CHALMERS
UNIVERSITY OF TECHNOLOGY

SUSTAINABLE COMMUTING

Analysis of current mobility management actions at Chalmers University of Technology and Stanford University

Master Thesis in Industrial Ecology
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Department of Energy and Environment
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2015

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Combination of the presented concepts, illustrated by author, 2015.

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I also want to thank Stanford's Precourt Energy Efficiency Centre who welcomed me with open arms during my visit. Also a big thanks to Stanford Parking and Transportation Services.

ABSTRACT

This report is a result from a study regarding sustainable commuting at Chalmers University of Technology. The aim was to find out what improvements are necessary to implement to encourage Chalmers employees to commute in a sustainable way.

Chalmers has today 3198 employees but is expecting an expansion with 4000 workplaces at campus Johanneberg within 10 to 15 years. By a restriction set by the City of Gothenburg, Chalmers is not allowed to increase todays amount of parking spots even if the area will have more than twice as many employees commuting to campus in the near future. This restriction is similar to Stanford University's General Use Permit (GUP) set by Santa Clara County. The GUP refers to a strict amount of cars allowed to pass the Stanford campus border during peak hours. To solve this problem Stanford has developed a large program that supports commuting without single car driving. To learn form Stanford's experience and knowledge about this issue a study was accomplished with the purpose to find solutions that could be redesigned and suggested as implementations at Chalmers.

A stay at Stanford was made to discover their commute program. Observation studies were accomplished as well as insightful interview with related researches and staff members regarding the topic. The information was thereafter analysed together with gathered information concerned Chalmers current situation.

The key foundings regarding changes in commute behaviour applied how important it is to provide commute services that are convenient, flexible and have a short commute time. To achieve this, the study showed that accessibility, combination of payment, good bicycle facilities and information are necessary. These insights were combined and presented in eight different concepts, five that are possible to implement in the near future and three that need long-term planning and collaborations.

Key Words: Commuting, Sustainable Commuting, Commute Behaivour, Mobility Managment.

TABLE OF CONTENTS

The report is divided into two parts where Part I adress the current situation and Part II focus on design for a change.

TERMINOLOGY

Carpooling: When two or more persons are riding a car together.
Car sharing: Arrangement among a group of automobiles accessible for use by members.
Chalmers Fastigheter AB: Chalmers real estate organisation.
Commuting: A regular journey between work and home
Commute behaviour: Which transportation mode and behaviour someone has during commuting.
Commute mode: The transportation mode used during commuting, e.g. bus, car or bicycle.
Commute split: The percentages of commute modes used.
Commute time: The time it takes to commute.
GUP: General use permit.
JB: Chalmers campus Johanneberg.
LH: Chalmers campus Lindholmen.
Mobility Management: A theory that combines existing infrastructure with information to achieve a more accessible society through commuting.
Multi-Modal Commuting: A city designed for multi-modal commuting provides many different one-way commute services where combining commute modes are more convenience.
Off-hours: Hours during the day with less traffic.
Peak-hours: The hours during the day when most people are commuting.
PT: Public Transportation.
Sustainable: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987)
Sustainable Commuting: Commute modes with low impact on the environment, commute modes that are transporting more than one passenger a time, commute mode that are using green energy.

INTRODUCTION AND BACKGROUND

Chalmers University of Technology (Chalmers) has a vision of a sustainable future. They argue that it is of everyone's concern to work towards a goal where we in the future can share the world's resources with 10 billion other humans, without lower our living standard. To be able to do so there is a need of research and development with focus on sustainability. Chalmers wants to practice as they preach and are therefore in charge of many sustainable projects such as self-sufficient student homes and the new initiative Challenge lab (Chalmers, 2014).

Today, Chalmers has 3198 employees (Sahlin, 2015) and around 10000 students. However, Chalmers is expecting expansion with 4000 workplaces at campus Johanneberg within 10 to 15 years, mainly due to the new science park Johanneberg (Hyllenius Mattson, Mattsson, & Joachim, 2012). This will include large challenges when it comes to commuting. Today, there are around 1200 parking spots at campus Johanneberg and 700 parking spots at campus Lindholmen (Andersson, 2014). Although, even if more than twice as many employees will be located around campus Johanneberg in the near future, Chalmers is not allowed to provide more than 1382 parking spots in the Johanneberg area due to infrastructure issues (Chalmers Fastigheter, 2015).

Stanford University (Stanford) in California, USA, has a similar restriction from the Santa Clara County. When Stanford wanted to extend and rebuild their medical facilities a restriction was established that Stanford could not increase the amount of new trips made by cars crossing Stanford boarder (Green, 2013). This agreement is called the General Use Permit and implies that not more than around 3500 vehicles can enter and exit the campus during peak hours (Helmke, 2015). This entailed a development of massive mobility management incentives to decrease the amount of single driving commute trips to Stanford. The restriction derive from the fact that peak-hour traffic contributes to mayor stress on the environment due to congestion, which result in heavy emission of green house gases. By decreasing the amount of vehicles commuting during peak-hours, traffic becomes more spread out and less congestion is achieved. This results in less emissions and is thereby more sustainable (Abadi ,Mandayam, Merugu, Prabharkar, Yue, Zhu, 2014).

This study will discuss and analyse Chalmers's and Stanford's current commute modes and mobility management services, Chalmers employees commute behaviour, identification of the barriers which occur when changing commute mode, and which mobility management incentives that Stanford today apply that could be adopted and implemented on a local level at Chalmers.

Potential improvements are presented and designed for instant realisations but solutions for future possibilities are also suggested and discussed. All in all, to develop for a sustainable future where Chalmers is able to handle the expansion of employees in the area and thereby the commute issues they might be facing in the near future.

PURPOSE

The purpose of this study was to identify the similarities and differences when it comes to commuting on and off campus at Stanford and Chalmers. The study included a benchmarking of the current commute services provide by the two universities, analysis of their current mobility management actions as well as analysis of current commute behaviour. As a result are potential improvements identified and solutions suggested of what could be implemented and enhance at Chalmers to meet future commute needs.

AIM

The aim was to improve the sustainable commute possibilities at Chalmers University of Technology.

FRAMEWORK

This study was mainly concentrate on the commute behaviour of Chalmers employees. How students' commute was not included due to any available data. The study mainly considered commuting on/off/between campuses, thus business trips outside Chalmers area were not considered. Commute issues regarding Chalmers campus Onsala were not included and future transportation alternatives further than 15 years was not considered.

RESEARCH QUESTIONS

Which commute services and mobility management incentives do Stanford and Chalmers provide today, and what could be improved and implemented to Chalmers by study and compare the two universities similarities, differences, progress and issues to be able to meet the future need of sustainable commuting.

1. How do the employees' commute behaviour look like today, and has it changed during the past years?

2. What requirements do Chalmers employees perceive as important to consider a change to an alternative commute mode?

3. Are there any successful services and incentives provide by Stanford that could be adopted to Chalmers, how should these be redesigned for local usage?

REPORT OVERVIEW

This report is organised into two parts. Part I consider the current situation addressing a benchmark study of the two universities, analysis of current commute behaviour and identification of barriers. Part II focuses on design for a change where the needs for commuting are identified and possible solutions and implementations for Chalmers future commute needs are discussed.

Part I includes research question 1 and parts of question 2 while Part II discuss parts of research question 2 and question 3.

PART I:
CURRENT SITUATION

CHAPTER 1
INTRODUCTION

Part I of the report address the current situation of Stanford University and Chalmers University of Technology. This part analyses the current services provide, and consider the current commute behaviour. Barriers appearing before usage or during use of different modes are studied and the main aspects of why users choose a specific mode are discussed.

1.1 THEORY

Theory regarding the important subjects, sustainable commuting and mobility management are described below.

1.1.1 SUSTAINABLE COMMUTING

Sustainability is defined by the World Commission on Environment and Development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). Sustainable transportation is usually defined in three levels (Sprei, 2015):

1. Reducing demand on transport
2. Efficient vehicles
3. Replace fossil fuel with green energy.

What is intended by sustainable commuting in this report is assigned as:

1. Commute modes with low impact on the environment, such as commute modes with zero emission e.g. walking and bicycling.
2. Commute modes that transport more than one passenger such as public transportation and carpooling.
3. Commute modes that replace fossil fuel with green energy.

1.1.2 MOBILITY MANAGEMENT

A theory often used when developing and planning for future commuting is Mobility management. Mobility management focus on solutions that use existing infrastructure where accessibility is important. This theory was therefore considered as important during the whole study.

Sparsely populated cities with poor accessibility contribute to higher car traffic. To avoid this is it important to plan the cities with good accessibility. Mobility management claims that accessibility is the possibility to reach a desirable location, which is not the same as mobility. Mobility is the possibility to movement and should therefore not be mixed up with accessibility. Accessibility is the advantage of movement. If the mobility increases, the accessibility decrease and the cost of movement rise. Thus, the fundamental guideline is to increase the accessibility without increasing the mobility (Forsell, 2010).

Mobility Management goal is to change commuters attitudes and behaviour (Trivector Traffic AB, 2015). This is done by combining hard values such as infrastructure and soft values such as arrangement for more effective usage of existing infrastructure and actions of how to influence the commute choice before travelling. It applies integration of action plans into the existing infrastructure instead of developing new infrastructure plans (Forsell, 2010).

To influence to a change in the behaviour can information campaigns, collaborations and marketing be good approaches. Other actions can be higher parking fees for cars, influencing for more and better car sharing programs, and lobbying for teleworking or four-day-working-week (Forsell, 2010).

CHAPTER 2
METHODS

The methods considered as suitable to achieve the purpose assigned to this study are presented below. In the end of the chapter follows a figure showing how the different methods in Part I have been used in relation to each other. The smaller polygons are sources used in the analysis methods, which are illustrated by larger red polygons. The result form the larger polygons were used in Part II.

2.1 LITERATURE REVIEW

An extensive data collection was conducted regarding questions about commuting. It was important to get a big perspective and an overview of how commute systems works in general and which threats and opportunities that are present considering commuting. The main insights were gathered by a literature study including reviewing report, scientific publications and TED talks.

Information and data about the current commute services provide by Stanford was mainly collected from Stanford's Parking and Transportation Services' website in combination of a visit at Stanford campus.

Information about Chalmers current commute services was gathered from various sources such as Chalmers website Insidan, which provide helpful internal information for Chalmers employees and students. Chalmers main website was also used as well as external websites linked to the current commute services.

2.2 VISIT

Between 2015-08-18 and 2015-08-28 a visit at Stanford University was made. The purpose with the visit was to gathering valuable information for the study in terms of real life experience of how the different commute services work, how the geographical environment differs from Chalmers as well as the opportunity to meet insightful people with knowledge related to commuting.

During the visit valuable expertise regarding commuting was discussed with researchers at Stanford's Precourt Energy Efficiency Centre and the department of Parking and Transportation Services.

The stay in California also included a short visit at Berkeley University of California. The ambition was to shortly get an understanding of their commute services since Berkeley University geographic is similar to Chalmers. The objectives were to capture valuable insight for the further development of improvements at Chalmers.

To get an understanding and to gain knowledge from how two universities are working today, what goals they are working towards and what restrictions they have to handle interviews with Chalmers Fastigheter AB (Chalmers real estate), Chalmers internal environment unit and relevant professors and researchers informed about the topic were made.

2.4 OBSERVATION

During the study different observation studies were conducted to gain insights according existing sustainable commute services and solutions, but also to get inspired for possible changes. Many of the current services at both Chalmers and Stanford were observed and used and during the visit at Stanford also smaller tours to places like Google and Facebook were accomplished. The purpose was to find out how they solved the commute issues of their employees.

2.5 COMMUTE BEHAVIOUR SURVEY

Data regarding the current commute situation at Chalmers was analysed through former commute behaviour surveys from 2006 and 2012. Data from the survey in 2006 was only available in a ready-made report created by Chalmers internal environment unit. The survey from 2012 was available in raw data possible to analyse on a deeper level.

2.6 PATH WAYS

The four most common commute modes were analysed by illustrating the fully pathway including all movements needed while commuting from A to B. This was conducted to identify potential barriers and opportunities during use of each mode from a user perspective. By collecting these variety of insights helps to identified the users needs, simplify the design process and create commute service that suites the user.

2.7 PAIN-POINTS

The result of the pathway method was used to identify potential pain-point during use of all Chalmers services. Through pin-point the barriers and issues, increased the opportunity to find solutions and potential improvements that could serve the right user needs in practice. These pain-points are presented in the end of each pathway but also analysed in a table including the level of the barrier and the current action made by Chalmers to solve them. The descriptions of the current commute services provide by Chalmers also state related pain-points.

2.8 HARD VALUE BENCHMARKING

Hard values that were comparable between the two universities were stated in a smaller benchmark table included aspects such as infrastructure, commute split and amount of employees etc. This was conducted to get a better view of the current situation's differences and similarities between Stanford and Chalmers.

2.9 MOBILITY MANAGEMENT BENCHMARKING

Since many of the services and incitements that the universities currently offer have a focus on mobility management was an analysis conducted regarding to this. The key aspects belonging to the theory of Mobility Management (Neergaard & Håkansson, 2011) were used to analyse the different positive and negative aspects the services and incitements contributes to. Safety and Health are aspects not included in mobility management but since these aspects were considered as important from a user-centred perspective they were added to be analysed as well.

2.10 SWOT ANALYSIS

A SWOT analysis is a way to analyse the strengths, weaknesses, opportunities and threats of e.g. an organisation. The strength and weaknesses are related to internal organisation objectives while the opportunities and threats are related to the external attitudes. The strengths and opportunities help the organisation to achieve their objective although the weaknesses and threats might be risks for the organisation to not achieve their objectives (Fine, 2009). After the SWOT analyses were attained they were compared to find similarities and differences between the universities. This analysis was made to be able to compare the soft values regarding the universities current and future situation.

2.11 KJ-ANALYSIS OF COMMUTE BEHAIVIOUR

The commute behaviour survey made by Chalmers environmental unit in 2006 (Linfab/Trafikkontoret Göteborg Stad, 2006) and 2012 (Chalmers Miljöenhet, 2012) were analysed by the cluster method named KJ-analysis. The KJ-analysis is a way to sort out reflections and comments from a larger amount of data. Reflections and comments from the 2012 survey were arranged into groups where each group represent the same objectives or insights. This made it accessible to identify different barriers, needs, wants, issues, benefits etc (Straker, 1995). The method was often used during the author's bachelor studies and was therefore considered as reasonable for this study.

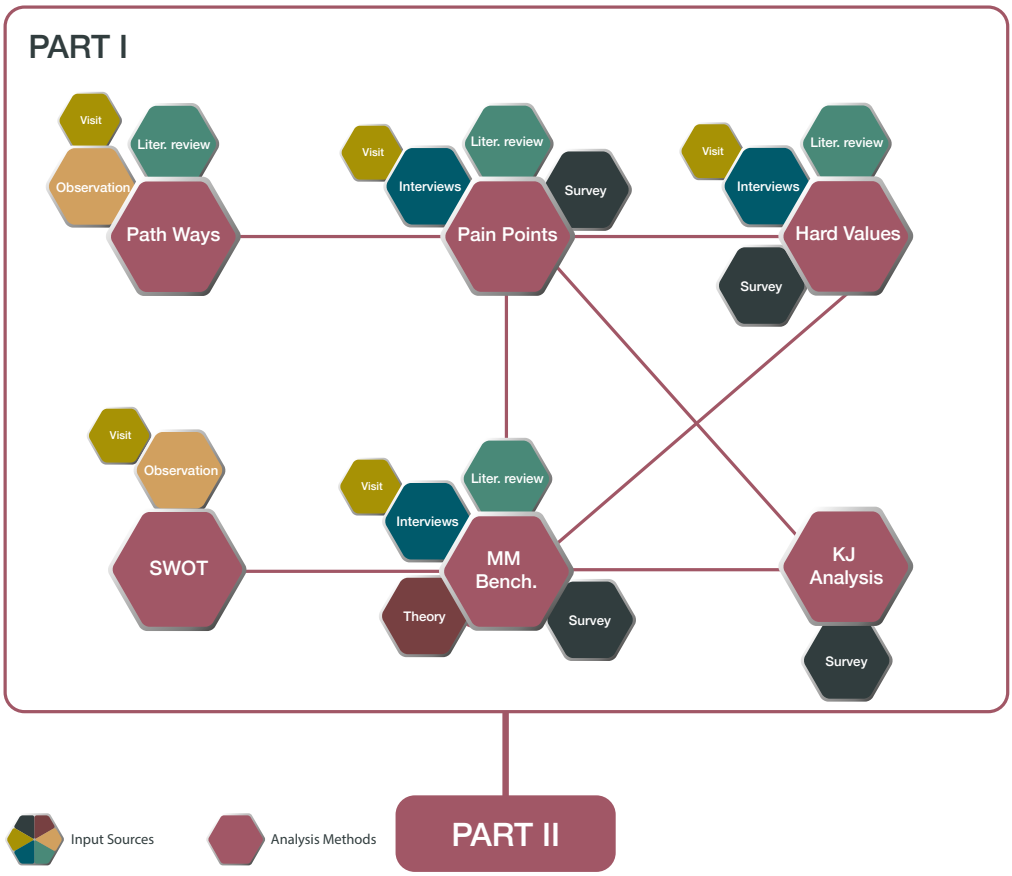


FIGURE 1: Illustration how the different methods in Part I were used in relation to each other. The result was later used as basic datain Part II.

CHAPTER 3
FINDINGS

In this chapter the findings from the analysis methods are presented.

3.1 COMMON COMMUTE MODE

The four most common commute modes are today, walk, bicycle, public transportation (PT) and car. The natural pathways while using each mode and the potential pain-point during use are described below.

WALK

Walking is one of the easiest ways to commute and is also good for health reasons. No equipment is required. To use walking as commute mode is it reasonable to live within 2 km from work place even if it is fully achievable to walk a longer distance (Kidd, 2015).

Potential interactions and pain-points during walking can be:

- Red light
- Hilly roads
- No side walk or walking road available
- Sweat and need for shower
- If any emergency happens, it may take long to get home
- Limited cargo capacity

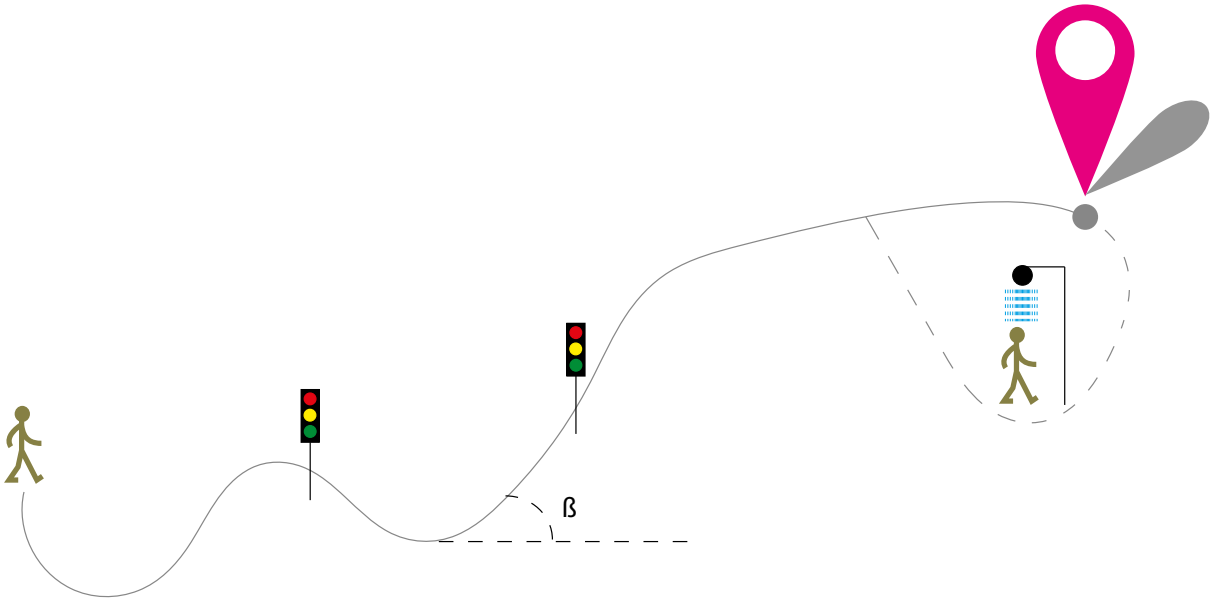


FIGURE 2: Pathway during walk commuting

BICYCLE

To cycle to work is an easy way to commute, which also has mayor positive effects on health. A fully working bicycle is necessary and a bicycle helmet is to recommend. The reasonable distance to use bicycle as commute mode is within 8 km (Kidd, 2015).

Potential interactions and pain-points during cycle can be:

- Red light
- Hilly roads
- No bicycle roads available
- Sweat and need for shower
- Ability to be able to change clothes after ride
- Ability to lock and/or store the bicycle during work
- If any emergency happens, it might take long to get home
- Limited cargo capacity
- The bicycle break during ride or no air in the tires

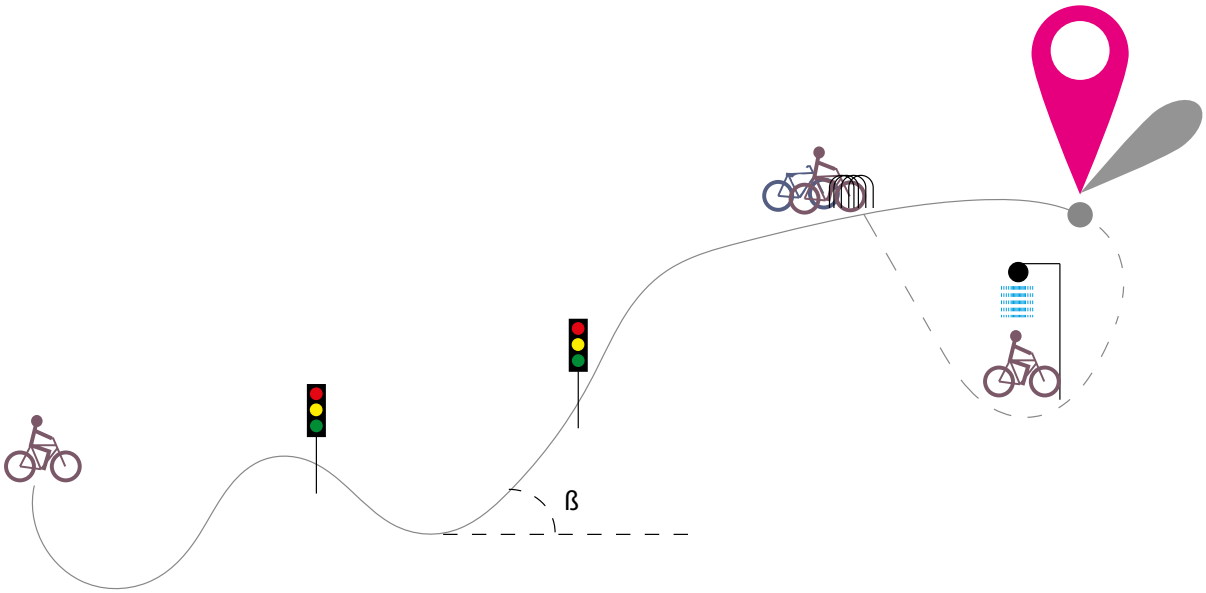


FIGURE 3: Pathway during bicycle commuting

CAR

To commute by car most often is perceived as a comfortable and a fast way to commute. Car commuting contributes to heavy traffic during peak-hours. It also requires a lot of space due to parking.

Potential interactions and pain-points during driving can be:

- Red light and thereby traffic jams
- High gas prices
- High parking prices
- No available parking spots
- Does not always include a parking next to the work place and require a walk after parking
- Heavy traffic can result in a much longer ride than alternative commute modes
- No increase in health
- Car breaks down

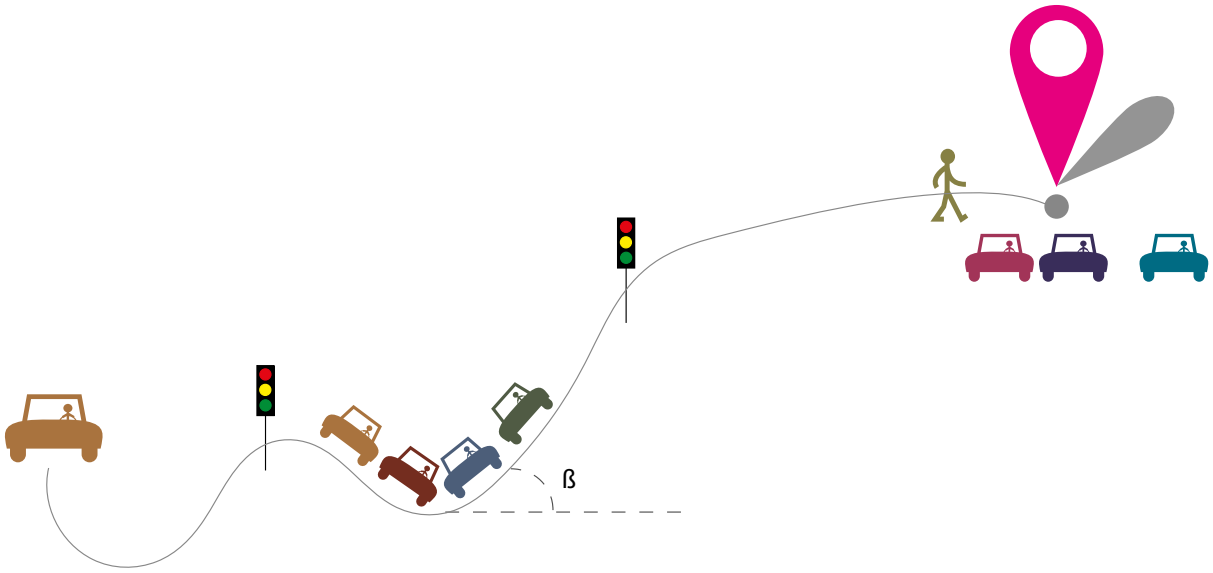


FIGURE 4: Pathway during car commuting

PUBLIC TRANSPORTATION

Public transportation (PT) is a commute mode that is accessible for most people. It does not require any equipment and is possible to use even with some health issues.

Potential interactions and pain-points during riding with public transportation can be:

- The accessibility to the bus stop can be far away from home
- The ride require a walk from bus stop to work place
- Change of public transportation mode may be required to reach destination
- The price can be consider as high
- The service may be under expectation
- The arriving time is not always as scheduled
- The ride may be cancelled
- The flexibility is not always high depending on the schedule
- Commute time can be much longer than commuting with other modes
- There is a risk for missing the scheduled ride or connection ride

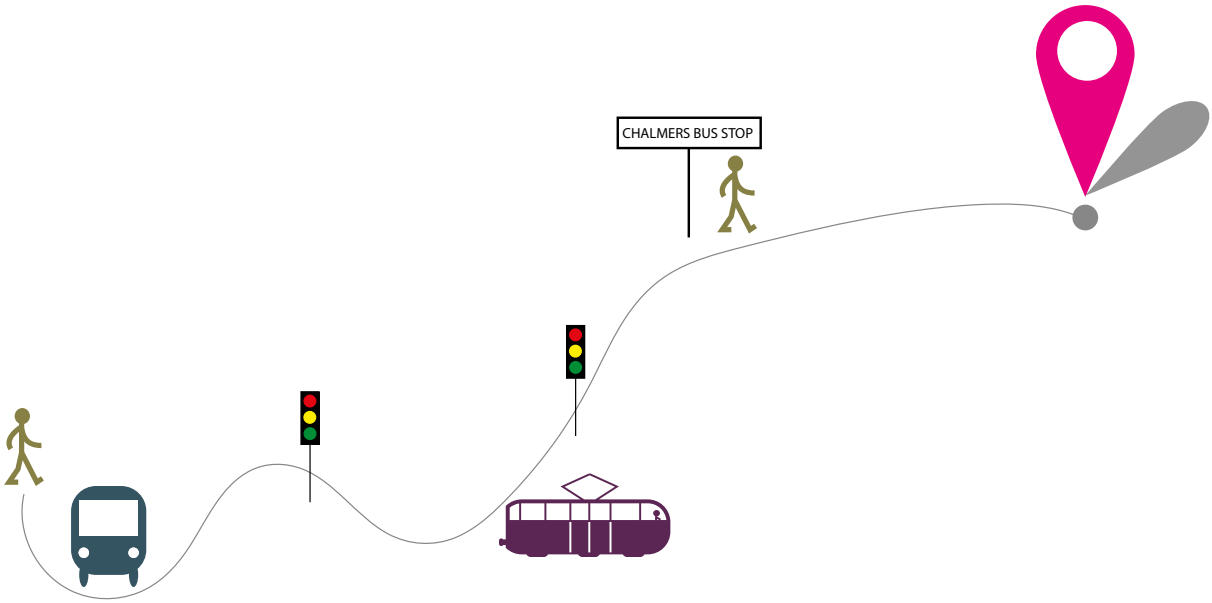


FIGURE 5: Pathway during public transportation commuting

3.2 GEOGRAPHICAL ENVIRONMENT DESCRIPTION

The two universities geographical environment differs distinguishable and should be consider during analysis and comparison of the two campuses. Down below follows a description of the geographical situation related to the study.

STANFORD

Stanford campus is located just outside Palo Alto, California, USA. It has a huge campus with an area of approximately 7 680 000 square meters (2400m x 3200m). The square is mostly flat with no distinguish height differences. The closest main train station is located in Palo Alto approximately 1,6 km from the main building (Google Maps, 2015). There are plenty of different parking areas around campus, both for bicycles and cars, see appendix I. Some parts of campus are closed for motorised vehicles and only bicycles and walkers are allowed except for Stanford's own maintained vehicles.

Sanford's neighbourhood is a part of the San Francisco Bay area and placed between the ocean and the desert. This contributes to widely swings in temperature. The sun is shining 200+ days of the year (Handy , 2012) and this includes Stanford to the Mediterranean climate zoon (Internet Geography, 2015) which consist relatively mild winters with temperatures around 5 to 10 degrees and an average of 50 cm of rain (Handy, 2012).

CHALMERS

Chalmers University of Technology is located in Gothenburg, Sweden and is divided into two campuses, Johanneberg (main campus) and Lindholmen. Campus Johanneberg is located on a hill with a slight slope from the city centre to campus. The main train station, which can be seen as based in the city centre of Gothenburg, is located approximately 2.5 km to 3 km (Google Maps, 2015) walking distance from campus Johanneberg. Chalmers campus Lindholmen is located on the other side of the river, named Göta Älv, which is running through the City of Gothenburg. Campus Lindholmen is located just by the river and has a water tram stop in conjunction with the main buildings. The walking distance from main train station is approximately 4 km over the bridge, named Göta Älvbron, and approximately 3 km (Google Maps, 2015) with use of the ferry, named Älvsnabbaren, which connecting the two parts of the city. Both campuses are located inside congestion tolls and a fee is required to be paid if driving through during weekdays.

Campus Johanneberg has a total area of approximately 500 000 square meters (1000m x 500m) and it takes about 15 minutes to walk form north to south. Campus Lindholmen is significant smaller and around 20 000 square meters (200m x 100m). The campuses areas are more or less free form cars but bicycles do exist, although no bicycle paths are defined. It is possible to access both campuses from all directions by driving, walking, cycling and public transportation. Car parking is well spread around both campus, see appendix II.

The Swedish west cost climate most often is hard to predict and rainy and windy days are more common then the sunny ones. Chances of snow during winter shifts along the years and the same account to higher temperatures in the summer (World Weather & Climate Information, 2015). This contributes sometimes to complications for not motorised commute modes such as walking and cycling.

3.3 CURRENT SITUATION – STANFORD UNIVERSITY

In year 2000, Stanford University signed the General Use Permit agreement (GPU) with Santa Clara County Board of Supervisors. This included several conditions regarding future growth and development of Stanford property. One concession, the approval G.4, was cited “Stanford shall mitigate the transportation impacts of its additional development and population growth either through a program of ’no net new commute trips’ or through proportional funding of mitigation measures for specified impacted intersections”. This implies that Stanford recived a goal to not exceed more than around 3500 vehicles passing the border to and from Stanford campus during peak hours (Stanford Parking and Transportations Services, Frequently Asked Questions).

A large issue when it comes to commuting in the Bay area is the “first mile, last mile issue”. It is a result from large distances between PT stops and departure/arrive destination. This applies to that the commuter often has a first mile to commute to be able to catch a PT or/and a last mile to get to final destination after getting off the PT. Many of Stanford’s commute services are therefore focused on to solve this issue (Helmke, 2015).

Stanford has currently 13748 employees including staff and faculty (Stanford Parking and Transportation Services, 2015). All employees and students are various of different commute services to decrease the amount of vehicles entering and exiting the campus area. The over all program is called Commute Club and includes many alternative commute modes and incentives with focus on mobility management. To be eligible a membership is a use of environmentally friendly commute mode required such as walk, bicycle, carpool, vanpool or public transportation. The members can be rewared with up to $300/year in Clean Air Cash or Carpool Credit if they sign up to not use their car as primary commute mode. Members of the Commute Club also receive $8,50 in Zipcar driving credits every month. The credits lasts for one month and are added to each members Zipcar account. Members also hold one free hour rental vouchers from Enterprise rental service per month (Stanford Parking and Transportation Services, 2015).

Since driving sometimes is unavoidable due to different personal needs are Commute Club members allowed to purchase up to 8 daily parking tickets per month. They are also automatically signed up for the emergency ride home program, see description down below (Stanford Parking and Transportation Services., 2015).

3.3.1 CLEAN AIR CASH

Members of the Commute Club are reward by not using single car driving as their main commute mode. This is called Clean Air Cash and accounts to $25/month. For every month the member meet the eligible requirements and do not have any Stanford parking permit except for daily scratches, Stanford Parking and Transportation Service pay the total amount of Clean Air Cash in the end of each academic quarter (Stanford Parking and Transportation Services., 2015).

Members that previously have used monthly parking permits save and rewards from $216 up to $1200 per year depending on usage of daily parking scratchers and previously type of parking permit (Stanford Parking and Transportation Services, 2015).

3.3.2 CARPOOL CREDITS

If a Commute Club member is not a Clean Air Cash user and would like to carpool to campus is it possible to receive Carpool Credits. To receive Carpool Credits is it required to be a member of the Commute Club and thereby eligible all the Commute Club criteria. The user must find one or more partners, which all have to be members of Commute Club and must not have a Stanford parking permit to form an official carpool. The service Stanford Ridematching Service, see description below, can help members to find a partner if needed (Stanford Parking and Transportation Services, 2015).

Stanford Commute Club offer Carpool Credits as partly refund the cost form carpooling. Every member of the carpool gets $12,5 per month in Carpool Credits and one free daily parking scratcher to use for a day when carpooling is not desirable. Every member is also allowed to purchase up to seven daily parking scratchers to use privately. Depending on previous parking permit and amount of daily parking scratchers used, does a Carpool Credit member save between $144 to $600 per year. To commute by carpool includes the benefit of premium reserved carpool-only parking spaces, see picture 2 (Stanford Parking and Transportation Services., 2015).

3.3.3 VANPOOL

Stanford Commute Club helps organise vanpools. A vanpool includes seven to fifteen people that ride together to and from work every day. Each vanpool belongs to a specific neighbourhood and has one to two pick up/drop off sites. Members can be full-time riders or occasional basis rides which rides on seat-available basis while full-time riders hold a reserved seat. Members of a vanpool and Commute Club have the right to receive Clean Air Cash if they meet criteria. The vanpool receives a preferred private parking spot and vanpool-parking permit for free. The additional costs are shared between the members and one month of vanpooling equals approximately the same cost as one driver pay for only gasoline per month by driving alone (Stanford Parking and Transportation Services., 2015).

The driver of the vanpool is responsible to pick up/drop off the members in time at designed site(s), fill up the van with gasoline and collecte monthly payment from the rest of the riders. In return does the driver ride for free and get the advantage of use the car during evenings and weekends. The riders benefits from the ability to receive Clean Air Cash and have a relaxing time in the van to read papers, books and sleep etc. There are currently six official vanpools register and two up coming (Stanford Parking and Transportation Services, 2015).

3.3.4 RIDE

Ride is Stanford ridematching service that match schedules and similar commute routes to help co-workers to create carpools. Anyone can sign up as a rider or a driver and later Ride organise the logistic, communication and payment, everything to make it easier for all parties (Stanford Parking and Transportation Services, 2015).

3.3.5 EMERGENCY RIDE HOME PROGRAM

Stanford emergency ride home program can be used by anyone that is registered for the program and are not commuting by car alone the current day. If any personal emergency happens does the program arrange a rental car or taxi for the person in need. The program covers emergencies such as injures and unexpected illness within the family, individual catastrophe such as house fire or if the carpool driver had to leave campus unexpected. The emergency ride home program is for free, and members of Commute Club are automatically registered, others need to apply online. The emergency ride home service can be used up to four times a year per register member (Stanford Parking and Transportation Services, 2015).

3.3.6 GUIDE EMPLOYEES

Stanford believes in a larger affect by influencing new employees commute choices than changing the old employees deep-rooted routines. This is achieved by informing about all alternatives that currently exist during the introduction day for new employees. Stanford Parking and Transportation Service also hands out information regarding, commute modes, living alternatives and commute maps (Helmke, 2015).

Stanford's Commute Buddy program matches experienced alternative commute commuters with employees and students that are willing to try an alternative commute mode such as bicycling or public transits. The two parties sign up at the commute buddy web page, thereafter will the experience buddy guide the beginner through the alternatives. Experience buddies receive $20 in a gift card for each fulfilled buddy program (Stanford Parking and Transportation Services, 2015).

3.3.7 BICYCLING

Stanford campus provides 18000 bicycle parking spots including 13 bicycle compounds with a total capacity for 208 bicycles. The bicycle storage can be rented for $50/yr for employees and $35/yr for students. The clothing lockers can be rented for $36/yr. There are also plenty of showers available at different sites around campus. Bicycle repair stands are placed all around campus where tools and air are available in case of reparation, see picture 1. Every Friday there is a possibility to free bike safety check-up and help to pump up the tiers (Stanford Parking and Transportation, 2015).

PICTURE 1: Bicycle repair station at Stanford campus (Stanford Parking and Transportation, 2015)

Stanford also promotes bicycle safety. Employees and students can therefore attend to free bike safety classes twice a month. Most of the shuttle- and public transits allow carrying the bicycle on board if space is available. Bicycle stands are accessible in front or/and the back of each transit. To solve the fist mile, last mile issue does Stanford subsides $100 on specific folding bicycle model purchase at Stanford's own bicycle stores. The bicycle store also solves barriers regarding bicycle questions and bicycle services (Stanford Parking and Transportation, 2015).

3.3.8 SHUTTLE SERVICES

The Marguerite shuttle is Stanford's free public shuttle system. The shuttle system purpose is to connect Stanford campus with public transportation, shopping area and dining possibilities. All Marguerite shuttle are supplied with free WI-FI and many of the buses uses battery-electrics. The service runs Monday to Friday and with special schedule during weekends and holidays. There are also plenty of other free shuttle services provided by the surrounded cities to connect the area to important destinations (Stanford Prking and Transportation Services, 2015).

3.3.9 BAY AREA TRANSIT

There are many different transit possibilities that make Stanford Campus accessible from all over the San Francisco Bay area. Most transits passes and tickets can be purchase with pre-tax payroll deduction for nearly all employees. The Caltrain commuter rail service is one of the main commute services that run between Gilroy and San Francisco. Every Clatrain accommodates 48 to 80 bicycles aboard and passengers can bring their bicycle for free if space is available. At most Clatrain station car parking is available where daily- or monthly parking permissions can be purchased. Other Bay area transits are also available and connects the whole Bay with Stanford campus. The Caltrain pass and VTA Eco passes are for free and all regular employees at Stanford are eligible to hold one (Stanford Parking and Transportation Services, 2015).

3.3.10 CAPRI

Congestion and Parking Relief Incentive (CAPRI) is a case study accomplished by Stanford University. The aim was to reduce peak-hour traffic to and from Stanford campus. CAPRI purpose was to change peoples commute behavior and encourage them to commute to campus before 8 am or after 9 am and leave campus before 5pm or after 6pm. This was accomplice by a point system where the commuters gain 10 points every time they commute during off-peak hours. Commuting during off-peak hours every day for one week, result in total points of 100/week. These points could be trade against $1 or be used in CAPRI'S chutes-and-ladders game online where the participators had the chance to win cash rewards ranging from $1 to $50. The chances to win increased depending on which statuses level the participator appertain to. All CAPRI commuters were assigned as bronze commuters when first signed up. Depending on the number of off-peak hours the participator achieved, the faster the level raised. The highest level was platinum, which was required to win the highest reward (Abadi et al., 2014).

30 percent of all Stanford's car commuters participated in the CAPRI project and it resulted in a total decrease of peak-hour commuters in the mornings with 21,2 percent and from campus in the afternoon with 13,1 percent. This shows that the CAPRI model is a success for changing

commute behaviour (Abadi et al., 2014).

3.3.11 CAR PARKING

Stanford has today 20760 parking spots at campus (Stanford Parking and Transportation Services, 2015) but due to the GUP they are restricted to not provide more than 21651 parking spots (County of Santa Clara, 2000). The parking spots are shared between the students and employees but the share is unknown. Stanford equips special parking for guests, carpoolers and vanpool, see picture 2 and 3. All around campus are also zip cars vehicles spread for easy access. Charging stations for electrical vehicles exist for hourly rate. The rest of the parking area is divided into different permit sections where the “A” parking permit is the most expensive. There are also possibilities to purchase daily stretchers, see price in table 1 (Helmke, 2015). In total were 21172 permits sold in 2014 whence 5531 were “A” permits and 8215 were “C” permits. Note that permits purchased by students are included (Stanford Parking and Transportation Services, 2015).

PICTURE 2 och 3 : Parking spots reserved for carpoolers and visitors (Picture taken by author 2015).

DURATION	A PERMIT	C PERMIT	VISITORS
Hourly (metered)	N/A	N/A	$1.5 - $2.0
Dalily	$11	$4.5	$12
Monthly	$81	$30	N/A
10-Month	$810	$300	N/A
12-Month	$972	$360	N/A

TABLE 1 : Table showing Stanford's parking cost depending on permit (Stanford Parking and Transportation Services, 2015)

3.4 CURRENT SITUATION – CHALMERS UNIVERSITY OF TECHNOLOGY

Today, there are 3198 employees at Chalmers University of Technology (Sahlin, 2015) but within 10 to 15 years Chalmers are counting on an expansion of more than 4000 new workplaces at campus Johanneberg, mainly due to the new Science Park (Hyllenius Mattson et al., 2012). Chalmers is currently providing different commute mode services to encourage sustainable commuting. Some of the modes are provided only by Chalmers and some services provides by collaboration with the City of Gothenburg or other organisations. Down below follow presentations and descriptions of all commute services that currently exist. All descriptions also include potential pain-points before or during use of each service.

3.4.1 PUBLIC TRANSPORTATION

There are many different public transportation options that can be used to commute to campus Johanneberg and campus Lindholmen. Currently there are thirteen different tram and bus lines available to reach Campus Johanneberg (see figure 6) within a walking distance of less than 400 meters. At campus Lindholmen there are eight different trams, buses and ferry lines connected to campus within walking distance (see figure 7) (Västtrafik, 2015). During weekdays between 01 am to 05 am the public transportation is not in traffic and it is not possible to commute to or from the two campuses. During nights to Saturday and Sunday the night traffic is running and connections to both campuses are available (Västtrafik, 2015). There are two bus lines that connect campus Johanneberg and campus Lindholmen without any transfer needed, line 16 and line 55. Due to security reasons, is it only possible to bring bicycles on PT ferries but not on any buses or trams (Chalmers Fastigheter, 2015).

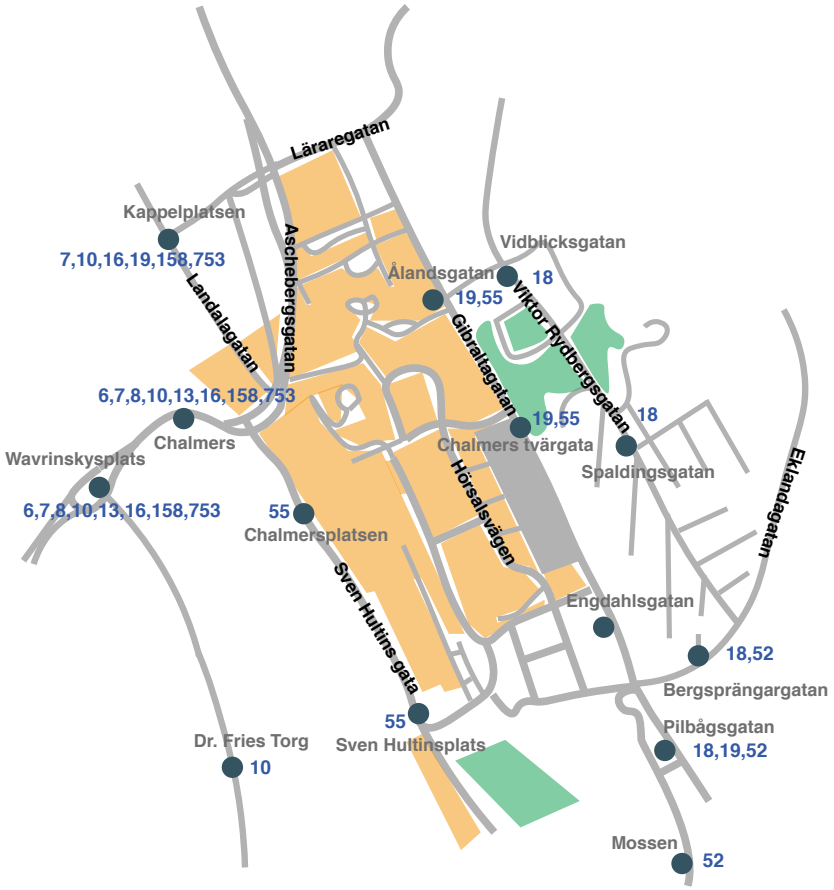


FIGURE 6: Map over all PT stops within 400m walking distance at Chalmers campus Johanneberg (Illustrated by the author).

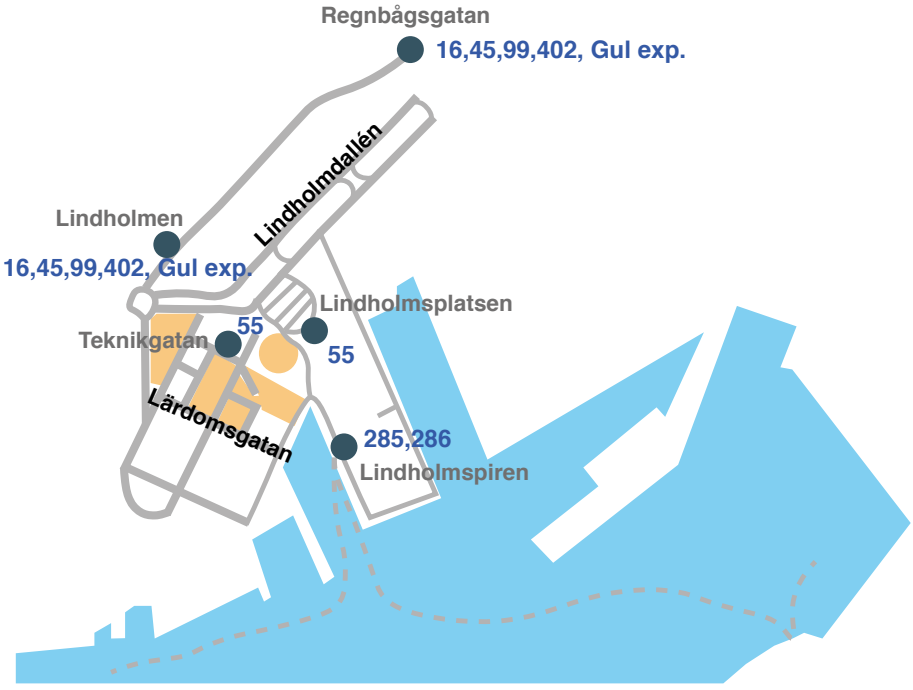


FIGURE 7: Map over all PT stops within 400m walking distance at Chalmers campus Johanneberg (Illustrated by the author).

3.4.2 VÄSTTRAFIKS YEARLY PUBLIC TRANSPORTATION PASS

Chalmers offer a net income deduction when purchasing a public transportation pass valid for one year. The public transportation system in Gothenburg is called Västtrafik and the pass is valid in the zones covered by them. The price for the pass is not subsidised but is divided into monthly payments, which is deducted from the employee's salary. Chalmers ambition with the yearly passes is to make it easier for the user to always have a valid pass and avoid a larger expense once a year while purchasing a pass (Kjällstrand, Chalmers Insidan, 2014).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know that the yearly public transportation pass exists.
- The potential user does not know how to purchase the pass.
- The user does not use the pass as much as she thought.
- The user would like to walk or cycle during summer time and days when the weather allows which does not benefits the price, since the pass is purchased for yearly use.
- The user forgets his/her pass at home.
- The card is not subsidised so the user does not see the point to buy it.

3.4.3 CHALMERS BUS PASS

Chalmers offer a special bus pass for students and employees. The card is only valid at bus line 16 and 55 which both connect the two campuses without transfer. The card is valid for one semester and are highly subsidised compared to regular price (Kjällstrand, Chalmers Insidan, 2014). To be able to purchase a card as an employee does the manger of the employee approve that he/she is expected to commute enough so a card is necessary. The card can only be used during work hours. Students require to study at least 15 points to be able to purchase a card (Cremona, 2015).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know that the Chalmers bus pass exists.
- The potential user does not know how to purchase the pass.
- The pass is only possible to purchase at special Chalmers distributers.

3.4.4 ELECTRICITY

Chalmers is a part of the initiative ElectriCity, which is collaboration between Volvo, Chalmers, The Swedish Energy Agency, City of Gothenburg, Västtrafik, Chalmers Science Parks among others. The purpose of the initiative is to create a sustainable and attractive public transportation system (Electricity, 2015). A large part of the project is to evaluate how electric buses can operate and be a part of the public transportation system. Thus an electric bus line was introduced between campus Johanneberg and campus Lindholmen June 15th 2015. The bus line is supposed to connect the two campuses in an attractive way. To do so have four more bus stops been implemented, two at campus Johanneberg and two at campus Lindholmen. One of the bus stops at campus Lindholmen is located inside a building to show the benefits of emission free electrical vehicles. This is possible since the electrical buses are almost silent and free from emissions. This will hopefully contribute to a different future city planning and a possibility to develop new kind of

public transportation. The bus is also equipped with WI-FI and USB-charger socket to provide the possibility to work on-board (Electricity, 2015).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know how to purchase a ticket.
- The user misses the ride.
- The ride is cancelled.
- The user has bicycle to campus and would like to bring the bicycle to the other campus.

3.4.5 BICYCLE FACILITATORS

Bicycle facilitators include showers, changing rooms, bicycle parking, bicycle storage, air pumps, tools and bicycle day. All described below.

SHOWERS

Chalmers provide shower possibilities at campus. There are showers available for both employees and students but are separated. For students there are eighteen showers available at campus Johanneberg and two showers available at campus Lindholmen. For employees there are around thirty-nine showers available plus showers and changing rooms belonging to the house of chemistry, see figure 8. At campus Lindholmen there are six showers available for the employees (Kjällstrand, Chalmers Insidan, 2014).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know where the showers are located.
- There are not enough showers.
- There are no lockers for storing clothes and personal belongings.

FIGURE 8: Map showing were all showers are located at campus Johanneberg (Illustrated by the author).

BICYCLE PARKING

There are many parking spots available for bicycles at campus. All of them provide the availability to lock and tie up the bicycle against a pole or something similar. Some parking spots are covered by a roof to protect against rain and heavy weather (Kjällstrand, Chalmers Insidan, 2014). New bicycle parking with roof are scheduled to be built in late 2015 at campus Lindholmen and the Vasa area at campus Johanneberg (Chalmers Fastigheter, 2015).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- There is no spot available.
- There are no poles or similar to lock up the bicycle against.
- The bicycle gets wet during rainy and snowy days.
- The potential user does not trust the bicycle parking and are afraid of loosing his/her bicycle.

BICYCLE STORAGE

Employees at the department of Engineering Sciences and Mathematics, department of Civil and Mining Engineering and the employees belonging to the House of Chemistry have all access to bicycle storages where it is possible to storage the bicycle (Kjällstrand, Chalmers Insidan, 2014). Chalmers Fastigheter has no plans to build more indoor bicycle storage at the moment. If there are any wishes for more storage locations, each department has to finance it themselves (Chalmers Fastigheter, 2015)

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The user has an expensive bicycle and does not want to leave it at unsafe location on campus.
- The potential user does not know about the storage.
- The potential user has no access to the storage.

BICYCLE PUMP

At the moment does Chalmers provide campus Johanneberg with two stations where it is possibility to add air into bicycle tires. One additional pump is available only for employees. Students and employees located at Campus Lindholmen are directed to use an air pump station just outside the campus area (Kjällstrand, Chalmers Insidan, 2014).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know where the air pumps are located.
- The distance to the air pump is too far.
- The air pump is broken.

BICYCLE DAY; RECYCLE

Chalmers try to arrange two bicycle days per year to encourage students and employees to use their bicycle when commuting to campus. These two days includes access to bicycle mechanics and Chalmers also invite different bicycle companies for exhibition purposes (Kjällstrand, Chalmers Insidan, 2015). The goal with the day is also to provide exchange students with old donated bicycles to be used during their stay (Miljöenhet, 2015).

3.4.6 CHALMERS BICYCLE AVAILABLE FOR SHORTER USE

The department of Administration, department of Civil and Mining Engineering, the Centre of Environment and Sustainability and the departments of Chemical and Biological Engineering have all access to bicycles to borrow for shorter usage related to work (Kjällstrand, Chalmers Insidan, 2014).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know that borrowing bicycles are available.
- The potential user does not know how to book a bicycle.
- There are no bicycles available when the user needs it.
- The bicycle needs to be returned earlier that the user is able to.
- The user uses the bicycle to commute to the other campus and needs to commute back in the end of the day to return the bike before returning home.
- The user needs to transport large goods.

3.4.7 STYR & STÄLL

(Not provided by Chalmers but available at campus)

In the city of Gothenburg there is a bicycle-sharing program called Styr & Ställ available. The members can borrow a bicycle at any of the bicycle stations around the city and return it to the

same or to a different station. The membership costs 75 sek per season and includes unlimited usage but with a limit of 30 minutes a time. If the user would like to use the bicycle longer is it possible to either return the bicycle to a station and receive a new one, or start to pay 10 sek for additional 30 minutes, 20 sek for 30 more minutes and after that it costs 40 sek for every additional 30 minutes (JCDecaux, 2015). There are four stations located at or close to Campus Johanneberg. The system does not exist outside the city centre and therefore is not available at campus Lindholmen (Kjällstrand, Chalmers Insidan, 2015). However, in 2015 will the first electrical Styr & Ställ bicycles be installed. One station will be located at the main train station and the other station at Lindholmen. The electrical bicycles will hopefully encourage more people to try to bicycle over Göta Älvbron, which today is seen as a heavy bridge to bicycle over. In the beginning will only these two stations exist as a pilot project. To keep track on the bikes, a GPS will be installed in each bicycle (Wilhelmsson, 2015).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know that the service exist.
- The potential user does not know how to use the service.
- The potential user does not know how to purchase a subscription.
- The user forgets his/her pass.
- There are no bicycles available when needed.
- There are no free spots to return the bicycle.
- The user needs to transport large goods.
- The user needs to commute further than the stations are located.

3.4.8 THE BICYCLE CHALLENGE

(Not provided by Chalmers but employees are encouraged to participate)

The bicycle challenge is arranged by TL event in collaboration with municipalities, county council and different administrative authority every year. Any company or authority in Sweden can participate and the aim of the challenge is to encourage people to use their bicycle to work to improve health and lower emission of carbon dioxide (TL Event, 2015).

3.4.9 CHALMERS ELECTRICAL CAR SHARING

Chalmers is a member of the car sharing Move About AB and provide thereby six Nissan Leaf available at campus. Three vehicles are reachable at campus Johanneberg and three at campus Lindholmen. The car sharing is accessible for both students and employees. For work related usage the vehicles is available for free and for private usage and for students there is a different payment plan, see table 2 (Move About, 2015).

MEMBERSHIP	MONTHLY COST	WORK RELATED	DURING DAY, 06-17	DURING EVENING, 17-23	WEEKENDS
Chalmers employee	0 sek	0 sek	99 sek/hour 324 sek/half day 499 sek/day	59 sek/hour 169 sek/evening	499 sek/weeke.
Chalmers student	62 sek	-	99 sek/hour 324 sek/half day 499 sek/day	59 sek/hour 169 sek/evening	499 sek/weeke.
Other	124 sek	-	99 sek/hour 324 sek/half day 499 sek/day	59 sek/hour 169 sek/evening	499 sek/weeke.

TABLE 2 : Prices for Move About members (Move About, 2015)

370 employees and students have a registered account at the provider Move About. The employees booked 904 bookings in 2014, whence 681 were business trips and 223 bookings were for private usage (Move About, 2015).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- The potential user does not know that the service exists.
- The potential user does not know how to create an account.
- The potential user does not know that the service is for free for Chalmers employees.
- The user does not know how the service works including booking, using, retuning.
- The user is afraid that the battery will not last.
- The user is traveling further that the battery last.
- The user needs the car in the begging of the day and is not living close to the car sharing station.
- The user needs the car for an appointment in the end of the day and will not return to campus before returning home.

3.4.10 CAR PARKING

Chalmers campus Johanneberg provides in total seventeen different parking areas where fifteen of them accept Chalmers parking permits. Chalmers campus Lindholmen provides five areas whence two of them accept Chalmers parking permit, see appendix II (Chalmers Fastigheter, 2015). The employees use most of the parking spots and the share used by students is insignificant (Chalmers Miljöenhet, 2015). The prices for the different parking permits are presented below (Chalmers Fastigheter, 2015).

PARKING PRICE JOHANNEBERG, ALSO VALID AT LINDHOLMEN

TYPE OF PARKING PERMIT	PRICE
Yearly	6270 sek
Half Year	3420 sek
Seasonal (Bicycle card) Valid from October 01 to March 31	3420 sek
Monthly	570 sek
Parking sticker for subsidised hourly rate	360 sek + 4 sek/h, Maximum 40sek/day
Hourly rate	15 sek/h (all days 07:00-18:00) 4 sek/h remaining hours

TABLE 3 : Prices for parking permits valid at JB and LH (Chalmers Fastigheter AB, 2015)

PARKING PRICE LINDHOLMEN

TYPE OF PARKING PERMIT	PRICE
Yearly	4620 sek
Half Year	2520 sek
Seasonal (Bicycle card) Valid from October 01 to March 31	2520 sek
Monthly	420 sek
Parking sticker for subsidised hourly rate	360 sek + 4 sek/h, Maximum 40sek/day
Hourly rate	8 sek/h Maximum 60sek/day

TABLE 4 : Prices for parking permits valid at only at LH (Chalmers Fastigheter AB, 2015).

PARKING PRICE PARKING GARAGE JOHANNEBERG SCIENCE PARK

TYPE OF PARKING PERMIT	PRICE RANDOM SPOT	PRICE RESERVED SPOT
Yearly	12375 sek	16500 sek
Half Year	6750 sek	9000 sek
Monthly	1125 sek	1500 sek
Hourly rate	15 sek/h (all days 08:00-18:00) 2 sek/h remaining hours	-

TABLE 5 : Prices for parking permits valid at JB parking garage (Chalmers Fastigheter AB, 2015).

Table 6 below shows how many and what kind of parking permits sold at Chalmers in year 2014 (the parking garage at Johanneberg Science park did not exist in 2014) (Andersson, 2014).

VARIOUS KIND OF PERMITS	AMOUNT
Yearly (JB)	287
Half Year (JB)	98
Monthly (JB)	1528
Season (JB)	12
Yearly (LH)	31
Half Year (LH)	17
Monthly (LH)	269
Season (LH)	1

TABLE 6 : Amount of parking permits sold for JB and LH in 2014 (Andersson, 2014)

Chalmers provides a number of charging stations for electrical vehicles. The charging stations are located at the three main parking areas at Johanneberg. The charging is included in the regular parking price and no additional cost is added for usage of the stations. To avoid that not electrical vehicles block the parking spots where charging is available it is required to have a specific green pass permission. The implementation of charging stations is a way for Chalmers to prepare for the switch of more electrical vehicles in the future. This also communicates that Chalmers is early an adopter of new techniques and support sustainable solutions that contributes to a better future (Kjällstrand, Chalmers Insidan, 2014).

POTENTIAL PAIN-POINTS BEFORE AND DURING USE:

- There are no parking spots available.
- The potential user considers the parking price as too high.
- The potential user does not know how to purchase a permit.
- The user want to commute with a different mode but have already paid for parking.
- The potential user does not know that charging stations are available.
- There are no charging station available.
- The user will still need to pay a high parking fee even if the charging is for free.

3.5 HARD VALUES BENCHMARKING

Infrastructure and comparable data from the universities are presented in the table 7 below. The data derive from Chalmers Fastigheter, Chalmers official websites, Stanford Parking and Transportation organ, Google maps, Västtrafiks reseplaneraren and Marguerite shuttle schedule.

FACTORS	CHALMERS	STANFORD
Area of Campus	1000 m x 500 m (JB) 300 m x 200 m (LH)	2400 m x 3200 m
Number of Employees	3198 employees	13748 employees
Commute Split	*Year 2012*	*Year 2014*
Walk	19 %	2,7 %
Bicycle	19 %	12,8 %
Public Transportation	36 %	25,7 %
Car	16 %	49,4 %
Carpooling/Vanpooling	6 %	8,4 %
Other	4 %	1 %
Distance to main Train station *	2500 m - 3000 m (JB) 3000 m - 4000 m (LH)	1200 m from main building
Frequency of routs to T-station**	Every 8th minute	Every 20th minute
Number of parking spots	1200 (JB), 700 (LH)	21172
Monthly parking cost ***	420 sek to 1125 sek / month	$30 to $81/month
What is subsidised	Nothing	Free PT passes. Free campus shuttles around campus. Discounted folding bicycles.

* Approximate walking distance from main building on campus to the closes main train station, taken from maps.google.com.

** The timetable is regarding routs without any transfer from campus main building to main train station. Chalmers buslines 16, 55, 7 and 13 are consider as feasable routs according to vasttrafik.se. Stanfords Marguerite shuttle X and Y are consider as reasonable transfer alternative.

*** The prices refers to monthly permits and not based on half year/yearly prices.

TABLE 7 : Comparison between Stanford and Chalmers regarding of hard values.

3.6 MOBILITY MANAGEMENT BENCHMARKING

To evaluate the mobility management aspects currently used in the services and incitements provide by Stanford and Chalmers this were stated in a table. Each mobility management aspect was analysed regarding the universities on-going actions and defined as positive or negative.

The fact considered in the analysis derived from the observations and knowledge gathering from the study of the current services, the interviews made with essential people and from the visit at Stanford University as well as data from Stanford Parking and Transportation Services.

ASPECTS REGARDING SUSTAINABLE COMMUTING AND MOBILITY MANAGEMENTS	STANFORD	
	POSITIVE ASPECTS	NEGATIVE ASPECTS
PARKING - parking fees, distance from parking to work space, distrubution of space	- Gradual increase in parking price every year. - There are plenty of electrical charging stations. - Special parking for carpoolers and vanpoolers. - Special guest parking. - Stanford are not allowed to build more than a specific number of parking spots due to the General Use Permit agreement.	- The cost for parking is relatively low. - Car parking is closer to work place than larger PT stops. - Yearly permits are cheaper than daily permits.
EXISTING INFRASTRUCTURE - ability to use existing infrastructure, needs of new infrastructure, improving of walking and bicycle friendly roads, cycling facilities, improvements of public transport, transits	- All services included in the Commute club program uses existing infrastructure. - Tools and air pumps for bicycles are available on campus. - The bicycle roads around campus are improving. - The Marguerite shuttle schedule has been updated to more frequent routes.	- Many bicycle roads are not considered as safe from a user perspective. - There are still major concerns regarding the "*first mile, last mile issue*".
POLICY AND REGULATION - laws, fondations, regulations	- Stanford has the posibility to hand out free PT passes. - The US Law support tax-free PT passes up to $130 per month. - The GUP agreement force Stanford to find new solutions.	- The US Law support tax-free parking up to $250 per mont.
POOLS - carpools, bicyclepools, special parking, special prices, distance, reserved spaces, guaranteed ride-home	- Reserved parking for carpool/vanpool. - Emergency ride home program. - Clean Air Cash for carpoolers/vanpoolers/walkers/cyclists/PT. - Carpool matching online.	- No bike sharing on campus.
COLLABORATION - with surrounding cities, companies, institutions	- Stanford collaborate with the surrounding cities regarding PT and bicycle roads.	
INFORMATION - campaigns, courses, promotion, awareness raising, information about various modes and travel options	- Stanford provide free bicycle classes. - Commute buddy program. - All new employess are provided with information about alternative commute modes. - Monthly P&TS emails updates sent with information about alternative commute mode and program.	- Not all employees are aware of all incentives and commute services that Stanford provide.
SUBSIDISED - public transportation passes, equipment, parking tickets	- All employees are offered different PT passes for free. - Discounted folding bicycles as a way to solve the first mile, last mile issue.	- Long-term parking permits are cheaper than parking on daily basis.
DECRESES EMISSION AND TRAFFIC	- Commute Club. - The General Use Permit agreement. - Many transit options uses alternative fuel such as biofuel and electricity.	- Over 50 % of the employees at Stanford commute by car.
ACCESSIBILITY - improving site accessibility by all modes, distance, alternative choices for mini trips during the day, multi-modal travel	- As one solution of the fist mile, last mile issue does Stanford provide discounted folding bicycles at their bicycle shop. - By handing out free PT passes gives the opportunity to commute in an alternative way without paying more.	- The bicycle roads are not precived as safe. - The mile distance between the main train station and campus is a big barrier.
FLEXIBILITY - flexible working hours, tele-working, 4 days working week	- Flexible work hours differ between job titles and departments but do exist.	- Not all job titles are able to work flexible work hours such as maintain staff.
SAFETY - roads, emergency rides, in time arrival	- Provides emergency ride program. - Offer safety bicycle classes.	- The surrounding bicycle roads are not percived as safe.
HEALTH - improve health	- The Commute Club and bicycle alternative provide health.	- The common behaviourcto drive within campus if attending another building is not increasing health.

TABLE 8: Positive and negatives aspects regarding mobility management at Stanford.

ASPECTS REGARDING SUSTAINABLE COMMUTING AND MOBILITY MANAGEMENTS	CHALMERS	
	POSITIVE ASPECTS	NEGATIVE ASPECTS
PARKING - parking fees, distance from parking to work space, distrubution of space	- Chalmers is not allowed to build more than 1382 parking spots at Johanneberg due to the surrounding infrastructure. - Chargers for electrical vehicles are available at some parking spots and can be used for free.	- Car parking is closer to work place than PT stops. - Yearly parking permits are cheeper than daily permits.
EXISTING INFRASTRUCTURE - ability to use existing infrastructure, needs of new infrastructure, improving of walking and bicycle friendly roads, cycling facilities, improvements of public transport, transits	- Styr & Ställ uses existing infrastructure. - ElectriCity uses existing infrastructure in a new innovative way. - The bicycle roads are improving. - There are possibilities to charge electrical vehicles.	- There are not enough bicycle facilities, such as air pumps and tools. - The information about where showers and changing rooms are not spread enough. - New walk/bicycle roads are not always fully complete and connected.
POLICY AND REGULATION - laws, fondations, regulations	- Employees are provide with a free membership of the electrical carpool and free usage for business trips.	- It is hard to subsidise alternative commute modes due to tax issues. - Employees get more paid by using their private car when traveling in business purpose than using a ”eco” marked rental car.
POOLS - carpools, bicyclepools, special parking, special prices, distance, reserved spaces, guaranteed ride-home	- Electrical carpool with discounted price for employees and students. - Styr & Ställ is available on campus Johanneberg. - Some departments has access to bicycle for borrow during the work day. - Chalmers are planing to introduced a electrical bicycle sharing stations accessible for employees in late 2015. - Styr & Ställ are planing to run a pilot project with electrical sharing bicycles between the main train station and Lindholmen in late 2015.	- Styr & Ställ is not available at campus Lindholmen. - Not all departments have access to borrow bicycles. - The electrical carpool is not suitable in the beginning/end of the working day since the car needs to be returned before the employee can return home.
COLLABORATION - with surrounding cities, companies, institutions	- ElectriCity is a collaboration of many different parties in the city of Gothenburg.	
INFORMATION - campaigns, courses, promotion, awareness raising, information about various modes and travel options	- The bicycle day ReCycle is a good initiative to offer employees free bicycle service and teach students how to fix their bike.	- Information and knowledge about all available services are not spread enough. - The information about available showers and changing rooms is not spread enough.
SUBSIDISED - public transportation passes, equipment, parking tickets	- The Chalmers 16/55 buss pass is subsidised and a way to provide cheap commute alterative between the two campuses.	- The swedish law makes it hard to subsidise any environementlly friendlly commute modes.
DECRESES EMISSION AND TRAFFIC	- ElectriCity. - Electrical carpool. - Styr och Stäl.	- Chalmers still pay employees for using their own car for business purposes.
ACCESSIBILITY - improving site accessibility by all modes, distance, alternative choices for mini trips during the day, multi-modal travel	- Extension of Styr & Ställ has been achived. - New bus stops for ElectriCity. - Better bicycle roads has been buildt.	- All bicycle roads and walking paths are not completly connected, sometime they end unpredictably. - It is hard to commute in a multi-modal way.
FLEXIBILITY - flexible working hours, tele-working, 4 days working week	- There are many well-equipped web conference offices. - All employees have flexible working hours. - No meeting should be schedule before 9.00 or after 15.00.	- Information about the web conference equipment existents is low. - The knowledge of how to use the web conference equipment is weak.

TABLE 9 : Positive and negatives aspects regarding mobility management at Chalmers. Part 1 of 2.

ASPECTS REGARDING SUSTAINABLE COMMUTING AND MOBILITY MANAGEMENTS	CHALMERS	
	POSITIVE ASPECTS	NEGATIVE ASPECTS
SAFETY - roads, emergency rides, in time arrival	- Cars are only allowed to a certain extent at campus area	- Not all bicycle/walking roads are perceived by safe by the user - The trust for the public transportation and arriving in time is low - There is no fast way to ride home if necessary
HEALTH - improve health	- The bicycle competition encourage to a healthy commute way	- There are no rewards for commuting in a healthy way

TABLE 10: Positive and negatives aspects regarding mobility management at Chalmers. Part 2 of 2

3.7 SWOT ANALYSIS

A SWOT analysis was conducted for both of the universities as a way to compare the soft values and identify the similarities and differences. The analyses are created with information from previous data in this chapter.

3.7.1 SWOT ANALYSIS STANFORD

STRENGTHS

Stanford has a well organised mobility management program.

They are providing free PT passes.

There is a decrease in single car driving.

California State provides benefits by purchase an electrical vehicle .

There is special parking for carpoolers/vanpool.

There are good bicycle facilitators on campus.

Regulated maximum parking spots that can be build.

Excellent research and knowledge, which contributes to valuable solutions.

Is a big and powerful organisation with great influence on the society.

Providing a new employee program as a attempt to affect their choice of commute mode.

WEAKNESSES

50 % of all employees still drive to campus.

Big issues with the ”first mile, last mile” problem.

Low parking costs.

Unsafe and not connected bicycle roads.

No bicycle sharing on campus.

High middle age on employees, which contributes to harder changes in behaviour.

It is not possible to combine tickets for different commute modes which decreases the flexibility.

Commuting by PT does most often require longer commute time than driving.

OPPORTUNITIES

To make Stanford and it’s surrounding more bicycle friendly and the opportunities are largewith it’s flat landscape.

Great experience in sustainable commuting solutions and thereby big opportunities to find new workable solutions.

Make more people aware of consequences and the effect on using not sustainable commute modes.

Big chances to influence the surrounding cities and PT since they are a large provider of employees.

Create change agents that will influence the private sector and business world.

There is an upcoming bicycle trend that Stanford can take advantage of.

The UN millennium goals will be updated soon, thus forcing to a change.

Create better relation and solution with different actors.

Other big organisations in the surrounding area are also conducted to the GUP agreement which may create new collabrations.

To affect all new employees to chose a sustainable commute mode from the beginning.

THREATS

They are not reaching the GUP goal.

The collaboration with the public transportation provider ends.

House prices continue to rise and employees are forced to move further away.

The price for driving decrease.

People feel good about purchasing an electrical vehicle and argue that they don’t need to commute with alternative commute modes. This will not contribute to a decrease in numbers of cars and it will be harder to reach the GUP goal.

Less people attend Commute Club.

The information about the Commute Club is not spread.

FIGURE 9: Illustration of SWOT Analysis regarding Stanford.

3.7.2 SWOT ANALYSIS CHALMERS

STRENGTHS

Chalmers vision is “for a sustainable future”.

The share commuting with car is relatively low, 20 %.

There are many different public transportation alternatives accessible from both campuses.

A “green commute plan” exists.

No more parking spots can be built.

Provides sustainable commute modes such as electrical carpool and Styr & Ställ on campus.

Has good collaborations and relationship with the City of Gothenburg.

Has first class research and thereby great knowledge.

Is a big and powerful organisation with great influence on the society.

Located in a attractive area inside the congestion tolls.

WEAKNESSES

Hard to subsidise sustainable commute modes due to tax issues.

Bicycle facilitators are not enough.

Bicycle roads and walking paths are not consider as connected.

Chalmers Johanneberg is located on a hill which obstruct the choice of not motorised vehicles.

The weather.

The internal communication about available sustainable commute modes are weak.

It is not possible to combine tickets for different commute modes which decreases the flexibility.

Most employees have already choose their preferable commute mode.

OPPORTUNITIES

Make Chalmers and its surrounding more bicycle friendly.

Increase the internal communication.

Make more people aware of consequences and the effect on using not sustainable commute modes.

Create big changes since the real estate is owned by Chalmers.

Create change agents that will influence the private sector and business world.

There is an upcoming bicycle trend that Chalmers can take advantage of.

The UN millennium goals will be updated soon, thus forcing to a change.

Create better relation and solution with different actors.

Chalmers has conducted to complete changes stated in “Green commute plan”.

To affect all new employees to chose a sustainable commute mode from the beginning.

THREATS

The demand for car sharing dies.

The collaboration with the public transportation provider ends.

The collaboration between all parties involved in ElectriCity ends.

The congestion tolls are removed.

The price for gasoline decreases.

The price for public transportation increases.

Employees moves further away.

A more rainy climate.

Chalmers as an organisation stops moving towards a sustainable future.

Employees keep choosing the not sustainable commute mode and are not willing to change, even if another sustainable one would be more convenient.

Information about current and new sustainable commute services are not spread.

FIGURE 10: Illustration of SWOT Analysis regarding Chalmers.

3.7.3 SIMILARITIES AND DIFFERENCES BETWEEN STANFORD AND CHALMERS

SIMILARITIES

. Both Stanford and Chalmers have a restriction regarding number of parking spots.

. Both needs to find new solutions that help people choose alternative commute modes.

. Both universities have great knowledge and access to excellent research regarding the applied challenge.

. They are trying to provide alternative commute mode on campus.

. They are collaborating with the surrounding cities.

. Both are important organisations for the surrounding business life and the cities.

. Single car driving is decreasing at both universities.

. If purchasing yearly parking permit, the price per day is very low.

. Both universities should try to increase the enjoyable to use a bicycle as commute mode.

. The bicycle trend exists in both countries.

. The new UN millennium goals will affect both of them.

. Both are depended on a good relationship with the PT provider.

. They will both be affected if the gasoline price decreases/increase.

. The housing problem is an issue for both of them.

DIFFERENCES

. Stanford is currently working with mobility management to a greater extent than Chalmers.

. Stanford has greater issues with the fist mile, last mile problem.

. Stanford is located in a suburban area when Chalmers is more or less located in the city.

. The landscape at Stanford is more flat compared to Chalmers.

. Since Stanford is located in a suburban area, the distances are much larger compared to Chalmers.

. Stanford has a more privileged law system when it comes to free and/or discounted alternative commute modes.

. Chalmers has more safe and connected bicycle roads, but Stanford has better bicycle facilitators at campus.

. Stanford has a program where they try to influence their new employees when it comes to commuting.

. Around 50 % of the employees at Stanford are single car drivers compared to 20 % at Chalmers.

. The weather at Stanford can be considering as better for alternative transportation modes.

. The campus area and number of employees are much larger at Stanford.

. Transfer from campus to the main train station is twice at frequent at Chalmers compared to Stanford.

. Stanford provides reserved parking for guests and special parking for carpoolers/ vanpool.

3.8 COMMUTE BEHAVIOUR STANFORD

Available data measures Stanford's employees commute behaviour since 2003, just a few years after Stanford introduced Commute Club, which focuses on mobility management. Stanford's employees commute behaviour is measured through a yearly survey. In 2003, Stanford had 10261 employees including staff and faculty. In 2014 was the number of employees 13748 (Stanfors Parking and Transportation Services, 2015). 72 percents of the employees in 2003 commute by single car driving. This number decreased to 49 percents in 2014. In 2003, 9 percents carpooled and 8 percents carpooled in 2014. 11 percents commuted by public transportation in 2003 and in 2014 did 26 percent commute with PT. 6 percent used bicycle as their main commute mode in 2003 and in 2014 were this number 13 percents. Only 1 percent of the employees walk to campus in 2003 and in 2014 did 3 percents walk see figure 11 (Stanfors Parking and Transportation Services, 2015).

If the change in commute behaivour is an affect of Commute Club and other incentives is hard to say. Even if Stanford make regular commute behaivour surveys so have not eugnof or correct demographic data been collected to be able to draw such a conclusion (Clewlow, 2015).

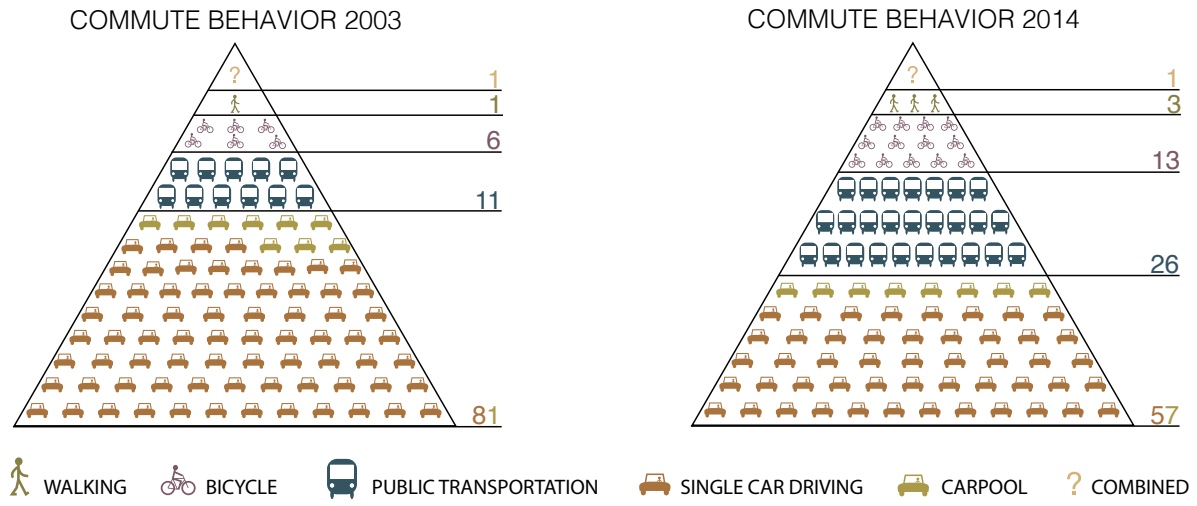


FIGURE 11: Stanford's employees commute behaviour in 2003 and 2014 (Illustrated by author, 2015).

The main aspects regarding which commute mode Stanford's employees choose have mainly to do with convenience, flexibility and commute time, which are connected to the employee's professional and private schedule. This was found in a focus group study regarding Stanford's employees commute behaviour in 2015. The study showed that the cost of using a specific commute mode is not the first argue for most people, even if this aspect most often is considered and regulated to attempt to decrease the use of not sustainable modes. Examples of this are the Clean Air Cash and higher prices for parking permits. Those kinds of actions do influence the choice of commute mode, but studies show that the affect would be larger if the need of convenience, flexibility and commute time would also be fulfilled (Ng, 2015). What also was found, was that most employees that have access to a car do drive once in a while due to their private and professional schedule. Sometimes driving is a necessary option. This finding led to the insight that the frequency of driving for each possible driver has to decrease and the possibility to commute in a multi-mode way is instead required (Ng, 2015).

Furthermore, the chances to change commute behaviour are greater by influencing the once that not already have form a routine. The study indicate that most of the current employees at Stanford have tried nearly all commute modes to find the one that suite their preferences. Thus, this implies that it is hard to convince to a change. Therefore is it important to influence all new employees to a sustainable commute behaviour (Ng, 2015).

3.9 COMMUTE BEHAVIOUR CHALMERS

Two commute behaviour surveys for Chalmers employees have been accomplice during the years. The first one was completed 2006.05.26 and the second one was concluded between 2012.06.14 and 2012.07.04. The first survey included 1541 unique participator (Linfab/Trafikkontoret Göteborg Stad, 2006) and the second one 1639 participators currently employed at Chalmers (Chalmers Miljöenhet, 2012). This represents an answering frequency of 79 percents in 2006 and 60 percents in 2012. According to the participators demographics were these percents assumed to be representative for Chalmers in all. During 2012 were 88,4 percents of the employees mainly located at campus Johanneberg, 8,4 percents were primarily located at campus Lindholmen, 2 percents were mainly located at Onsla space observatory and 1,2 percents reported location as other (Chalmers Miljöenhet, 2012). Unfortunately there are no data available on the distribution of main working location during 2006.

The distances between the employees home and work place had an insignificant change between 2006 (Linfab/Trafikkontoret Göteborg Stad, 2006) and 2012 (Chalmers Miljöenhet, 2012). 20 percents of the employees had less than 2 kilometres one-way to commute. Around 20 percents had a distance of 2 to 5 kilometres, 23 percents had between 5 to 10 kilometres, 25 percents had 10 to 30 kilometres and 12 percents had more than 30 kilometres to commute one way, see figure 12.

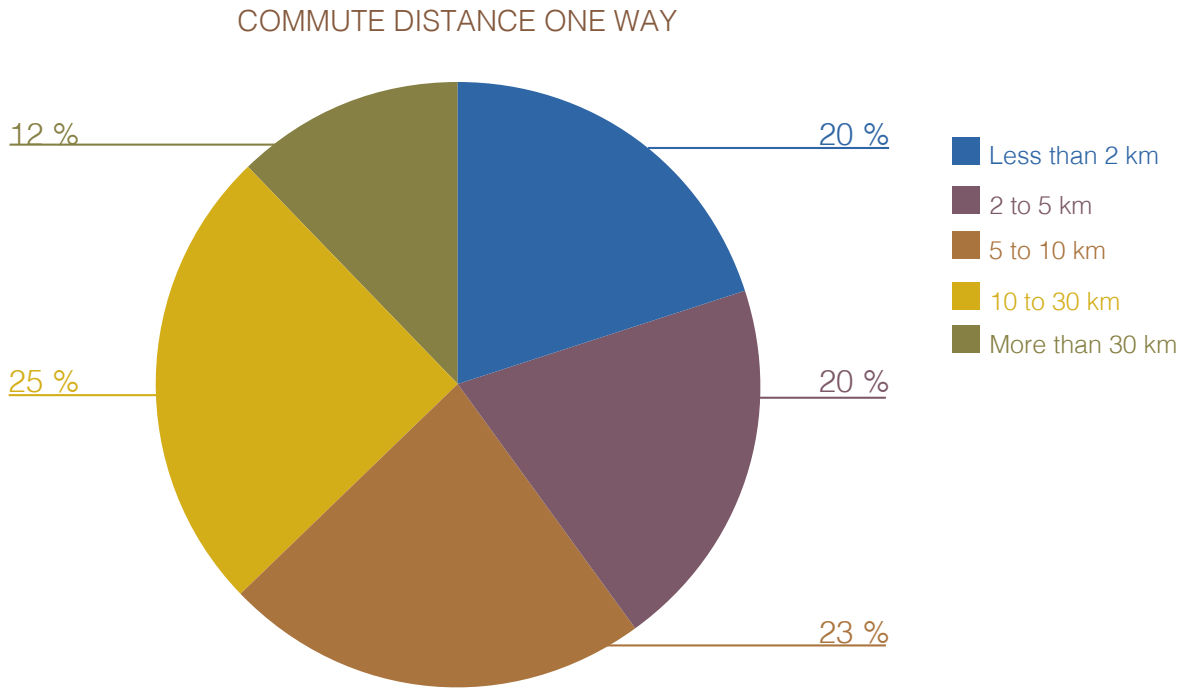


FIGURE 12: Pie diagram showing one way commute distances for Chalmers employees in 2012.

Both surveys were structured with questions and already stated answers to choose from. Many questions also had the alternative Other. This choice hold a clear space for free text were the participator who chose this alternative were required to write her own comment. Some questions did not include any ready-made answers and the participator then was required to fill in personal text. Depending on which alternative answered in the different questions, different follow-up-questions were asked. For example, the participator who had answered that he/she most often used his/her car as commute mode were asked the follow up question: What could make you commute less with car?. This question was not asked to the participator who had answer that he/she most often commute by bicycle.

3.9.1 COMMUTE BEHAVIOUR FINDINGS

During 2006, 34 percents of the employees commuted by car, including single driving and carpooling, 22 percents commuted by public transportation. In comparison to 2012, 22 percents of the employees commuted by car (including 6 percent of carpooling) and 36 percents commuted by public transportation. The commute modes bicycle and walking did not differ between the years and consisted 19 percents each. Remaining employees commute with other/combined commute modes, see figure 15. Apparently a change happened between 2006 (Linfab/Trafikkontoret Göteborg Stad, 2006) and 2012 (Chalmers Miljöenhet, 2012) when it came to public transportation and driving. The both commute modes switched places and the later survey shows that Chalmers employees are slowly decreasing the commute mode driving. No data is available on why this happend between 2006 and 2012. The byciyle sharing program, Styr & Ställ, was introduced in 2010 and can be one reason, but it cannot be the only action made.

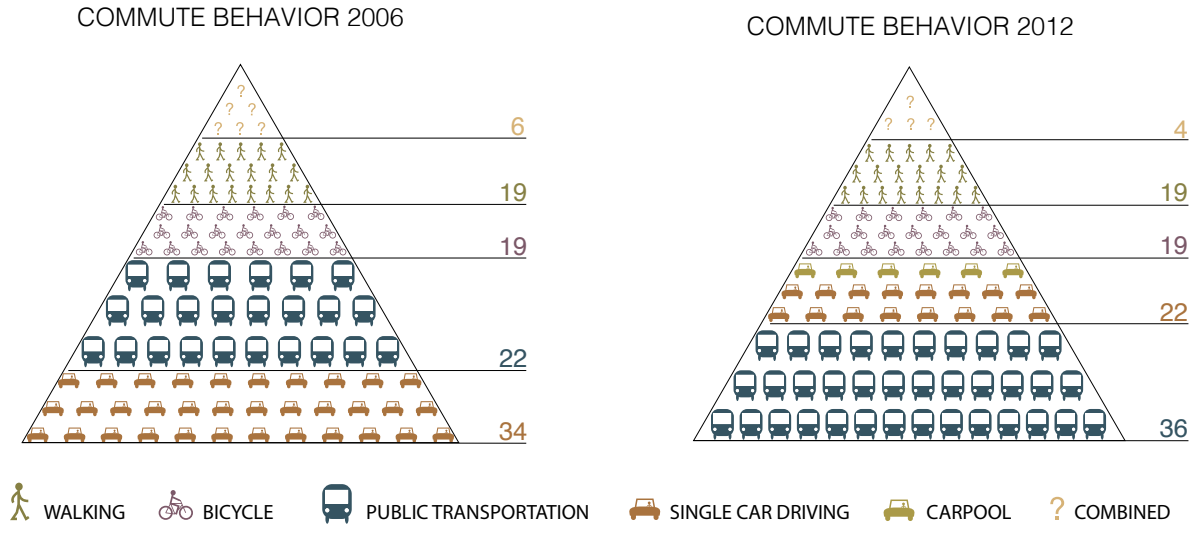


FIGURE 13: Illustration of how Chalmers employees commuted in 2006 VS. 2012 showed in percents (Illustrated by author, 2015).

The study also shows that the commute distances increases with the employees commute by car and public transportation in comparison to walk and bicycle (Chalmers Miljöenhet, 2012).
50 percents of the employees in 2006 announced that they change commute mode depending on season. This also refers to if the employee had an appointment or activity scheduled before or after work where the main commute mode were not convenient (Linfab/Trafikkontoret Göteborg Stad, 2006). In 2012, 60 percents announced that they switch commute mode by reason of the season and 40 percents answered that they sometimes changed commute mode according to appointments or activities before or after work. Important to mention is that the survey in 2012 announces that approximately 60 percents of the Chalmers employees have regular access to a car (Chalmers Miljöenhet, 2012).

All participators were asked which commute mode they mainly used, see figure 13. The following up question was Why they choose to commute as they did. All participators were allowed to choose more then one alternative given in the question. The alternatives that received more than 10 percents are presented below.

PUBLIC TRANSPORTATION

Diagram 1 below shows the aspects of why the employees choose to commute with public transportation.

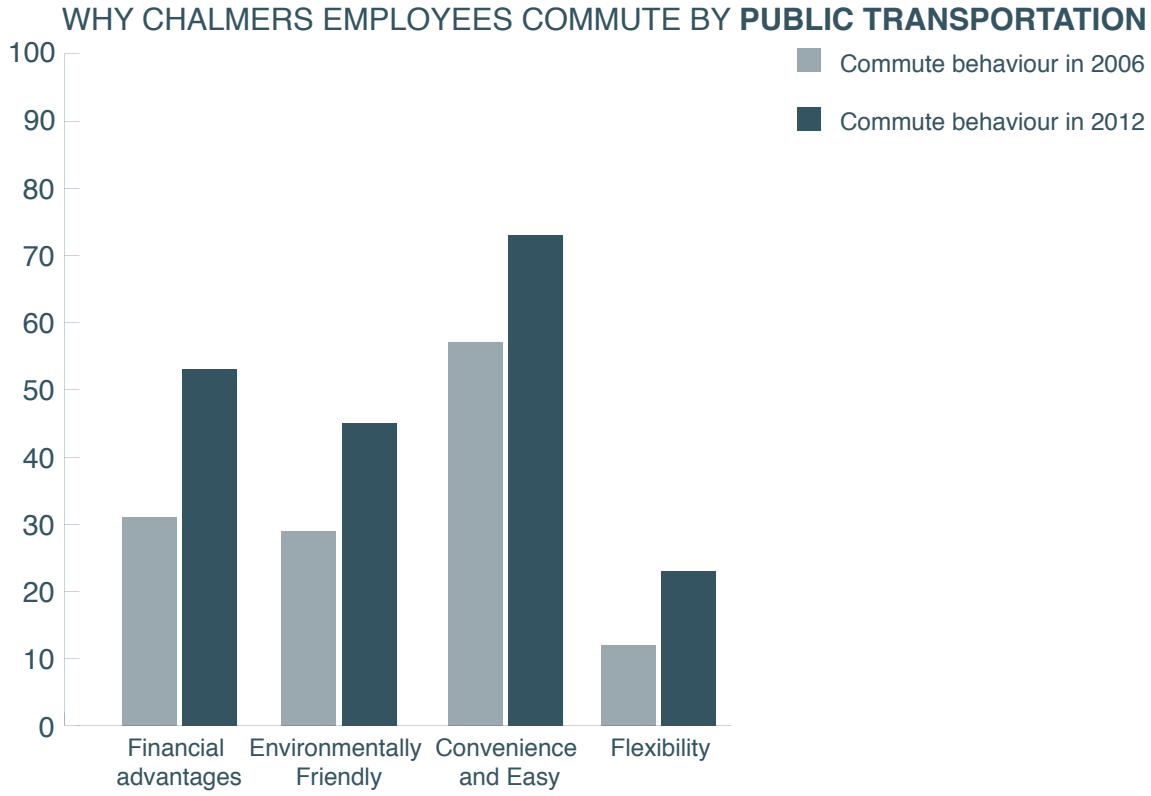


DIAGRAM 1: Percent of why Chalmers employees commuted by public transportation in 2006 (light blue) and in 2012 (dark blue) (Chalmers Miljöenhet, 2012), (Linfab/Trafikkontoret Göteborg Stad, 2006).

Diagram 1 shows that both the financial advantages and flexibility almost doubled in why people choose to commute by PT between 2006 and 2012. The aspects environmental friendly and convenience also increased.

The survey made in 2012 asked the participators commuted by public transportation what they thought could be done to encourage more employees to commute with public transportation. This question was asked without ready-made alternative answerers and a free text square were used instead. A common comment was to introduce more flexible work hours to be able to adapt better to the timetables. Subsidised public transportation passes was also desirable. Many participators also had opinions regarding subsidised parking permits for car commuters. This was seen as unreasonable and higher parking fees should be introduced as an action to stop stimulate car commuting. The ability to include work hours during commuting if work was achieved was also a mentioned (Chalmers Miljöenhet, 2012).

WALK

Diagram 2 below shows the aspects of why the employees choose to commute by walking.

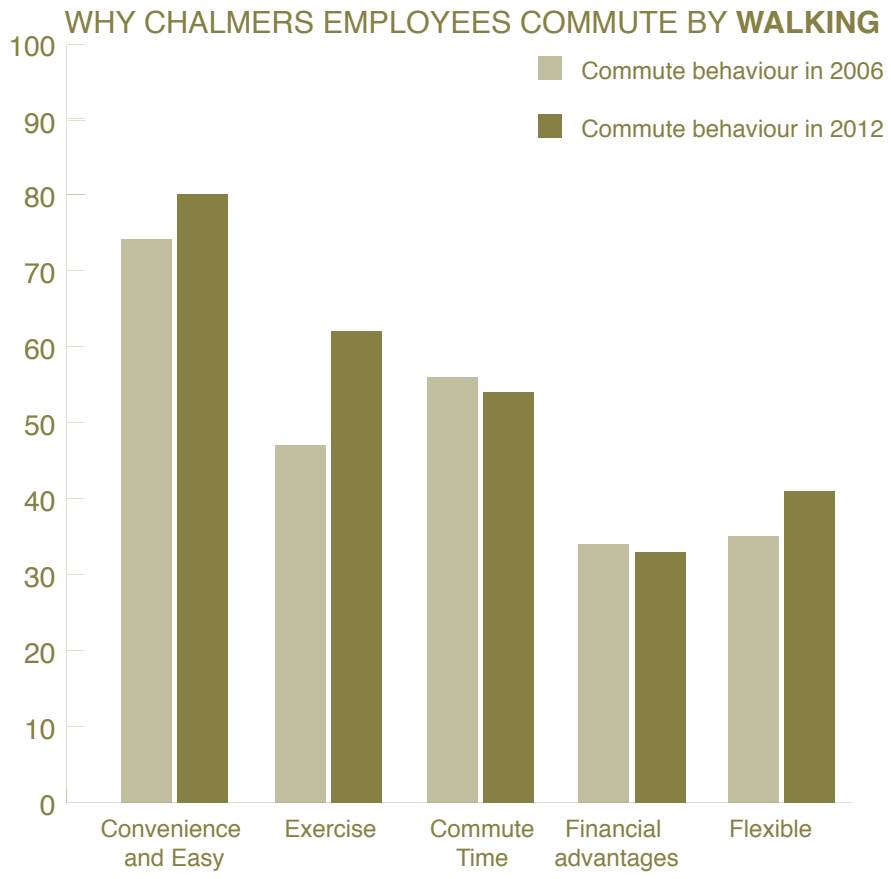


DIAGRAM 2: Percent of why Chalmers employees commuted by walking in 2006 (light green) and in 2012 (dark green) (Chalmers Miljöenhet, 2012), (Linfab/Trafikkontoret Göteborg Stad, 2006).

The largest change in diagram 2 is the attitude to exercise. The aspect exercise increased with more than 10 percent between the years and shows clearly that the willingness to walk is growing. In 2012 were the participators asked what Chalmers could do to encourage more employees to

use walking as their main commute mode. This question was asked without any ready stated answers and a free text square were used instead. Comments like step competitions and free pedometer were common. Many employees also suggested that walking commuters should be reward in forms of an extra health hour or reduction of one working hour at Fridays. Better possibilities to shower and changing rooms were also requested as well as discount on walking shoes (Chalmers Miljöenhet, 2012).

BICYCLE

Diagram 3 below shows the aspects of why the employees choose to commute by bicycle.

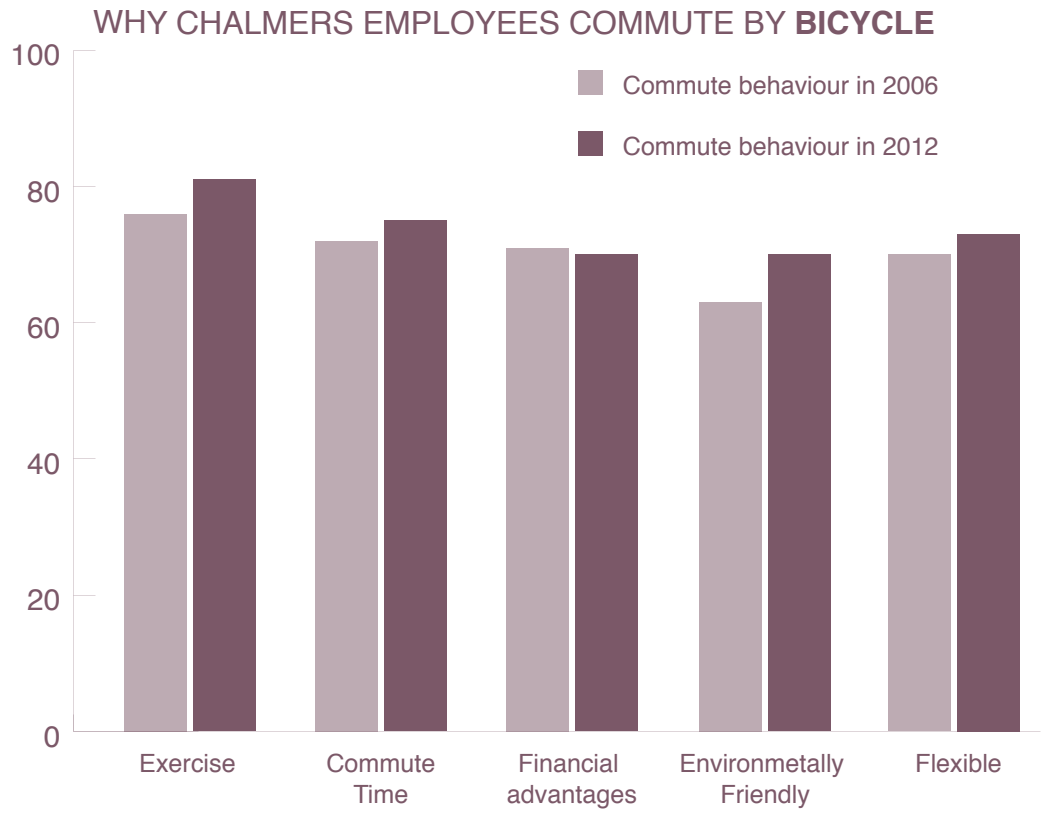


DIAGRAM 3: Percent of why Chalmers employees commuted by bicycle in 2006 (light purple) and in 2012 (dark purple). (Chalmers Miljöenhet, 2012), (Linfab/Trafikkontoret Göteborg Stad, 2006).

There were no major changes in why people choose to use bicycle as commute mode between 2006 and 2012, see diagram 3. However, the aspect exercise was increasing and shows that the willingness to activity is growing here as well, just as in diagram 2 regarding walking.

The employees that used bicycle as their main commute mode were asked what Chalmers could do to support a better bicycle commute. In 2006, 74 percents announce that better bicycle roads could be implemented and in 2012 only 41 percents answered the same. 26 percents in 2006 answered that the parking situation for bicycles could be improved and in 2012, 35 percents announced the same. 20 percents of the cyclist in 2006 argued that showers and locker rooms would be necessary to increase the amount of people commute by bicycle. This percent increased to 46 percents in 2012. In 2012, 56 percents also announce that they would appreciate free bicycle service on campus for employees (Chalmers Miljöenhet, 2012), (Linfab/Trafikkontoret Göteborg Stad, 2006).

CARPOOLING

Diagram 4 below shows the aspects of why the employees choose to commute by carpooling.

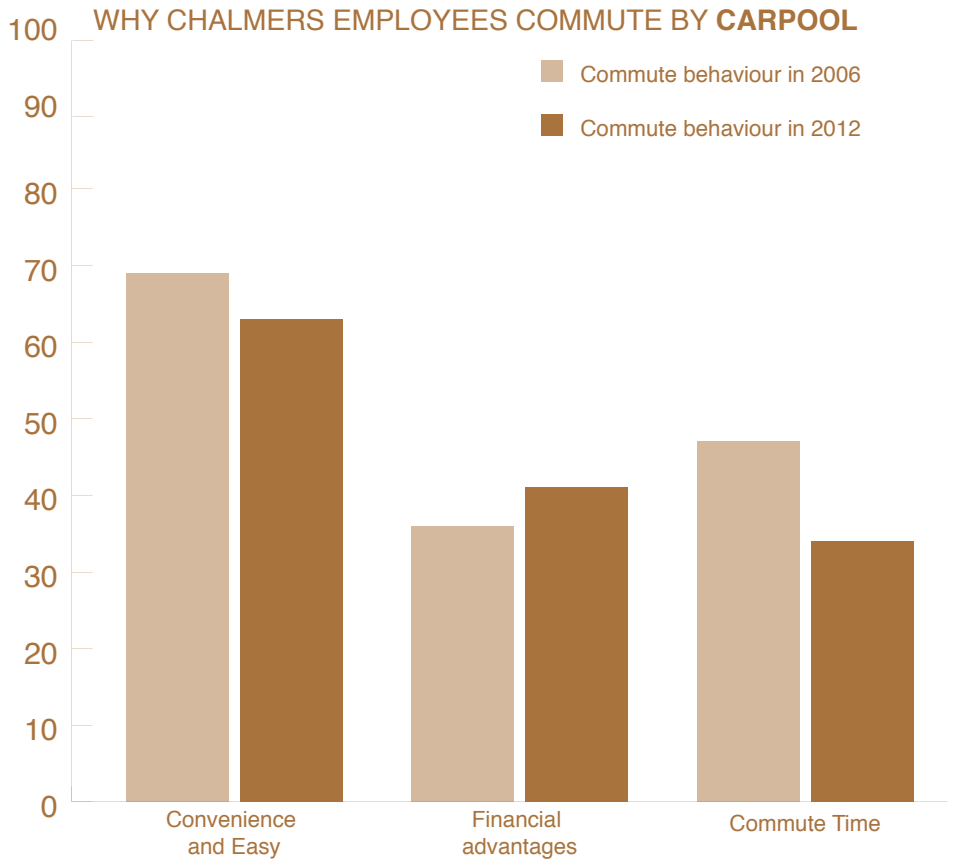


DIAGRAM 4: Percent of why Chalmers employees commuted by carpooling in 2006 (light orange) and in 2012 (dark orange).

(Chalmers Miljöenhet, 2012), (Linfab/Trafikkontoret Göteborg Stad, 2006).

Why people carpool refers to convenience, financial advantages and commute time. The aspects convenience and commute time decreased between 2006 and 2012 when the aspect financial advantages became more important.

SINGLE CAR DRIVERS

Diagram 5 below shows the aspects of why the employees choose to commute by car.

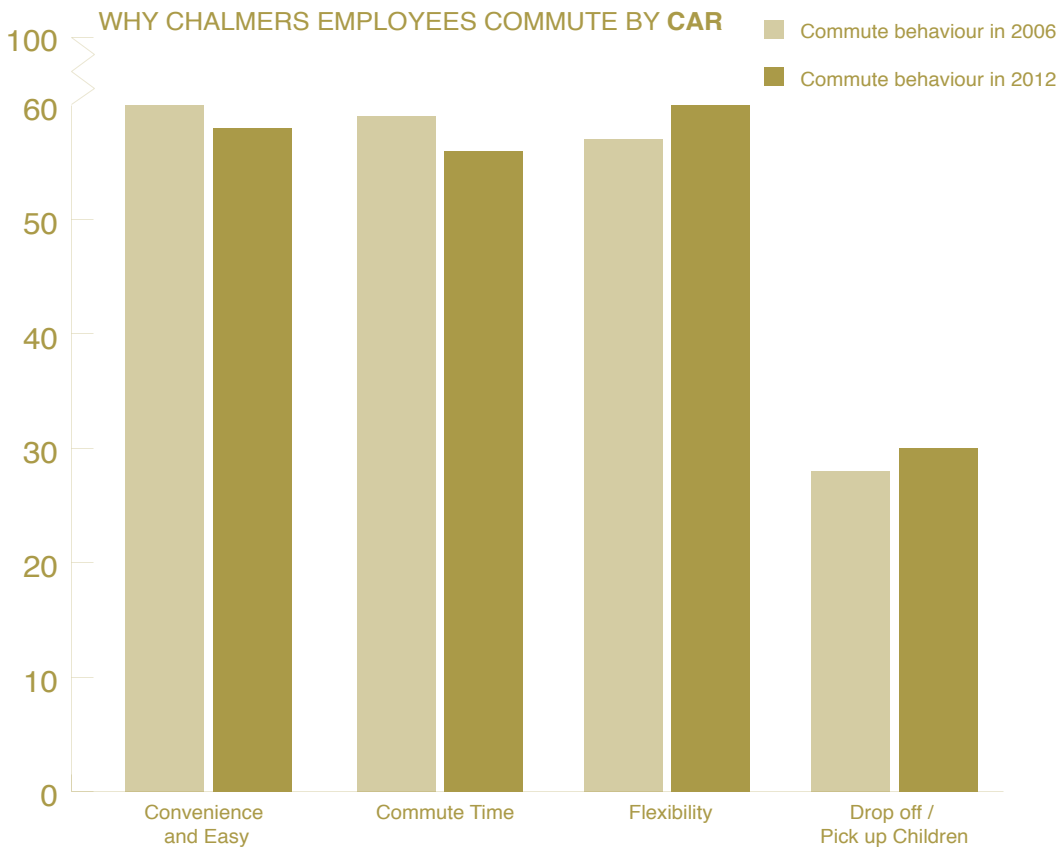


DIAGRAM 5: Percent of why Chalmers employees commuted by car in 2006 (light yellow) and in 2012 (dark yellow). (Chalmers Miljöenhet, 2012), (Linfab/Trafikkontoret Göteborg Stad, 2006).

Convenience and commute time became less important during the years when it comes to why people commute by car. The opposite happened to flexibility and drop off / pick up children which both became more important between 2006 and 2012, see diagram 5.

The car commuters were asked the question what could make them commute less by car. 52 percents in 2006 answered that better public transportation probably would make them stop commute by car and in 2012 were the same respond 62 percents. The ability to work partly from home would change 29 percents of the car commuters commute behaviour in 2006 and 23 percents in 2012. In 2012 the alternative subsidised public transportation cards was included, which 36 percents of the car commuters chose. 19 percents in 2006 respectively 13 percents in 2012 announced that nothing could make them change (Chalmers Miljöenhet, 2012), (Linfab/ Trafikkontoret Göteborg Stad, 2006).

The survey in 2012 also included the question if the car commuter thought they would commute less after the introduction of the up coming congestion tax in the centre city. 40 percents thought they would (Chalmers Miljöenhet, 2012). In general the traffic in the City of Gothenburg has decreased with 7-8 percents since the congestion tax was introduced in 2013 (Göteborg Stad, 2015).

The 2006 survey included a question about parking price at Chalmers. 49 percents of the car commuters paid the parking fee on yearly bases and provide a yearly parking permission and 21 percents used daily parking permits. Just after the survey in 2012 was the price for parking raised with approximately 40 percents. According to Chalmers Fastigheter did this together with the introduction of the congestion tolls decrease the amount of drivers, how much is unfortunately unknown. Chalmers Fastigheter believes that another rise could create negative effects such us a decrease in visitors, whcih is not desirable (Chalmers Fastigheter, 2015).

3.9.2 ARGUMENT FOR COMMUTE CHOICE

All participators in the survey in 2012 were asked the question of why they chose to commute as they did. The answers differed depending on commute mode but were in general equal, see diagram 1 to 5. When putting all arguments together from all different commute modes convenience, commute time and flexibility were the most important aspects (Chalmers Miljöenhet, 2012).

3.9.3 KJ - ANALYSIS OF COMMUTE BEHAVIOUR

To analyse the data from the 2012 commute behaviour survey and benefit from real-life insights derive from the commuters themselves, a KJ analysis was conducted. The most repeated statements and opinions from the survey were clustered into groups. This was manually coded considering the many different terms and expressions the participators used. Each group was named with a headline and organised in the order of most mentioned. Thereafter the headlines were arranged into two main groups, one that was related to infrastructure and hard values and one that concerned attitude and soft values.

The figures below shows the small groups divided into the two main groups and organised in order of most mentioned. Under each group and headline the common key words are mentioned. The first table shows the believes in “What actions are required to change commute mode”. The second table consider “Why they (the participators) sometimes commute with a different commute mode”, see table 11 & 12.

WHAT IS REQUIRED TO CHANGE COMMUTE MODE?

ATTITUDE
INFRASTRUCTURE

	HEADLINE	KEY WORDS
1.	COMPETITION	Step competition, Raffles with lottery, Rewards in forms of free PT pass.
2.	BICYCLE FEASIBILITIES	Free service, Air pumps, Safe parking, Parking with roof.
3.	WORK HOUR REWARD	Extra health hour, Well-care allowance, Reduction of work hour, Possibility to count commute time as working time if e.g. reading papers.
4.	BETTER PT	New bus stops, More frequent routs, Better PT at countryside, Ability to bring bicycle on PT, Faster and more reliable.
5.	HOUSING	Provide housing closer campus, Currently living to far.
6.	NON-PRO PARKING	Higher fees, No employees parking, Stop subsidise
7.	FINANCIAL HELP	Subsidised PT passes, Subsidise purchase of bicycles/electrical bicycles/walking shoes.
8.	BETTER BIKE/ WALKING ROADS	Maintenance, Separated walk/bike/car roads.
9.	SHOWERS/CHANGING ROOMS	Better access, Possibilities to dry clothes.
9.	NO CHILDREN TO DRIVE	Need to drop off/Pick up chilren.
10.	FINANCIAL PUNISHMENT	Congestion tax, Make it harder to drive.
10.	PRO PARKING	Parking closer, Free parking, More parking spots.
11.	WORK FROM HOME	The ability to work from home
11.	LESS STRESS	Less work load

TABLE 11: Kj-analysis over statment mention in the commute survey Chalmers Miljöenhet, 2012).

WHY PEOPLE SOMETIMES COMMUTE WITH A DIFFERENT COMMUTE MODE

ATTITUDE
INFRASTRUCTURE

	HEADLINE	KEY WORDS
1.	MEETING AT DIFFERENT LOCATION	Meeting in beging of the day, Appointment after work, Meeting during day
2.	BROKEN EQUIPMENT	Broken bicycle, Car on service, Cancelled PT
3.	CARGO	Need to carry something heavy
4.	EXERCISE	Need/Want extra exercise
5.	BAD HEALTH CONDITION	Sick, Hurt, Tired
6.	DIFFERENT LOCATION	Sleeping somewere else, Are attending a different location
6.	TIME	In a hurry, Streesed, Need to commute fast
7.	FEELING	Comfortable, Mood
8.	PICK UP/ DROP OFF	Children, Grocerys
9.	NO PT TRAFFIC	Working late, Working during weekends

TABLE 12: Kj-analysis over statment mention in the commute survey Chalmers Miljöenhet, 2012).

3.9.4 PAIN-POINTS ANALYSIS

For the five most common commute modes a pain-point analysis was conducted. The pain-points were analysed from the KJ-analysis which statements derive from Chalmers commute behaviour survey in 2012. The analysis first involved description of potential pain-points or barriers before using a specific commute mode or during the use of the mode. Thereafter the level of how important it is to solve a barrier was valid between large (red), medium (yellow) and small (green). Current actions to solve these pain-points made by Chalmers were also stated.

PAIN-POINTS DURING USE OR REASONS FOR NOT USING MODE	BARRIER	CURRENT ACTIONS MADE BY CHALMERS TO AVOID PAIN-POINT
WALKING		
Red light	🟢	
Hilly roads	🟢	
No side walk or walking road available	🔴	- Influences the City of Gothenburg to build new walking paths
Sweat and need for a shower	🔴	- Provides showers and changing rooms in many buildings
Distance	🔴	- Provides some students home on and around campus
Have an appointment further away, not within walking distance	🟡	- Provides bicycles to borrow at some departments - Carpool available for free if the appointment has to do with work - There are 2 Styr & Ställ station located at Chalmers
Weather	🟡	
Do not enjoy to walk	🔴	
Not maintained roads	🟡	- Chalmers real estate maintains the roads around campus
Not convenience enough	🟡	- Trying to influence aspects that results in a pleasent walk
Long commute time	🔴	
To much to carry	🔴	
May be hard to get home fast if something unexpected would happed	🔴	
To complicated to pick up/drop off children	🟡	
Not motivated enough	🟡	- Pedometer competition

TABLE 13: Pain-point analysis part 1 of 6.

PAIN-POINTS DURING USE OR REASONS FOR NOT USING MODE	BARRIER	CURRENT ACTIONS MADE BY CHALMERS TO AVOID PAIN-POINT
WALKING		
Not season		
Not feeling safe		- Improving walking roads around campus
Health issues		
Already paid for unlimited public transportation pass		
Already paid for unlimited car parking		
BICYCLE		
Red light		
Hilly roads		
No bicycle roads available		- Influences the City of Gothenburg to build better bicycle roads
Roads with high stress		- Influences the City of Gothenburg to build better bicycle roads
Not maintained roads		- Influences the Gothenburg city to maintain the roads better - Makes sure that Chalmers Fast. maintaines the roads belonging to them
Not feel safe at the road		- Influences the City og Gothenburg to build better and more safe bicycle roads
Distance		
Long commute time		
No parking available		- Building enough bicycle parkings

TABLE 14: Pain-point analysis part 2 of 6.

PAIN-POINTS DURING USE OR REASONS FOR NOT USING MODE **BICYCLE**	BARRIER	CURRENT ACTIONS MADE BY CHALMERS TO AVOID PAIN-POINT
Ability to lock and/or store the bicycle during work	🔴	- Builds safe bicycle parkings with the ability to lock againt a pole
Secure parking during night	🟡	
Sweat and need for a shower	🔴	- Provides showers in some buildings
Need to change clothes	🔴	- Provides changing rooms in some buildings
Wet clothes	🟡	
Weather	🟡	
Bicycle break down	🔴	- Provides bicycle service on campus 2 times a year
No air in tires	🔴	- Provides 3 air pumps on campus Johanneberg
To much to carry	🔴	
To expensive to buy	🟡	
May be hard to get home fast if something unexpected would happed	🔴	
To complicated to pick up/drop off children	🟡	
Have an appointment further away, not within walking distance	🟡	- Provides bicycles to borrow at some departments. - Car sharing available for during work hours - There are 2 Styr & Ställ station located at Chalmers
Not season	🟢	
Not convenience enough	🟡	- Trying to influence aspects that results in a pleasent walk

TABLE 15: Pain-point analysis part 3 of 6.

PAIN-POINTS DURING USE OR REASONS FOR NOT USING MODE	BARRIER	CURRENT ACTIONS MADE BY CHALMERS TO AVOID PAIN-POINT
BICYCLE		
Not motivated enough	🟡	- Bicycle competition
Do not enjoy to cycle	🔴	
Already paid for unlimited public transportation pass	🟡	
Already paid for unlimited car parking	🟡	
PUBLIC TRANSPORTATION		
The accessibility to the bus stop can be far away from home	🔴	- Influences the Västtrafik to build better connections
The ride require a walk from bus stop to work place	🟡	- Influences the Västtrafik to build better connections
Change of public transportation mode may be require to reach destination	🟢	- Influences the Västtrafik to build better connections
The willingness to pay do not match the actual price	🔴	- Offers the ability to purchase a subsidised PT pass valid at rout 16/55
The service may be under expectation	🟢	
The arriving time is not always as scheduled	🔴	
The ride may be cancelled	🔴	
The flexibility is not always high depending on the schedule	🟡	- Influences ti flexible working hours
The commute time can be much longer than commuting with other modes	🔴	
How to ride may be unclear (which bus lines to chose)	🟡	- Provides personal guidance if requested

TABLE 16: Pain-point analysis part 4 of 6.

PAIN-POINTS DURING USE OR REASONS FOR NOT USING MODE	BARRIER	CURRENT ACTIONS MADE BY CHALMERS TO AVOID PAIN-POINT
PUBLIC TRANSPORTATION		
May be hard to get home fast if something unexpected would happed	🔴	
The ride may be consider as too crowded	🟡	
To much carry	🟡	
To complicated to pick up/drop off children	🟡	
The frequencies of routs are not high enough	🟡	- Collaborate with the provider of public transport
No flexible work hours obstruct to match a ride	🟢	- Provides the possibility to flexible working hours if possible
Need to commute to different location where PT does not cover	🟡	- Provides car sharing on campus
Already paid for unlimited car parking	🟡	
DRIVING / CARPOOLING (includes driving constrains as well)		
Red lights and thereby traffic jams	🟡	
High gas prices	🔴	
High parking prices	🔴	- Part of the parking price is subsidised
No parking spots available	🔴	- Building new and more parking areas
Does not always implicate parking next to the work place and require a walking after parking	🟡	- Building a new parking garage close to the new Science park Johanneberg
If heavy traffic, the ride can take much longer than alternative commute modes	🟡	

TABLE 17: Pain-point analysis part 5 of 6.

PAIN-POINTS DURING USE OR REASONS FOR NOT USING MODE **DRIVING / CARPOOLING** (includes driving constrains as well)	BARRIER	CURRENT ACTIONS MADE BY CHALMERS TO AVOID PAIN-POINT
No increase in health		
Not environmentally friendly		- Provides charging for electrical vehicles for free
No possibility to work during commute time		
Not relaxing		
No charging station for electrical vehicles available		- Provides charging stations at campus
High congestion toll fees		
Already paid for unlimited car parking		
Do not have anyone to ride with		
Not flexible, cannot leave whenever		- Provides car sharing cars at campus
No benefits except for cheaper gas and car-costs		
Parking is not subsidised		
Prefer to ride alone		

TABLE 18: Pain-point analysis part 6 of 6.

CHAPTER 4
DISCUSSION

There are large differences between Stanford and Chalmers when it comes to geographic such as distances, location and climate. However the main problem and constraint seems to be similar. The both universities have, or will carry soon, challenges with transporting their employees with a low impact on the environment. At the same time, the employees have comparable constraints regarding what aspects that are important to prefer a commute mode. This implies to convenience, flexibility and commute time. Also barriers related to private and professional schedule and e.g. need for good bicycle facilities address both of them. Since Stanford has a well-developed program regarding mobility management there are many actions Chalmers could learn from and implement on a local level. Down below some important aspects are discussed regarding what was found in part I of the study.

It is reasonable to say, that there currently is a bicycle trend around the world. People are willing to spend more money on a good bicycles and bicycling has become a life style. The study also showed that Chalmers employees are willing to use bicycle as commute mode. This requires safe storage possibilities. If Chalmers would offer the employees a safe way to store their bicycle could increase the amount of employees investing in a good bicycle or a e-bicycle, which would decrease the barrier for hilly roads. By combining this with better information about shower possibilities could increase the amount of employees commute by bike.

Important to consider during movement and implementations for sustainable commuting is that most people are not always commuting with the same mode. Today there are no possibilities to combine commute modes in an accessible and affordable way. This may be a reason of why people sometimes commute with a mode that actually is not the most suitable for the situation.

By study the amount of parking permits sold by Chalmers last year, accords to at least 10 percent of the Chalmers employees drove on regular bases regarding the 318 yearly parking permits sold. 115 employees, equivalent to 3,5 percent, commuted regular by car for half a year. By an assumption that everyone that purchased a monthly pass bought it 3 times during the year equals to that 599 employees drove on regular basis for 3 months (1797 permits sold ÷ 3 months). Those numbers shows that many employees do drive once in a while to work, the daily permits are not even included. If it would be possible to decrease the frequency of driving and replace them with alternative commute modes would contribute to a large difference.

It is reasonable to believe that frequency of driving could decrease if it would be possible to combine different commute modes and their payment in an easy way. The ability to combine different commute modes depending on the situation would make alternative commute modes more accessible and increase the usage.

Previous changes in parking price, both at Stanford and Chalmers has shown that this has an effect on choice of commute mode. If the will is to decrease the share commuting by car, could an increase in parking price be an option. Chalmers Fastigheter believes though, that if the parking prices would rise too much, Chalmers could become unattractive for visitors and since Chalmers has a vision of great collaboration between the society and the industry is this not desirable. Stanford solved this dilemma by providing guest parking at attractive locations around campus as well as special payment, something that Chalmers should consider as well.

A difference that matters between Stanford and Chalmers is that Stanford has the possibility to provide free and subsidised alternative commute modes due to different legislation, which support sustainable actions. A change in the Swedish legislation might benefit a change towards more sustainable modes as well. However, there are possibilities to promote non-motorised commute mode where commute tickets are not required. The majority of Chalmers employees live within an 8 km distance. 56 percent of the employees have less than 8 km to commute on way, 24 percent have between 8 km and 20 km and 20 percent have more than 20 km to commute one way (Chalmers Miljöenhet, 2012).

It is reasonable to say that most people that have less than 8 km to commute, could either use walking or bicycle as commute mode (Kidd, 2015). Figure 16 below show roughly within which areas it is possible to commute by walking (inner green circle, 2 km from campus) and by bicycle (purple circle, 8 km from campus) with Chalmers campus Johanneberg as a base.

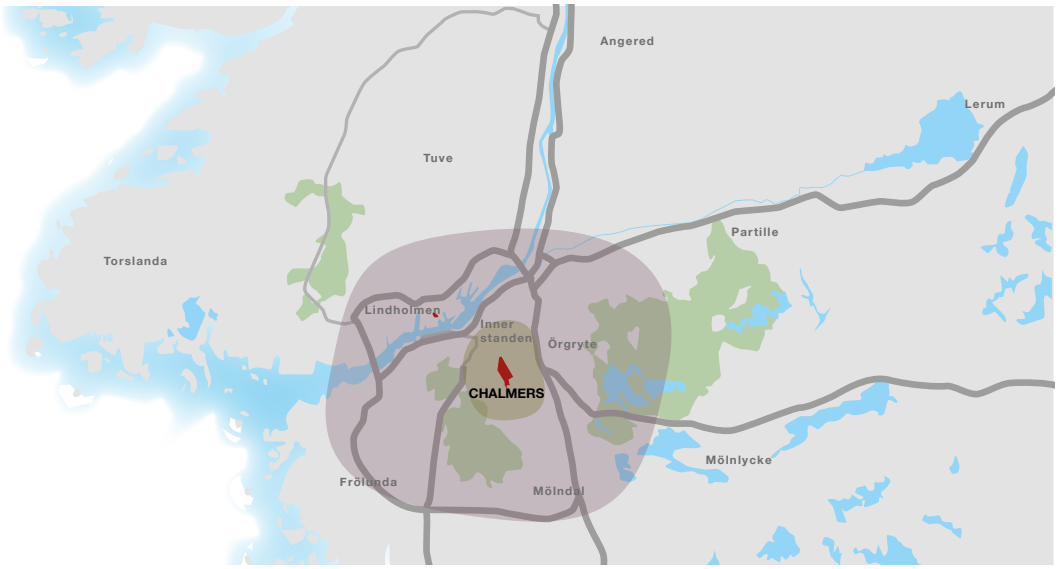


FIGURE 16: Map showing within which distances it is reasonable to walk (green) and cycle (purple) in relation to Chalmers campus Johanneberg (Illustrated by author, 2015).

As mention in chapter 3.9.1 and shown in the figure 14 below did 36 percent of the Chalmers employees commuted by bicycle or walk in 2012. By comparing this with the commute distance, would it be possible to increase the percent of employees cycling or walking to 56 percent. It is reasonable to say that employees living within 8 to 20 km could use public transportation as commute mode, which equals 24 percent. The reminding 20 percent, which have more than 20 km to commute one way, might need to commute by public transportation, car, carpooling

or combined commute mode. In 2012, approximately one third of all employees that commuted by car carpooling. If one third of the 20 percent that have more than 20 km to commute would carpool would this equal 6 percent. If 4 percent of the reminding 14 percent would use public transportation as commute mode would the percent that commute by single car driving decrease to only 10 percent, see figure 14.

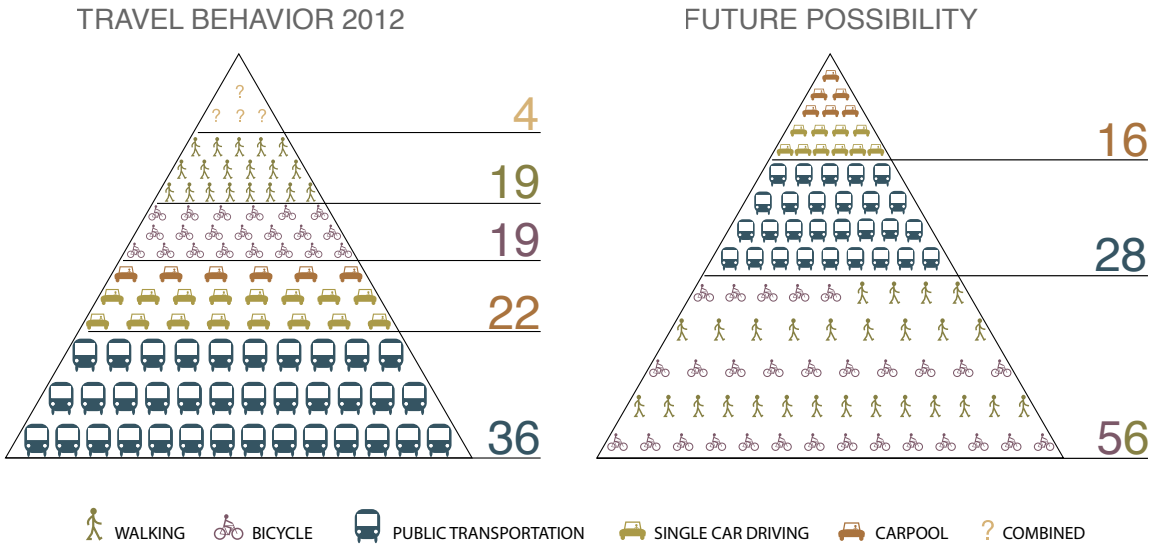


FIGURE 14: Percent of how Chalmers employees commuted in 2012 and what would be possible (Illustrated by author, 2015).

There is a chance that Chalmers's employees have a similar attitude to change commute mode as Stanford's employees. The focus group study made by Stanford in 2015 found that many of the current employees have tried most of the different commute modes at least once to find the most preferred one. According to this, it is hard to convince to a change. Therefore it is important to influence all new employees recruited by the organisations operating at Chalmers campus. By influence the individuals with no yet developed routines towards more sustainable actions may have a larger affect than convincing the ones with a deep routed behaviour.

CHAPTER 5
CONCLUSION

While the shares of walkers and cyclist have been constant during the past years at Chalmers, there is a decrease in car commuters and an increase in public transportation commuters. Chalmers car commute share with 22 percent in 2012 is relatively low compared to Stanford. The major concern though, is how to encourage more than 4000 new recruits within Chalmer area to choose sustainable commute modes. Chalmers currently provide different kind of commute services with focus on mobility management but not to the same extent as Stanford.

Since many employees occasionally commute with another commute mode than their regular one, which also includes driving, it is important to find solutions that decrease the frequency to choose driving and simplify the process for choosing alternative commute modes. This indicates that a multi-modal commute plan might be important to meet the needs of the future. If an employee that today commutes by car 5 days a week would start to use PT ones a week and work from home ones a week would make a large difference. To achieve this in reality there is a need to eliminate the potential barriers that occur when changing to an alternative commute mode.

Chalmers and Stanford currently provide many solutions and services that support mobility management and thereby are using existing infrastructure. There is no data available that clarify if those actions are related to the decrease in use of non-sustainable commute modes, but it is reasonable to believe so and should therefore be further developed. Important insights to consider during further development are the main factors found in the study. What influences the choice of

PART II:
DESIGN FOR A CHANGE

CHAPTER 1
INTRODUCTION

This part of the report is based on the findings from Part I. These are used to identify the needs for Chalmers employees regarding commuting and through that develop suitable solutions that help Chalmers to keep their current positive commute split or even to decrease the percents of driving. Diverse methods are used and the solutions are presented in five concepts possible to implement in the near future and three concepts that need major planning and should be seen as visions for Chalmers future regarding commuting.

1.1 LITERATURE REVIEW

A literature review was conducted to gather insights from similar challenges. This was done to get an understanding of related problems and how issues can be solved. Below concepts are described that have been used as insperation during the development of improvents for Chalmers.

1.1.1 CITY PLANNING FOR MULTI-MODAL COMMUTING

To decrease car use in cities it is important to plan cities for greater use of all alternative commute modes. To do so, it is required to design cities for all kind of modes and to encourage the citizens to a more dynamic use of transportation. Leaving the car at home in the morning most often includes the use of many more different commute modes comparing to leave with the car. Without the car is it possible that the user may walk to the coffee shop, use a sharing bicycle to get to the gym and public transportation from the grocery store back home. This is called multi-modal commuting and is necessary for a sustainable future. If the same user would have left his/her home by car would it been more likely that all this subsequent trips would have been completed by car, which is not suitable for a sustainable future. A city designed for multi-modal commuting provides many different one-way commute services where combining commute modes are more convenient (King, 2014).

A city that has made a movement towards multi-modal commuting is Copenhagen. They considered an introduction of congestion tolls to decrease the car traffic and thereby also the emission of green house gases. Since this kind of movement is to deterring a specific behaviour did the city of Copenhagen instead decided to try to encourage another behaviour, to cycle. Nearly 60 percents of all trips in Copenhagen within a distance of less than 5 km were already made by bicycle. 20 percent of all trips over 5 km were made by bicycle and by nuding this number up with additional 10 percent would result in relieving congestion with the same as the toll, but also have a positive impact on the citizens health. This was achived by a large bicycle infrastructure project with focus on suburban commuters, featuring smooth pavement, good lightning, separation from car traffic, safe road crossings, rain shelters, and air pumps (Zinck, 2014).

1.1.2 OCTOPUS

Octopus mainly is a payment system founded in Hong Kong. The system was established to make the payment for the public transits system easier and today the service is extended to all kind of small frequently payments such as fast food and parking (Smart Card Alliance, 2003). It can be filled up with cash or through bank transfer if desired, but the card can be used anonymous and does not have to be connected to a bank account. If the user chooses to register the card as a personal one and the card can be programed and used as a key and special access to connected systems (Smart Card Alliance, 2005). The system has been reward for WITSA Global IT Excellence Award 2006 due to its innovative use of technologies and easiness to pay public transportation (Cohen & Greenwald, 2006).

CHAPTER 2
METHODS

This chapter describes the methods used during Part II of the study. The methods are related to needs identification and idea generation. They were chosen as suitable to find implementations that would be relevant for Chalmers regarding sustainable commuting.

2.1 NEEDS ANALYSIS

To be able to develop suitable solutions for Chalmers employees, it is require to identify their needs. This was conducted by analysing chapter 3.6 Positive aspects and complications with current services, 3.7 SWOT analyses, 3.8 Commute behaviour Stanford and 3.9 Commute behaviour Chalmers. The needs were divided into the four main commute modes, walking, bicycle, PT and driving. This was done since all commute modes have different needs that should be fulfilled to be attractive to use. A general needs group was also created where the needs regarding all commute modes were considered.

2.2 BRAINSTORMING

Brainstorming is a common method to use to come up with new ideas. It allows to not limit the ideas and can help to think in new directions (Johannesson, Persson, & Pettersson, 2004). The identified needs were used as inspiration during the brainstorming session and improvements for each commute mode were handle separated as well as combined in a more general commute approach.

CHAPTER 3
RESULT AND CONCEPTS

As a result from the need identification and idea generation five concepts were developed that would be useful for Chalmers to implement as an action to solve the near future commute issues. These five concepts are classified as Changes For Today and are presented as one vision. Detailed development will be needed before realization. Presentation follows in section 3.2.1-6.

Additional three concepts were developed for later implementation. These were classified as Future Changes. Some concepts require changes in the Swedish law system or/and collaboration between huge actors. These concepts can be seen as visions towards which direction Chalmers should operate regarding sustainable commuting. Presentation follows in section 3.3.

3.1 NEEDS ANALYSIS

The user needs for choosing commute mode.

WALK

Needs for Walking:

- Good weather
- Ability to get fresh after walk
- Distance within 0-2 km
- Carry possibilities
- Free and safe roads
- Possibility get home fast if necessary
- Motivation
- Enjoy walking
- No scheduled appointments further away that current day
- Good health

BICYCLE

Needs for Cycle:

- Good weather
- Ability to get fresh after cycle
- Distance within 0-8 km
- Carry possibilities
- Free and safe roads
- Possibility get home fast if necessary
- Motivation
- A good bicycle
- Safe storage
- Ability to change commute mode if necessary

- Workable bicycle
- Good parking
- Motivation
- Enjoy cycling
- No scheduled appointments further away that current day
- Good health
- Ability to repair bicycle

PUBIC TRANSPORTATION

Needs for Public Transportation:

- Carry possibilities
- Access to a PT line from A to B under commute time 45 min (Sandow & Westin, 2006)
- Access to a bus stop within walking distance 400m (Sandow & Westin, 2006)
- Not too many transfers during ride (completeness)
- Valid PT pass
- Arrive and depart in time
- Trust
- Tight traffic (flexibility)
- Express rides
- Wi-Fi (to be able to work on board)
- Understanding of the system
- Enough space while commuting
- Possibility get home fast if necessary
- Flexible working hours
- Information about departure/arrival
- Enjoy
- Value the service

DRIVING

Needs for Driving:

- A car
- Gas
- Parking space
- Driving licence
- Parking permit
- Not too much traffic
- Maintained roads
- Safe roads
- Enjoy

General needs for Commuting:

- Convenience
- Fast

- Flexible
- Ability to combine different commute modes in a easy way
- Ability to purchase more then one commute mode
- Flexibility to leave whenever
- Flexibility to change commute mode during the day, multi-modal commuting
- The willingness to pay matches the actual price
- Matches both professional and private schedule
- Access to a specific commute mode
- Geographic possible
- Willingness to commute time match the actual commute time

3.2 CONCEPTS

The concepts described below are divided into two groups, Changes for the near future and Future visions. The five concepts developed for the near future consider bicycle facilitators, parking policy, combination of commute tickets, influencing new employees and improvements of internal communication. Figure 1 describes shortly each concept, more detailed explanations follow.

The three concepts designed as future visions are Always Move About, Chalmers Card and Chalmers Spots.

FIGURE 15: Presentation of the five concepts possible to introduce to Chalmers today (Illustrated by author, 2015).

3.2.2 BICYCLE IMPROVEMENTS

BICYCLE

Around 50 % of the Chalmers employees live within a distance of 8 km from campus, a fare distance to use bicycle as commute mode. There is also a worldwide bicycle trend going on and thereby a willingness to buy better and more expensive bikes, including e-bikes, something that Chalmers should take advantage of. Expensive bicycles require a safe storage during the day, which has been a wish from the employees for a long time. There are easy and cheep solutions on the market for this purpose which could be implemented at Chalmers, see appendix 3. These solutions do not require more than roughly four parking spots but would be able to store a big amount of bikes. The storage could be accessible with the employee's key card and provide air pumps and useful bicycle tools inside.

The commute behaviour surveys show that the possibility to bring bicycle on-board public transportation is a big request. Unfortunately this is not possible due to security issues. There are safe solutions in many other cities, including Stanford. Therefore, this should be investigated further to solve it. The ability to bring a bike on-board PT would increase the flexibility and convenience for bike mobility.

To encourage employees to use bicycle as commute mode collaboration with a bicycle store could be shaped. Collaboration like this could include discounted bicycle services or competitive prices on electrical bicycles with an instalment plan.

3.2.3 PARKING POLICY

PARKING

The past has shown that higher parking prices are affecting the usage of the car. Studies made by Stanford prove this and the mobility management approach has similar recommendations.

An alternative could be to give up the monthly and yearly parking permits and make drivers pay every day instead. They would feel the pain and understand the actual price of driving and parking.

Chalmers Fastigheter expresses a fear to rise the parking prices too much. They argue that this could result in a decrease of visitors from external organisations. Stanford solves this potential threat by providing visitor parking, something that Chalmers should consider as well.

3.2.4 COMMUTE COMBINATION

COMBINATION

The existing Chalmers card should connect all different commute modes to support a more flexible way of commuting. The card should supply a subscription for Styr & Ställ, the electrical car sharing Move About, PT pass, parking permit and give access to bicycle storage. Combining all passes in one card would make all commute modes more accessible and convenient.

Not being registered to all existing commute modes is a common barrier before use. He/she would need to go through the registration process before usage would be possible. This decreases the convenience to choose the best and most effective commute mode. Therefore it should be possible to purchase flexible tickets/permits depending on the users professional and private schedule. We need to avoid that users are commuting by car just because they already paid for parking.

To stimulate employees to use PT as their main commute mode and still be able to drive if necessary, a customized PT pass could be designed. This could include part-time PT and 4 discounted daily car-parking permits per month.

The Chalmers card could easily be connected to the employee's salary and the cost for commuting could be deducted each month.

Transporting heavy goods is a common reason to choose the car. A frequent situation is grocery shopping. To solve this everyday task promoting home delivery services could be an option. Long-term contracts with service companies could guarantee special prices for Chalmers employees.

3.2.5 NEW EMPLOYEES

NEW EMPLOYEES

Creating good behaviour in a smooth way can be to affect the ones that still haven't created a behaviour or routine. Inspire new employees and steer them in the right direction increases their chance to choose a sustainable commute mode.

Preregistration of all commute modes to the Chalmers card and offer it to all new employees would make this decision easier. The card could also include free service on Styr & Ställ, the car sharing Move About and PT for the first 14 days.

Stanford's has a new employee program to inform about alternative commute modes. This should be implemented at Chalmers as well. Each department could assign a commute ambassador to be responsible for informing about alternative commute modes. Basic information about the commute services should also be accessible on Chalmers internal network.

3.2.6 INTERNAL COMMUNICATION

INTERNAL COMMUNICATION

Employees do not have enough knowledge about all commute services Chalmers provides. Therefore, the internal communication needs to be improved. One solution would be the commute ambassador, mentioned in part 3.2.5. He/she could become the link between Chalmers employees and the service providers to communicate changes, improvements, wishes etc.

In the beginning of each semester a specific information campaign could be made on the internal webpage. This campaign could inform about existing services, bicycle feasibilities, shower locations, smaller user-stories and special offers could be provided. The main purpose of the campaign should be informing about the diversity of the different commute possibilities and their environmental footprint.

For increasing the number of users or the awareness of certain services, special offers could be provided. For example the electric car sharing Move About is not used to its full extent so a free month for certain departments could be offered.

3.3 FUTURE CHANGES

Three concepts were developed as visions for future implementations. All of them have a focus on how to spread the Chalmers knowledge and good behaviour to the rest of the society.

ALWAYS MOVE ABOUT

Pick up and leave your Move About car at any charging station

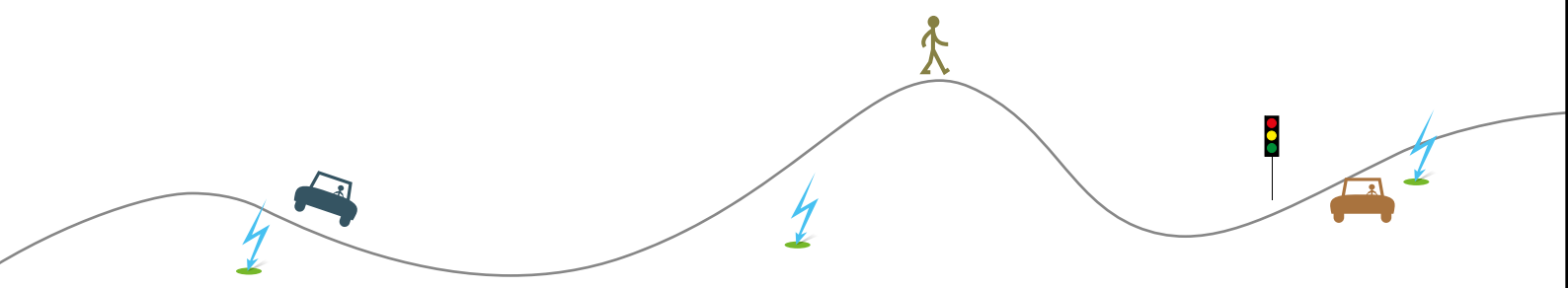
WHY

To create a more accessible car-sharing program that makes Move About more flexible and convenience.

HOW

By develop a system where all the available charging station around the city is accesseible for Move About, would allow the user to be more flexible and spontainiuse.

STIMULATES	KEY ACTORS	BENEFITS
FLEXIBILITY.	COLLABORATION.	MORE FLEXIBLE COMMUTING.
CONVINIENCE.	FLEXIBLE DRIVING.	INFLUENCING SOCIETY.
ACCESSIBILITY.	PLUG-IN HYBRID CARS.	
COMMUTE TIME.		

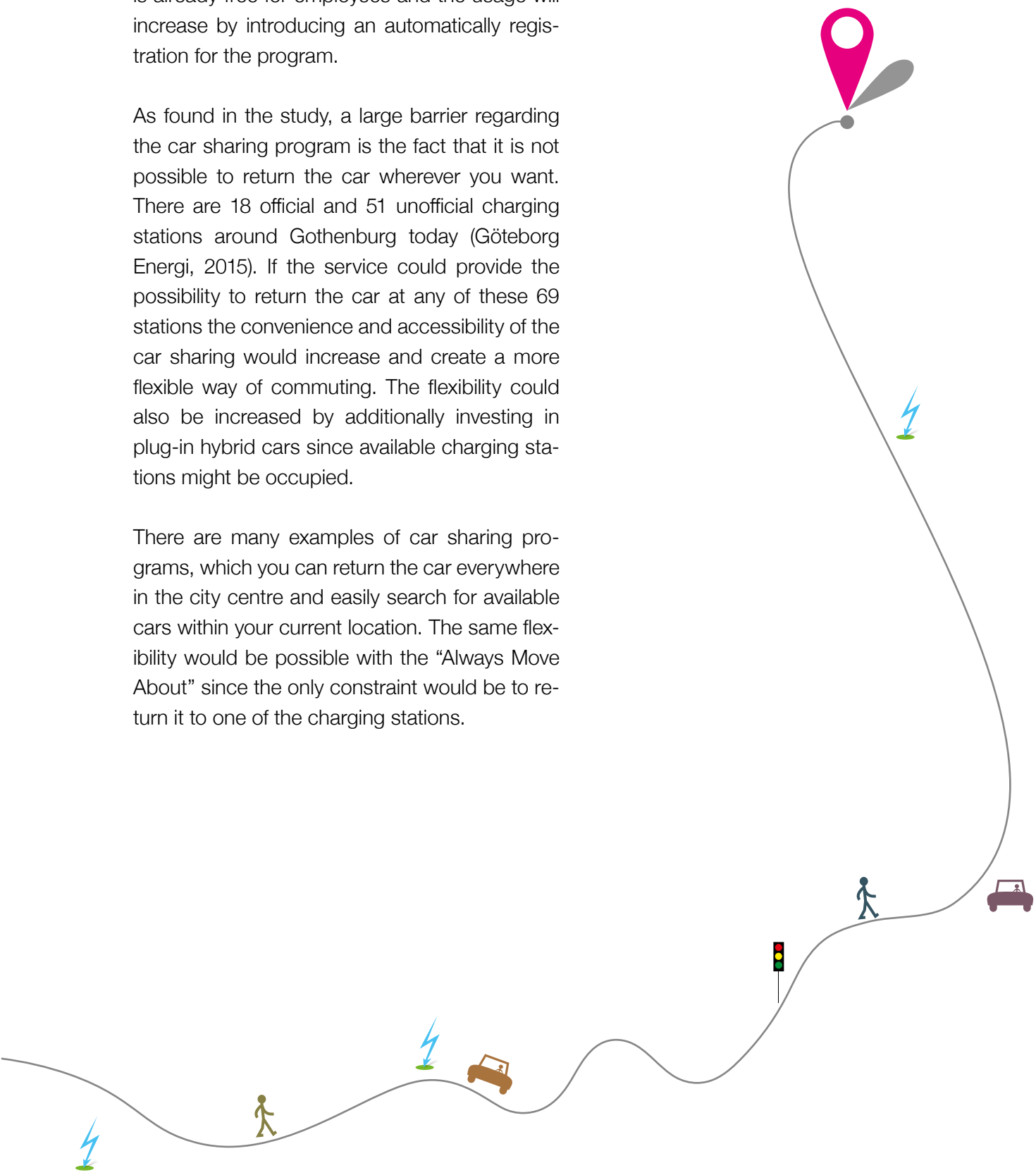


DETAILED DESCRIPTION

The electrical car sharing “Move About”, which is accessible at Chalmers campus, is a great initiative for a sustainable future. The membership is already free for employees and the usage will increase by introducing an automatically registration for the program.

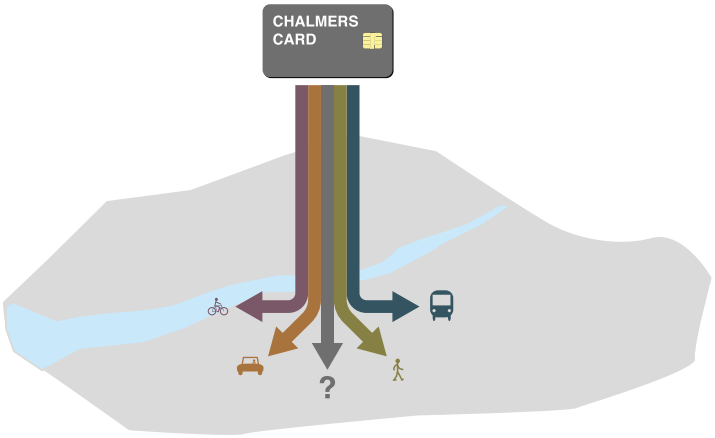
As found in the study, a large barrier regarding the car sharing program is the fact that it is not possible to return the car wherever you want. There are 18 official and 51 unofficial charging stations around Gothenburg today (Göteborg Energi, 2015). If the service could provide the possibility to return the car at any of these 69 stations the convenience and accessibility of the car sharing would increase and create a more flexible way of commuting. The flexibility could also be increased by additionally investing in plug-in hybrid cars since available charging stations might be occupied.

There are many examples of car sharing programs, which you can return the car everywhere in the city centre and easily search for available cars within your current location. The same flexibility would be possible with the “Always Move About” since the only constraint would be to return it to one of the charging stations.



CHALMERS CARD

A commute card where all transportation modes are included



WHY

To simplify commuting and a way for Chalmers to act like Change Agents and influence the rest of the society towards sustainable commuting.

HOW

By offer all employees a commute card as a salery benefit. The card should also include Bring A Buddy program where the employees are able to bring a buddy while commuting.

BRING A BUDDY

A way to influence the society by introducing a Bring A Buddy program, which allows Chalmers employees to bring a buddy for free while commuting.

DETAILED DESCRIPTION

In the Priority Operational Development 2015-2019 report Chalmers has set the goal to create change agents. To achieve a sustainable future it is important to have both employees and students that have the knowledge and behaviour to inspire society towards a more sustainable future. If Chalmers would provide an unlimited free commute pass as a salary benefit to all their employees it could increase the use of alternative commute modes. This would affect the commute behaviour both during work hours and free time. It is a chance for Chalmers to show that they practice as they preach.

A “Bring a Buddy” program could be included in this commute card to spread the good behaviour in a charming way. This program could for instance contain the opportunity for Chalmers employees to use two of the Styr & Ställ bikes during weekends. One for themselves and one for a buddy. By letting others explore the benefits of the service two things would happen at the same time. The advantages of Styr & Ställ would spread and Chalmers would act as change agents. Another proposal could be to include rides on other commute modes where the employee can bring a buddy for free during certain days of the week. This would result in an appreciable benefit for the society and the city would hopefully gain from less individual traffic. Chalmers Card users become change agents.

It would need research and development to refine a program like this. However, the aim of this idea is basically to find ways for Chalmers to spread their good behaviour. Society should gain from knowledge and the behaviour of Chalmers Change agents.

Today it is illegal to provide commute passes to employees for free without paying fringe benefits tax. If the Swedish tax legislation would change to include tax-free sustainable commuting, hopefully more people would be inspired to choose sustainable options.

STIMULATES

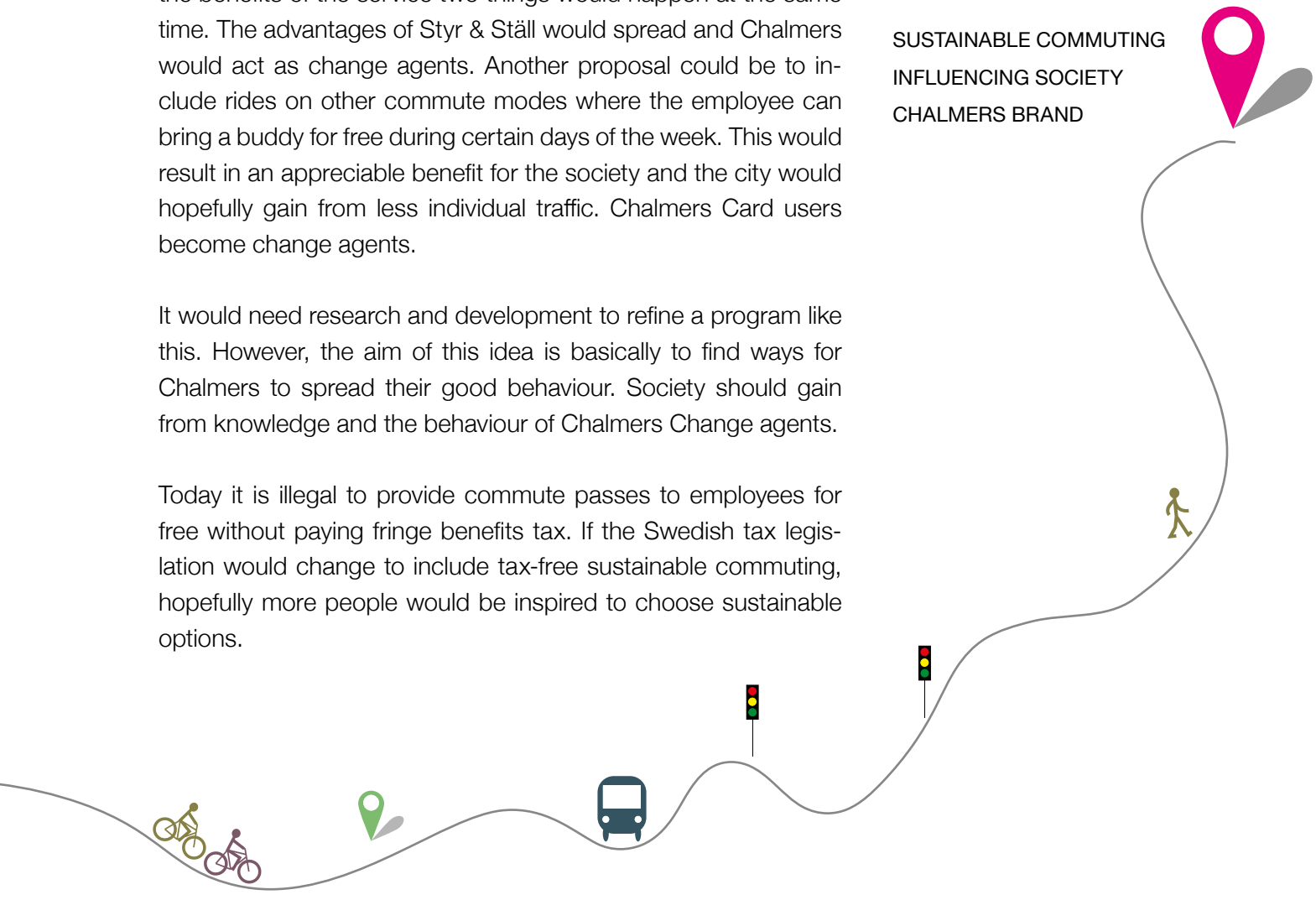
FLEXIBILITY
CONVINIENCE
ACCESSIBILITY

KEY ACTIONS

CHANGE AGENTS
PRACTICE AS YOU PREACH
BRING A BUDDY

BENEFITS

SUSTAINABLE COMMUTING
INFLUENCING SOCIETY
CHALMERS BRAND



CHALMERS SPOTS

Bring Chalmers closer the employees

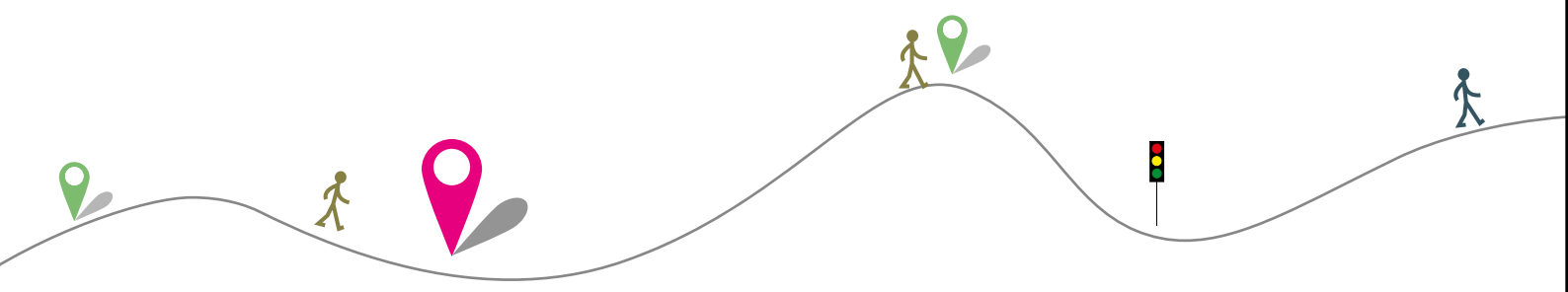
WHY

To increase the accessibility to Chalmers and decrease the need for commuting.

HOW

Introduce smaller workplaces around the city where it is possible to work or study when you do not have appointments related to main campus.

STIMULATES	KEY ACTIONS	BENEFITS
FLEXIBILITY.	SMALLER CHALMERS SPOTS.	EMPLOYEES COMMUTE BEHAIVOUR.
CONVINIENCE.	DECREASE THE DISTANCE BETWEEN WORKPLACE AND HOME.	A MORE INTEGRATED CHALMERS IN THE SOCIETY.
ACCESSIBILITY.	CLOSER RELATIONSHIP WITH INDUSRTY.	
COMMUTE TIME.		



DETAILED DESCRIPTION

Commuting is related to housing. The need for commuting depends on the distance between main work and the employees home. So bringing Chalmers closer to the employees and students would reduce the need of commuting.

This would probably not be desirable by all parties but smaller Chalmers Spots around the city could increase the accessibility and decrease the need of commuting, which is the main goal of mobility management.

Chalmers Spots could be smaller workspaces where both, employees and students could meet up when they do not have any specific appointments related to the main campus. The spots should be spread around the city to decrease the distance of commuting. Employees should be able to attend an open workspace with students but also be able to have separated employees workspaces. Students should be able to visit the Chalmers Spots for studying but also to meet employees and students belonging to different departments. Modern technology like smartphones with position detection could make it possible to find the closest Chalmers Spot for all participants of a certain meeting purpose.

By locating these Spots nearby the local industries and implement them as a part of larger organisation parks the education could relate closer to the industry and the industry would get an easy access to fresh thinking students, something that is valuable for future growth. The intention should not only be to bring Chalmers closer to where Chalmers people are living, but rather create a more dynamic education where interdisciplinary encourages future solutions which fits in to a sustainable society.

It is important that the Chalmers Spots should not replace the main campuses. They should become an additional workspace and a way to mix students, employees and knowledge between departments and institutions to enter new ways of innovation.

CHAPTER 4
DISCUSSION AND CONCLUSION

To affect peoples choice of commute mode you need to make sure that the modes are perceived as convenient, fast and flexible. This was the main finding from Part I and was considered during the development of the eight concepts in Part II.

The concepts regarding bicycle facilities, combination of tickets, Always Move About, Chalmers Card and Chalmers Spots are all connected to convenience and flexibility but also contribute to larger accessibility regarding commuting. Accessibility is the core aspect applied in mobility management, which is the theory that present during this study.

A main approach used in mobility management is greater information and campaigns. The concepts referring to new employees, internal communication and the program Bring A Buddy are all actions to spread information. Higher parking prices for cars and provide different access to parking are also often used in mobility management. According to this, the concepts support the theory.

Stanford provides services and incentives that have been redesigned for suitable use at Chalmers. Stanford arranges a program to influencing new employees commute behaviour. This is repeated in the implementations suggested for Chalmers. The Commute Buddy program supplied by Stanford influenced the creation of the Bring A Buddy program but on a broader level. The Bring A Buddy program allows Chalmers to also influence a better commute behaviour external and thereby an opportunity to act like change agents around the city.

To include an unlimited commute card in the employee's salary is an imitation from Stanford's free or subsidies transit passes. To make this possible at Chalmers a change in the Swedish law is require, which need further research. It is reasonable to believe though, that a change like this would benefit Sweden and the environment in a long-term perspective.

What both universities should deeply consider to investigate further is a way to combine payment for diverse commute modes. This study, together with the focus group study made by Stanford, confirm that a movement like the combination concepts would most likely change many peoples commute behaviour. If we want to make commuting more accessible and more convenience, an easy payment is necessary for the future.

The same applies to Chalmers Spots. If we want to stimulate accessibility, commute time, flexibility and convenience but at the same time influence towards new possibilities and better internal and external collaborations, do we have to open up for new perspectives and question how tomorrow's universities could look like. The Chalmers Spots would integrate Chalmers in the whole City of Gothenburg and the chance to act like change agents would increase. All concepts

also open up for better possibilities to develop towards a multi-modal commute environment.

Due to limited time, the concepts presented were not evaluated or tested in real life. Before realization is possible there is a need for further investigations and detail planning. Prototypes should be made and repeated iterations are necessary to validate the quality and usability of the concepts.

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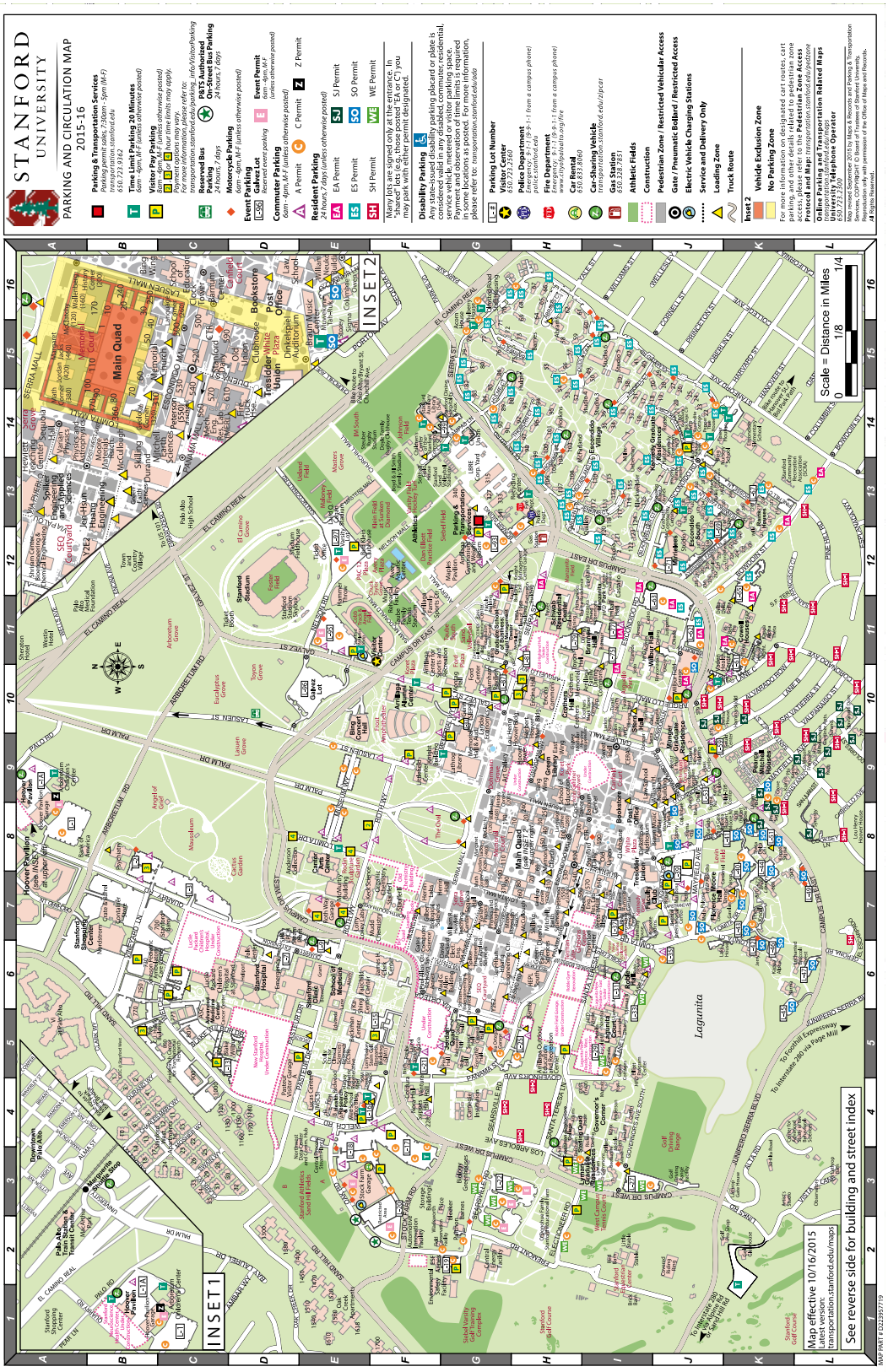
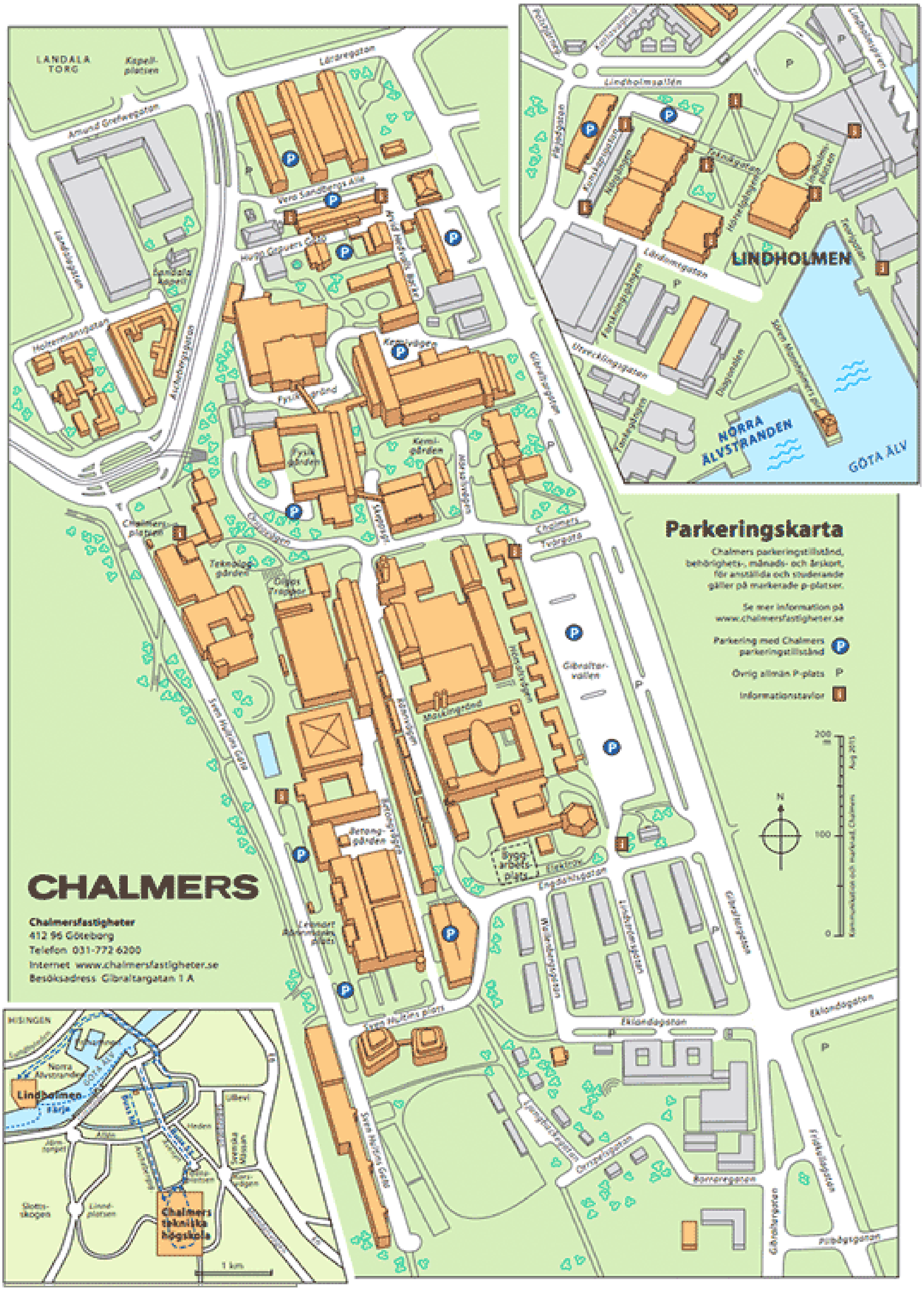
Appendix I

Map over parking possibilities at Stanford campus (Stanford Parking & Transportation Services, 2015).



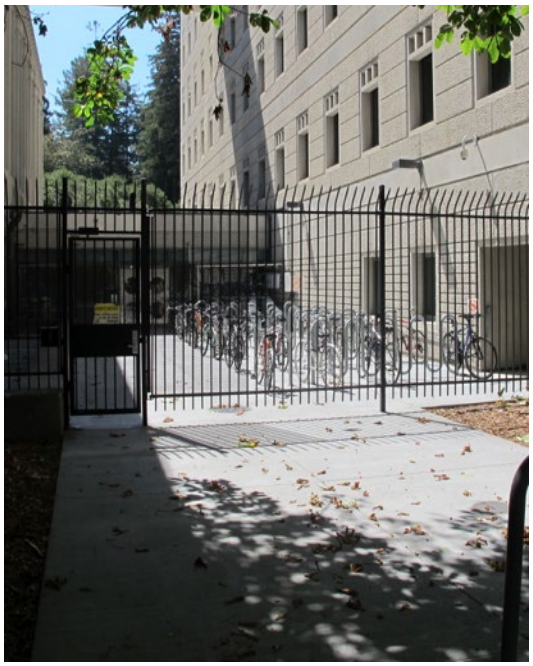
Appendix II

Map over parking possibilities at Chalmers campus (Chalmers Fastigheter AB, 2015).

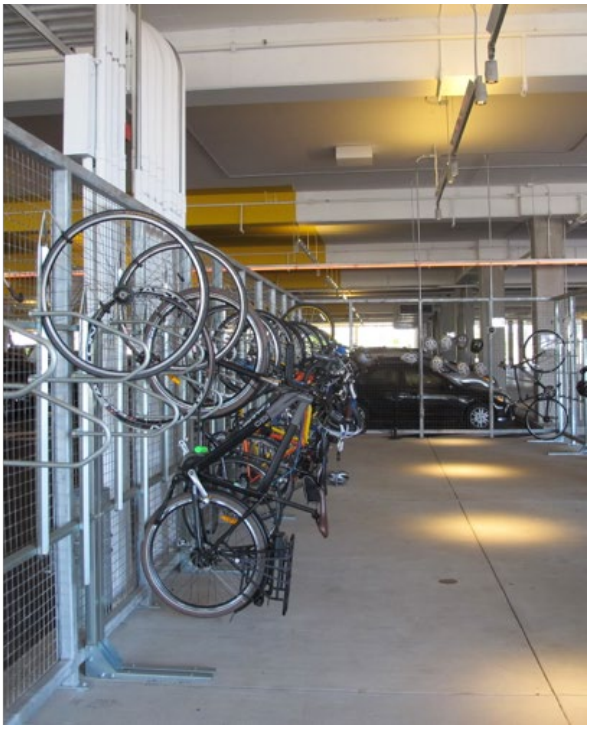


Appendix III

Solutions of safe bicycle storage founded at University of California, Berkeley and Facebook Palo Alto.



University of California, Berkeley (Photo taken by author, 2015).



Facebook, Palo Alto (Photos taken by author, 2015).