station often departed 10 minutes behind each other. The problem with this is that only one departure could be recorded every time. It was impossible to record both departures because when the first train left from one platform, another X2000 train had already entered the second platform. As the departures on platform 10 often were the earliest it also meant that they were less blocked and that more photos were taken of departures from that platform.

The problem with passengers blocking each other only happened when the load was large; at those times photos were taken from different locations to try to minimize the count loss. Problems with mix of passengers from different departures also became apparent sometimes. The recorded departure was removed from the study if the mix was estimated to be too great. On platform 11, there were also problems with passengers from departures on platform 12, which is located on the other side of the same platform as platform 11. This problem was not as great as when passengers from different departures waited on exactly the same side. When there was a departure on platform 12 close to the departure on platform 11, all passengers standing on the platform 11 side were counted as passengers of that platform. Passengers standing on the track 12 side were ignored. This leads to some measurement errors as passengers using the train departing from platform 11 might wait on the other side of the platform even though their train will not stop there. The same but opposite is true for passengers on trains departing from platform 12. The measurement errors due to this are after several observations not estimated as very large.

**Empirical problems: Japan**

In Japan it soon became clear that the methodology was very difficult to use for its purpose. All theoretical disadvantages discussed above presented themselves. There were too many trains blocking the view of the platform of interest. Another problem that appeared was the heavy mixed of passengers on the platforms. It was impossible to know which person would take which train just by taking photos. The platforms were also often too long and bent to take photos.
from one location eliminating the advantages of the methodology. Due to all
problems, no data was gathered. Discussion of observations will be done instead
of presenting data in the result chapter of this study.

4.1.3 Questionnaire survey

A questionnaire was developed for the Swedish part of study. The questions
were built up using results and discussions from earlier studies and by
brainstorming about the behaviour of passengers in a reference group. Before
conducting the actual 8-day questionnaire survey, two pilot studies were
conducted on two separate days of the same week. The purpose of these pilot
studies were to see how participants answered the questions and if there were
any misunderstandings. After the first pilot study several adjustments were
made to the questionnaire. Main adjustments were shortening and clarifying of
the questions. Adjustments to the structure of the questionnaire were also made.

The second pilot study was done with the remade questionnaire. The main
purpose of pilot study 2 was to test different manners of surveying. The manners
tested were to survey by handing out the questionnaires to passengers and
letting them answer the questions themselves or surveying through directly
asking them questions orally. Pilot study 2 was also meant to see if
misunderstandings due to the new survey design were made. During pilot study
2 it was clear that the handing out method was the most efficient and the best
one to use. No significant misunderstandings were recorded due to the survey
design. The design used in the second pilot study was therefore used in the 8-day
survey. Both data gathered during the first and second pilot study are used in the
data analysis of the study, if questions are completely answered and no
misunderstandings and mistakes were made. Where questions differ from the
final questionnaire the result will be removed from the analysis only for that
particular question. The final survey and questions used can be seen in Appendix
C and D.

Before handing out the questionnaire to a passenger a mark with the subsection
on which the passenger is standing was done in the questionnaire. This
information was later used to calculate the passenger’s distance to his or her
door. If a passenger moves to another subsection after answering the questionnaire the position is changed, when possible. The passenger’s arrival time before departure time and if he or she is seated is also recorded in the questionnaire. Besides handing out questionnaires, a form to indicate the train stopping position also existed. The stopping position of the train was written on this form when the train had arrived and had stopped at the platform. This data together with the passenger’s subsection data was then used for calculating the distance to the closest and indicated door. The exact way of calculating the distance is described below.

The distance between the passenger and his or her car is calculated from the middle of the subsection to the door of the car. The distance will be calculated both to the closest door and the door indicated by signs on the train. As mentioned, distances are always calculated from the middle of the subsection even though passengers in reality could stand anywhere on the subsection.

![Figure 4.4, Illustration of distance calculation method](image)

Because of limited resources, the survey needed to be done by only one person. The platforms were divided into four sections that would be surveyed separately during different departures, this because the platforms are too long to be surveyed properly during one departure for one person. The section borders were chosen by analysing the data from the platform distribution and the platform length. Each section had to be short enough for one surveyor to have time to move between different parts but also have similar passenger distribution characteristics.

There are several ways to decide which section should be surveyed on a particular departure. The best way would normally be to choose a section
randomly. That method is however only good if the study is done over a long period of time so that all sections will be chosen many times and thus reducing biases. When the time period is short as it will be in this study it would be possible for one section to become chosen many more times than other sections leading to significant biases. The survey was therefore done by letting each section be surveyed as much as possible. The sections surveyed were rotated between days and departure times as much as possible. In that way every section would be surveyed in the study on several different days and during different departure times eliminating as much bias as possible due to departure time, particular days, weather and more. Due to several platform changes of trains a predefined rotating schedule could not be done. Instead the schedule had to be modified as the time went depending on which particular trains were cancelled or had to change track.

At each section the passengers where to be chosen randomly.

*Theoretical advantages and disadvantages*

The main advantage of this method is that it is possible for one person to conduct while still getting data from all sections over a short time period. No section will be surveyed many more times than others eliminating biases.

The main disadvantage is that passengers arriving close to the arrival of the train or after the arrival of the train will be missed by the survey. This because they do not have time to answer the questions. It is an apparent exclusion bias that the survey has and that is magnified due to the choice of an origin station where the trains arrive several minutes before departure time. There are ways to combat this problem by for example giving late-coming passengers a questionnaire and a stamped envelope. In that way they could later on post back the questionnaire. This method however is too costly for the budget of this study.

Another large disadvantage is that all sections cannot be surveyed for the exactly same departure. Even though all sections are surveyed on a particular departure time, but on different days, it still will include bias due to the differences between the particular departures. The method tries to minimize bias due to days and departure time by rotating as much as possible but it would always be
better to survey the whole platform for the particular departure to minimize the bias.

Another disadvantage has to do with the time, which is a general disadvantage of the whole study. The survey will be conducted during two weeks which will be too short time to get a large enough data size in each section to get statistically significant results in all questions relevant to the study, especially at a disaggregate level. The time will not allow all sections to be surveyed all days and over all departures. The data will due to these limitations include some biases. The estimation of the population by the data is because of all biases questionable.

One thing that also can be discussed is the randomness when choosing the participants. The surveyor might cause bias by himself by choosing passengers that look nice and open rather than passengers that look angry or grumpy continently or incontinently. The tactic of this study was to try to ask as many people as possible but biases due to the surveyor’s preferences and feelings when choosing participants might not fully be eliminated.

**Empirical problems: Sweden**

During the survey the maximum number of passengers that could be handed a questionnaire and had time to answer was between 11 to 20. So even if there were more passengers on a section no more than maximum 20 if the train was delayed could answer. Of these 20 passengers, passengers that arrived early had bigger chance of being asked than people arriving late. The passengers arriving early are however not as many as passengers arriving later so it is difficult to say how much it really matters. An additional problem that has to do with the design of the questionnaire was that if the seat and arrival time box were forgotten to be checked it was difficult to know if the person was seated or not. This could have been counter measured by having two checkboxes for seats instead; one box for standing and one for seated passengers instead of just one for seated passengers as in the current design. As many boxes were not checked by the surveyor due to stress when many passengers came, no analysis of arrival time
or seated passengers will be done from the data gathered during the questionnaire survey.

### 4.1.3 Video survey

Due to declined permission to conduct a questionnaire study on JR East platforms a video survey was performed instead. A section of the platform was chosen and video filmed with one video camera around 2 minutes before the arrival of the train, until all people on the section had boarded the train. The sections were chosen loosely and not as detailed as in the Swedish case, but sections along the whole platform were recorded. Analysis on how close to the door passengers waited were then done manually from the video afterwards.

The video survey was conducted on three different stations; Tokyo Station, Ueno Station and Shinagawa Station during 2-hour intervals on different days and during different times between 10 and 16 on weekdays. The survey was conducted during 8 days.

**Theoretical advantages and disadvantages**

The main advantage with this methodology is that it is very easy to perform for one person while obtaining a relatively large data in a short time.

There are several disadvantages with the method. The main disadvantage for this study in particular, is that the methodology cannot answer one of the main questions of the study about whether the passengers have used information and what kind of experience they have. Another great disadvantage with this method is the difficulty of calculating the exact distance when passengers move far away from the camera or behind the camera. To combat this problem the camera can be rotated to follow people that move far away or behind the camera in situations where it is allowed.

Biases due to days, departure times, weather and more can exist. The same disadvantages exist and were discussed in the questionnaire study. They will therefore not be further discussed here. To combat this, a rotation of sections surveyed can be and was done.
Empirical problems: Japan

Tokyo Station was to become the major station of the study. But due to early train arrivals, around 15 minutes before departure time it was difficult to record passengers waiting on the platform as many of them had not yet arrived to the platform before their train arrived. Because of this reason, Ueno Station instead of Tokyo Station was chosen as the major station of the study. Ueno Station is an intermediate station where trains arrive around two minutes before departure time.

As the study in Japan mainly was conducted on an intermediate station and the study in Sweden was done at an origin station, it can be difficult to compare the results. The results at Ueno Station are however almost exactly the same as when a train arrived closer to departure time at Tokyo Station. Shinagawa Station which also is an intermediate station was surveyed during one day to see if the behaviour was similar to both Tokyo and Ueno Station. The results at Shinagawa Station were similar. The choice of platform does not seem to matter so much in the Japanese case and the results from both the Swedish and Japanese studies are therefore seen as comparable even though different station types are studied. The main difference between the studies will be that the Japanese data has less exclusion bias than the Swedish where passengers arriving after the train arrival (around 5-10 minutes) will be missed.

Besides the above-mentioned problem the video study did not face as many problems as expected. Due to the behaviour of passengers there were almost no problems with people moving far away or even behind the camera. When movements behind the camera happened it was always possible to rotate the camera and follow them without missing other boarding passengers on the section.
4.2 Descriptive Data

4.2.1 Case study: Sweden

Platform 10

Platform distribution data

In total, the platform distribution was recorded for 19 different departures on platform 10. Table 4.1 show all X2000 departures between 10 and 16 on platform 10 on all days included in the study. If the departure was recorded it is marked with a 1. If the box is unmarked it means that the departure by some reason is unrecorded. It can be because it was blocked, the train had been changed to another platform or that there were too many passengers from different departures mixed on the platform.

Table 4.1, Departures studied in the platform distribution study on Platform 10

<table>
<thead>
<tr>
<th>Dep Time</th>
<th>Pilot</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31-aug</td>
<td>7-sep</td>
<td>8-sep</td>
<td>9-sep</td>
</tr>
<tr>
<td>10:21</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12:10</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13:15</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14:10</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14:21</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15:15</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

In total 81 observations were made between 35 to 5 minutes before these 19 departures. Table 4.2 show how many observations were done depending on the time before departure. Table 4.2 also shows when the train arrived during the 19 departures surveyed.

Table 4.2, Observations and arrivals by time before departure on Platform 10

<table>
<thead>
<tr>
<th>Time before departure (min)</th>
<th>Number of observations</th>
<th>Number of arrivals</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>19</td>
</tr>
</tbody>
</table>
Figure 4.5 shows the passenger distribution with the average number and standard error of passengers waiting on every subsection of platform 10 for all 19 arrivals. The figure also indicates which subsection was included in which section in the questionnaire study.

![Figure 4.5, Average number of passengers on Platform 10 at train arrival with standard error showed as error bars.](image)

Data from the questionnaire survey

In total 213 individuals answered the questionnaire. The study had 6.2% refusals. Almost but not all individuals answered all questions. Individuals that did not answer questions will be removed from the analysis of that particular question only.
Table 4.3 shows which section was surveyed and how many answers were gathered at which day and departure.

**Table 4.3, Section and number of participants by day and week of the questionnaire study on Platform 10**

<table>
<thead>
<tr>
<th>Time</th>
<th>Pilot 21-sep</th>
<th>28-sep</th>
<th>29-sep</th>
<th>30-sep</th>
<th>1-okt</th>
<th>5-okt</th>
<th>6-okt</th>
<th>7-okt</th>
<th>8-okt</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:21</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>12:10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>13:15</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>66</td>
</tr>
<tr>
<td>14:10</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td>14:21</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>15:15</td>
<td></td>
<td>12</td>
<td>11</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>16</td>
<td>34</td>
<td>38</td>
<td>34</td>
<td>16</td>
<td>18</td>
<td>26</td>
<td>19</td>
<td>213</td>
</tr>
</tbody>
</table>

(Sections are shown bold while the number of participants is shown in brackets)

Figure 4.6, Participants of the questionnaire study on Platform 10 by subsection and answer on knowledge about where the car will stop along the platform

Figure 4.6 shows the representation of answers by subsection in each section. In all section the general trend is similar to the trend in Figure 4.5 but some subsections are over or underrepresented in their section. This is probably most due to the very limited number of departures studied for each section. If more departures where studied the distribution would probably look more like it did in the passenger distribution study. Subsections 6 and 11 are overrepresented in their sections compared to the passenger distribution in Figure 4.5. Subsection 1,
7, 10, 12 and 13 are underrepresented. This over- and underrepresentation is an important bias when analysing the data more aggregately in 4 sections and especially over the whole platform.

The subsections inside of each section also seem to have similar properties regarding informational aspects. Some border subsections as for example subsection 6 stand out a little from their sections and should maybe have been included in their neighbouring section instead. No change to the sections will however be done and it is important to remember these facts in the analysis. In Table 4.4 below show the total number of participants in each section.

Table 4.4, Participants in the questionnaire study by section on Platform 10

<table>
<thead>
<tr>
<th>Section</th>
<th>No of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
</tr>
</tbody>
</table>

Platform 11

Platform distribution data

In total, the platform distribution was recorded for 15 different departures on platform 11. Table 4.5 show all X2000 departures between 10 and 16 on platform 11 on all days included in the study. If the departure was recorded it is marked with a 1. If the box is unmarked it means that the departure by some reason is unrecorded. It can be because it was blocked, the train had been changed to another platform or that there were too many passengers from different departures mixed on the platform.

Table 4.5, Departures studied in the platform distribution study on Platform 11

<table>
<thead>
<tr>
<th>Dep Time</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7-sep</td>
<td>8-sep</td>
<td>9-sep</td>
</tr>
<tr>
<td>10:10</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11:21</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12:21</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15:21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

56
In total 71 observations were made between 35 to 5 minutes before these 15 departures. Table 4.6 shows how many observations were done depending on the time before departure. Table 4.6 also shows when the train arrives during the 15 departures surveyed.

Table 4.6, Observations and arrivals by time before departure on Platform 11

<table>
<thead>
<tr>
<th>Time before departure (min)</th>
<th>Number of observations</th>
<th>Number of arrivals</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>71</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

Figure 4.7 show the passenger distribution as the average number of passengers waiting on every subsection and the standard error for all 15 arrivals. The figure also indicates which subsection was included in which section in the questionnaire study.
Data from the questionnaire survey

In total 198 individuals answered the questionnaire. The study had 6.7% refusals. Almost but not all individuals answered all questions. Individuals that did not answer a question will be removed from the analysis of that particular question only.

Table 4.7 shows which section was surveyed and how many answers were gathered at which day and departure.

**Table 4.7, Section and number of participants by day and week of the questionnaire study on Platform 11**

<table>
<thead>
<tr>
<th>Pilot</th>
<th>21-sep</th>
<th>23-sep</th>
<th>28-sep</th>
<th>29-sep</th>
<th>30-sep</th>
<th>1-okt</th>
<th>5-okt</th>
<th>6-okt</th>
<th>7-okt</th>
<th>8-okt</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:10</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td></td>
<td>42</td>
</tr>
<tr>
<td>11:21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>12:21</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>57</td>
</tr>
<tr>
<td>15:21</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>18</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>14</td>
<td>23</td>
<td>29</td>
<td>20</td>
<td>32</td>
<td>198</td>
</tr>
</tbody>
</table>

(Sections are shown bold while the number of participants is shown in brackets)

Figure 4.8, Participants of the questionnaire study on Platform 11 by subsection and answer on knowledge about where the car will stop along the platform

Figure 4.8 show that most of the subsections follow the same trend inside of their section as they do in the average passenger distribution in Figure 4.7. There
are some exceptions though. Some sections are under- and overrepresented. As on platform 10 this is probably most due to the very limited number of departures studied on each section. If more departures were studied the distribution would probably look more like it did in the passenger distribution study. Subsections 8, 12 and 16 are underrepresented in their sections compared to the passenger distribution. This is a bias which is important to keep in mind when analysing the data more aggregately in 4 sections and especially over the whole platform.

The subsections inside of each section also seem to have similar properties regarding informational aspects. Some border subsections as for example subsection 7 and 11 stand out a little from their sections and should maybe have been included in their specific neighbouring section instead. No change to the sections will however be done and it is important to remember these facts in the analysis. Table 4.8 below show the total number of participants in each section.

<table>
<thead>
<tr>
<th>Section</th>
<th>No of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>56</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>198</td>
</tr>
</tbody>
</table>

4.2.2 Case study: Japan

The Japanese case study will as described earlier not be as comprehensive as the Swedish one; it will barely be observational. As has been described earlier the platform distribution could not be recorded. The platform distribution has nevertheless been studied through observations during 4 days, between 18th and 22nd of October 2010. Observations where made 2 days at Tokyo Station and 2 days at Ueno Station.

The behavioural study was made on 8 weekdays between 25th of October and 5th of November 2010. In total, observations were made of 26 departures and 315 passengers. The behavioural study was mostly done at Ueno Station. Studies were also done one day at Tokyo and on day at Shinagawa station.
4.3 Limitations

In this section the major limitations of the study will be briefly summarised.

- The study is only being carried out in Sweden and Japan. Due to this it is unknown whether results and conclusions might or might not be transferable to other countries as they could differ due to differences in the cultural setting in the particular country.
- The platforms and trains studied are limited in number, which might make it difficult to draw conclusions for all types of platforms and different designs.
- The time of day is limited to low-peak hours on weekdays; meaning between 10 and 16 o’clock. The transferability of the results to high-peak hours when there might be more passengers riding the train might therefore be affected.
- Only weather situations with around 10-20°C; sometimes with light rain but mostly without rain have been included in the study. The results of the study might not be transferable to other weather situations, especially extreme situations such as very cold winter days with much snow.
- The results of the study are limited because the study uses easy methods conducted over a limited amount of time, which may cause biases. Major biases are; exclusion bias of passengers arriving late, bias due to specific days and departures and over- and underrepresentation of some subsections in the data.
- Distances in the study have estimation and measurement errors estimated to some metres.
- The data size is small which together with biases of the methodology affects the accuracy of the estimations. Statistically significant results are not to be expected by disaggregate analysis of the data as the size is too small.
4.4 Evaluation and future recommendations

Above the major limitations were presented. As seen in this chapter the study has many limitations. The methodology in this study is relatively simple and includes important biases. The data size will be small and some results will not be statistically significant at a high level of confidence. The results should therefore be seen as indications rather than statistical proof. The results will be enough to give us some clues about disadvantages and advantages of today’s solutions in Sweden. The results will also deepen the understanding of the behaviour of passengers and allow us to discuss, draw conclusions and make examples of possible improvements, which also hopefully also will be useful for decision makers, planners, scholars and professionals working with these matters. The study will open up the field and test some methodologies. As these are the main objectives and goals of the study it also means that the methodology and data is good enough for this study even though it could have been better.

For future studies, which want to study this area to a more detailed extent, for example with the goal to create a complete model, there are several lessons to be learned from the experience of this study. First of all it is much better if the platform distribution and individual behaviour is surveyed at the same time, instead of doing two different surveys as in this study. This will lead to more accurate estimations than if the data is combined from two surveys. It will also eliminate biases.

If not too many trains stop on the opposite platform, the platform distribution can be recorded by using a camera and taking pictures from there. A better way would probably be to record it using several cameras on the relevant platform especially if the cameras are located above the heads of the passengers. Alternatively the passenger distribution could be counted manually on the spot, but it would require a large number of surveyors. Recording the passenger distribution from the actual platform will eliminate problems with other trains blocking the platform, which was the largest problem in this study.
A questionnaire survey is a good way of recording personal thoughts and behaviour. It would even be better if it is combined with video, especially if movements are to be studied. It would also be better if sections were smaller as it was difficult for one surveyor to survey enough passengers on one large section. The sections should maybe even be as small as the subsections in this study to get the best result. At least half of the section size used in this study is recommended. All sections should also be surveyed for the same departure if possible. This would require more surveyors conducting the survey but would have several benefits such as getting a larger number of data in shorter time and eliminating biases due to specific departures and days. All passengers on the platform could be studied if the sections were small enough and the study would then be getting the passenger distribution automatically (if refusals also are recorded).

To remove the exclusion bias that occurs on especially origin stations where the train arrives to the platform several minutes before the departure time a stamped envelope could be given to the late coming passengers along with a questionnaire. This survey would however not be a reviled preference (RP) study but a stated preference (SP) study as the passenger actual behaviour is not seen. This would however allow including these passengers in the study. Another way to reduce the exclusion bias is to study intermediate stations where the train arrives only some minutes before departure time.

Finally, two weeks are not enough. A future study would need to record many more departures than what was done in this study, especially if a model is to be built. This will help eliminate or reduce the over- and underrepresentation of different subsections making the estimations more accurate and more representative of the true population.
5. Results

In this chapter the results of both the Swedish and the Japanese study will be presented. Presenting averages is normally a good way to summarize data but with the limitations and objectives of the study in mind it is important to remember that the data is small and includes biases which will affect the accuracy of the average values. As expected many of the results were not statistically significant at a desired level (e.g. 95% or 99%). Statistical significance will further only be calculated for some results. ¹ ² Remember that one of the main objectives is to find advantages and disadvantages on a Swedish setting. Average results will give a good picture of aggregate behaviour and will thus be presented and summarized in the results. But only analysing averages has a disadvantage as some, especially rare behaviour, advantages and disadvantages can be missed. When analysing the result great effort has therefore been done to analyse each specific departure; both from the collected data but also by observing behaviour in real time on the platform. The results for each specific departure will be difficult to show in graphs and tables, as the report then would be full of figures and charts.

5.1 Case study: Sweden

5.1.1 Platform distribution survey

Platform 10

On average 144 passengers occupy platform 10 when an X2000 train arrives at the platform. Our data is however ranging between 75 and 211 passengers on particular departures.

¹ Statistical significance is calculated by t-tests for 2 independent samples assuming unequal sample size and variance. One-sided test are always done to test the hypothesis if a value significantly is higher than another.

² This study will approximate the binomial distribution to be a normal distribution for all statistical significance calculations of proportions. This is estimated to work as all data complies with the rule of thumb: \( np \geq 5 \) and \( n(1-p) \geq 5 \). Whether the approximation is good or not is not analysed further in this study.
The standard deviation of the data is quite high. This tells us that the behaviour and passenger occupancy on the platform differ between each specific departure. Even so, some major aggregate trends have been observed during this study. These trends can be seen on most of the specific departures in the study, even though they sometimes differ from each other regarding passenger numbers and passenger distribution. Some trends can partly be observed by the figures below while others have been observed in real time during the study.

At first, when there is a lot of time left until departure time, passengers tend to cluster on subsections with seats. Seats soon become occupied. Passengers then continue to cluster on subsections with seats or subsections around them even though all seats are occupied. Subsections with seats closer to the main entrance on subsection 14 tend to have higher loads on average.

As the time come closer to departure time, two distinct behaviours can be observed. Firstly, some passengers seem to aim for a specific position on the platform, evening out the distribution on the platform. Secondly some passengers seem to gather around the main entrance on subsection 14. The second trend often prevails leading to an average unilateral skewed distribution around the main entrance as the train arrives. These trends can partly noted in Figure 5.1, which show the average passenger distribution by number of passengers during different minutes before departure.

![Figure 5.1, Average passenger distribution by minutes before departure on Platform 10](image-url)
Similar to Lam et al. (1998) a bottleneck have been observed to build up due to the crowding that appears close to the entrance on the most occupied subsections 12, 13 and 14. This bottleneck seems to prevent some passengers from moving to subsections located further away on the platform at the same time as it creates more crowding around the entrance. The crowd at the entrances make it impossible or at least very difficult to see the car-location poster from the main entrance.

Figure 5.2 further illustrates the uneven distribution on the platform by showing the occupancy as a ratio between the percentage of passengers and the percentage of the platform length of each section. When the train arrives to the platform, section 3 tends to have the highest occupancy of the four sections. On average section 3, which is around 24% of the platform length, is occupied by 49% of the passengers on the platform.

One commonly observed behaviour is that passengers often turn their head in both directions directly after entering the platform, like if they were looking for something. It is suspected that they are trying to find information about their train; such as for example if this is the correct platform, if the train is delayed or where to stand along the platform. Many of the passengers with this behaviour
then chose to wait close to the entrance. This is especially true when the platform is crowded around the main entrance.

Much movement on the platform were observed after the train had arrived. This suggests that many passengers waited on different locations than where their car or at least where their closest door stopped. Passengers often waited until the train had stopped until they began to move.

Depending on how many minutes before the departure time the train arrived there was a different amount of passengers arriving to the platform after the train (and thus missed in the passenger distribution study). The range in our study is estimated to be between 5 and 40 (on both platform 10 and 11) depending on the arrival time of the train but also on the specific departure itself. Among these passengers two distinct different types of behaviour were observed. Firstly, some passenger seemed to know their way directly when they entered the platform. They often headed for their car directly without looking at information or even stop to look around. This suggests that these passengers have experience or at least know where their car was before entering the platform. Secondly some passengers seemed confused and often stressed as they entered the platform. They often ended up asking staff on the platform if this was their train or not and where they should be seated. These passengers probably did not have much experience or were stressed because they were delayed.

**Platform 11**

On average around 110 passengers occupy platform 11 when an X2000 train arrived at the platform. The range in our data is between 60 and 148 passengers.

The standard deviation of the data is as in the data of platform 10 is quite high, suggesting that behaviour and passenger occupancy on the platform differ between each specific departure. But as in the study of platform 10 some major aggregate trends have been observed among more or less all particular departures. The observations are similar to the observations on platform 10 but with some small differences.
Figure 5.3 above shows the average passenger distribution during different minutes before departure time. The figure confirms the same trend of passengers locating on and around subsections with seats when there is a long time left until departure time and even after all seats are occupied as we could see on platform 10. What is different however is that passengers also seem to choose to wait around the main entrance on subsection 12 already long time before departure, even though no seats are located there. This could not be seen on platform 10. Two possible reasons are suspect to explain this among many others. Firstly, the train/car-location poster is located on subsection 12. Passengers entering through the main entrance on subsection 12 were observed to look at the poster when they entered and then move to another position or stay around subsection 12, probably because their car was indicated to stay there. Secondly, because of facilities on subsection 10 and due to the curved design of the platform, seats are not very visible from subsection 12. The passenger might therefore stay where he or she entered which in this case also is more or less in the middle of the platform.

As the time comes closer to departure time, passengers seem to continue to choose to wait on subsections with seats or entrances or subsections around them. As on platform 10 two distinct behaviours can be seen closer to departure time. Firstly, some passengers seem to aim for a specific position on the
platform, evening out the distribution on the platform. Secondly some passengers seem to gather around the main entrance on subsection 10 and 12. As on platform 10, the latter behaviour often prevails leading to a peak of passengers around the main entrance on section 10 and 12.

When crowding increases, a bottleneck sometimes appear on subsections 9 and 10. The main cause of this bottleneck seems to be the many passengers located on the both subsections. The bottleneck also seems influenced by the limited space on subsection 10 due to a facility that is located there.

Note that the load on subsection 11 is lower than the surrounding subsections. It is suspected that the cause for this to be the limited available space on that subsection caused by the staircase located there.

Figure 5.4 illustrates the average occupancy at the arrival of the train by section. It is clearly seen that the middle sections (section 2 and 3) are the most crowded. Section 2, which constitutes 21% of the platform length, is on average the most crowded with 41% of the passengers waiting there when the train arrives.

![Figure 5.4, Average occupancy by sections on Platform 11 (95% confidence interval of the mean indicated by error bars)]
Passengers further showed the same behaviours as they entered platform 11 as they did on platform 10. This is true for passengers arriving after the train as well. Movements were also observed on platform 11 after the train had arrived suggesting that passengers waited on other positions that where their closest door stopped. The problems getting from the waiting position to the closest door however seemed more problematic on platform 11 than on platform 10. This is probably due to the narrower subsections on platform 11, which makes it difficult to walk fast in crowds.

5.1.2 Questionnaire survey

Platform 10

Passengers on different sections of platform 10 wait at more or less the same average distance from their closest door when the train arrives. Figure 5.5 on the next page show that section 3 is the only section standing out. Passengers on section 3 significantly stand further away from their closest door on average compared to sections 1 (p<0.01%), 2 (p<0.01%) and 4 (p<0.05%). As seen in Figure 5.5, the trend seems to be true for the indicated door as well. Figure 5.5 also show that passengers in our sample on average wait closer to their closest door than their indicated door. Passengers on section 4, are the only ones waiting at around the same distance to their indicated door, as they wait to their closest door. This is probably due to the fact that many passengers on section 4 have seats reserved in car 6, which only has one door.

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3 In this section several usages of the terms passengers with knowledge and passengers without knowledge will be used. They all refer to the answers on Question 3 in the questionnaire study (See Appendix C and D). A passenger with knowledge is a passenger answering yes on that question. A passenger without knowledge is a passenger answering no on that question.
Sections 2, 3 and 4 have significantly higher (p<0.01%) percentage of passengers that say that they do not know where their car will stop along the platform compared to section 1. Section 3 has the highest percentage of passengers in our sample. The lowest percentage is found in Section 1. Table 5.1 and Figure 5.6 below show an increasing trend of passengers who do not know where their seat-reserved car will stop along the platform from the edges of the platform towards Section 3.

Table 5.1, Total passengers and passengers per section on Platform 10 answering yes or no to the question (Q3); Do you know where your seat-reserved car will stop along the
Passengers saying that they know where their car will stop along the platform wait significantly closer to their car when the train arrives than passengers answering that they do not know where their car will stop. This is true for both the distance to the indicated door (p<0.01%), as well as for the distance to the closest door (p<0.01%). On average a passenger with knowledge about where his or her car will stop, stands 12 metres from his or her closest door. He or she on average further stands 18.5 metres from the door indicated by signs on the train when the train arrives. The same numbers are 23 and 29 metres for a passenger without knowledge. Note that the only significant result between the distance to the closest door between the two groups by section is for passengers on section 2 (p<0.01%) and section 3 (p<0.05%). Figure 5.7 below however confirms a similar trend along the whole platform where passengers with knowledge in our sample are standing closer to their cars in all sections of the platform. Figure 5.8 further illustrates this trend by showing that a bigger proportion of passengers without knowledge in our sample are standing further away from their doors.
Figure 5.7, Average distance to the closest door on each section on Platform 10 by passengers answering yes or no (on Q3)

Figure 5.8, Percentage of passengers on platform 10 answering yes or no (on Q3) standing at different distances to their closest and indicated doors
Passengers with knowledge significantly (p<0.01%) travel more (have more experience) than passengers without knowledge; this is true both for the specific departure but also for travelling with trains in general. Figures 5.9 and 5.10 further illustrate this by summarizing answers about travel frequency from the questionnaire.

Figure 5.9, Travel frequency of the specific departure time by passengers on platform 10 answering yes and no (on Q3)

Figure 5.10, Travel frequency on trains in general by passengers on platform 10 answering yes and no (on Q3)
Below the behaviour of passengers with and without knowledge will briefly be described independently from each other.

**Passengers without knowledge**

When asking passengers without knowledge about where their car will stop along the platform, if there is information about that, around 63% out of 68 passengers answered that they either did not know or that they did not believe that there was any information. 28% answered that they knew that there is information but that it was either too difficult to find or too indistinct. Only 9% said that they knew that information existed.

When asking them if they would like to wait were the their car stops, if they knew about where their car stopped, only 2 out of the 68 passengers who answered the question said no. Both of these passengers had also answered that they knew that information existed. One of them had mentioned smoking as a reason to not stand where the car stopped (to not bother others) and another said that he or she would wait until the train arrived until going to the door.

Appendix E show how passengers without knowledge answered when asked which choice of waiting corresponded best on their behaviour today. 49% answered that they chose to wait where they believed that their car would stop. 18% answered that they chose to stand close to the stairway entrance or elevator to the platform,

**Passengers with knowledge**

Passengers who answered that they know where their car will stop were asked how they knew that. Two categories of passengers with knowledge were sorted out by their answers. One category which answered that they knew where their car stopped through experience and another which answered that they had used information on the platform. The passengers who had knowledge through experience also had significantly higher travel experience (p<0.01%). This is true both for the specific departure but also for travelling with trains in general than both passengers using information on the platform and passengers without knowledge. Passengers using information on the platform had significantly (p<0.05%) higher travel experience for the particular departure compared
passengers without knowledge. They also had slightly significantly higher (p<0.1%) travel experience than passengers without information regarding train travel in general. The average experience of the two groups were however not so large.

Looking at the whole platform as well as on each section there is no significant difference between the distances to the seat-reserved cars between the two groups with knowledge. Figure 5.11 however shows a trend where passengers with knowledge through experience in our sample seem to stand a little closer than passengers using information. One exception is section 2 where passengers using information stand closer.

![Graph showing average distance to the closest door on each section of Platform 10 by different passengers saying that they know where their seat-reserved car will stop.]

The majority, around 88% of the 143 passengers that answered that they know where their car will stop along the platform said that they wait where they believe that their car will stop. Most of them also say that it was their major tactic. 6% say that they do not care where they wait. These passengers often waited on a seat or close to the entrances.
**Platform 11**

Figure 5.12 shows the average distances to the closest and indicated doors. Opposite to platform 10, passengers on different sections of the platform seem to wait at different average distances to their cars when the train arrives. Passengers waiting on section 2 and 4 also stand significantly (p<0.01%) further away from their closest door than passengers on sections 1 and 3 (there are no significant differences between section 2 and 4 or 1 and 3 respectively). As on platform 10, passengers on platform 11 seem to wait further away from their indicated door than their closest door. Again passengers on section 4 can be seen waiting almost as close to their closest door as to their indicated door, which further supports the theory that many of these passengers have seats in car 6. Passengers on section 4 in our sample are also the ones on average standing furthest away from their closest and indicated door when the train arrives.

![Figure 5.12, Average distance to closest and indicated doors by passengers sections on Platform 11](image)

Section 2 closely followed by section 3 has the highest percentage of passengers that answered that they do not know where their seat-reserved car will stop along the platform. There is no significant difference between section 2 and 3 and 1 and 4 respectively, but both sections 2 (p<0.01%) and 3 (p<0.05%) have significantly higher percentage of passengers that answered that they do not know where their car will stop along the platform compared to both sections 1
and 4. The lowest percentage in our sample is found in Section 4. Table 5.2 and Figure 5.13 below show an increasing trend of passengers who do not know where their seat-reserved car will stop along the platform from the edges of the platform towards Section 2.

Table 5.2, Total passengers and passengers per section on Platform 11 answering yes or no to the question (Q3); Do you know where your seat-reserved car will stop along the platform

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1</td>
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<td>12</td>
<td>45</td>
</tr>
<tr>
<td>Section 2</td>
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<td>31</td>
<td>63</td>
</tr>
<tr>
<td>Section 3</td>
<td>31</td>
<td>25</td>
<td>56</td>
</tr>
<tr>
<td>Section 4</td>
<td>26</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>75</td>
<td>197</td>
</tr>
</tbody>
</table>

Figure 5.13, Percentage of passengers on each section on Platform 11 answering yes or no to the question (Q3); Do you know where your seat-reserved car will stop along the platform

Passengers saying that they know where their car will stop along the platform do as on platform 10 also stand significantly (p<0.01%) closer to their cars when the train arrives compared to passengers that did not know where their car stops. This is true for both the closest and the indicated doors. On average a passenger with knowledge about where his or her car will stop stands 13 metres from his or her closest door while 18.5 metres from the door indicated by signs on the train when the train arrives. The same numbers are 26 and 35 metres for
a passenger without knowledge. Figure 5.14 confirms the trend along the whole platform, where passengers with knowledge are standing closer to their cars in all sections of the platform. (Significant results on section 1 (p<0.01%), section 2 (p<0.01%) and section 3 (p<0.05)). Figure 5.15 on the next page further illustrates this trend by showing that a bigger proportion of passengers without knowledge in our sample are standing further away from their car.

![Figure 5.14, Average distance to the closest door on each section on Platform 11 by passengers answering yes or no (on Q3)](image1)

![Figure 5.15, Percentage of passengers on platform 11 answering yes or no (on Q3) standing at different distances to their closest and indicated doors](image2)
Precisely as on platform 10, passengers with knowledge seem to travel more frequently than passengers without knowledge as the average is significantly (p<0.01%) higher for both the specific departure and for travelling by trains in general. Figures 5.16 and 5.17 illustrate this by summarizing the frequency questions in the questionnaire.

**Figure 5.16, Travel frequency of the specific departure time by passengers on platform 11 answering yes and no (on Q3)**

**Figure 5.17, Travel frequency on trains in general by passengers on platform 11 answering yes and no (on Q3)**
Below the behaviour of passengers with and without knowledge will briefly be described independently from each other

**Passengers without knowledge**

When asking passengers without knowledge about where their car will stop along the platform, if there is information about that, around 51% out of 75 passengers answered that they either did not know or that they did not believe that there was any information. 29% answered that they knew that there were information but that it was either too difficult to find or too indistinct. 15 passengers or 20% said that they knew that such information existed.

When asking them if they would like to wait where their car stops, if they knew about where their car stopped, only 4 out of the 74 passengers that answered the question said no. The passengers saying no once again (as passengers on platform 10) mentioned smoking as a reason for this. As on platform 10 one answered that there is no problem in walking a little when the train arrives.

Appendix F shows how passengers without knowledge answered when asked which choice of waiting corresponded best on their behaviour today. 33% answered that they chose to wait where they believed that their car would stop. 18% answered that they chose to stand close to the stairway entrance or elevator to the platform, which they also did. 11% answered another reason than what was stated in the questionnaire. Among these passengers, one mentioned that he or she chose to wait where there was room enough. Another answered that it does not matter where a he or she stands; it is always possible to move along the platform when the train arrives. The last passenger that stated another reason mentioned a combination between choosing to stand in the middle and where many other passengers stand.
**Passengers with knowledge**

Passengers who answered that they know where their car would stop were as on platform 10 asked how they knew that. From these answers the same two categories as on platform 10 were sorted out. Passengers who had knowledge through experience also had significantly (p<0.01%) higher travel experience both for the specific departure but also for trains in general than passengers using information on the platform. Passengers using information on the platform had similar average experience as passengers without information. The difference between the averages was between these groups not significant.

On platform 11, passengers with knowledge through experience stand significantly closer to their closest door than passengers with knowledge through information. The average distance is however not so different. Passengers with experience stand 10.5 metres from their closest door while passengers with knowledge from information stand 14 metres. Figure 5.18 shows that the same trend can be seen on every section each section, besides section 4 (significance on section 2, p< 0.01%).

![Figure 5.18, Average distance to the closest door on each section of Platform 10 by different passengers saying that they know where their seat-reserved car will stop](image)

The majority, around 91% of 120 passengers answering that they know where their car will stop along the platform say that they wait where they believe that it will stop, most of them also say that it was their major tactic. 4% say that they do not care where they wait.
Further studying Platform 11

At the very end of this work it was discovered that no information existed on the car-location poster for all 12:21 departures on Platform 11. Other information such as car order and more however still existed. The information about the stop location of the 12:21 departures exist on the poster located on Platform 10 instead of the poster located Platform 11. This suggests that the train of this departure in normal cases should stop at Platform 10. During the study it however almost always stopped at Platform 11. This is an unfortunate mistake as the intention of this study was to study departures which had all information available on the platform. All other departures did also have all information available. To not have noticed that the information on the car-location poster was not available, is a small mistake by itself, but could affect the results presented above for Platform 11. The problem that theoretically appears is that passengers might have different behaviours if there is information available on the poster or not. As around 25% of all participants in the questionnaire study of platform 11 did not have information available on the poster, the possibility to compare the values of Platform 11, to those of Platform 10, where all departures had all available information, could therefore be affected.

If this fact had been discovered earlier, it would have led to a slightly different approach when analysing the data above. What would have been done is that passengers on 12:21 departures would have been analysed independently from other departures, which had available information for the particular departure. Differences could then be analysed. The fact was however unfortunately discovered at the very end of the study, after all analysis had been done and without any time to redo all the work. This section will nevertheless briefly study the trends in results of the 12:21 departures and compare these to other departures on platform 11. This study will not be as comprehensive as the analysis that was done previously but it will give some important indications of possible differences between behaviours when information on the poster exists and not.
First of all, there is a similar trend in the percentage of passengers with information through experience, through information and passengers without knowledge on the 12:21 departures as on all other departures. This suggests that passengers still use information as they do on other departures. It is not clear from our study which information they used. Passengers could use information about the car-order only. Observations however show that some passengers still use the car-location poster and then move to another spot on the platform exactly as passengers on other departures. This suggests that they use information from other trains to estimate the stop location of the specific train.

Further analysis of the results of 12:21 departures shows all the similar aggregate trends that have been seen in the analysis of all departures on platform 11 above. Only three things have been seen to stand apart from other departures, and two of them are just slightly different. First of all passengers without knowledge on the 12:21 departures in our sample slightly answer more that they know that information exist but that it is too indistinct. A slightly higher trend towards choosing to stand where many other wait has also been observed among passengers with knowledge among the 12:21 departures compared to passengers of other departures. Both these findings point towards passengers on 12:21 departures not trusting the information as much as passengers on departures with all available information.

Passengers on section 2 and 4 on the 12:21 departures further seem to stand further away from their closest doors compared to passengers on other departures. Passengers on section 4 especially stand further away. This is believed to be caused by two reasons where one is the lack of information on the poster. The second cause for this has to do with an additional difference that can be seen on 12:21 departures compared to most other departures. The additional difference that has been found on 12:21 departures, compared to other departures on Platform 11, is that shorter trains arrive to the platform. 5-car trains normally arrived instead of 6-car trains, and this also seemed planned as the poster on platform 10 indicates that. That poster can however not be seen from Platform 11, so it does not matter if it is indicated or not. Section 5.1.3 is dedicated to analyse the effects due to information and the train's performance,
including its stop position. This matter will therefore be further discussed and analysed in that section.

To summarize the findings; the mistake that was discovered in the end of this work could have some impact on the results of Platform 11. The effects on trends are after a brief evaluation not estimated to be that large. The 12:21 departures seem to fit the average trends presented on Platform 11 above well. What will be affected however is the comparability to the average values of Platform 10. The fact that information on the poster was not available on some departures has however not only been negative. The brief evaluation above has given new insights on the behaviour which probably would not have been observed if this mistake was not done.

**Summarizing comments from passengers on both platforms**

During the study several comments were made by passengers (both written and orally). The most common comments related to our study are summarized below.

**Information**

- Information is commented to be too unclear and too difficult to find by many passengers. They especially complain that it is too bothersome to find information (especially about where the train stops) if carrying much or large luggage. They mention that it not should be necessary to make an effort to find information. The information should be well placed so it is easy to see already when entering the platform.

- English information is needed; this is both mentioned by Swedish and non-Swedish speakers.

- Many passengers say that they do not trust the information and some of them say that they because of that stand more to the middle of the platform than what the information indicates.

**Seats**

- Passengers complain that there are too few seats.

- Seats with wind shelters are needed along the whole platform 11.
Behaviour

- Some passengers say that they used the display on the platform showing car ordered but that they do not know from which direction the train will come. Many said that they guessed the direction. Some passengers that guessed mentioned that they did not go as far as they thought that their car would stop as a precaution if they were wrong. Some also said that they chose to waited were other waiting.

5.1.3 Information and the train performance

Stopping position of trains

As some passengers commended that information could not be trusted, and because shorter trains (5-car trains) normally arrived on 12:21 departures on platform 11, an analysis of the trains stopping position is done. This is done to evaluate the correctness of the information given. This is also done to see if there were difference between the stopping positions between trains on different departures, and to analyse if the train length could have an impact on the passengers distance to the closest door. Appendix G and H show the stopping positions for all trains surveyed in this survey both on platform 10 and 11.

Stopping positions were found to vary a lot between different departures even when they had the same indicated stopping position. The information itself is not accurate. Information on the car-location poster did not even exist for all departures on a particular platform. The poster indicating the train position seems standardized and not perfectly corrected for the specific platforms (especially the positions of A-E signs). It has long lists with departure times and gives an approximate location of where the train will stop. As can be seen in appendices G and H the stop location of each car indicated by the poster is somewhat different than what is possible in reality if an X2000 train stops there. If a train is changed from its planned departure track to another, no information normally exists there.

Trains on platform 10 tend to stop a little before the position indicated by the information while normal length (a 6-car) trains arriving at platform 11 stop relatively well compared to what is indicated by the poster.
On one departure a short length train (5 cars with car numbers 2 to 6) arrive to platform 11 even though the information on the posters indicated that a normal length train would arrive. This also happened one time on Platform 10. Most of the time however, a short train arrived to platform 11 without any information on the car-location poster. As seen in Appendix H, the short length trains did always not follow the by the information indicated stopping positions of normal length trains.

On platform 10 the maximum difference in distance between the same doors between different departures was 19 metres. On platform 11 the same number was 46.5 metres. The large difference on platform 11 is largely due to the fact that the locomotive on a 5-car train (car 2 to 6) tends to stop around the same position as the locomotive of normal 6-car trains (car 1 to 6) which means that car 2 stops on the normal position of car 1. This displaces the whole train with one car, meaning around 25 metres. The rest of the 46.5 metres are largely due to the fact that even trains with the same length stop on different positions between different departures.

The effect on the distance to the closest door by the dislocation between shorter and normal length trains were analysed on platform 11. What should be remembered is that most of the short length trains, all but one actually, arrive at 12:21 departures, which had no indicated stopping position on the car-location poster. Figure 5.19 on the next page shows the average distance to the closest door on each section for normal and short trains.
Figure 5.19, Average distance to the closest door on each section of Platform 11 depending on a short or a normal length train arrives to the platform

When a short train arrived the passengers waiting on section 4 had much higher (significant p<0.01%) distance to the closest door than what they normally had when a full length train arrived. This could be due to the lack of information that exists on 12:21 departures. The same result, a much longer distance (42 metres instead of the normal average of 12 metres) to the closest door can however also be seen by analysing the only departure where information existed on the poster. On that departure it was indicated that a normal length train would arrive.

That section 4 is the section on 12:21 departures that has the longest average distance to closest door and at the same time is the most affected by the stopping position of a 5-car train is by the author not believed to be a coincidence. Observations also show that passengers most affected by a short train are passengers waiting on and around the seats on subsection 18. They often entered car number 6 or 5 which if a normal length train arrived would stop closer to the subsection. The author therefore suggests that the higher average that could be seen on 12.21 departures is caused by both the lack of information on the poster and the fact that a 5-car train arrived to the platform.

The data indicates that lack of information causes passengers to not trust the information. As seen these kind of passengers tend to locate to entrances or
where others stand which often is on subsections with seats and entrances or more to the middle of the platform. Passengers both with and without information might therefore when no accurate information exists locate to subsections on section 2 explaining the higher average distance to the closest door there.

The high average distance to the closest door on section 4 is probably most explained because 5-car trains stops on a different location than a normal length train. The author further speculates that all type passengers could be attracted to subsection 18 as it is a subsection equipped with seats. The seats could be luring passengers to the edge of the platform which creates problems when a short train arrives and does not stop there. Further research is needed to confirm this.

The lack of information on the poster and the fact that short train cars stop on other locations than what is normal, is in any case believed to partly explain the high average distance trends that have been seen on section 4 in the analysis of platform 11 above.

**The boarding time**

An analysis of four delayed trains was also made. 150 to 200 passengers were estimated to occupy the platform when the delayed train arrived on all four departures. The analysis shows that it took around three minutes to empty the platform and fill the train with all passengers that were waiting there.

It was very difficult to see which the cause that affected the time it took to board the train was. In every observed case it either looked like the design of the train (width of the door or hallway or other design aspects) or the queuing behaviour to board or in the train that affected the time. Passengers standing far away did always seemed to have time to walk to their doors either before all passengers waiting close to their door had time enter their doors or before the time it took for the dimensioning door to board all its passengers. Crowding and movements have however always been observed on the platform after the train had arrived. This could also have affected the time it took for the boarding of the train. This study cannot say the limiting reason for the dwell time. More research is needed to investigate this.
5.1.4 Combining the data

Finally point estimates from the both studies are combined. This is done in order to get an easy estimate of how passengers with and without knowledge about where their car stops are located along the platform. Important to remember is that this estimate is even more inaccurate than the previous estimations as it adds the inaccuracies from both the previous estimations together. Nevertheless it will give us some important insights on how the distribution of the platform might look like Figure 5.20 on the next page shows the percentage of passengers with and without knowledge on platform 10 (combining percentages of passengers from the platform distribution study and questionnaire study). Figure 5.21 on the next page shows the same for Platform 11. Around 40% of all passengers on both platforms are estimated to be without knowledge when the train arrives to the platform. 89% of all passengers without information are estimated to gather on section 2 and 3 on platform 10. On platform 11, 84% of all passengers without knowledge are estimated to wait on section 2 and 3.
Figure 5.20, Average estimate of percentage of passengers with knowledge (yes on Q3) and passengers without knowledge (no on Q3) on Platform 10

Figure 5.21, Average estimate of percentage of passengers with knowledge (yes on Q3) and passengers without knowledge (no on Q3) on Platform 11
5.2 Case study: Japan

5.2.1 Platform distribution and individual behaviour

The platform distributions on all Japanese platforms studied were observed to be very different from the distributions observed in the Swedish study. There was no observed concentration of passengers around entrances. Seats were occupied not always occupied. Passengers did not seem to gather around seats when they were occupied as they did in Sweden. To summarize, no aggregate trends around either entrances or seats could be observed in the platform distributions of all Japanese platforms studied. What easily could be observed thought was that passengers stood in queue at the indicated stopping position of doors of the train. This indicates that passengers stand where they believe that their car will stop.

![Passengers standing in queue at their door when a Shinkansen train precisely has arrived to the platform at Tokyo Station](image)

As a train arrived to the station (any station in the study) no or very few movements on the platform could be observed. Those passengers that moved were often not passengers of the train that arrived. Passengers who moved and that were observed taking the train that had arrived often seemed to be latecomers (arriving to the platform after the train) or passengers that had bought lunchboxes at one of the various kiosks or restaurants located at the platform. This was observed because they were often holding a lunch box in their hand. Many of these passengers that moved through the platform after the train
had arrived looked stressed and ran to their car. They however did not seem to be confused about where their car had stopped, indicating that they either were experienced or had good information. Many of them looked at the car stopping position information hanging down from the roof as they ran which further indicates that some of them used information.

315 passengers were observed in the behavioural study. Of these 315 passengers, 294 were standing on the particular section of the platform studied before the train had arrived. 21 passengers came to the particular section studied after the train had arrived. Of the 294 passengers that were standing on the particular section before the train arrived, 250 passengers were standing in queue at a stopping position of the train. They all entered the door that they waited for. This means that they waited around 1-2 metres from the door they finally boarded. 15 of the 294 passengers were standing and waiting on the particular section but not in a queue. These passengers often boarded a door that stopped between 5-15 metres from the position they waited. They never seemed confused and headed straight for their train as it arrived.

29 of the passengers that waited on the particular section studied were seated before the train came. These passengers where often seated exactly where the door they entered stopped or some metres (10-15m away). Some passengers that were seated walked away to another section of the platform when it was announced that their train would come (around 1-2 minutes before the train arrived). These passengers walked different distances along the platform, but observations show that they often reached the location of door they entered before the train arrived.

The 21 passengers that came to the particular section studied after the train arrived had often walked or ran from far away, approximately 50-100 metres. As discussed above these passengers often looked like latecomers because they were observed coming from a stairway or other entrance (indicating that they arrived to the platform after the train). Some passengers had also bought something at kiosks or other facilities on the platform as they carried lunchboxes. These passengers often hurried to their door. Many ran. They could
however as also have been discussed above move easily along the platform. All observed passengers did enter their door before scheduled departure time. They did not affect the dwell time of the train.

5.2.2 Information and the train performance

As in the Swedish case an analysis of the stopping position of the train for each departure was done. In contrast to the stopping position of the X2000 trains, the Shinkansen trains always stopped on their indicated stopping position with some metres (approximately 0-5 metres) margin.

Figure 5.23, The door of car number 1 of a Shinkansen train at Tokyo Station stopped where was indicated to stop.
6. Summarising, discussing and analysing the main results

6.1 Aggregate trends on the Swedish platforms

**Platform distributions: Clustering around entrances and seats**

The platform distribution looks different depending on the platform studied. In the Swedish study passengers have been seen gathering around the platform entrances precisely as has been discussed and found in earlier studies (Heinz, 2005; Wiggenraad, 2001; Lam et al. 1998). A trend towards passengers gathering around seats on the platform has also been seen in this study. Seats get occupied when there is long time left until departure but passengers continue to gather around them even after they are fully occupied. This behaviour is especially observed if the subsections with seats are closely located to entrances. Entrances on the studied platforms tend get occupied closer to arrival time. The average passenger distributions on platform 10 and 11 are different even though they, as passengers will ride on the same kind of train, could be expected a look similar. Studies of ticket sales for all the particular departures would however need to be studied to confirm this, which has not been done in this study.

![Figure 6.1, Platform distributions on both Platform 10 and 11](image_url)
The results above suggest that the platform is affecting the position where passengers wait even though there is information available showing where the train stops along the platform. This also suggests that the information either is not well used, too difficult to understand or too difficult to find by some reason.

**Bottlenecks around the main entrance**

As in Lam et al. (1998), a bottleneck sometimes appears around the main entrance on both platforms 10 and 11. This bottleneck is hindering passengers from moving to other subsections and makes it difficult to see the car-location poster. Passengers crowding around the entrances, but also facilities and narrow spaces (on platform 11) seem to be a reason for the bottlenecks. The bottlenecks are further believed to cause even greater crowding around the platform entrances, this as passengers cannot move or see the information they might need to see to know where they should stand.

**Movements along the platform**

When the train had arrived to the platform it was not uncommon for passengers to begin to move along the platform. This further suggests that passengers do not stand where their cars stop and that information is not well used or badly designed. Crowding and queuing on the platform made it difficult for some passengers to move to their car. Tendencies towards both the train design and the crowding on the platform have been observed to be limiting factors for the boarding and alighting time. More research is needed to explain the cause of the length of the dwell time.
6.2 Passengers on the Swedish platforms

**The passengers distance to their cars**

This study shows that passengers on both platform 10 and 11 who say that they have knowledge about where their cars stop, stand significantly closer to their cars when the train arrives compared to passengers who do not believe themselves to know where their cars stop. The average distance to the closest door is much higher for passengers saying that they do not know where their car will stop. This trend can be seen on all sections on both platforms. Passengers without knowledge in our sample also had a bigger proportion of passengers standing far (more than 40 metres) away from both their closest and indicated doors.

**Passengers’ knowledge and behaviour**

Passengers saying that they know where their car will stop through experience, travel significantly more than both passengers using information and passengers who do not know where their car will stop. Some trends in our data suggest that passengers with knowledge through information on the platform have a little more experience than passengers without knowledge. The overall trend however is that passengers who know where their car will stop through information seem have similar or just slightly higher travel experience than passengers with no knowledge. As none of these passengers seem to know more through experience it suggests that some passengers have looked for information or been lucky enough to find information on the platform while some have not.

Most passengers without knowledge said that they either did not know that information about where their car would stop existed, or that it did not exist, even though it did exist on all departures studied (partly on some; information on the car-location poster was missing on some departures on platform 11). Others said that they knew that information existed but that it was either to indistinct or too difficult to find. Others, however fewer said that they knew that information existed. If some passengers without knowledge had used information or not is unclear from this study. But as some passengers know that information exists, it is not impossible that they could have used information, but
not believed or trusted it enough to say that they know where the train will stop along the platform.

Passengers without knowledge, on both platform 10 and 11, have been seen gathering in the middle sections of the platform. The studied sample show increasing trends of the percentage of passengers without knowledge from the edges of the platforms towards the section with the main entrance and seats. Many passengers without knowledge also say that they chose their waiting position because it was close to the entrance or because many other passengers were standing there. This finding is similar to behaviour that has been discussed in Heinz (2005) earlier. Others say that they choose to wait where few other people were standing, which many times contradicted their real behaviour as many passengers gathered around subsections with entrances or seats which already had a high number of passengers waiting. Passengers answering that they chose to stand where few other people were standing could have answered so, because they chose a place with fewer people than the most crowded subsection on the platform.

Surprisingly many (33% on platform 11 and 49% on platform 10) passengers without knowledge however said that they waited where they believed that their car would stop, even though they had said they did not know where their car would stop. This suggests that some passengers guess where their car will stop. They might even use information to guess their cars position as some said they knew information existed. They might as mentioned earlier use information but not believe it or think it to be too unreliable to say that they know where their car will stop. Comments about not trusting or relying on information have been brought up by several passengers further supporting this theory. This is also consistent with the customer satisfaction score presented in Banverket (2010) where the reliability of the information get very low scores.

Most passengers with knowledge (on both platforms) said that they primarily chose to wait where they did because they believed it to be where their car would stop. Those few passengers who did not chose to wait where they believed that their car would stop commented smoking as one of the reasons.
6.3 Aggregate trends and behaviour on Japanese platforms

In the Japanese study no aggregate patterns due to seats and entrances on the platform could be observed. Almost all passengers were waiting in line where their car was supposed to stop. There were almost no movements on the platform when the train had arrived further indicating that passengers waited where their car stopped. Passengers that did move along the platform after the train had arrived often seemed to be latecomers (meaning that they arrived to the platform after or at the same time as the train) or passengers buying lunchboxes or other snacks at the various kiosks and small restaurants located on the platform. These passengers seemed stressed, and often ran to their car. They did however not seem to have any problem moving through the platform or to find their car when they had decided to do so.

The study cannot prove that the information is the cause for the passengers on the Japanese platforms to stand so close to their doors when the train arrives. All passengers could be experienced but this seems unlikely. As many passengers stand and wait in queue at the indicated spot where their car should stop, it can be assumed that information in many cases is the cause for passengers locating as they do. Observations of some passengers looking at the information as they walked along the platform further suggest this. The cars of the train always stopped on the informed position (plus/minus approximately 5 metres). The information and traffic seem well synchronized. The information on the Japanese platforms seems well designed for its purpose to inform people on where the train will stop along the platform.

6.4 Analysing and discussing information on Swedish platforms

Information on Swedish platforms: Several problems have been found

The information on the Swedish platforms is able to inform the approximate stopping position of the car quite well in normal situations. Passengers who say that they know where their car will stop along the platform through information on the platform on average stand relatively close to their closest door. They do however seem to stand a little further away compared to passengers with knowledge through experience but are estimated to on average stand close enough to move along the platform as the train comes to not cause any
discomfort to themselves or higher dwell time delays for the train. The estimation is made with the assumption that a passenger standing less than 20 metres from his or her door when the train arrives easily can move along the platform and be very close to the door before the train breaks, stops and opens the doors in any situation even if the platform is crowded or the passenger carries larger luggage. More research is however needed to know at what distance the passengers begin to feel stress and could cause higher dwell times for the train.

Even though information seems to be able to indicate the approximate stop location of the train quite well in normal situations the study has found several results indicating that the information on the Swedish platforms have several problems. To begin with, it is roughly estimated that around 40 percent of the passengers on both platforms do not believe themselves to know where their car will stop. If they have used information or not is unclear but a large part of the passengers in the studied sample do not know that information exists or believe it to be too indistinct or too difficult to find. Passengers without knowledge are also waiting much further away from their door when the train arrives at the platform compared to passengers saying they have knowledge.

If it is assumed that some passengers standing between 20 and 40 metres from their door could feel discomfort or be able to affect the dwell time (e.g. passengers with disabilities, elderly or passengers with big or large luggage), and if it is also assumed that most passengers standing 40 metres or more from their car could feel discomfort or be able to cause dwell time delays in some situations. Then with those assumptions a passenger without knowledge seems much more likely to feel discomfort and/or cause dwell time delays to the train. More research is however needed to investigate when the passengers standing far away could cause dwell time problems

From the sample of this study it is possible to see that some passengers, who said that they know where their car will stop, also are standing far away from their car when it arrives to the platform. Of course the percentage of passengers standing far away among these passengers is lower than among passengers
without knowledge, but this still indicates that the information can be difficult to understand or is unreliable. Most passengers are also standing further away from their indicated door compared to the closest door. If the goal with having doors indicating the seat number is to get passengers with those seat numbers to board that door then the information on the Swedish platforms is not detailed enough.

Analysing the stopping position of the train confirms that the information is unreliable because trains do not always stop on the indicated stopping position. The stopping position is not even indicated for some departures which might make passengers guess the location. Trains between different departures tend to stop on different locations. Sometimes even shorter trains than informed on the car-location poster arrive. The cars on shorter trains often stop on totally different locations than the cars on normal length trains. This has been seen to create problems for passengers.

The study has shown that passengers on section 4 on platform 11 stand much further away from their car when a short train arrives than when a normal length train arrives. This is believed to be the result of both bad information (meaning that information does not exist or that the poster indicates the wrong position) and because seats on the platform are located where the train does not stop which might lure passengers there.

Passengers will probably not trust the information available on the platform if they use it and the train then stops at a totally different position. Passengers will probably also be discouraged to look for information if information often does not exist for all departures on a platform. It is therefore very important to always show the correct information.

It should be mentioned that information about the next arrival on the variable displays always show the car order. Many passengers however do not seem notice this. Even if they did notice, they would not know where the cars would stop, just the car order, which is commented to be a problem.
6.5 Final analysis and discussions
As in Japan, the author believes that more passengers would stand closer to their car if information becomes better and more reliable on the Swedish platforms. Of course critics could argue that Japanese passengers have another culture, tradition and behaviour than passengers in Sweden and that Swedish passengers not would stand close to their cars. Of course there might always be passengers standing far away from their cars or coming late. This has also been seen in Japan. Some passengers in the Swedish part of the study did also mention that they do not care where they stand. The data of this study however indicates that most passengers, both knowing and unknowing, would like to wait where their car stops. Almost all passengers without knowledge said that they would like to wait close to their car if they knew where it would stop. Passengers with knowledge both say that they wait where they believe that their car stops and in average also wait quite close to their cars.

Excellent information; regarding aspects such as design, placement and reliability is needed for all passengers, even those who come late or chose to stay far away from their car. Passengers who chose to stay far away would still be able know where their car will stop and could easily head there when it arrives without confusion. Even if some passengers choose to not look at information because they do not care at where they stand at all, problems moving along the platform when the train has arrived due to crowding and movements by other passengers would probably not be large as today as most passengers are estimated to stand where their car will arrive.

Observations of latecomers in the Swedish case have shown two types of passengers, experienced passengers which would know where their car is located without information in most situations. But even these passengers would in some special situations like for example when the train’s car order is reversed be in need of information. The second type of latecomers observed in the Swedish study seemed stressed and confused and are probably less experienced passengers. These passengers would especially be in need of information both so they can feel less stressed but also so they do not affect the trains dwell time more than needed.
Finally, our study clearly has a number of limitations that affects the results. As mentioned before results are not always statistically significant. Even though result might be statistically significant we have to remember that the data also include a number of biases and assumptions which can affect the reliability and accuracy of the results.

Due to bad design of the questionnaire survey and stress that appeared during the survey this study could not analyse the effects of seats in greater detail than that passengers seem to gather around them. More research is needed to see the effect of the location of seats on the distance to the seat-reserved car. More research is also needed to get more accurate data of more types of platform and design. This will be further discussed in Chapter 8

The study has anyway found results that give clues about trends of the behaviour of passengers on railway platforms. The study has also found some advantages and disadvantages with different solutions. In the next chapter final conclusions and suggestions for improvements will be made.
7. Conclusions

7.1 Disadvantages today and suggestions for a better tomorrow

As discussed many results point towards several disadvantages with the information on and design of the Swedish platforms. The platform, its entrances and seats, seems to affect the position on were passengers stand even though information exists.

Seats attract passengers both before and after they are occupied. Misplacements of them might therefore cause passengers to wait at positions on the platform where the train does not stop. More research is however needed to isolate the effects of both seats and entrances.

Information is unreliable, sometimes too difficult to understand and does not seem to reach all passengers. Some information, does on some departures, not even exist. Because of these reasons, many passengers do not know where their train and its cars stop along the platform. This is reflected by these passengers standing further away from their car when the train arrives compared to passengers that have used information on the platform or passengers with experience.

As discussed in the beginning of this study, it is practical, from many perspectives, to have passengers standing close to their cars. It is first of all a service to the passengers. Passengers standing far away could also in theory affect the dwell time and thus also the total travel time and the reliability of the overall train service. As most passengers also want to stand where their car stops, it is bad and unnecessary to not have information and infrastructure on the platforms which allow them to stand where their cars and doors stop.

Having the results, analysis and discussions made not only in this study, but also by other studies in mind, four properties which are necessary to think about in order to make information and location of facilities on the platform better are presented on the next page.
1. **Information with good reliability**
Information must be both reliable and trustable. Trains must always stop as is indicated by information. It will not matter how many other improvements are done to the information if the information is not followed.

2. **Information must reach all passengers**
Information must exist for every departure and information must be placed so it easily can be seen. Passengers should not need to make an effort to look for information, especially if they carry large or much luggage. Information must be available to them as soon as they enter the platform. *Information should not be needed to find other information.*

3. **Clear and easy information; language, design and consistency**
Information should be made for everyone to understand. All information should be given in Swedish and in English. Information should be difficult to misunderstand which requires very good and pedagogical design. All information channels (e.g. all signs) should also give the same information. It will create confusion if one sign for example indicates that 5 cars will arrive while another indicates 6 cars.

4. **Good and well thought placement of seats and other facilities**
Much more research is needed to isolate the effects of each individual facility. But as some disadvantages have been observed some points to think of is advised. Facilities should first of all not be placed so they cover information. They should not occupy so much space so that passengers wanting to wait at one location cannot wait there. As seats seem to attract passengers they should not be placed on locations along the platform where the cars of some trains do not stop. Seats should only be placed along the part of the platform where all trains stop.
7.2 Proposing tangible improvements

The Japanese platforms seem to comply with the properties stated above quite well. Information is reliable and seems clear and easy to understand. It also seems to be visible and reach most passengers. As in Japan, dynamic signs along the whole platforms, indicating the stopping position of each door of the train would be preferable also on Swedish platforms. This solution would probably make the information clearer and more visible but also require severe changes to infrastructure on platforms, the rail and maybe even on the trains themselves. This kind of solution would have several advantages for the overall service and information but also require large economic investments and will therefore not be discussed further here. As most platforms in Sweden already seems to be equipped with car-positioning signs (A-E), this section will, by keeping the properties suggested above in mind, instead discuss and suggest tangible improvements relating the stopping position of the train to them. The solutions that will be presented can be seen as a step along the way to reach a goal were the information will look similar to the information available in Japan, but adopted and remade to fit the Swedish situation.

It shall however be remembered that many passengers pointed out information to be difficult to understand. The car-positioning signs can have something to do with that. So even though they are used in the improvements suggested below it is strongly recommended to further investigate the effect and clarity of different information through testing it on passengers. It might for example be easier to understand the signs if they use numbers instead of letters.

*Increase reliability through availability and standardisation*

Standardise the information on all platforms. The distance between each car-positioning sign should be the same on all platforms. Information about the trains’ stopping position in relation to the car-positioning signs should always be available on the platform and trains should always stop at the indicated location. Standardise the trains stopping position and make it easy for the driver to know where to stop. This could be done with for example ATO or by having signs indicating the stop position depending on number of cars of the train.
Not only the train but also the trains’ cars should stop at the same location every time. If the cars stop at the same location every time, the long static lists of different departure times which are shown on the car-location poster today will not be needed any more. One indication for each train type would instead only be needed. This will make it much easier to have available information on all platforms. It will probably also make it easier for passengers to understand the information, especially if it is static.

**Figure 7.1, The train’s cars should stop at the same location in every case**

**Place information along the whole platforms and especially at entrances**

The one and only poster that exist on both platforms 10 and 11 today are not enough. Information about where the train and its cars stop along the platform should be visible along the whole platform. It should especially be located at entrances and preferably at head level or a little higher so that it is easily spotted already when entering the platform. Because the posters today are not located at entrances, just nearby, they are easily blocked and made invisible by crowding and bottlenecks. It becomes very difficult to see the poster from the entrance even though passengers look in both directions. Easily spotted information at entrances and along other parts of the platform will eliminate these visibility problems.
Car-position showed by dynamic displays

Information about where the train and its cars stop along the platform should be incorporated in dynamic displays. It is true that the car order today is shown by dynamic displays on the platforms, but it is just that; the car order. The cars location in relation to car-positioning signs A to E should be clearly incorporated in the information as well. Dynamic information has a great advantage compared to today’s static posters as information easily can be changed depending on the situation and train type. This is especially useful in unexpected situations such as when the train will arrive reversed.

A new dynamic information screen should be incorporated to current the information on the Swedish platforms. The screen should be located at the entrances, especially the main entrance of the platform but preferably at all entrances. It should also be located on some other spots along the whole platform. This screen should show information of the next and following departure and include information such as departure time, type of train service, destination and where the car stops along the platform. The screen should show information in both English and Swedish.

As dynamic screens showing the stopping position can change the information at unexpected situations it would allow giving preliminary information about the stop position of the cars on tickets. This is however only possible if it at the same time is strongly indicated to look at the screen when entering the platform to confirm the location (in most of the cases the train should arrive as on the ticket).

Figure 7.2 on the next page show an example of how the new screen could look like. Keep in mind that it is just an example and that the design of a new screen should be tested on passengers so that it gets as clear and understandable as possible. Appendix I shows the situation at the entrance at platform 10 today compared to with the new dynamic screen. The difference in visibility can clearly be seen even when the platform is empty. Just imagine how difficult it is to see today’s poster from the entrance if the entrance and its surroundings were crowded.
Figure 7.2, Example of a variable display including information about the stop position of the train and its cars
8. Future research

During this work two areas for future research were discovered. They are presented below.

1. There is a need to further continue with the same kind of research that was done in this study. The research should be done over a longer period of time to get more accurate data and to include more abnormalities. Methodologies can be developed by analysing advantages and disadvantages from the methodologies used in this study. Focus should be on three or four different layouts of platforms with different location of entrances. The study should if possible test different information on the platform and maybe even on tickets. The study should also try to isolate the effect on passengers’ behaviour due to seats. This could be done by moving seats around between different departures and analyse difference in behaviour.

2. Heinz (2005) introduced the term the dimensioning door as the single entrance door of the train that needs the most time to alight and board its passengers. More research is needed to try to find the cause for the time it takes for the dimensioning door board and alight all its passengers at normal situations as well as during delays. The study should relate the time to the amount of passengers on the platform and answer questions such as when it is the vehicle design that is the limiting factor for the time and when it is one or several passenger standing wrong along the platform that is the limiting factor. Other factors could also be investigated. This research will give clues on what solutions are needed to improve and minimize dwell time delays.
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Appendices

Appendix A:
Layout along Platform 10

Appendix B:
Layout along Platform 11

Appendix C:
Questionnaire used in the study

Appendix D:
Questions in the questionnaire translated to English

Appendix E:
Summary of Q10 among passengers without knowledge on Platform 10

Appendix F:
Summary of Q10 among passengers without knowledge on Platform 11

Appendix G:
Informed and real stopping positions of the trains on Platform 10

Appendix H:
Informed and real stopping positions of the trains on Platform 11

Appendix I:
Platform 10 before and after the new information screen
# Appendix A

## Layout along Platform 10

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<td>3</td>
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</table>

- **Entrance**
- **Seats**
- **Car-location poster**
- **Car-positioning sign**
- **Entrance to the platform**
Appendix B
Layout along Platform 11

- Subsection No.: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 19

- Entrances
- Seats
- Car-location poster
- Seats with wind shelter
- Car-location poster
- Car-positioning sign

- Entrance
- Seats
- Car-location poster
Enkätundersökning för tågresenärer
- Examensarbete på KTH -

I mitt examensarbete inom trafikteknik på Kungliga Tekniska Högskolan (KTH) gör jag en undersökning om resenärers beteenden på plattformar. Vill ni hjälpa mig genom att svara på denna enkät. Enkäten tar mellan en och tre minuter att svara på.

1. Vilket tåg åker du med idag? □ X2000 □ Annat
   Avgångstid: ........................................

2. Vilket är ditt vagns- respektive platsnummer?
   Vagnsnr: .................. Platsnr: ............... □ Obokad vagn

3. Vet du var din platsreserverade vagn stannar utmed plattformen? □ JA □ NEJ

   Svara enbart om JA på fråga 3:

3a. Hur vet du detta?
   □ Genom erfarenhet
   □ Jag har använt en informationstavla på plattformen
   □ Annan orsak: ........................................

3b. Vänntar du där du tror att din platsreserverade vagn kommer att stanna?
   □ JA
   □ NEJ, det fanns ingen ledig sittplats där
   □ NEJ, det fanns ingen sittplats alls där
   □ NEJ, jag bryr mig inte var jag står
   □ NEJ, annan anledning
   vilken? ................................................................

3c Vet du om det finns information om var tågets vagnar stannar utmed plattformen?
   □ VET INTE
   □ JA, information finns, men för otydlig
   □ JA, information finns, men för besvärligt att hitta
   □ JA, information finns
   □ NEJ, ingen information finns

3d. Om du visste var din vagn stannar skulle du då vilja vänta där den stannar?
   □ JA
   □ NEJ, varför?
   ........................................................................


EN SIDA TILL ➞ VÄND ➞
7. Vilket ärende har du med dagens resa?
☐ Tjänsteresa (resa i arbetet)
☐ Resa till/från arbete eller skola
☐ Fritidsresa (privata ärenden, besök osv.)
☐ Annat ärende, vilket? ..........................................................

8. Hur ofta reser du med just dagens tåg? (välj det som stämmer bäst)
Det vill säga, tåg med exakt samma slutdestination och avgångstid som idag

<table>
<thead>
<tr>
<th>Mer sällan</th>
<th>Några ggr per år</th>
<th>Några ggr per månad</th>
<th>Varje vecka</th>
<th>Dagligen</th>
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9. Hur ofta reser du med tåg i allmänhet? (välj det som stämmer bäst)
Räkna bara med fjärrtåg och regionaltåg, bortse från Pendeltåg och Tunnelbana

<table>
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<tr>
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<th>Några ggr per år</th>
<th>Några ggr per månad</th>
<th>Varje vecka</th>
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</table>

10. Vilket av följande påståenden stämmer bäst in på ditt val av plats att vänta utmed plattformen?

☐ Jag valde att vänta där jag tror att min vagn kommer att stanna
☐ Jag valde att vänta där många andra personer väntade på tåget
☐ Jag valde att vänta där flitiga andra personer väntade på tåget
☐ Jag valde att vänta nära utgången/trappan/hissen till plattformen
☐ Jag valde att vänta där det fanns en ledig sittplats
☐ Jag väntar med sällskap som ska sitta i en annan vagn än jag och står därför inte där jag tror att min vagn kommer att stanna.
☐ Annat, beskriv gärna nedan:

....................................................................................................................................................................................................................................................................................................................

11. Har du kommentarer eller synpunkter så ge dem gärna här:

_Tack så väldigt mycket för din medverkan!_
Appendix D

Questions in the questionnaire translated to English

Q1. Which train do you travel with today? □ X2000 □ Other
Departure time: ........................................

Q2. What is your car and seat number?
Car no: .................. Seat no: .................. □ Not reserved

Q3. Do you know where along the platform your seat-reserved car will stop? □ YES □ NO

Q3a. How do you know that?
□ From experience
□ From information on the platform
□ Other cause: ...........................................

Q3b. Are you waiting where you think that your seat-reserved car will stop
□ YES
□ NO, there was no available seat there
□ NO, there was no seat there at all
□ NO, I do not care where I wait
□ NO, other reason
which? ....................................................

Q3c. Do you know if there is information about where the train’s cars will stop along the platform?
□ I do not know
□ Yes, information exists, but it is too indistinct
□ YES, information exists, but it’s difficult to find
□ YES, information exists
□ No, no information exists

Q3d. If you knew where your car would stop would you then want to wait where it stops?
□ YES
□ NO, why?
.....................................................

Q4. What is your age: .................

Q5. Gender: □ Man □ Woman

Q6. Do you travel alone or with company: □ Alone □ With company, how many? .............
Q7. What purpose do you have with this trip?
- Work trip (trip within work)
- Trip to/from work or school
- Leisure trip
- Other purpose, which purpose? ..................................................................................

Q8. How often do you travel with exactly this train
Meaning, train with exactly the same departure time and final destination as today

<table>
<thead>
<tr>
<th>More seldom</th>
<th>Some times per year</th>
<th>Some times per month</th>
<th>Every week</th>
<th>Every day</th>
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</tbody>
</table>

Q9. How often do you travel with train in Sweden?
Just count S) trains (regional and interregional trains), not metro and commuter trains

<table>
<thead>
<tr>
<th>More seldom</th>
<th>Some times per year</th>
<th>Some times per month</th>
<th>Every week</th>
<th>Every day</th>
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</table>

Q10. Which of the following statements describes your choice of position to wait along the platform best?

- I chose to wait where I believe that my car will stop
- I chose to wait where many other people were waiting
- I chose to wait where few other people were waiting
- I chose to wait close to the entrance/stairs/elevator to the platform
- I chose to wait where there was a free seat
- I am waiting with other people (company) that have different seat-reserved cars than I have and therefore do not wait close to my seat-reserved car will stop
- Other reason, please describe:

........................................................................................................................................

Q11. If you have additional comments please give them here:
Appendix E

Summary of Q10 among passengers without knowledge (answering no, on Q3) on **Platform 10**

Total number of answers: 65

- **I chose to wait where I believe my car will stop**
- **I chose to wait where many other people were waiting**
- **I chose to wait where few other people were waiting**
- **I chose to wait close to the entrance/stairs/elevator to the platform**
- **I chose to wait where there was a free seat**
- **I am waiting with other people that have a different...**
- **Other reason**
Appendix F

Summary of Q10 among passengers without knowledge (answering no, on Q3) on Platform 11

Total number of answers: 73

- I chose to wait where I believe that my car will stop: 32%
- I chose to wait where many other people were waiting: 6%
- I chose to wait where few other people were waiting: 21%
- I chose to wait close to the entrance/stairs/elevator to the platform: 19%
- I chose to wait where there was a free seat: 17%
- I am waiting with other people that have a different...: 0%
- Other reason: 4%
Informed and real stopping positions of the trains on Platform 10
Appendix H

Informed and real stopping positions of the trains on Platform 11
Appendix I

View from main entrance on Platform 10: **Today** or **with** the new screen

- **TODAY**
  - Car-location poster

- **WITH SCREEN**
  - NEW SCREEN

- **LEFT**
- **SRAIGHT**
- **RIGHT**
Appendix I

Close up straight from the main entrance **with** the new screen
Appendix I

Close up left from the main entrance today