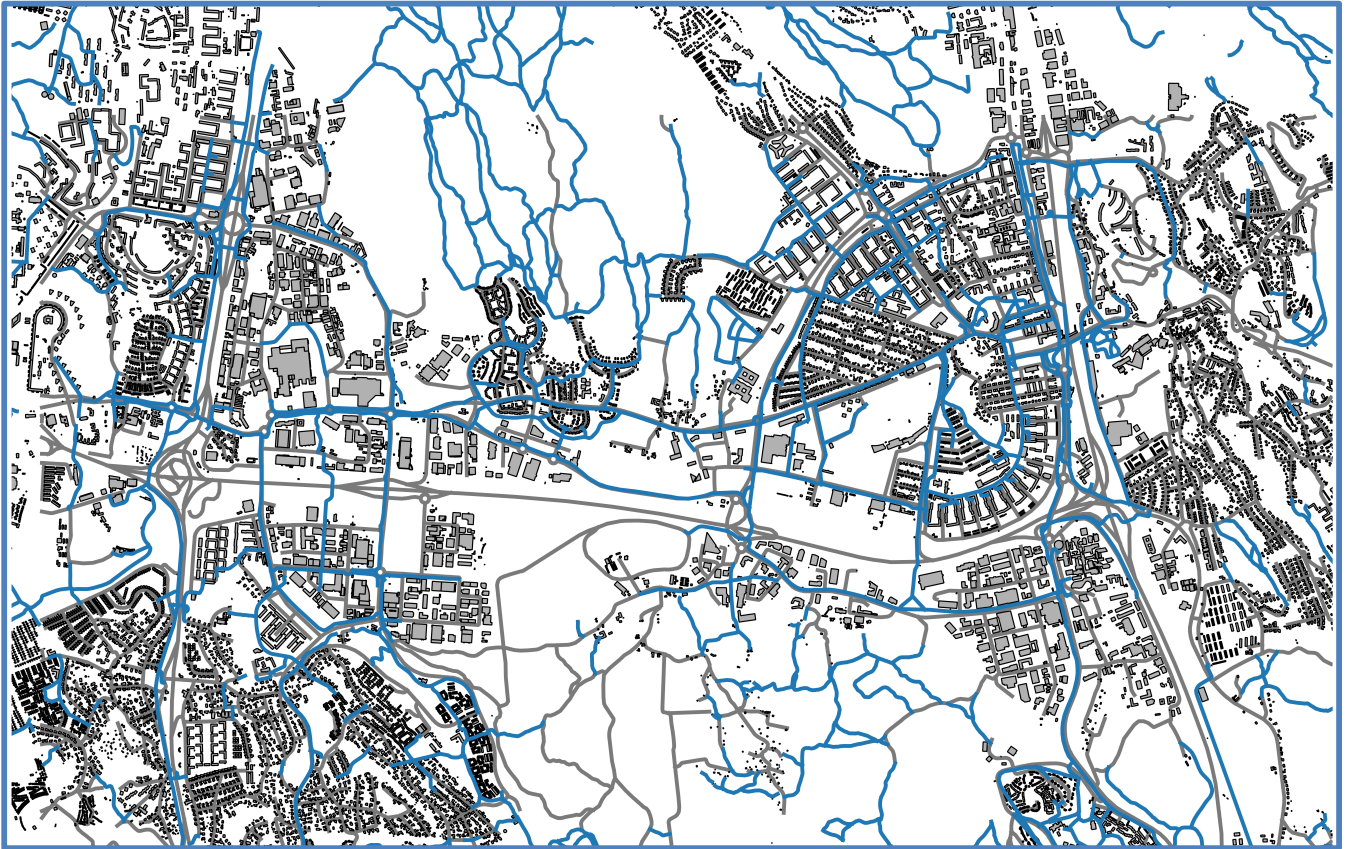




**CHALMERS**  
UNIVERSITY OF TECHNOLOGY



# **Increased bicycle use in Fässbergsdalen**

A case study to investigate appropriate bicycle measures in an expanding project area

Master's Thesis in the Master's Programme Infrastructure and Environmental Engineering

IDA ALAINENTALO  
HANNA NILSSON

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Department of Civil and Environmental Engineering  
*Division of GeoEngineering*  
*Road and traffic Research Group*  
CHALMERS UNIVERSITY OF TECHNOLOGY  
Master's Thesis BOMX02-16-52  
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Examensarbete BOMX02-16-52/ Institutionen för bygg- och miljöteknik,  
Chalmers tekniska högskola 2016

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Cover:

A map of the studied area Fässbergsdalen with the bicycle paths marked with blue lines, developed in QGIS by Hanna Nilsson with data from Lantmäteriet.

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## ABSTRACT

Sustainable transportation is a main part in the urban planning today and tomorrow, and this includes cycling as an alternative. Cycling has many benefits, such as better health, more attractive environment and a simple and lower cost of mode of transport. Fässbergsdalen is an expansive area around the route Söderleden; divided between the municipalities of Gothenburg and Mölndal and consisting of both residential and industrial areas. In the current situation, traffic on Söderleden is a problem and it is expected to increase with the planned expansions that are planned during the approaching years in the area. An increase in traffic can result in a complicated traffic situation and risk of accessibility problems on Söderleden. Trafikverket is responsible for the route and together with Gothenburg and Mölndal a declaration of intent with targets and actions for Fässbergsdalen. A reduction of the share of car traffic has to be changed in the current situation in favour of an increase in trips made by public transport, bicycle and pedestrian. Hence, this thesis has investigated appropriate measures to increase of bicycle use, with focus at short trips of residents and commuting in the area. Studies of general information of bicycle use, traffic strategies in Gothenburg and Mölndal and examples of bicycle measures have been performed for deeper knowledge. The proposed measures has been formed by the gained knowledge and a situation assessment with selected methods, as SWOT analysis, web survey to existing cyclists, comparison between car and bicycle routes and analysis of a previous travel habits survey etc. This resulted in a problem description and a potential regarding bicycle use in the area. The measures are presented according to the Four Step Principle, where advocacy and campaigns is seen as an important part of getting people to start cycling. A satisfied and good infrastructure to ensure preconditions f, physical measures is also needed. As step 1 and 2, a continued and expanded work with existing projects “På egna ben” in schools and “Bicycle Friendly Workplace” in companies are suggested in the thesis. Physical actions in step 3 and 4 are complementary measures as separation between pedestrians and cyclists and improved lighting for increased safety. Additionally, an expansion of the missing links in the bicycle network is proposed in order to achieve improved continuity. These measures are assessed in this thesis, to achieve the target to increase cycling in Fässbergsdalen, but a continuous effort is required.

Key words: bicycle, bicycle measures, traffic, sustainable transport mode





## Ökad cykel användning i Fässbergsdalen

En fallstudie för att undersöka lämpliga cykelåtgärder i ett expanderande projektområde

*Examensarbete inom masterprogrammet Infrastructure and Environmental Engineering*

IDA ALAINENTALO

HANNA NILSSON

Institutionen för bygg- och miljöteknik

Avdelningen för geologi och geoteknik

Forskargrupp Väg och trafik

Chalmers tekniska högskola

## SAMMANFATTNING

Hållbara transporter är en viktig del i dagens och framtidens samhällsplanering. Till detta hör cykling som ett alternativ. Cykling har många positiva effekter, som till exempel bättre hälsa, attraktivare omgivning samt att det är ett enkelt och billigt transportmedel. Fässbergsdalen är ett expansivt område runt Söderleden, delat mellan Göteborgs- och Mölndals kommun och består av både bostads- och industriområden. I dagsläget är trafiken på Söderleden ett problem och den förväntas öka med de planer och expanderings som finns. En ökning av trafiken kan leda till en ytterligare försvårad trafiksituation och riskera framkomligheten på Söderleden, som även är av riksintresse. Trafikverket, som ansvarar för väghållningen av Söderleden, har tillsammans med kommunerna upprättat en gemensam avsikthandling med mål och åtgärder för Fässbergsdalen. En minskning av andelen biltrafik till förmån för en ökning av transport med kollektiv trafik, cykel och gång måste ske för en hållbarare situation. I detta examensarbete utreds därav lämpliga åtgärder för att öka cykelanvändandet i området, med fokus på arbetspendling och korta resor av boende i området. För att få djupare kunskaper har studier av allmän information om cykelanvändning, trafikstrategier i Göteborg och Mölndal och exempel på cykelåtgärder genomförts. Bakgrunden till de föreslagna åtgärderna ligger i den erhållna kunskapen samt en genomgripande nulägesanalys av området med valda metoder som en SWOT-analys, web enkät till befintliga cyklister, jämförelse mellan bil- och cykelfärdvägar och analys av en tidigare relevansundersökning. Nulägesanalysen resulterade i en problembeskrivning samt potentialen som finns i området gällande cykelanvändning. Åtgärderna presenteras enligt fyrstegsmetoden, där påverkansarbete och kampanjer ses som en viktig del för att få folk att börja cykla. Det krävs även en grundlig och tillfredsställd infrastruktur för att säkerhetsställa förutsättningar för cykling, vilket innefattar fysiska åtgärder. Som steg 1 och 2 föreslås ett fortsatt och utökat arbete med de redan befintliga projekten "På egna ben", i skolor, samt "Cykelvänlig arbetsplats", på företag. Fysiska åtgärder i steg 3 och 4 ses kompletterande åtgärder som separation mellan gående och cyklister och förbättrad belysning för ökad säkerhet. Utbyggnad av saknade länkar i cykelnätet läggs som förslag för att få en ökad kontinuitet. Dessa åtgärder bedöms enligt detta arbete ha störst effekt för att få en ökad cykling och förhoppningsvis nå målen, men det krävs ett kontinuerligt arbete.

Nyckelord: cykel, cykelåtgärder, trafik, hållbart transportsätt

# Contents

ABSTRACT	I
SAMMANFATTNING	III
CONTENTS	IV
PREFACE	VII
1 INTRODUCTION	1
1.1 Background	1
1.2 Aim and objectives	3
1.3 Delimitations	3
1.4 Method	4
1.4.1 Literature study	4
1.4.2 Evaluating the area	5
1.4.3 Investigation of possible measures	6
1.4.4 Discussion and conclusion	6
1.5 Outline of the report	6
2 BICYCLE USE IN THE CITY	7
2.1 Bicycle friendly city	7
2.2 Statistics about bicycle development in Sweden	8
2.3 Reasons to use bicycle or not use bicycle	10
2.3.1 Why people use bicycle	10
2.3.2 Why people do not use bicycle	12
2.4 Potential to increase the bicycle use	13
2.5 The initial situation in Gothenburg	14
2.6 The initial situation in Mölndal	15
3 INCREASE THE BICYCLE USE	17
3.1 Planning regarding bicycle use	18
3.1.1 Users need and assessment situation	18
3.1.2 Policies and co-ordinations	18
3.1.3 Strategies and managing document	19
3.1.4 Means and personnel	22
3.2 Actions concerning bicycle use	23
3.2.1 Conditions for bicycle use	23
3.2.2 Advocacy	24
3.2.3 Implementations	24
3.2.4 Examples of measures	26
3.3 Monitoring	35
4 THE STUDIED AREA FÄSSBERGSDALEN	37

4.1	History	37
4.2	Today	38
4.2.1	The infrastructure and traffic situation	38
4.2.2	Problems	39
4.3	Future plans	40
4.3.1	Plans according to Göteborgs Stad	40
4.3.2	Plans according to Mölndals stad	42
4.3.3	Plans by Trafikverket regarding Söderleden	43
4.4	Travel survey in Fässbergsdalen	43
4.4.1	The residents	44
4.4.2	The employees and the visitors	45
5	THE CYCLING SITUATION IN FÄSSBERGSDALEN	46
5.1	Situation assessment of the area	46
5.1.1	Already implemented measures	46
5.1.2	Analysis of the travel survey	47
5.1.3	SWOT-analysis	48
5.1.4	Web survey about travel habits and bicycle measures	48
5.1.5	Distance to school and every-day facilities	51
5.1.6	Travel route comparison between bicycle and car	53
5.1.7	Analysis of missing links	60
5.2	Problems regarding bicycle	61
5.3	Target for the area	62
5.4	Planned measures	64
6	PROPOSED MEASURES AND ANALYSIS OF THE EFFECT	65
6.1	Bicycle project in schools	66
6.2	Project at companies	67
6.3	Maintenance	68
6.4	Complementary measures	69
6.5	Building new links	69
7	DISCUSSION	71
8	CONCLUSION	75
9	FURTHER STUDIES	76
10	REFERENCES	77
APPENDICES		





# Preface

This report aims to evaluate bicycle measures in the area Fässbergsdalen, in the region of Gothenburg, and it is a result of a Master Thesis at the Department of Civil and Environmental Engineering, Chalmers University of Technology.

The thesis was carried out during the spring 2016 at the consultancy firm COWI by the authors Ida Alainentalo and Hanna Nilsson.

In the thesis during the work process help and advices has been received from some persons. First of all, we would like to thank our supervisor Pernilla Sott, transport planner at COWI. You have been a great help with advices, help with information, meetings and supervision, we are appreciated for taking your time to us. Also the rest of the Infrastructure group at COWI for inspiration, interest in our thesis and showing how to work at a consultancy works. We will give a special thanks to Pär Sköld that involved us in the beginning in this the project.

We would also like to thank all persons that has been involved in interviews and meeting during the thesis project; Anders Pihl at CPAC System, Marianne Graselius at Askims skolan. Extension of our regards will also be to the the reference group with Ulf Bredby at Mölndals stad, Lisa Örberg at Trafikverket and Malin Månsson at Trafikkontoret, Göteborgs Stad.

Following, thanks to our supervisors Gunnar Lannér and Claes Johansson and our examiner Anders Markstedt at, Chalmers University of Technology for guidance and comments.

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Göteborg, June 2016

Ida Alainentalo and Hanna Nilsson

*“Life is like riding a bicycle  
to keep your balance, you must keep moving”  
Albert Einstein, 5 February 1930*

# 1 Introduction

Sustainability is a highly topical subject in the society today; infrastructure and urban planning are main parts regarding sustainability. Regarding the issue about climate change and the increase of congestions in the city, a reduction of the car traffic has to be changed in favour to trips made by public transport, bicycle and pedestrian. Both public transport and bicycle are more sustainable transports; public transport can take more passengers at the same space with lower energy consumption and bicycle does for example not produce emissions in same grade. Where urbanization, population growth and densification are current, it is important to change the transport mode in sustainable and socio-economic aspects. Sweden is an urbanized country, about 85% of the citizens today live in urban areas (Svanström, 2015) and especially in the metropolitan regions there are an ongoing densification.

In Sweden around 8% of all trips are made by bicycle today (Trafverket, 2015). The transport by bicycles has become more important for the local authorities in Sweden and among politicians in the last decade (Göteborgs Stad Trafikkontoret, 2015). Cycling can be positive in the perspectives from the individual person, the city and the society in general. Cities are changing their infrastructure and bicycle is becoming parts in their city plans. Gothenburg and Mölndal have a vision to offer everyone an effective, safe and sustainable mobility (Trafikkontoret, 2014). An important assignment is to create conditions for the transport where each individual's choice is good both for the individual and for the community.

Both Gothenburg and Mölndal have tried to increase the cycling during the recent years, but still having a low amount of trips by bicycle compared to other cities (Göteborgs Stad Trafikkontoret, 2015). Bicycle is not an obvious choice of transportation to work, supermarket, shop and for errands etc. for the citizens. Traffic should be based on this holistic work for the travel choices that are good for the environment and the journey should be affordable easy and pleasant for the individual.

## 1.1 Background

The area Fässbergsdalen, in the municipalities of Gothenburg and Mölndal, has developed to an industry and business area along Söderleden; see Figure 1, but also with residential areas along the valley. Thereby there are three defined groups of interest of travel; visitors for shopping, employees commuting to companies and industries and residents in the area.

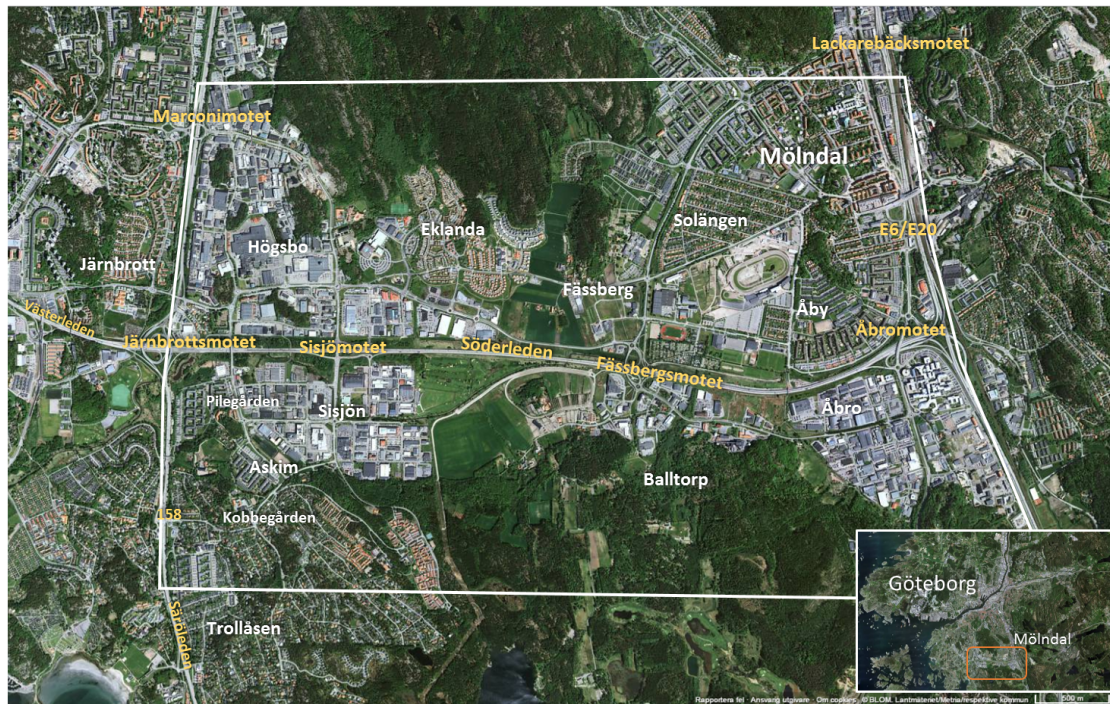


Figure 1 Map of the studied area, © Lantmäteriet (2014).

Further urban densification with expansion of industries and increase of residential areas are planned. The two municipalities in Fässbergsdalen have different interest in the land use. In the area related to Gothenburg almost all land territory is used. Therefore, an increase of the population must be through densification. Contrary to this there are big areas of unused land territory at the area related to Mölndal, which is planned for new expansions (Göteborgs Stad, Mölndals stad, 2012).

An establishment of more businesses, industries and residential will result in more traffic and the traffic is already a problem in the area. Traffic has during the years increased both at national roads and at municipal roads. This generates issues concerning congestion and environmental impact in the area. Söderleden is the main route thru the area and it is a connection for transportation of goods to and from the harbour of Gothenburg. It is also an important circular road for commuting to work, shopping in the area and for residents along the road. The route is a national route witch Trafikverket is in charge of and their intention is to keep the traffic low along Söderleden (Structor Mark Göteborg AB, 2015). Other partners interested in the area are Västtrafik due to the public transport (Göteborgs Stad, Mölndals stad, 2012).

Because of common interests from municipalities of Gothenburg and Mölndal, Trafikverket and Västtrafik, they are working together in a committee to change the distribution of current transport choice in Fässbergsdalen (Göteborgs Stad, Mölndals stad, 2012). Measures and actions to improve the traffic situation by enhancements at Söderleden, expansion of the public transport and an increase of the transportation by bicycle and walking are parts in the project. The committee have set targets for the area; see 5.3 for detailed numbers to reach until year 2035. To achieve the set targets some planned measures by the committee for change in transport mode are already developed, see Section 4.3.

## 1.2 Aim and objectives

A long-term goal by the committee is that the private transport should decrease for the benefit of public transport and transportation by bicycle and walking in Fässbergsdalen.

Therefore, the aim of this thesis is to investigate and evaluate possible measures to increase the use of bicycle transportation in the case studied area Fässbergsdalen. Expected impacts of the measures will be estimated, according to the agreed targets and visions set by the committee. The following questions has been addressed:

- What are the positive and negative aspects in the current situation according to bicycle use in Fässbergsdalen?
- How could the number of people use bicycle increase in the area Fässbergsdalen?
- Are the proposed measures suitable to achieve the assigned targets for Fässbergsdalen?

## 1.3 Delimitations

This thesis focus on the area between Åbromotet and Järnbrottsmotet, see the marked area in Figure 1, around the traffic route Söderleden, called Fässbergsdalen. Specified boundaries have been set up for the thesis to define the studied area. At the north latitude of Söderleden the boundary is between Marconimotet and Lackarebäcksmotet, and respectively in the south it is until Trollåsen in west and to Östra Balltorp in the east.

Further bicycle and walking is often considered collectively in many investigations, but in this thesis only transportation by bicycle was evaluated. The set targets in the letter of intent by the committee for Fässbergsdalen, concerns both bicycle and walking. Because of difficulty to divide the percentage increase between bicycle use and walking, the target will only be applied and generalised for trips by bicycle. Neither public transport will be considered in this thesis, even if it is a sustainable transport mode and brings benefits regarding traffic congestions.

The thesis is covering the topic and aim in general; technical details have therefore not been investigated and treated. Measures in Fässbergsdalen are only evaluated with respect to advantages and increase in bicycle use, due to the aim of the thesis. How the measure should be implemented or who should be in charge of the implementations are not considered. Furthermore, the thesis is not investigating problems with cycling during the construction process in the studied area during the upcoming years. Economic and costs regarding measures has neither been taken into account due to difficulties finding information and make calculations.

Only the target groups of employees and residents in the area have been considered when developing measures. These groups are more likely to change their behaviour and easier to reach than visitors. Also gender has been generalised and differences between genders has not been investigated. Following the time aspect has not been taken into account in terms of long-term goals and short-terms goals. It was considered to be more important to evaluate appropriate measures, rather than when in time the measures should be done.



## 1.4 Method

The process in the project includes four different phases that are illustrated in Figure 2 and further described in sections below. The first phase was a literature study, the second phase was an evaluation of the area by doing a situation assessment and investigate the problems and potential. Developing appropriate measures and analysing their effect in the area was phase three. Finally, the fourth phase included recommendation for increasing bicycle use in Fässbergsdalen in a discussion and conclusion.

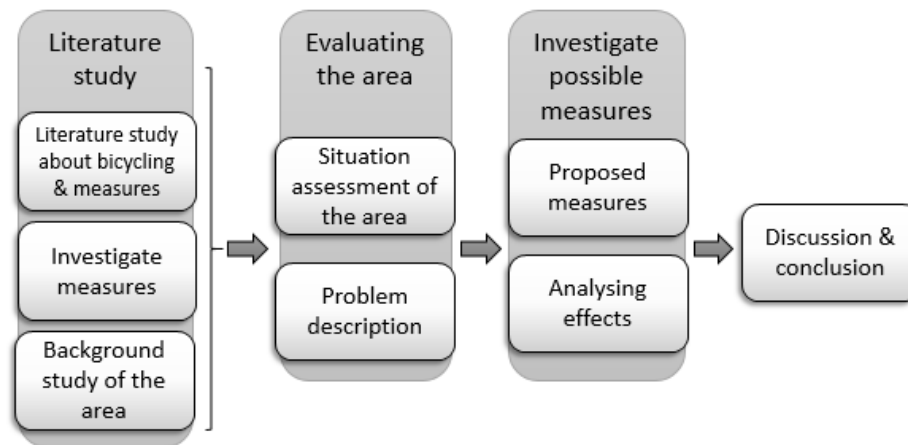


Figure 2 A schematic illustration of the working process in the thesis.

### 1.4.1 Literature study

The literature study in the thesis included reports, handbooks and documents concerning cycling in general and examples of bicycle measures. This was done to receive a deeper understanding and insight of the use of bicycle, how to plan regarding cycling and the background as well as current situation in Gothenburg and Mölndal.

Also background studies about the existing project in Fässbergsdalen and the area in general were done. This included data about the area and its development during the upcoming years and a survey from the Trafikverket regarding travels among visitors, employees and residents in the area. Excursions in the studied area, Fässbergsdalen, were made to get an overview of the area from the view of a cyclist.

Investigations of bicycle measures in general were performed with continuous consulting with a reference group consisting of persons with strategically specialities for deeper understanding. A workshop, regarding possible measures with persons from the traffic group at COWI, and a participation in a seminar about bicycle in the future, at Chalmers University of Technology, gave further inspiration. A summary of general measures is presented in a table according to the Four Step Principle, examples of already done measures and project are detailed described with their effect.

A cyclist enthusiast and health inspirer at CPAC System was interviewed to investigate the result of their work. There was also a meeting with a teacher in a middle-age school in the area to study how they have worked and their evaluation of the project “På egna ben”. A breakfast meeting with enthusiast from the sewage works company Gryaab gave insights in the project “Bicycle friendly working place”.

### 1.4.2 Evaluating the area

The second phase in the thesis was to make a problem description by a situation assessment of the area. The following different kinds of analysis were used to receive a broad range of data to make a clear problem description for the area;

- Investigation of already implemented measures
- Analysis of the travel survey
- SWOT-analysis
- A web survey about travel habits and bicycle measure
- Analysis of distance to school and every-day facilities
- A travel route comparison between bicycle and car
- Analysis of missing links

Investigations about already done advocacy measures and actions regarding cycling in the recent years are important to know what is already improved and tested in the area. The information and examples are gathered from reports and implementation projects. An analysis of the travel survey, by Trafikverket, was made to be able to see the possibilities and potential in the area. Additional possibilities and problem in the area was assessed in a SWOT-analysis (Strength, Weakness, Opportunity and Threat). It is a commonly used tool to identify positive and negative aspects in an easy way.

A web survey was made with both direct questions and open-answer questions. The purpose was to receive data and confirmation of the problems with cycling in Fässbergsdalen and what could be enhanced. The survey was sent to companies and working places in the area and distributed to bicycles in the area by tag them with notes with the web link. There were 35 answers at the survey, which could be seen as low. Although the survey is considered as qualitative with moderately detailed comments and opinions that still was useful in the thesis.

The computer programme QGIS, a geographical information system, was used to map out and evaluate distances in the areas with different targets. Also a comparison between transports by bicycle and car at different routes in the area was performed in the context of distance, time. With an ocular analysis of the proposed routes with the website OpenStreetMap the amounts of stops at the stretches was evaluated. Additional an ocular analysis was also done by studies of the bicycle map and visits to the area to see if missing links exist.

Thereafter, a problem description for the area was performed by the thesis regarding the main identified problems from the different analysis above and previous literature study. The problem description was the background for the proposed measures in the next phase.

### **1.4.3 Investigation of possible measures**

Next phase in thesis was to develop suitable and possible solutions and measures in order to increase the use of bicycles in the studied area. Both measures in the sort of physical structures and advocacy are evaluated and presented in the way of the Four Step Principle. The measures are suggested in the thesis with potential to increase the cycling situation in Fässbergsdalen.

The proposed measures are mainly inspired from examples in other cities and from literature. Because of difficulties to gauge the effects of measures, the measures are proposed with the authors of the thesis views of most appropriate and profitable measures. Result described in similar projects was taken into consideration.

### **1.4.4 Discussion and conclusion**

Finally, there is an overall discussion and conclusion. The discussion is based on positive and negative aspects of the result and the conclusion will state the recommended measures. Recommendations about further studies are also suggested.

## **1.5 Outline of the report**

The thesis has following structure. First an introduction of the thesis and thereby background information in general about cycling in cities. This proceeds in analysis of the studied area and a result as proposed measures.

Beginning with chapter 2, it is general about cycling; both the development and how the cycling situation is today in Sweden with some statistics.

Following, chapter 3 treats how the bicycle use could increase by planning for bicycle use, different kind of measures and evaluation of it. Examples of previous projects will be given here.

Chapter 4 provides background information about studied area including plans of the area from different stakeholders and information from a travel survey of the area, developed in 2015.

In Chapter 5 a situation assessment of the cycling situation in Fässbergsdalen are presented by different kinds of analysis by the thesis. This results in a problem description of the studied area. Both the set targets and already planned measures are also presented.

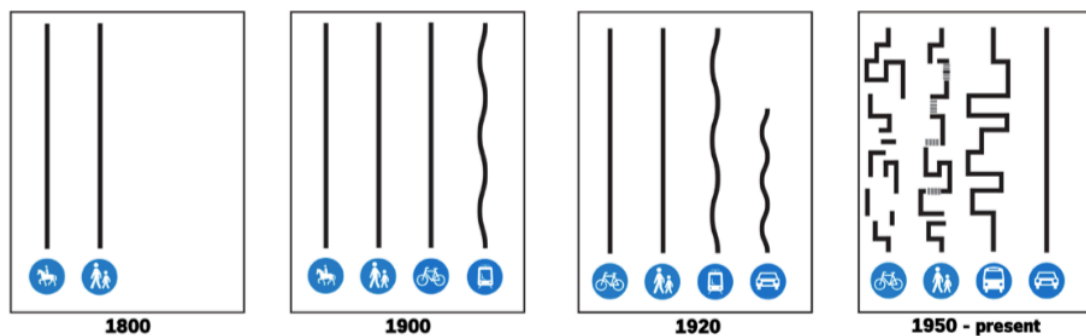
Chapter 6 presents the result of the thesis with the proposed measures for the area. The effects are valued and estimated to strengthen the proposed measures.

A discussion regarding the thesis and the result of the suggested measures are held in Chapter 7.

Finally, Chapter 8 will give a conclusion of the thesis and suggestions of further studies are given in Chapter 9. In the end of this thesis, some appendices are attached for additional and more detailed information.

## 2 Bicycle use in the city

Cities in Sweden have been built and developed based on motorised vehicles, especially during the period after the Second World War. Vehicles have been prioritised in urban planning in a long time, according to Envall (2015). One example is “Ölandsbron”, which does not have a bicycle- or walking path even though Öland is a popular bicycle destination. Another example is Sergels Torg, which was constructed in 1967 in Stockholm, and is built with motorised vehicles in focus. There are significant greater traffic areas for vehicles than bicycle- and walking paths and the connections for the latter are far from satisfactory. Prioritises of vehicles mobility and accessibility in the urban planning in the 1950s and 1960s resulted in discontinuous, unsafely bicycle- and walking paths. It became often detours in the stretch for cycling and walking, illustrated in Figure 3.



*Figure 3 The developing of different transport mode in form of continuity and direct ways, from 19th to 21th century (Trafikverket, Tillväxt, miljö och regionplanering, Landstingets trafikförvaltning (SLL), & Länsstyrelsen i Stockholms län, 2014).*

Figure 3 shows the simplicity to go by bicycle or walk in a direct way in the 19<sup>th</sup> and beginning of the 20<sup>th</sup> century. From the middle of the 20<sup>th</sup> century it became more and easier to transport by vehicles; cycling and walking routes became discontinued.

The following chapters explain how the cycling situation is in Sweden in general and presents statistics about the development throughout the years and difference in cities concerning the amount of travels by bicycle. Descriptions of why people bicycle or not and the potential to increase cycling in city are also investigated. Finally, the initial condition and statistics in the municipalities of Gothenburg and Mölndal are presented.

### 2.1 Bicycle friendly city

Nowadays, in the last decade, bicycle planning has developed to an important part in the traffic planning in Swedish cities (Göteborgs regionen kommunalförbund, GR, 2012). In spite of that, there are needs of resources and reprioritising of the infrastructure in many cities, which is a challenge in order to become a “bicycle city”. There is no clear definition of a “bicycle city”. Plenty of expressions to explain a bicycle city exist. For example, some expressions of a “bicycle city” are that bicycles are prioritised in the city and have precedence, the city is attractive for cyclists or the city

has a goal to become and develop to be a better city to cycle in. Even though there are many people those using bicycles in a city, it does not have to be a “bicycle city”. According to a definition of a “bicycle city” from Norway (Växjö kommun, 2005);

*“In a bicycle city the work process is target oriented to encourage the bicycle as a transport mode through physical actions, organisational methods and services and campaigns. It is an obvious part in the planning of land use and transport to facilitate for bicycle, but also in other parts and sections in the society. There are a lot of bicycle users and the city is characterised by a developed bicycle culture.”*

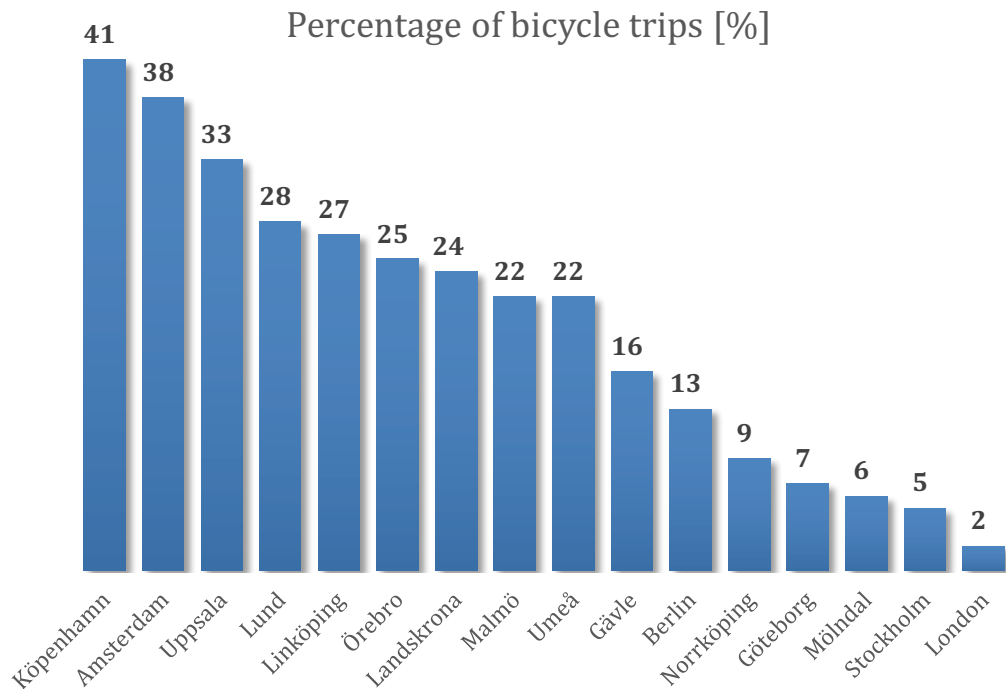
## **2.2 Statistics about bicycle development in Sweden**

In a report about the bicycle development in Sweden by Trafikanalys (2015), a government agency in the transport policy, cycling in terms of cycled distance per citizen including both adults and children has decreased. The decrease was around 40% between the years 1995 and 2014, according to national travel surveys, which has been carried out by a selection of Swedish nationally registered persons. Today about one out of ten trips in Sweden are done by bicycle, Envall is stated (2015).

Furthermore the number of trips to school by bicycle has been reduced with 48%, also stated in the report from Trafikanalys (2015). It is mainly in the 21<sup>st</sup> century that children have changed their way of transport to school. The percentage of children transport themselves to school by bicycle were 94% in 1981, 77% in 2000, 67% in 2003 and the latest result was 47% in 2009 (Eriksson T. , 2012).

There are differences in the amount of bicycle trips in cities in Sweden. In two of the biggest city there are a huge difference in an amount of bicycle trips. In Malmö about 22% (Kummel, 2015) of all trips are made by bicycle compared to Stockholm where the amount is 5% (Regional cykelplan för Stockholms län 2014-2030, 2014), see Figure 4. The presented numbers in Figure 4 are assumed to be most relevant, but different numbers has been found in different studies. There are difficulties to measure the bicycle trips and according to measured time, measured method and if the measured number includes the municipality or city, the numbers differs. The used numbers are in most of the cases from reports by Kummel (2015) and Spolander (2013). Specific numbers from some of the cities are from reports from Örebro (2013), Linköpings kommun (2015), Uppsala kommun (2015), (Mölnads stad, 2015) and Stockholms län (Trafikverket, Tillväxt, miljö och regionplanering, Landstingets trafikförvaltning (SLL), & Länsstyrelsen i Stockholms län, 2014).





*Figure 4 The percentage of bicycle transport in different cities in Sweden and Europe (Kummel, 2015) (Spolander, 2013) (Spacescape, 2013) (Linköpings kommun, 2015) (Uppsala kommun, 2015) (Mölndals stad, 2015) (Trafikverket, Tillväxt, miljö och regionplanering, Landstingets trafikförvaltning (SLL), & Länsstyrelsen i Stockholms län, 2014).*

Theory gives following reasons for these differences between cities; climate, topography, quality of the infrastructure and distances in the cities. In reality, it is more complex. Referring to Envall (2015), one example is Lund, which has a level difference of 80 metres in the urban area, but still is one of the cities with biggest share of bicycle use in Sweden. Umeå has also a high share (Figure 4) of cyclists, despite its location in the northern latitudes with winter climate.

As can be seen in Figure 4; Uppsala, Lund, Linköping and Umeå have all high modal share for bicycles; furthermore all these cities are significant student cities in Sweden. An indication could be that there exist a relation being a student city and a bicycle city, due to economic situations.

Today about 7% of all trips are made by bicycle in Gothenburg (Figure 4), which is a low percentage compared to other cities of similar size and conditions. Köpenhamn in Denmark has approximately around the same population as the municipality Gothenburg. Gothenburg is known as a hilly city, which approximately has the same conditions concerning elevation as Lund. Still the amount of trips in both Köpenhamn and Lund are considerably higher than in Gothenburg. The culture could be a reason for this notable difference.

## 2.3 Reasons to use bicycle or not use bicycle

Whether people use bicycles as a transport mode or not could be because of several reasons, many studies have been made concerning this. The question is if people use bicycle or not, in which range and what the reasons are. The answer will differ from person to person according to their personality, socio- demographic aspects, surroundings and environmental conditions. A student or younger person without children and economic conditions for having a vehicle is more likely to use bicycle. The reasons why people in general are use bicycle or not use bicycle as a transport mode are investigated in the following chapter. A sum of this are presented in Table 1 and it originates from literature studies and personal experience by the thesis.

*Table 1 Sum of general reasons by the thesis why people use bicycle or not.*

Why people use bicycle	Why people do not use bicycle
Sustainable transport	Prefer comfort by vehicles
Easy and fast	Lack of bicycle paths
Good health	Stolen bicycle
Increase the physical performance	Physically exhausting
Environment and the climate	Errands during the way
Economic aspect	Habits and behaviour

### 2.3.1 Why people use bicycle

Using bicycle as a transport mode is an important part in the society today to reach a sustainable transport system. It consume a lower amount of non-renewable resources than motorised vehicles and save space compared to cars (Chrapkowska, 2015), see Figure 5, which are imported in more densified cities today. Other advantages with cycling are that it is quiet and flow smoothly in urban areas compared to transportations by car. It decreases the stress at the road network and public transport. It is an easy way of transportation in a big city and many access points are easier to reach with a bicycle than with a car (Göteborgs Stad Trafikkontoret, 2015).



*Figure 5 The photos shows how much space is needed to transport a certain amount of people with cars (to the left), bus (in the middle) and by bicycle (to the right) (Gävle kommun, 2011).*

According to Figure 4, almost a third of all the trips are done by bicycle in Köpenhamn and the majority of the road-users refer to cycling as the easiest and fastest way to get around in the city (Envall, 2015). This is also stated in other surveys; it is important to be able to get from A to B in an easy, fast and comfortable way when choosing transport mode. Forward (2014) state that in the choice of bicycle as transport; the trip has to be within an appropriate distance and without detours.

The citizens of Köpenhamn also list the fact that cycling gives exercise and increased health as a reason for choosing it as a transport mode (Envall, 2015). The physical activity is decreasing due to technology and the development in society, schools and workplaces where people become more sedentary. According to Folkhälsomyndigheten in Sweden (2014) this leads to issues as obesity, cancer, heart- and vascular disease. Obtaining daily exercise could be an important incentive for cycling and thereby increase the physical activity, with background in the opinion of citizens of Köpenhamn. Cycling has the advantage that it can be a part of the daily normal life. Research also shows that cycling decrease the mortality, due to a healthier lifestyle and therefore longer life. This if it is done at a regular basis compared to people that not use bicycle, with independent of other physical activities (Andersen, Schnohr, & Schroll, 2000). This refers to a frequently activity, not in a specific amount of time each time but with a total extensive amount of time.

There is a study by Hendriksen, Zuiderveld, Kemper and Bezemer (2000) regarding the effect on the physical performance by commuting with bicycle among male and female employees in Amsterdam. The result showed that cycling at a relatively low intensity three times at a week with a minimum distance of six kilometres daily could increase the physical performance ( $W_{max}$  per bodyweight). Several studies, trials and studies that prove physical effects and increased health from cycling have been done in the recent years in different countries. Increased physical changes have then been observed, in for example improved aerobic capacity, increased body strength and increased use of fats as an energy source. It has also showed improvements in emotional and psychological health and well-being and tolerance to stress (Cavill & Davis, 2007). The World Health Organisation, WHO, has developed a tool called “Health Economic Assessment Tool” (HEAT, 2014) for economic assessments of health benefits of cycling. It could be used for example planning of infrastructure regarding bicycle or to estimate the reduced mortality connected to cycling.

Use bicycle is positive for the environment and the climate; it is a sustainable transportation. The  $CO_2$  emissions contributing to bicycle use is very low in comparison to vehicles, which is responsible for a large amount of  $CO_2$  emissions. In Sweden, the road transport is responsible of 30% of  $CO_2$  emissions. These contribute to the greenhouse gases and therefore the climate change (Naturvårdsverket, 2015). A city with high share of cyclists will result in a more attractive city, due to decreased congestion on streets and traffic noise and, also to a calmer environment with better air quality (Cykelfrämjandet, 2016). Traffic noise and air pollution are the main environmental issues today, according to WHO; The World Health Organization. Still the environment and sustainability are not common reasons for people to cycle instead of using vehicles.

For the individual person, bicycle use is also an advantage in an economic aspect. Firstly, a bicycle is a cheap investment compared to a car and secondly it has a low cost of maintenance. Bicycles not really have a regular specific monthly cost, compared to vehicles with petrol and insurances and for public transports, with monthly cards. A simplified comparison between the cost for car, consideration both leasing a car and buying a car, public transport and bicycle are shown in Table 2 below, detailed cost calculation is presented in Appendix I. The cost differs due to models and types of car and bicycle, thereby the costs are approximated and rough.

*Table 2 Estimated cost comparison between car, public transport and bicycle for an adult (Råd&Rön, 2015) (Konsummentverket & DN, n.d.) (Västtrafik, 2016) (CykelGuiden.nu, 2016).*

	Monthly cost [SEK]	Total cost for three years [SEK]
Car (leasing)	≈ 4 050	145 000
Car (buying)	≈ 4 840	174 000
Public transport	600	21 600
Public transport (two municipality)	1 055	37 980
Bicycle (Investment + cost/year)	12 000 + 1 000	15 000

In the calculation in Table 1 the monthly cost for car, insurance, congestions fees and parking spot are included. The public transport is calculated both for a simple monthly card for an adult in the Gothenburg's inner area and for a monthly card valid in two municipalities, because the studied area contains of both parts of Gothenburg and Mölndal.

### 2.3.2 Why people do not use bicycle

Reasons why people do not choose the bicycle is for example comfort, insecurity and safety of personal belongings where the bicycle itself is included (Envall, 2015). A main statement is that people prefer comfort and will therefore choose vehicle as transport mode. Another reason for not use bicycle can be referred to fear of vehicles or other traffic in bigger cities when going by bicycle. The lack of bicycle paths and a good infrastructure are other reasons. There is an uncertainty of where to cycling, which creates insecurity and thereby a dislike towards cycling among people according to Anders Pihl<sup>1</sup>, a bicycle enthusiast at the company CPAC System working with health and bicycle questions.

A common reason why people stop cycling is a stolen bicycle, according to Envall (2015). In 2014, there was 70 900 bicycles registered as stolen in Sweden, which is around 6% of all households in Sweden and only 1% of these bicycles were found and returned to the owner (Brottsförebyggande rådet (Brå), 2016). As a result of these, secure and locked bicycle garage is a solution and important way to prevent thefts. In Malmö and Lund a concept with locked bicycle garage in connection to public transports stations has been developed (Malmö Stad Gatukontoret, 2016). Users of

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<sup>1</sup> Anders Pihl, Chief Technical Officer & Human Resource Director, CPAC System. Interviewed 31 of March 2016.

these are satisfied and have given high response to security of this kind of bicycle parking in a survey by (Franjic, 2015).

The weather also has a major role in the choice of transport mode and is a resistance for many people to use bicycle; it varies between days and brings issues such as proper clothing and parking facilities (Chrapkowska, 2015). A distinguished part of cyclists is not cycling on a daily-basis, just part-time cyclists when the weather is satisfied. In spite of the general known result of obtaining good health by cycling, indolence is a frequent occurrence for not use bicycle as a transport mode. The risk to sweat is another reason for why people choose to not use bicycle, and instead choose more comfortable transport mode.

Regarding commuting by bicycle, the working place could be a determinant factor (CykelGuiden.nu, 2016). For example, working at an office and wearing suits and uniforms could be a complexity for some. Also the need of transportation by car in work is an essential reason for commuting by car to and from work. A common reason and excuse for not taking the bicycle is making stops and errands during the way, for example grocery shopping and leaving children at preschool and schools. Cycling with a package, as grocery bags, could be a complication (Eriksson & Forward, 2010).

According to Forward (2014), habits have an essential part in the choice of transport mode. People do not reflect over their habits, therefore a change of a habit requires an effort that poses as an obstacle when it comes to choosing the bicycle as a transport mode. Break habits is required and a main step of change behaviour and impact the attitude of a person. Behaviour is coming from surrounding social networks but also as a hereditary from parents and their actions that influence their children. New routines take time and studies have shown that create new habits is not easy especially when it takes both mental and physical strength to start bicycle, according to Lally, van Jaarsveld, Potts and Wardle (2010). The conclusion of the study is simpler habits can be created in about 21 days but it takes twelve weeks to get a more permanent change. Certain habits and behaviours, are shown in the previous mentioned study, seem to be more difficult to change than others depending on various factors. This is a major barrier why people do not bicycle; people are too accustomed to their habit.

## **2.4 Potential to increase the bicycle use**

Increase the mentality and habits among people takes time and a potential is thereby to start with children of young ages. There are studies by Telema, et al (2005) showing that the behaviour a person has as a child follows into adult life; physical activity in young age predict a physical active life as an adult. That is why children in pre-schools and schools could be a target group for increasing the bicycle use in a long-term goal. Habits from parents are also handed down to their children and depending their choice of transport to schools. If parents experience unsafely by cycling or walking to school, it will have a negative affection and children will be more likely to an active transport if the parents are not worried, pursuant to Schantz & Ek (2012). Students in pre-school and first grade are entitled to school transport if the distance are more than two kilometres, otherwise walking or cycling are recommended, this is applied in Mölndals stad (2016) as an example.

The potential to increase the proportion that uses bicycle is probably highest for short trips, distances up to about ten kilometres. As an example, in Stockholm the average distance is nine kilometres for commuting to work (CykelGuiden.nu, 2016). A solution towards increase the bicycle use is by enhance the access by bicycle to everyday functions as for example supermarkets, pharmacies, recreational activities, schools and preschools and reduce the travel by car for short trips. If 10% of all trips are made by bicycle at the distance up to ten kilometres, the cycling trips would increase with around 50% (Göteborgs Stad Trafikkontoret, 2015).

Another potential to increase the bicycle use is to improve the amount of commuting trips by bicycle. Commuting travels represent a large part of all travels and are specified to specific times and places (Heinen, 2011). During the peak hours with most congestion, the target group commuting to work is homogenous group of people that have the same reason to travel and a common behaviour. An action of improvement could be to establish continuous bicycle routes for rapid cycling for example, which makes it easier to cycle in a high speed without stops. Good possibilities as parking facilities and changing rooms at the workplace increase the potential of commute to work by bicycle.

During the recent years electrical bicycles has become more common, which attract a new group of cyclists (Koucky & Ljungblad, 2012). It may also be worthwhile to try convincing people to use the bicycle all over the year, not only in the summer and spring period; i.e. changing part-time cyclists to full-time cyclists. Electrical bicycles could be a potential to travel longer distance and commuting to work with less physical effort.

## **2.5 The initial situation in Gothenburg**

There has only been a small change in the increase in cycling in the recent years in Gothenburg. An exception was in 2013, when the congestion charge stations were introduced. Then the transport by car was decreased in favour for an increase in cycling with 20%, which is mentioned in the Bicycle program (2015) for the city. The Bicycle Programme in Gothenburg is a deepening and specification of the traffic strategy with focus at the bicycle topic and development to be a more bicycle city. Today, with data from 2015 shown in Figure 4, 7% of all trips in Gothenburg are made by bicycle. Unfortunately, it differs during the time of the year; during April to September about 8% of all trips are made by bicycle but only 4% are during wintertime (Göteborgs Stad Trafikkontoret, 2015). A travel survey in 2013 showed that about 42% of the inhabitants in Gothenburg thought the city was a good and attractive bicycle city in that time. The target is to raise this number to 75% to year 2025.

The previous Bicycle Programme from 1999, C99, had the aim to lower the accidents involving bicycle and increase the amount of cycle trips to 12% in Gothenburg until 2012. The strategies in C99 was to enhance the infrastructure to expand the cycling network, making the road safer and ensure quality and continuity in the network. These recommendations were based on a survey about what cyclists thought was important. The evaluation of C99 was that the cycling path had expanded from 360 kilometres to 470 kilometres, with a designing approach focused at safety. The conclusion from Trafikkontoret at Göteborgs Stad (2015) is that the target of decreasing accidents was

satisfied, but not the target of increasing the trips by bicycle. A reason is the condition of accessibility has not been prioritized.

The survey among Swedish municipalities by Cykelfrämjandet (2015), the Swedish national cycling advocacy organisation, shows a steady-state result regarding different areas of bicycle measures in Gothenburg since 2011. It is an independent and comparing survey in the form of a poll to the local authority, with different areas regarding bicycle. The municipality collects points depending on their planning and working concerning bicycle during the year. Gothenburg has a top score in the two of the categories; bicycles activities respective follow-up and measuring in the mention surveys above. Contributing they have received low score in the existing bicycle network. The bicycle network length per inhabitant is 1.5 meters in Gothenburg, comparing to the average of 2.2 meters for other cities in Sweden. On the other hand, the population density does not matter. Compared to two other big cities, Malmö and Stockholm, Gothenburg has a low density. In the category infrastructure and maintenance, Gothenburg received also a low score due to an investment per inhabitant and year, 191 SEK per inhabitant and year, compared to the Swedish average of 286 SEK (Cykelfrämjandet, 2015).

## **2.6 The initial situation in Mölndal**

According to Mölndal's own bicycle account, which they perform every second year to establish the development of increase the bicycle use, the result of the bicycle share is 6% of the total amount of trips (Mölndals stad, 2015). The cycling account was performed according to the Cykelhandlingsplan in Mölndal (2011) and is based on a survey that was answered by 355 inhabitants in Mölndal in the year 2014. According to the cycling account measurements at three of the commuter routes were done in 2012 and totally 753 814 trips were done by bicycle. In 2014 this number had increased to 892 783 trips. Thus, the enhancement was almost 9%, which is more than the already annual target of 6% increase per year in the Cykelhandlingsplan, developed from the bicycle strategy.

The bicycle strategy 2010-2014 in Mölndal (2010) state that it exists 105 kilometres of separated bicycle routes in Mölndal municipality. In generally the bicycle paths are directed in both way and usually shared with pedestrian traffic.

In the Cykelhandlingsplan, measurements in Mölndal from 2009 showed that 44% of the inhabitants thought that Mölndal was a good and attractive bicycle city in that time. The target was to increase this number to 60% until 2015 (Mölndals stad, 2011). From the bicycle account, a marginal increasing in happiness and satisfaction of cycling was identified, even though actions for increased bicycle use was done (Mölndals stad, 2015). This low increased number could be explained due to one of the heaviest loaded bicycle paths and a large commuter-route, Göteborgsvägen, were under construction.

According to the survey by Cykelfrämjandet (2014), mentioned before in section 2.5, Mölndal did not participated during 2015 but attended in 2014. The progress between 2010 and 2014 showed a great improvement. Mölndal, as same as Gothenburg, had a top score in the two of the categories, bicycles activities respective follow-up and measuring, in the mentioned survey above. The bicycle network length per inhabitant was 1.9 meters in Mölndal comparing to the average of 2.2 meters for other cities in Sweden. Investments in the category infrastructure and maintenance Mölndal reached 209 SEK per inhabitant and year, compared to the Swedish average of 286 SEK.



### 3 Increase the bicycle use

There are several ways and measures to increase the use of bicycle and make it a more obvious choice of transportation for people in the city. Different actions, projects and strategies can be seen in cities in Sweden. Bicycle planning in cities has become a complex problem; there are many factors that matters and has to be considered (Aretun & Robertson, 2013).

To aim for awareness and of quality throughout the organizational process, the process is divided in three main parts; planning, action and monitoring (Figure 6). Following chapter will cover the process with inspiration from TRAST (2015) and BYPAD (2016), see Section 3.1 for further explanation. Although, organisations and municipalities can organise this process in different ways.

Parts to take into account in the plan are different needs, the current situation, strategies and what resources are needed. Action is different measures in order to create good conditions for the cyclists and to create a bicycle friendly city. Below are examples of measures and examples of projects and actions for increasing bicycle use. In the monitoring phase evaluations of effects and following ups is explained. The chapter will be in general, but strategies and implementations specific for Gothenburg and Mölndal will be explained in detailed.

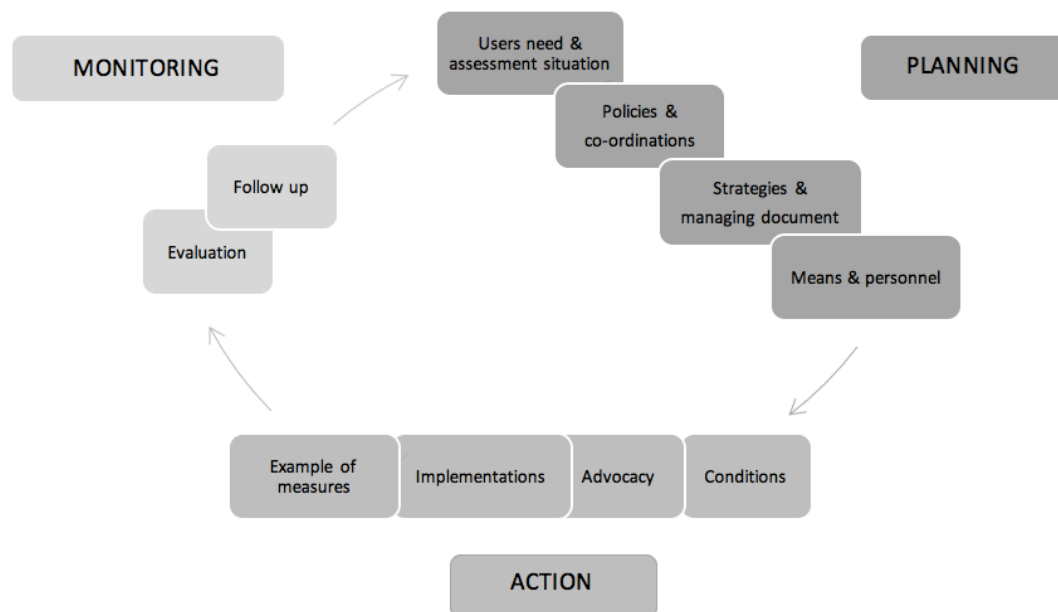


Figure 6 The chain of planning, actions and monitoring in the process of planning for increased bicycle use.

### **3.1 Planning regarding bicycle use**

In the process of planning, main tasks in the beginning are to analyse the users and the public's needs and to make an assessment of the situation in the area, region or city. Thereafter, a strategy is developed and specific targets for the future are decided (Sveriges Kommuner och Landsting SKL, 2012). The targets could be developed with short-time and long-time goals and be both measureable and theoretical. It is important to co-ordinate policies with organisations and projects. Strategies, financial aspects, targets and measures are all anchored in decisions from the policies and underlying the whole process of planning. It is also an essential part to involve personnel in the planning and whole process for reach a result.

#### **3.1.1 Users need and assessment situation**

The users need is obviously of high interest to increase the bicycle use. It is the target group that will be impacted of the process and measures. The answer of what kinds of measures are suitable is connected to the demand from the public to use bicycle. More about the reasons of why people use bicycle or not in general are described in Section 2.3 and the potential of increase the bicycle use, specified for the studied area, is developed in Section 2.4.

In the beginning to affect users it is important to highlight the changing process and positive elements with a reward in a short-term perspective. The changing of a travel habit is not an easy process and it could take time. Different persons can be in different stages in this process and will have a different will or motivation of changing habit, stated by Forward (2014). According to Forward it is already generally known that cycling is good for the users health and environment.

A current situation assessment is important in the way to evaluate the existing conditions; both strengths and deficits should be gauged. Without an assessment it is hard to know what kind of measures that are appropriate and needed for the case (Sveriges Kommuner och Landsting SKL, 2012). There are several kinds of methods for evaluation. Examples are; traffic counting, accidents counting, travel surveys, reports from the public at websites or applications.

#### **3.1.2 Policies and co-ordinations**

Policies decision has a great influence at the bicycle use. It determines where and in which areas investments and efforts should be done and what is further in the interest for the local and national governments. One example is Denmark; between the years 1982 to 2001 it was stated in the law that money should be allocated to every Danish municipality to improve the bicycle infrastructure (Heinen, 2011). This could be a reason for their bicycle culture and good infrastructure today. In Netherlands, another leading bicycle country, the government in the past privileged the commuting by bicycle by institute the opportunity for employees buying a bicycle from the salary before taxes (Heinen, 2011).

To plan for a sustainable city, three of the 16 environmental quality goals that Riksdagen in Sweden decided in 2005 are related to traffic planning; limited climate impact, fresh air and a good urban environment (Miljömål, 2016). Accordingly, the environment goals have after that being updated milestones have been developed during recent years. Measurements have further been done to indicate how the environment is in Sweden (Sveriges Kommuner och Landsting & Trafikverket, 2010). Thereafter the municipalities have to develop their own quality and goals to meet up with the national environmental goals. The environmental goals are referred in handbooks about planning.

In all ways, resources and economics are fundamental for planning, building, maintain and implement actions regarding the use of bicycle. However it is difficult to get bicycle measures financed, it is often not in high priority and thereby it is one problem and obstacle of increasing the bicycle trips (Koucky, 2009). Funding from extern parts as Trafikverket, EU and the government is possible to apply for and it have has a significant importance in several municipalities in Sweden (Sveriges Kommuner och Landsting SKL, 2012).

A research project between the year 2010 and 2013 in the form of co-ordinations was CyCity (2016) by VINNOVA, Sweden's innovation agency. It concern cycling in Sweden and aimed for more bicycle-centric cities. Within the program researchers with expertise gathered information regarding bicycle in areas such as transport planning, transport modelling, health and physical activity, behavioural science, history, safety, operation and maintenance of bicycle paths.

A subproject of CyCity was a co-ordination between five municipalities. In that study cooperation across the border of municipalities was performed, which has not been seen often before (WSP Sverige AB, 2012). This lead to knowledge of the cyclists' habits and that the ability to cycle across the border is limited. The results indicated that the responsibility from policies, planning and collaboration have to increase towards prioritising bicycle.

A European-wide network is BYPAD, an EU-founded project started in 1999. It is a tool and cooperation between countries and experts to get "*More quality for bicycle traffic*" (BYPAD, 2016). This aids for cities, regions, and countries to keep quality and track throughout the process of planning. It has its knowledge and starting point from cities with good bicycle infrastructure and planning, and it have helped Swedish cites to preformed bicycle audit (Trivektor, 2016).

### **3.1.3 Strategies and managing document**

There are numerous ways and strategies to plan for bicycles in the city today for the municipalities in Sweden. In the recent years, several handbooks and documents regarding plans and strategies for bicycle have been developed to be helpful in the planning process. For example a handbook for walking, bicycle and mopeds, "Gång-Cykel – och moped, GCM" (2010), is an important complementary handbook to the overall traffic planning document for traffic: "Trafik för en Attraktiv stad, TRAST", (2015) and "Vägar och gators utformning, VGU" (2015). Sveriges Kommuner och Landsting, SKL, (2012) has also developed a publication with ideas and examples

regarding the planning for bicycle use aimed for local authorities as a complement to the previous mentioned called “Vägen till ett cyklande samhälle”.

There is no clear boundary what managing document will include and it can be rather unclear sometimes between strategies, policy documents and plan- and action programs for bicycle (Sveriges Kommuner och Landsting SKL, 2012). Different municipalities have also different name for their documents, but they can nevertheless contain the same information. Some municipalities have all three documents, but the most common is that they are merged into one document, a so-called bicycle plan. It contains visions and planning but also proposals for concrete actions. Göteborgs Stad have a bicycle strategy including planned actions, which is described more in section 3.1.3.3 and section 3.2.3.1. Mölndals stad have also a bicycle strategy from (2010), but use their more present bicycle plan, described in section 3.1.3.4 and their plans of actions are described in section 3.2.3.2.

### 3.1.3.1 The Four Step Principle

A method or strategy for traffic and transport planning and implementation in a sustainable direction is the Four Step Principle, where measures are analysed in four steps (Trafikverket, 2012):

- |         |                    |                                                                                                               |
|---------|--------------------|---------------------------------------------------------------------------------------------------------------|
| Step 1: | <i>Think again</i> | Measures that affect the transport demands and mode choices. It includes planning, effecting and regulations. |
| Step 2: | <i>Optimize</i>    | Involves efforts that result in more efficient use of the existing infrastructure.                            |
| Step 3: | <i>Reconstruct</i> | Implicates improvement measures and reconstructions in existing infrastructure.                               |
| Step 4: | <i>Build new</i>   | Construction and investments of new infrastructure, for example new road.                                     |

The method originates from Vägverket, the original Trafikverket, and is well used by this authorities and different municipalities today in the planning process in the area of transport. It aims to use existing network more efficient and a consideration between different kinds of measures in the transport and infrastructure division. Other solutions, often cheaper, then just reconstructing and building new roads, are being treated in the Four Step Principle. Step 1 and 2 focus at work with attitudes and influence, for example by promotions and advocacy.

### 3.1.3.2 Pull and Push strategy

An efficient strategy to get the community in right direction is to combine pull and push factors as a strategy, also mentioned as “carrot and stick” measures (Naturskyddsföreningen, 2016). This could be seen as indirect and direct measures to favour bicycle use (Chrapkowska, 2015). Direct measures encouraging bicycle use directly, as for example; decrease the cost for bicycle use, better bicycle networks and good facilities for cycling, as parking places. Indirect measure may e.g. increase the costs of other transports modes, for instance car parking fees or congestion fees.

Further examples are car free zones in the city centre and less parking spaces. It can result in less cars in the city area, due to forcing cars to detours thereby make it complicated to driving car. Instead people choose other transport modes, as for example bicycle. A good example according to Bjerkemo (2006) is Köpenhamn, a city that successfully implemented car free zones with more space and priority for cyclists and pedestrians.

Indirect measures can be a reason for people choosing other transport modes than car and maybe choose bicycle as a first choice, if the advantages for bicycle are the most favourable (Research, 2014). A combination of direct and indirect measures can make bicycle to an attractive transport mode.

### **3.1.3.3 Strategies and visions in Gothenburg**

Gothenburg's bicycle strategy is declared in the document “Cykelprogram för en nära Storstad 2015-2025” and specified from the traffic strategy. The vision regarding bicycle states bicycle as a transport mode should be easy, fast and safety to use (Göteborgs Stad Trafikkontoret, 2015). With the densification of the city, locations are planned in walking and bicycle distances. The importance of create an attractive urban space is explained in the bicycle strategy. Cyclists and pedestrians should have priority and measures should be taken in order to reach this. A statement is increased bicycle use is suitable for the city and make it to a more attractive environment. Both the bicycle strategy and the traffic strategy (Trafikkontoret, 2014) determine though that the traffic system in Gothenburg has to be developed and suited to bicycle use.

In Gothenburg, according to the traffic strategy (2015), it is important to create a balance between the key factors; free mobility, traffic security and traffic flow. Places where people and road-users visit and use should be designed so they can be reached without any barriers. To optimise the urban spaces in Gothenburg it requires an understanding of the persons that move and transport in the area. The use of roads and traffic network has to be streamlined to have a suitable existing infrastructure and can be performed through measures that affect the demand and reduce traffic.

There are four strategic nodes outside the inner city according to the traffic strategy in Gothenburg; Backaplan, Frölunda Torg, Gamlestaden and Angered centrum. These are in important to connect for increase continues urban areas and living places for the whole city (Trafikkontoret, 2014). Adjacent centres in different municipalities, as Mölndal and Partille, are also a part of the development of a continuous urban area with good connections to Gothenburg. By increase service, shopping, meeting points and every day facilities in the local areas around the city, the amount and length of trips could decrease.

An increase of the total amount of trips in Gothenburg is estimated to 27% until 2035, as a result of an increase and growth of the region. This requires that the urban planning treat and affect the choice of transport mode (Göteborgs Stad, 2016). According to “Trafik- och resandeutvecklingen 2015” (2016) the targets for the amounts of trips in specific transport modes are the following:

- Decrease the trips by car from 46% in 2015 to 29% 2035.
- Increase the public transport from 27% in 2015 to 36 % 2035.
- Increase the bicycle use from 7% and the amount of pedestrians from 20% in 2015 to a totally amount of 35% including both bicycle and pedestrian in 2035.

#### **3.1.3.4 Strategies and visions in Mölndal**

Gatunämnden in Mölndal stated a bicycle strategy in 2009 with a description of the situation in that time with the vision and goals dividing in seven different areas (Mölndals stad, 2010). From this strategy an action plan, Cykelhandlingsplanen, was set up in 2011 with a current vision valid now. The plan was developed by an EU-project, where Mölndal participated with ten other municipalities in the Nordic countries. It describing a vision of a future scenario and a description of cycling in three conditions - can, will and know. The city should be a well-established bicycle city where bicycle is a natural transport in the all-day life. This should be performed in Mölndal by creating higher attraction for bicycle use by better flow in continues network and with wider and enhanced paths with fewer stops (Mölndals stad, 2011). The action plan, Cykelhandlingsplanen, also aims to indicate measures in each area to achieve the goals with specific result, see further description in section 3.2.3.2.

A goal in the general vision for Mölndal is that more than half of the trips in 2022 should be done by a sustainable transport mode (Mölndals stad, 2013). An increase in cycling gives profits both to the community and the individuals. Each second year Mölndals stad performs following ups showing the improvements in the cycling situation and result implementations from the current year. This account is help for continued planning and developing for Mölndal. Specific measures are to reach their goals regarding bicycle use, by extension of the bicycle network, speed secure intersections and projects aimed for different interest group (Mölndals stad, 2015).

#### **3.1.4 Means and personnel**

To plan for a bicycle use, a key factor is to have a group or person with competence, knowledge and interest in cycling during the whole process. Having a specific person being responsible for bicycle issues that works has been a good solution in several cases. It is also important with bicycle experience during the construction process, it can be a chance to avoid missing links and problems in the bicycle network. For example Örebro established a bicycle coordinator in 2000 in the municipality (Sveriges Kommuner och Landsting SKL, 2012). The purpose was to inject the bicycle thinking in the whole urban planning process and take it for granted. Another example is the forming of a bicycle council in Gävle, which work as a reference group for the municipality (Sveriges Kommuner och Landsting SKL, 2012). Their purpose was to come up with advices and suggestions of changes and report deficits regarding bicycles.

## 3.2 Actions concerning bicycle use

To increase the bicycle use in cities and the society today different kind of actions as measures can be done and implemented. In general terms actions can be divided into conditions for cycling and advocacy, affecting of the public. Further the measures can be categorised for example in groups regarding their issue:

- Infrastructure and design
- Availability and mobility
- Maintain and operation
- Traffic safety and security
- Health and environment
- Behaviour and attitude

### 3.2.1 Conditions for bicycle use

Infrastructure regarding bicycle paths and network could have different design depending of the intention. Rapid bicycle paths are one example to create short-circuits with few stops at crossings for example. It is a central part for commuters for short and simple travel route and reduced travel time (Chrapkowska, 2015). Bicycle paths can be designed in different ways according to the purpose and preconditions in the area. The dividing of cyclists towards other road-users could look different; separated from pedestrians, totally separated from both vehicles and pedestrian and bicycle paths with only one direction.

The infrastructure and design of bicycle paths is also connected with traffic safety, availability, continuity, comfort, and mobility (Envall & Koucky, 2013). These parameters are imported for experience of the cycling. Nevertheless, difficulty lays in how to measure what quality they have and how it related to better infrastructure. Traffic safety is related to different kind of measures and actions, as mentioned. Diverse speed limit actions, both in connections to crossing but also in general, can be referred to traffic safety and security for cyclists. The environment around bicycle routes also matters to security. It is appalling to cycling in a dark area without satisfying lightning; it could give an uncomfortable feeling. Use a bicycle is a more exposed situation than travel in a vehicle. Availability and continuity of bicycle network is essential for people to travel from A to B in the shortest amount of time.

Maintain and operation of bicycle networks, parking places, signs etc. are important part for a high quality of cycling with comfort and traffic safety. Good quality of bicycle paths includes well-managed and cleared paths without holes and irregularities in the paving (Sveriges Kommuner och Landsting SKL, 2012). Clearing is important in maintenance works to make bicycle attractive during whole year round. There are different kind of methods for snow clearing and ice combating, “Sopsaltning” is a relative new method that can be used and it is described further in section 3.2.4.1. Demands of completed snow clearing early in the morning, to facilitate for commuters by bicycle, could be an approach. In order to have information of the control over the quality of bicycle paths new method can be used to achieve error reports from cyclists. One example is apps in smartphones and websites.

### 3.2.2 Advocacy

Change in behavior is stated as highly effective and interesting compared to actions such as technics and policies, according to Ihrén (2015), expert on trends and strategies for sustainable development. A number of actions can be associated to changing behavior and attitude among people (Koucky, 2009). The projects or campaigns are often concentrated to specific target groups, for example commuters, recreational travelers or children.

Information is a part in changing behavior for higher attraction and simplification of cycling and thereby increases the share of cyclists (Sveriges Kommuner och Landsting SKL, 2012). Correct and updated maps of bicycle network are example of information that could be effective. As well as knowledge about what can be gained from cycling with respect to health and economic.

An example is a project in Århus, Denmark, during one year 1995-1996 (Nilsson, 2004) with the aim to move personal transports from car to bicycle. A number of 175 persons participated and was provided with a new bicycle, rain clothes, annual public transport card and free bicycle repair, in exchange of not taking the car as much as possible. Before the project eight out of ten travels were made by car and after the project the share had decreased to one out of three travels.

Some projects that have been tested in the region aimed to specific target groups are presented in next Section 3.2.4. The studied projects are;

- “Vintercyklisten”, translated to “The winter cyclist”
- “På egna ben”, translated to “On your own feet”
- “Cykelvänligarbetsplats”, translated to “Bicycle friendly working place”
- “Testcyklisterna”, translated to “Test cyclists”

### 3.2.3 Implementations

Implementation of an action is often done in a project with a definite start- and endpoint. (Sveriges Kommuner och Landsting SKL, 2012). The action plan identifies what are the pre-conditions and what kinds of complements or advocacy are needed. The principles for how it should be performed are mainly in the last stages of implementation planning process.

#### 3.2.3.1 Implementations in Gothenburg

Implementation in Gothenburg cannot happen all at once. In line with the strategy, some initiatives are prioritised. Examples of prioritised actions are the central part of the bicycle network, collaborate measures, plan for good connection to public transport stops and good availability during construction (Göteborgs Stad Trafikkontoret, 2015).

To reach knowledge, skills and communication towards bicycle implementations is a prerequisite for the strategy to work (Göteborgs Stad Trafikkontoret, 2015). Coordination between different stakeholders is essential in this question. Regarding the strategy concerning Gothenburg the vision and goals are developed in four categories for implementations with the aim to aim to create an attractive bicycle city:



- *Infrastructure* - to form and develop the bicycle infrastructure.  
To create conditions and opportunities for the citizens to cycle in main areas in the infrastructure, including during construction phases. Essential parts should be identified for the cyclists accessibility; along the stretch, in intersections, regarding bicycle parking and cycling during construction.
- *Operation and maintenance* - to ensure and secure the bicycle standards.  
Some main principles are set up to secure the standard; winter maintenance, regular sweeping, even paving, signs and other maintenance in order to ensure safety and comfort. This needs are guidelines to have good maintenance as well complements from collections of information about faults and errors from the users.
- *Support and Service* – offer support and service that facilitate cycling.  
Support and service should be given before, during and after the bicycle trip. Examples of support and services are technical support as applications to plan the trip, service like bicycle pumps during the trip and good parking possibilities at the end of the trip.
- *Communication* - strengthen the image of bicycle use in Gothenburg.  
Guidelines and strategy is a working process in four main areas; image communication, product communication, behavioural communication and communication during the construction stages.

### 3.2.3.2 Implementations in Mölndal

Mölndal has worked for an increase of bicycle use during the last decade with extensions of the bicycle network, improved crossings and existing bicycle paths, different kind of bicycle project and campaigns (Mölndals stad, 2015).

The general goals for Mölndal are divided into seven areas, each having its own performance. The goals are to indicate of what kind of measures and action are needed to provide support (Mölndals stad, 2011). The action plan regarding cycling in Mölndal includes, as mentioned previously, a situation assessment, a vision for cycling in Mölndal and the overarching objectives in seven areas:

- *Infrastructure, Parking and Service*  
A more continuous network and clear main roads for bicycle, parking opportunities and enough space for all. Services in this include implementation of the complementary for improvement of the bicycle infrastructure.
- *Accessibility*  
Cyclists are more sensitive for obstacles and barriers and unnecessary stops than other travellers. Measures here are to remove physical obstacles and separate walking and bicycle.
- *Safety and security*  
Accidents involving bicycle should decrease. Important action to accomplish this is to improve both maintenance and behaviour. Most accident happens in

intersection between cyclists and cars and because of deficiencies in operation and maintenance during winter time.

- *Operation and maintenance*  
With high standard of operation and highly prioritised maintenance, cyclist will have the opportunity to cycle all year around.
- *Children cycling*  
An aim is to influence the children to cycle to school, so their first choice is bicycle in order to increase the bicycle use in the future.
- *Dialogue, campaigns and information*  
Action and measures for travel habits in Mölndal are to increase the knowledge about different choice of transport mode, social attitudes and willingness and valuation. This will be achieved through information, consultation, campaigns, idea directory and a dialog with different stakeholders.
- *Follow-up*  
To show and inform what changes have been completed. Also measurements accomplished for see what the action resulted in.

### 3.2.4 Examples of measures

According to the Four Step principal, explained previously in Section 3.1.3.1, a list of summarised general measures to increase the bicycle use are presented in Table 3 below. The measures are taken from ideas by knowledge and inspiration from reading literature and participation in workshop and seminars for the thesis. All measures are for general cases, not specific for the studied area. They are not explained in detailed and not suitable due to all aspects.

In **step 1** the measures are aimed at mobility management to influence the demand. These measures are divided in the categories of information, dialogues, try outs and force factors. It will demand different efforts and resources depending on information towards people comparing to have a dialogue or try outs, which will cost more and will be more time consuming. The measures in **step 2** are, optimizing and more efficient use of already existing infrastructure. They are divided in the categories maintain and operation, support and service and bicycle during construction.

For **step 3** the measures are improved infrastructure and reconstructions. They are more advanced and need more resources than step 1 and 2. Included here are specific infrastructure in form of roads and paths, parking and complementation connected to the main infrastructure. In **step 4** are some examples of what can be built new to improve the infrastructure.

All measures have been connected to a potential effect to show the result of different kind of actions. To categorise measures according to their effect may contribute to a prioritising of implementation projects.

Table 3      *Examples of possible measures regarding increase the bicycle use organised within the Four Step Principle.*

<b>Step 1 - Affects the need for transport and choice of transport mode</b>		<b>Effect</b>
<b>Information - Information to stakeholders</b>		
	Information campaigns in schools for children with bicycle projects. For example, one week specified on the bicycle, as well as information on how to cycle, traffic safety, repair of bicycles, etc.	Knowledge
	Home visits – information about start cycling	Knowledge/ Inspiration
	Information sheets that says how much you will save by start cycling in aspects of health, economic, environment etc.	Knowledge/ Inspiration
	Facebooks groups/sides with motivation and inspiration.	Inspiration
	Information/articles in newspaper about what have been done regarding bicycle.	Knowledge
<b>Dialogue - Communication with stakeholders</b>		
	Bicycle projects in schools.	Encouragement /Knowledge
	Bicycle projects at the workplace (example Bicycle Friendly workplace).	
	Healthcare contribution specified for cycling.	Encouragement
	Benefits when cycling a number of kilometres at the company.	Encouragement
<b>Try out - pilot project for behaviour change</b>		
	Possibility of trying electric bicycles at the workplace.	Inspiration
	Get salary/bonus if one does not take the car to work.	Motivation
	Get bicycle computer and equipment sponsored in return of reporting.	Motivation
	Cargo bicycle projects/test to shop, transport children to preschool etc.	Inspiration
<b>Force (Pull and Push) – fewer car results in more people have to take the bicycle</b>		
	Inset car parking fees.	Forcing
	Impair the public transport, a lot of change.	Forcing
	Car free zones (in city centre for example).	Forcing

<b>Step 2 - Optimize, efficient use of the existing infrastructure</b>		<b>Effect</b>
<b>Maintain and Operation</b>		
	Paving material and condition of bicycle paths.	Comfort/Safety
	During winter use the method "Sopsaltning".	Safety
	Sand sweeping.	Safety
	Count-down function at traffic lights.	Continuity
	Extra Long green signal phases or green wave (admission of speed).	Continuity/ Travel time
	Lightening the surrounding area, not only cycling road.	Safety
	Sign at the streets – make it clearer and easier to orientation.	Simplicity
	Correct system of signs.	Simplicity
	Reduce the speed limit for vehicles.	Safety
	Bicycle boulevard – priority to cyclists.	Simplicity/ Safety
	Decreasing speed limits.	Safety
<b>Support and service - facilitate cycling and increase the attractiveness</b>		
	Be able to take the bicycle on public transports.	Simplicity
	App at smartphones/Facebook sides/web sites to report deficits.	Simplicity
	App at smartphones to see possible bicycle routes.	Simplicity
	Radio support - daily information, traffic accidents etc.	Safety/Travel time/Simplicity
	Program/applications for planning bicycle routes.	Simplicity/ Travel time
<b>Bicycle during construction</b>		
	Good possibilities of bicycle routes during construction.	Continuity
	Ensure safety when cycling thru construction areas.	Safety
<b>Step 3 - Reconstruct</b>		<b>Effect</b>
<b>Infrastructure</b>		
	Coloured bicycle paths.	Simplicity

	Speed obstacles/bump along the road or in intersection with car traffic.	Safety
	Separate cyclists and pedestrians with colour or lines.	Safety
	Rapid bicycle paths and routes.	Travel time
	Redirect traffic from residential area and schools and prioritise cyclists and pedestrians.	Safety
	Secure bicycle crossings and bicycle priority crossing, according to the design.	Safety/ Simplicity
<b>Parking</b>		
	Facilities as locker rooms, compressors etc. at bicycle parking places.	Comfort
	Bicycle parking under roof at traffic nodes.	Comfort
<b>Complementation</b>		
	Rails at certain intersections to facilitate the bicycle use.	Simplicity/ Comfort
	Making tunnels under Söderleden nicer with lighting, painting, etc.	Attractiveness
	Shelter to break the wind.	Comfort
<b>Step 4 - Build new</b>		<b>Effect</b>
<b>Infrastructure</b>		
	Construct so there is few or no interruption in the bicycle network.	Continuity
	When building new, secure that it is from a cyclist point of view.	All
	Separate bicycle and walking paths.	Safety
	Separate car traffic from bicycle paths.	Safety
<b>Parking</b>		
	Parking places in connection to traffic nodes, workplaces and visiting areas.	Simplicity
	Good parking facilities with locker rooms.	Comfort/Safety
	New buildings require bicycle parking facilities- according to new car parking standards.	Safety/Comfort

Some examples from previous implemented projects in the western region of Sweden are described below.

### **3.2.4.1 “Sopsaltning” – maintenance of bicycle paths during winter time**

A preventive action that could result in better quality of bicycle path in the winter is the method “Sopsaltning”. According to a report from VTI (2014), eight out of ten accidents related to cycling are single-bicycle accidents. This is often correlated to slipping because of ice and snow, but also to remaining “rolling gravel”, used during winter maintenance. The method is to use a specific brush for taking away the snow and then the slipping is controlled by saline. It has been showed to be more effective to remove snow and ice than conventional methods, and there is no sand and gravel on the paths in snow free weeks (VTI, 2014). The method is only useful in temperatures higher than eight degrees below zero and if there are heavy snowfalls, complementary ploughing is needed. Another disadvantage is the risk of rust from the salt and it could also exist a risk of refreezing after saline use. It is also more expensive than the method with gravel and sand because of higher cost for labour (Österbeg, 2015).

In Stockholm the method of “Sopsaltning” was introduced in 2012 and the number of bicycle paths where the “new” method is used has increased during the years. The result is an increase of 30% cyclists in the winter time (Österbeg, 2015). Also in Mölndal the method has been introduced in the winter 2014/2015 throughout the bicycle network, after test in specific areas the previous winter (Mölndals stad, 2015). About half of the participants in “Vintercyklisten” comment the result as an improvement of conditions for cycling. In Gothenburg “Sopsaltning” was tested in the winter season 2014/2015 in some of the main bicycle paths (Göteborgs Stad, 2016) and it continued during this winter, 2015/2016. It is a new method and there are investment costs of new machines but it is also in general more expensive than traditional maintenance with chippings. That is a reason for the progressive change in Göteborgs Stad to “Sopsaltning”, according to Erika Åkerblom (Planeringsledare, Trafikkontoret Göteborgs Stad, 2016).

### **3.2.4.2 “Vintercyklisten”**

A project called “the winter cyclist”, in Swedish named “Vintercyklisten”, began in 2015 by Västra Götalandsregionen (2016) together with the participated municipalities Ale, Alingsås, Mölndal, Lidköping, Stenungsund and Öckerö. The purpose was to increase the number of part-time cyclists and reach to people that use the bicycle in the summer period but not in the wintertime. A number of 40 participants, who were users of vehicle in the winter, were chosen to be a part in the project. The cyclists received inspiration from other cyclists, studded tires and changing of tires. In exchange they had to commute and travel by bicycle at least three days a week and report their experience and their travel habits. The project was on-going between 14 December 2015 and 14 March 2016.

Similar projects have been made in other cities in Sweden. One example is in Gävleborg, where the number of participants in the project has increased from 40 the first time to 100 participants four years later. Replaced trips by car was in 2013/2014 a total of 43 680 kilometres (Region Gävleborg, 2014). In this project the cyclists registered their trips in an app and they were rewarded with studded tires, saddle cover and a reflective vest.

### 3.2.4.3 “Testcyklister”

A project implemented in 2014 was “test-cyclists”, in Swedish “Testcyklister”, with the purpose to inspire people to increase their bicycle use by showing the opportunities with bicycle as transport mode. This was a collaboration by Hållbar Utveckling Väst (HUV), Göteborgsregionens kommunalförbund (GR) and seven municipalities; Halmstad, Alingsås, Mölndal, Ale, Lidköping, Lilla Edet and Öckerö (2015). In the spring five persons in each municipality, in total 35 persons from students and commuters to young children, was chosen to be test-cyclists. The requirement was to replace everyday trips by car, for example when going to shopping mall, school, recreational activities or work. The test-cyclists had to cycling at least three times a week in a period from April to October. An appropriate bicycle, it could for example be an electrical bicycle or cargo bicycle, was chosen to the test-cyclists with help of a bicycle expert. During the period, test-cyclists received personal advices from a coach. A travel survey and a health examination were also performed before and after the period.

The result of the project was beyond expectations, according to the test-cyclists and the managers of the project. The participants saved on average 1 400 SEK during the six months of period, they found new ways of transportation by bicycle and enhanced their health. From the result of the first health examination, 59% of the test-cyclists were in need of a lifestyle change. After the period the number had decreased to 37%. Both physical and psychological well-being were improved, according to the responsible actors Hållbar Utveckling Väst and Göteborgsregionens kommunalförbund (2015).

### 3.2.4.4 “På egna ben”

In 2012 the project “On your own feet”, in Swedish named “På egna ben”, was launched in the Region of Gothenburg in schools for children in class 4-6. The purpose was to integrate sustainable travels in the education in a playful and pedagogic manner; the approach was to connect behaviour with knowledge, challenges and exercises (Göteborgsregionen kommunalförbund, 2016).

The challenge for the school classes lasted for five weeks in the autumn, from the beginning of September to the middle of October. The aim for the students was to go to school by bicycle, walk or use the public transport, thereby skip the short travels by car. By score points, classes are competing against each other. There were awards for the winners, but all students received knowledge in health, environment and traffic safety (Göteborgsregionen kommunalförbund, 2016). Each year the project was evaluated in a survey to the teachers, see Figure 7 for summery from the last four year.

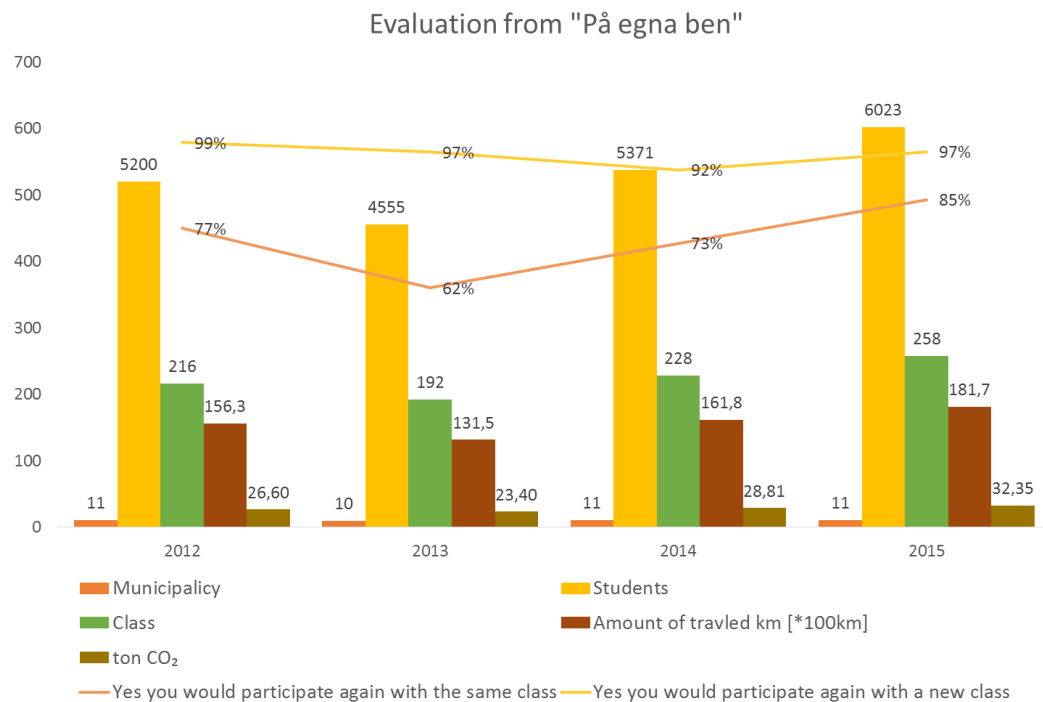


Figure 7 A summering of the project "På egna ben" between the years 2012-2015 (Göteborgsregionen kommunalförbund, 2016).

The evaluation shows that the schools participation has increased and CO<sub>2</sub>-emissions have decreased (Figure 7). Although the amounts of municipalities' participation in western Sweden is the same as start 2012 to latest 2015, the reduction that happen during 2013 can perhaps be explained by only ten participate municipalities. One factor that the teacher has answer is that they would rather participate with a new class then the same class again, see the lines in Figure 7.

A fifth grade class at Askimsskolan in Askim was the winner of the project in 2015. According to the teacher<sup>2</sup> of the class the project has been positive in a number of aspects. The project has created a team spirit in the class by competing together and the students have received general knowledge about health, environment and sustainability during the project. Parents and siblings have also helped the students in the class to score points and have had a positive attitude. To receive an impact from the projects encouragement, enthusiasm and a committed responsible person for the project are required.

### 3.2.4.5 Cykelvänlig arbetsplats

"Bicycle friendly workplace", in Swedish called "Cykelvänlig arbetsplats", is a project in western Sweden started in 2016 by Västra Götalandsregionen, which all working places in the area can take part. It encourages workplaces that work with bicycle issues and it is free to participate. All workplaces can take part, from private companies to public services and organisations. The workplaces are then competing for the title

<sup>2</sup> Marianne Graselius, Teacher, Askimsskolan. Interviewed 12 of April 2016.



“most friendly bicycle workplace in western Sweden” (Västra Götalandsregionen, 2016).

The workplace just has to register them by starting an account and go through a list of criteria for different levels of start status. There are three levels and each level require five met criteria (Västra Götalandsregionen, 2016). For each level the workplace receive a star, for example; for one star the working place have to check five criteria and for three stars fifteen criteria need to be checked. Then the workplace can have a diploma and sign display on the website with their logotype. It is recommended to have a bicycle responsible person at the workplace that works with bicycle related questions. This is also mentioned at a meeting regarding inspiration and advices for the project “bicycle friendly workplace”, arranged by Mölndals Stad 18 April 2016.

Gothenburg has their own award “Bicycle friendly workplace” open for all work places with at least ten employees and located in the municipality of Gothenburg (Göteborgs stad, 2016). It is almost the same with three levels, but in this case the criteria for each level are specified. Receiving a sign with the reward a “bicycle friendly workplace” gives the company an opportunity to use it in promotions and on their website.

Reasons why companies want to participate in the project “Bicycle friendly workplace” could primarily be referred to health and environmental policy from a research with the purpose to identify the aim at each company (Nyström & Bergdahl, 2014). Many companies have already stated environmental objectives and participate in project like this is a natural part to reach the environmental goals. The possibility to receive an environmental certificate or feel a pressure from the society to be environmental friendly could also be reasons to participate. Companies also consider it as positive to be identified with this project and it is a competitive advantage to have the opportunity to show the diploma. Companies mention reasons for not participating such as time, economic, the lack of knowledge or a dedicated person.

#### **3.2.4.5.1 Case studies of companies as good examples**

**CPAC System** is one company in the project “Bicycle friendly workplace” by Västra Götalandsregionen and they have received three stars. The company develops control system for the vehicle industry and is located in Mölndal, along Mölndalsvägen. About half of the employees, around 50 people, are commuting to work by bicycle, of them 25 employees are commuting at a full-time basis all year round<sup>3</sup>.

The company has a well-established health policy that places their employers in focus. Several possibilities are offered to give the employees opportunities and encouragement to be healthy. In the same building as the company there is a commercial fitness centre where all the employees get free memberships and scheduled time in the gym at working hours. According to an interview (2016) with Anders Pihl, engineer and HR-manager at CPAC System, this contributes to team building in the company when the employees, at all levels are exercising together. Employees also get more motivated to exercise when it is done during paid working time. Another measures is health checks

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<sup>3</sup> Anders Pihl, Chief Technical Officer & Human Resource Director, CPAC System. Interviewed 31 March 2016.

and tests when two doctors visit the company twice a year. The company has also access to a locked bicycle room with bicycle service facilities as compressor and repair accessories. In their offices there are changing rooms with showers, washing machine and drying cabinet, an advantage for commuting to and from work. Further an electrical bicycle can further be tested in the companies rent system for bicycle and there are persons that have purchased an electrical bicycle after testing it.

The result of the health-promoting job at the company is in the view of Anders Pihl very positive. It is shown in lower absences from work and more dedicated employees. The only negative effect from the healthy policy is a few persons have been damaged when practicing various workouts.

Anders Phil has noticed that common excuses or reasons for not cycling are the weather and possibility to sweat. Lacks of knowledge of where to cycle from home and the insecurity in the traffic are additional reasons. Anders Pihl is dedicated to cycling and helps with bicycle related questions as for example giving advice in the purchase of a bicycle or suitable clothes for cycling and he helps with suitable bicycle routes. He also assists with repairing of bicycles. In the springtime a “bicycle fix day” is arranged for employees to get their bicycles ready for the season and motivate persons start cycle in the spring when the weather is getting better. Conditions, helps and encouragement from the company make people test cycling. The first step in the process of using bicycle is to test it.

**Gryaab**, a wastewater treatment plant in Gothenburg, earned the title “Gothenburg’s most bicycle friendly working place” in 2014. The company have formed a bicycle group with engaged persons from different part of the organisation that dealing with the subject. They have arranged activities in terms of health and sustainable transportation with rewards and also invited bicycle companies, for reparations and tests of bicycles. According to Iryna Camp<sup>4</sup>, who is participating in a part in the bicycle group it is imported to work structured, analyse the situation about what can be improved and be sensitive to opinions from the employees.

Their success lays in involving relevant people and fulfilling the list of criteria of becoming “Bicycle friendly working place”. They decompressed the criteria in different colure; green - that they already fulfil, yellow - in what that have to improve with simple measures and red- measures that needed the management decision to implement. The attention from the management was positive and with the aforementioned dedicated bicycle the work with sustainable travel went efficiently. Having the bicycle parking closest to the entrance and showing the work and rewards of bicycle friendly working place makes people aware of the work and together with continues activities it keeps the interest among employees at a high level.

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<sup>4</sup> Iryna Camp, Engineer, Gryaab. Presentation in Mölndal 18 April 2016.

### 3.3 Monitoring

Other main parts in the process of increase the bicycle use are evaluations and following-ups (Sveriges Kommuner och Landsting SKL, 2012). It is important both for involved people in the process, at work and in general public to know how about the process and to ensure that the progress is going in the right direction and that right efforts have been done.

Measure and monitor the number of cyclists is important to know how many people that are cycling and if the municipality's target is achieved (Garandin & Rehnberg, 2012). Collecting statistics and information about the completed bicycle projects in a single document provides a comprehensive view of the actions completed during a year. Transfer of knowledge regarding both positive and negative aspects of the projects is also important. This can easily be compiled in an annual bicycle account.

Monitoring is, according to strategy in Västra Götalandsregionen, a key element to ensure if investments are made to fulfil and meet up to set targets by the municipality (Mattsson, Sundberg, Nilsson, & Trivector Traffic, 2016). Evaluation and follow ups should be done for different levels and focus; operating, quality or effects:

- *Operating* monitoring shows how the implementation proceeds and how it went, where cost-effectiveness can be an indicator.
- *Quality* monitoring shows if goals and strategy meet up to the condition, indicators respond to the improvement of the function of the investment measurements like destinations that are connected to bicycle paths, cycle flow or travel time before and after an operation.
- *Effect* monitoring is to see if cycling increases and becomes more secure. Indicators to monitor, are for example, share and the number of bicycle trips. Demand is often difficult to follow up, partly because of difficulties in gathering information, and because it is difficult to tie the outcome to concrete efforts.

Evaluations and follow-ups are often a missing link in the process because, it is low prioritised. It is a challenge to find out an appropriate method to do this easy (Sveriges Kommuner och Landsting SKL, 2012). Regularly surveys and travel habits are methods that could be used before and after an implemented project or a measure, as mention in Section 3.1.1.

There is plenty of literature and advice about how to do evaluations and measurements in form of travel survey, traffic counting etc. (Tyréns, Sveriges kommuner och landsting, 2015). Defects are not performed afterwards and evaluations for understanding the effects and expected impact of specific infrastructure measures are often missing. To create an overview of how the situation advancing it is good to have many measurements. Difficulties are based in how to address measurements and counting, as for example: the share of cyclists, amount of cyclists, what the opinions of the cyclists are, amount of trips by cyclist, cycle flow etc.

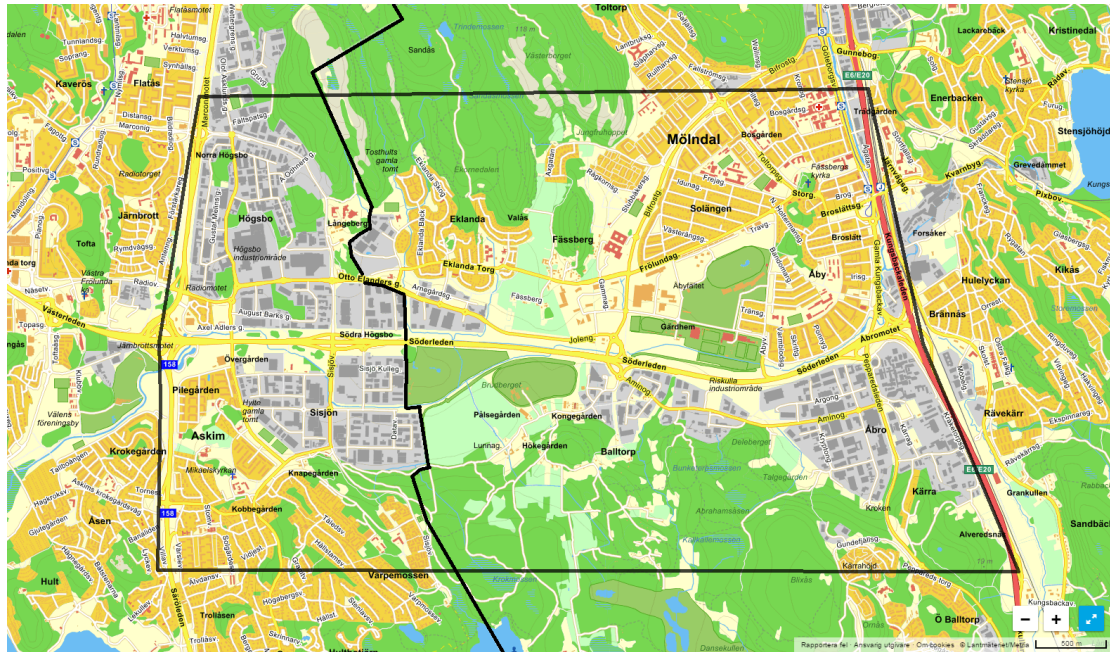
Feedback is an important step to keep the bicycle paths in good condition all year round and it is also essential with continuous supervision and inspection (Frodlund, Gustafsson, & Spolander, 2014). Damage and error to the bicycle path, such as holes, subsidence, cracks, speed limits and protruding edges should be notified to the responsible at the municipality.

Göteborgs Stad have in their bicycle strategy the point “Quality secure and follow up”, as an important step but it is not developed and has to be further developed (Göteborgs Stad Trafikkontoret, 2015). In the previous year, since 2012 the evaluation and monitoring were gathered in a document “Cykelåret”. In 2015 the compilation was done in a Traffic and travel development, that merged cyclists with pedestrian and public transport progress (Trafik- och resandeutveckling 2015; Göteborgs Stad, 2016).

Mölndal are using bicycle accounts as a tool in their process for their visions. It includes the situation assessment, comments from the cyclists, measures regarding bicycle and the result from them. The first performed bicycle account is from 2009 and the latest is from 2015 (Cykelåren i Mölndal 2013-2014).

## 4 The studied area Fässbergsdalen

Fässbergsdalen is an attractive and strategic area divided between two municipalities; Gothenburg in the west and Mölndal in the east, see the boundary marked with black line in Figure 8. This area includes both industries and residential areas and has developed from a farming area to a more urbanized area during the 20<sup>th</sup> century (Göteborgs Stad, Mölndals stad, 2012).



*Figure 8 Map over the area with the specified boundaries for the thesis and the municipality boundary, between Gothenburg and Mölndal, marked with black in the middle, © Eniro (2016).*

The area includes the region between Järnbrottsmotet and Åbromotet, with the north and south part of Söderleden. Söderleden, also named E6/E20, has a length of around 5.5 kilometres and is managed by Trafikverket as a part of the Swedish national road network.

### 4.1 History

In the beginning of 20<sup>th</sup> century almost the whole part of Fässbergsdalen was cultivated, it was one of the biggest connected agriculture land in the region of Gothenburg. The modern housing started in 1950s and 1960s, in the western part of Fässbergsdalen in the areas Frölunda, Järnbrott and Flatås. Before Hösbo was the first part in the area with residents and some industries. In this time also Hösbo-Sisjön industrial area, before named Norra Askim's industrial area, emerged and expanded with industries and companies. From being a production industrial area, the area Fässbergsdalen developed to a more logistic, commerce and services businesses area (Göteborgs Stad, Mölndals stad, 2012).

## 4.2 Today

Fässbergsdalen has during the last decades gone through a change in area of business to more commerce and extensions in new residence areas and densification.

In the industrial area Högsbo/Sisjön, in the west part of the studied area with Söderleden that divided them, there are about 1 650 companies in different businesses with approximately 20 000 employees (Företagarföreningen Högsbo-Sisjön, 2016). Store managers connected to Företagarföreningen Högsbo-Sisjön (2016) describes it as a interesting, expanding area with many customers, both private and businesses. On the other side, the east part of Fässbergsdalen is Åbro industrial area with for example the big companies AstraZeneca and Santa Maria. Approximately the studied area Fässbergsdalen has about 39 800 inhabitants. This amount of inhabitants are estimated by maps with data from Lantmäteriet (2014) and compared to statistics from Göteborgs Stad (2016) and Mölndals stad (2016).

In the area belonging to Gothenburg in Fässbergsdalen, almost all land territory is used and here transformation and densification is a topic. In contrary, there are areas of unused area for exploitation in the part of Fässbergsdalen that belongs to Mölndal. Regarding the expanding of the region of Gothenburg, there is a need of new areas for residents and businesses. Fässbergsdalen is a possible area expansion and both the municipalities have plans for the area. It also exists national interest in the area regarding the national road network, national preserves and the Swedish Armed Forces have facilities here. Västtrafik have interests connected to the public transport in the area (Göteborgs Stad, Mölndals stad, 2012).

### 4.2.1 The infrastructure and traffic situation

Söderleden is an important transport route and connection between Hisingen and the road network at the south and west part of Gothenburg. It is also a connection between the harbour in Gothenburg and the industries at Hisingen. This generates heavy traffic and traffic with dangerous goods (Structor Mark Göteborg AB, 2015).

At the present the network of pedestrian and bicycle routes are relatively extensive in Fässbergsdalen, see Figure 9. It is possible to cycle from Åbromotet to Järnbrottsmotet. From Mölndal city centre to the centre of Sisjön industrial area, it is about six kilometres to travel by bicycle. There are mostly two-way bicycle paths along most of the main streets, shared with pedestrians. Crossings of Söderleden exist at six places; two tunnels (black line across Söderleden in Figure 9) and four bridges (red crossing of Söderleden in Figure 9). However, one of the bridges has a staircase (marked with black double line), which is not bicycle friendly.

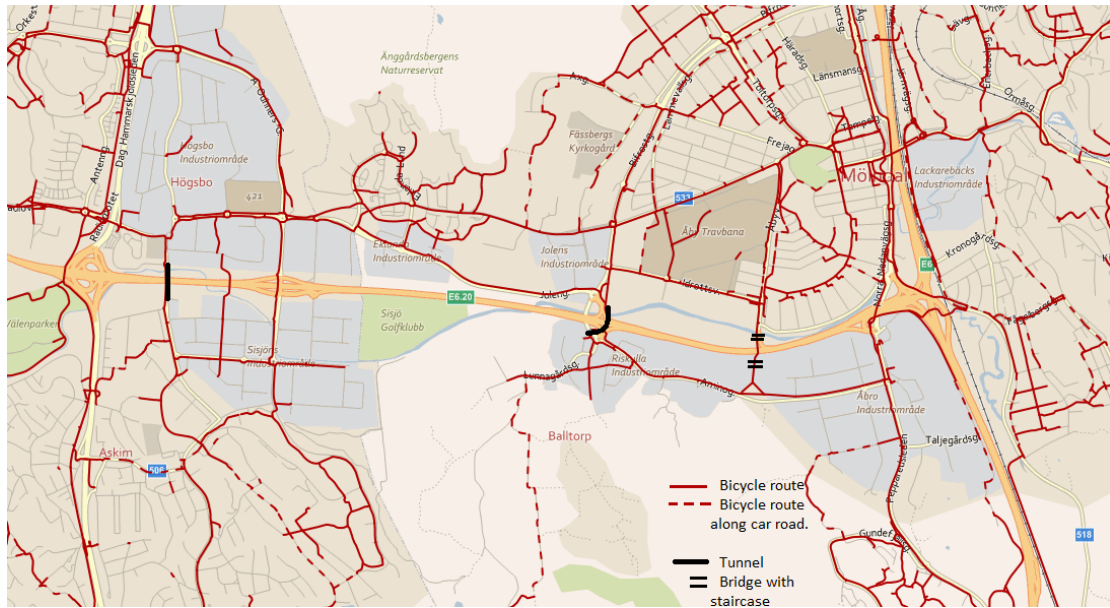


Figure 9 The bicycle network, showed as red lines, in Fässbergsdalen (Trafikverket, Västtrafik, & Göteborgs Stad, trafiken.nu, 2016).

## 4.2.2 Problems

One of the big problems in the area Fässbergsdalen is the traffic situation; the traffic has increased during the years both at local traffic routes and at national traffic routes in the area. The Annual average daily traffic, AADT, in a section at Söderleden between Sisjömotet and Fässbergsmotet, is measured to 56 990 vehicles in 2014, referring to Trafikverket (Vägrafikflödeskartan, 2016) and the heavy traffic amounts to approximately 8% of total traffic. The traffic has in general increased annual with 4% per year at Söderleden since the traffic route was constructed in 1970. As a comparison, the total traffic increase in the same period throughout Gothenburg was annually about 1.5-2%. Since 1970s, the traffic strategy in the region of Gothenburg has aimed to move the traffic from the central parts in the city to ring routes. The purpose has been to reduce air pollution and traffic noise. This is one reason for the increased traffic at Söderleden. The increase of traffic is also referred to the reduced accessibility at E6 through Tingstadstunneln, which is a reason for people choosing Söderleden/Västerleden (Structor Mark Göteborg AB, 2015).

Furthermore, the expansion of Fässbergsdalen and the increased trading area in Högsbo-Sisjön, is another reason for the increased traffic. Söderleden/Västerleden are of nation interest because of the transport to the ports in Gothenburg. Particular problem spots are for example Sisjömotet and Fässbergsmotet, with traffic congestions and queues at peak hours. At certain times the queues at the slip road ramps expands out to Söderleden (Göteborgs Stad, Mölndals stad, 2012).

Problems with the infrastructure, with congestion and traffic jams, is also a general opinion of store managers in Företagarföreningen Högsbo-Sisjön (2016) according to interviews about advantages in Sisjön and what can be improved. Enhancements regarding the infrastructure are stated from interviews that should be improved.

## 4.3 Future plans

Both Gothenburg and Mölndal have further plans concerning Fässbergsdalen in their comprehensive plans. Their respective Stadsbyggnadskontor have also cooperated and established strategies and visions concerning the land use, infrastructure and environment in Fässbergsdalen since 2010. This is done in a specific comprehensive plan; Översiktplan för Göteborg och Mölndal - fördjupad för Fässbergsdalen (2012), for the upcoming years.

Due to the increase in traffic, as mentioned before, there is need for a new infrastructure regarding public transport, road structure and measures to increase transport by bicycle and pedestrian. Specified plans and measures for increase the bicycle use in the area Fässbergsdalen can be seen in Section 4.3. Already in 2008-2009 the project started by investigation of the area to improve the traffic situation. In the same time Vägverket, known as Trafikverket today, did a pre-study about an expanding of Söderleden and Västerleden (Göteborgs Stad, Mölndals stad, 2012). The public transport should be developed according to K2020, a project and cooperation adopted in 2009 by six public bodies, concerning the public transport system in Gothenburg (Göteborgs Stad, et al., 2009).

Because of the interest from Trafikverket concerning Söderleden as a national interest, it is important to retain the local traffic from Söderleden. The cooperation between Trafikverket, Göteborgs Stad, Mölndals stad and Västtrafik, has established agreements and targets about change of land use. The expansion in land use is produced in respect to the comprehensive plans for respective city and the specific plans for each city are presented in following Sections 4.3.1 and 4.3.2.

### 4.3.1 Plans according to Göteborgs Stad

In the comprehensive plan for Gothenburg an extension and densification of the industrial area in Högsbo-Sisjön is desired. In the south and in the north, marked with a brown border in Figure 10, new residential and businesses areas are investigated. (Göteborgs Stad Stadsbyggnadskontoret, 2009).



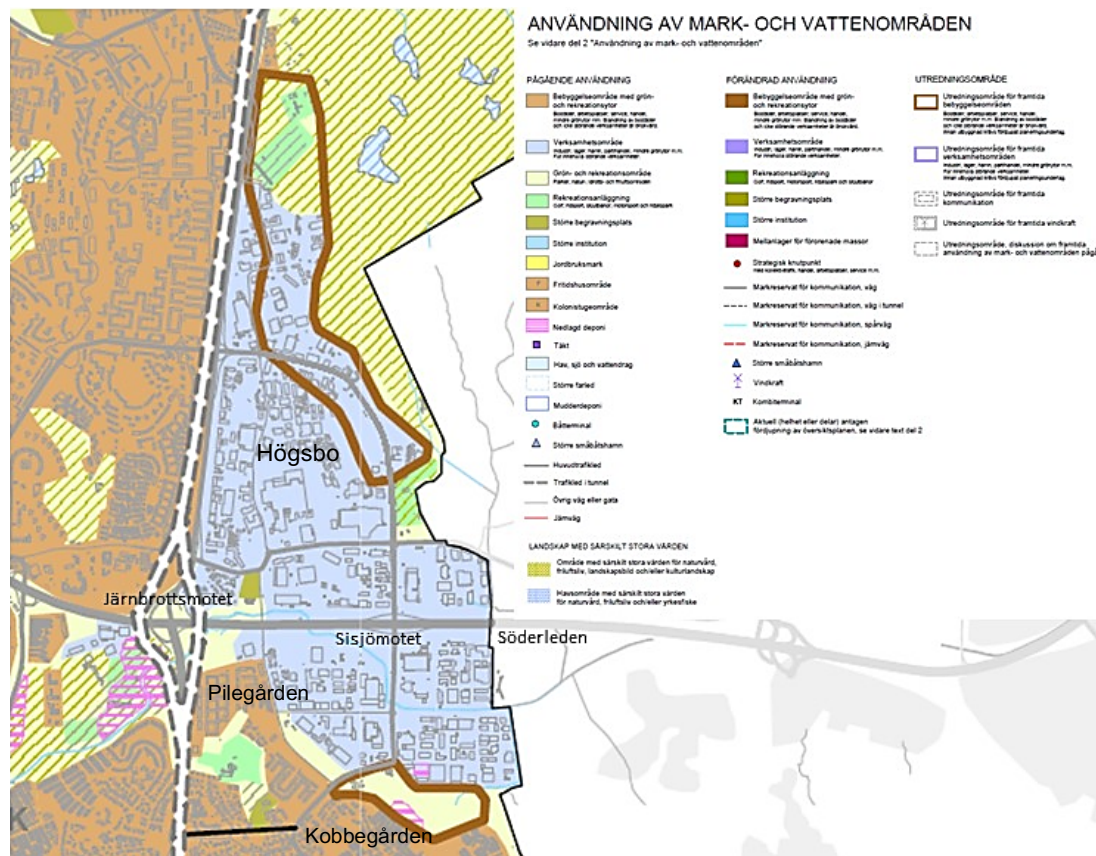


Figure 10 Reconstructed map in the comprehensive plan for Gothenburg. The marked brown areas are investigated areas for residences and businesses. (Göteborgs Stad Stadsbyggnadskontoret, 2009)

Infrastructure improvements are also in plans to be performed as supplementations at Radiomotet and Sisjömötet are going to be reconstructed with new ramps to increase the capacity in cooperation with Trafikverket. There are additionally plans of enhancements of the traffic environment at Otto Elandersgata and some smaller improvements in local streets in Sisjön (Göteborgs Stad, Mölndals stad, 2012).

The planned changes in land use concerning residential, industries and business areas are shown in Table 4, according to the agreement between the involved partners; Trafikverket, Göteborgs Stad, Mölndals stad and Västtrafik. This is the first step in the agreement, but they are not absolute if the measures concerning the congestion in traffic have not been effectuated.

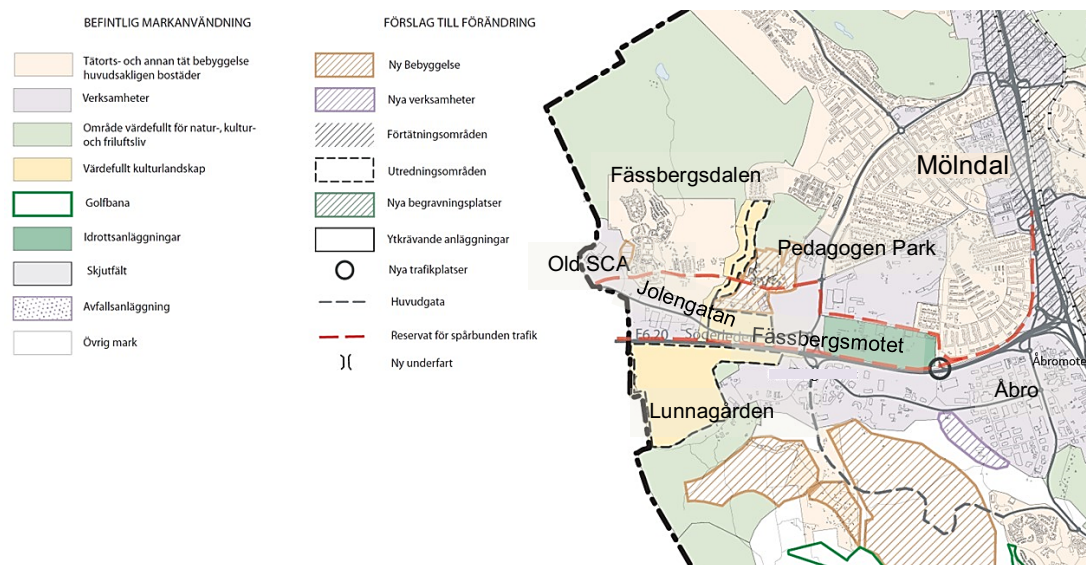
Table 4 The agreement includes the following change in land use of gross area connected to Gothenburg, see the areas in Figure 10.

	Residential [m2]	Retail [m2]	Business [m2]
Kobbegården	30 000	-	-
Pilegården	30 000	2 000	-
Retail and office at Sisjömötet	-	20 000	25 000
<b>Sum in Gothenburg</b>	<b>60 000</b>	<b>22 000</b>	<b>25 000</b>

The category “retail” refers to shopping areas, while the category “business” refers to companies. In total there are big areas of planned expansions; totally 107 000 square metres according to Göteborgs Stad in the area Fässbergsdalen. In Kobbegården the residential area includes plans of apartments in apartment blocks at existing parking areas according to Stadsbyggnadskontoret (2015). However, Bauhaus is in the moment constructing and establish a new store, covering around 17 000 square metres in the area Sisjön, but this construction is not included in the plans above. The same applies to Billema that is currently expanding with 7300 square metres in the north part of Sisjön, next to Söderleden (Holm, 2015) .

### 4.3.2 Plans according to Mölndals stad

In the comprehensive plan for Mölndal from 2006, there is a plan for a new residential area in western Balltorp and an expansion of residences in Eklanda. Both the areas are parts of Fässbergsdalen, which can be seen in the lined brown area in Figure 11. In connection to Balltorp, a new sport- and recreational area are proposed near the new residences. At both side of Söderleden there are bigger agriculture areas that can be used for other land-use in the future (Mölndal stad, 2006).



*Figure 11 Reconstructed map of Fässbergsdalen from the comprehensive plan for Mölndal. The marked brown-hatched areas are proposed new urbanization. (Mölndal stad, 2006)*

One or two new junctions are also proposed at Söderleden and further needs of broadening Söderleden and improved capacity at Fässbergsmotet are stated. E6/E20 is important both as a national route and local main road for Mölndal. (Mölndal stad, 2006).

The planned changes regarding land use in Mölndals stad concerning residential, trade and business area is shown according to the agreement between the involved partners; Trafikverket, Göteborgs Stad, Mölndals stad and also Västtrafik (Table 5). As mentioned before, this is the first step in the agreement nevertheless but measures concerning the congestion traffic has to be made.

*Table 5 The agreement includes the following change in land use of gross area in Mölndals stad see the area in Figure 11.*

	<b>Residential [m2]</b>	<b>Retail [m2]</b>	<b>Business [m2]</b>
<b>Pedagogen Park</b>	100 000	20 000	-
<b>Lunnagården etapp 1</b>	-	-	175 000
<b>Lilla Fässbergsdalen</b>	23 000		-
<b>Jolengatan</b>	-	-	20 000
<b>Old SCA, from office to residential</b>	100 000	-	- 30 000
<b>Sum of Mölndals Stad</b>	223 000	20 000	165 000

The old SCA building in Eklanda are planned for reconstruction from office and business premises to residential, see Table 5, this when SCA office moves to the new building in Mölndal centre. Pedagogen Park is another area with plans for expansions of residential. From a previous school building to a business centre, the next step for the area are development to a new part of the city with residential.

### **4.3.3 Plans by Trafikverket regarding Söderleden**

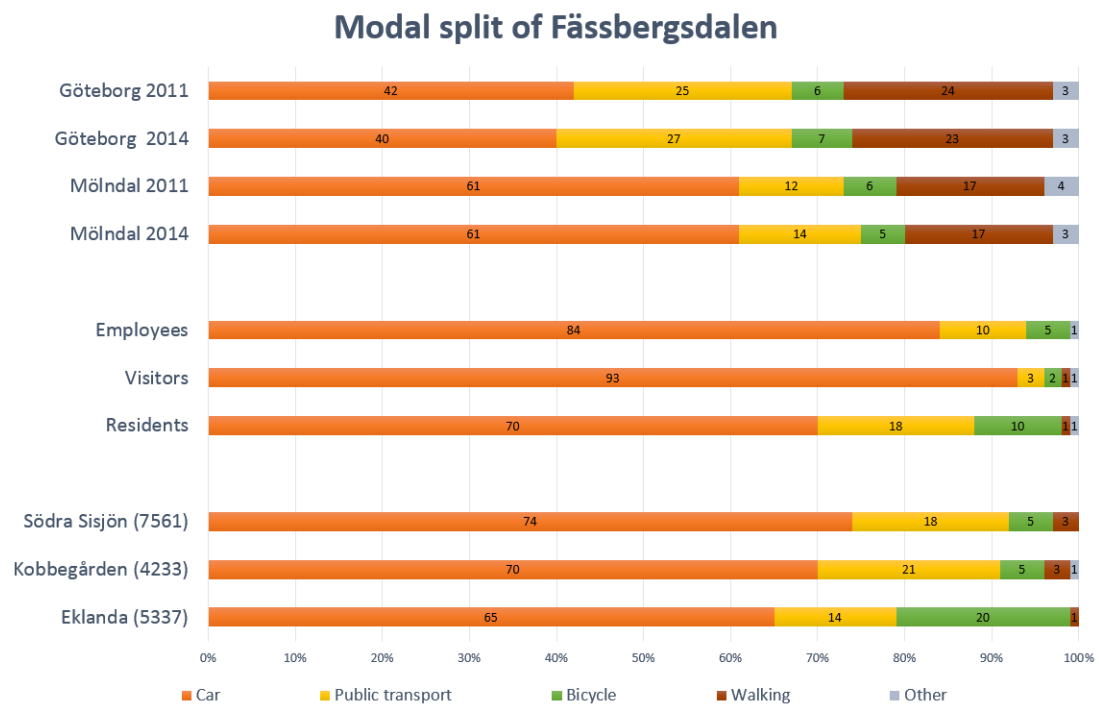
Trafikverket have plans of measures in order to increase the capacity and availability of Söderleden and in Sisjömotet. This will be done in order to keep its function as a well-working circular road. The plans will be performed and constructed between the years 2017 and 2019 (Structor Mark Göteborg AB, 2015).

The project of Söderleden includes an additional traffic lane on the both sides of the road from Sisjömotet to Fässbergsmotet. Between Fässbergsmotet and Åbromotet there will be an extended traffic lane only at the south side of the road. It is already extended at the north side of the road. This will result in more regular velocity and increase of accessibility (Structor Mark Göteborg AB, 2015).

The other part in the plan includes a reconstruction of Sisjömotet with reconstruction of the entrance and exit of Söderleden. The construction will gain both the local and regional traffic and development; it is a necessity for a continued development of the industrial area Sisjön (Structor Mark Göteborg AB, 2015).

## **4.4 Travel survey in Fässbergsdalen**

The survey company Markör did a survey in 2015 (Resvanor i Fässberg) on behalf of Trafikverket, about travel habits in the area Fässbergsdalen in cooperation with Göteborgs Stad and Mölndals stad. The basis of the survey was a statement from Trafikverket; future plans of expanding in Fässbergsdalen should not produce more local traffic that could intrude on the national interest of Söderleden. Therefore, the habits of the transportation of visitors, employees and residents have been studied and the choice of transportation mode from the survey is shown in a modal split in Figure 12.



*Figure 12 Modal split of the municipalities Gothenburg and Mölndal from 2011 to 2014 and modal split for employees, visitors and residents in Fässbergsdalen. Also the distribution of amount of trips in the three investigated residential areas; Södra Sisjön, Kobbegården and Eklanda is shown. (Trafikverket, 2015) (Göteborgsregionen kommunalförbund, et al., 2015).*

Correspondingly the modal split (Figure 12) show the choice of transportation and the change between the years 2011 and 2014 for the municipalities of Gothenburg and Mölndal from a travel survey made for the Västsvenska paketet (Göteborgsregionen kommunalförbund, et al., 2015). Further the modal split is explained in Sections 4.4.1 and 4.4.2.

#### 4.4.1 The residents

According to a summary by Trafikverket of the survey in 2015 (Resvanor i Fässberg), the interviews of the residents were done by telephone and in terms of a journal. In the interviews, the residents were asked how they travelled the day before. Totally 400 residents in the areas Södra Sisjön, Eklanda and Kobbegården with ages ranging between 18 to 84 years were interviewed. The result of the interviews was reported with respect to age, sex and resident area.

The numbers of cars are high in the area, an average of 89% of the residents have access to a car and the main transport mode is car. In the summary of the survey (Trafikverket, 2015), the total amount of all trips made by car by residents were 70% and 10% was made by bicycle, see Figure 12. For the three areas Södra Sisjön, Eklanda and Kobbegården, the total amount of trips is shown in bracket in Figure 12. The resident area Eklanda has a significant higher number of trips by bicycle then the other two investigated areas, 20% of the trips there are made by bicycle there.

Of all trips with starting point in Fässbergsdalen, 37% was in the area and 79% of these trips were done by car (Trafikverket, 2015). Another statement was that trips started in Södra Sisjön often had its final destination in central part of Sisjön and Högsbo industrial area.

#### **4.4.2 The employees and the visitors**

The survey among employees and visitors was done by interviews on-site, at nine different companies and stores. A total of 363 employees and 415 visitors in the area took part in the survey (Trafikverket, 2015). To get the total amount of trips in the area, both of the categories was multiplied at an annual basis with a coefficient.

According to the survey (Resvanor i Fässberg), 84% (Figure 12) of all trips were made by car among employees and 93% of the trips among the visitors. The trips by car were also including motorcycle. Only 5% respectively 2% were transports by bicycle. The employees were coming from more different areas then the visitors in Fässbergsdalen, the main part were from the city centre of Gothenburg, city centre of Mölndal and West and South of Gothenburg. Among the visitors, 49% only did a stop in Fässbergsdalen.

## 5 The cycling situation in Fässbergsdalen

This chapter will treat how the cycling situation is today in the studied area, Fässbergsdalen by an assessment of the area and the situation assessment will result in a problem description regarding bicycle use. Also the set targets group for the area and already planned measures by the committee will be presented.

### 5.1 Situation assessment of the area

Investigations and gathering of data of the present situation in the area is important in order to identify the problems and to get knowledge of what kind of measures that are appropriate to improve the situation for cycling. This will be done by:

- Already done measures referring to cycling.
- Analysis of the travel survey.
- SWOT-analysis.
- Web survey among employees and cyclists.
- Evaluation of distances to schools and every-day facilities.
- Travel route comparisons between bicycle and car.
- Analysis of missing links.

#### 5.1.1 Already implemented measures

In the studied area some projects have already been tested and implemented in the recent years regarding bicycle use, both at Mölndal's part and Gothenburg's part in Fässbergsdalen. Below some projects for the area are described.

For example, in the area belonging to Mölndal, the bicycle network has been extended and separations between pedestrians and cyclists with white lines have been improved. The separations have been considered as positive from the public (Mölndals stad, 2015). In the years 2004-2007, Mölndals stad performed a project called RAM, Resvanor till och från Arbetsplatser i Mölndal, i.e. travel habits to and from working places in Mölndal (Tyréns AB, 2015). The project was a kind of travel habit project with eleven big working places and development of a network for exchange of ideas, knowledge's and measures to facilitate the commute to work. It resulted in improved knowledge's about travel habits and lifestyles among the employees. In 2014 an evaluation of the project was performed by Göteborgsregionens kommunalförbund, GR (Tyréns AB, 2015). From interviews with participants, a conclusion and prosperity with RAM is the cooperation, contact and information from the municipality and the network. Both SCA and AstraZeneca, two big companies in Mölndal, participated in this project.

Other projects from the area in Fässbergsdalen responding to Mölndal are, as mentioned before, "Vintercyklisten" and improved winter maintenance with the method "sopsaltning". Mölndal stad has also had theme-weeks in 2014 (Mölndals stad, 2015); a road-user week, with the purpose to change transport mode from car, and a sustainable week with lectures regarding bicycle use and possibilities to test electrical and cargo

bicycles. Specific activities as arranged bicycle days with free bicycle service and participation in “cykelutmaningen” has been arranged by Mölndal.

In Högsbo-Sisjön area, at the part belonging to Gothenburg in Fässbergsdalen a project was launched to increase sustainable travels (Tyréns AB, 2015). Experience from the project could be recognised as the cooperation between Göteborg Stad and the company/business association in the area and the advantage with a concrete question for them to work with. From the report by Energimyndigheterna (Thorén & Svensson, 2012), two of the main measures were a bicycle pool system and improvements of close environment that was directly connected to bicycle measures. Unfortunately, the costs for the bicycle pool was perceived to high and the project were put on ice. The project to create close and safe environment in the area were also down prioritized due to lack of resources. In the project thoughts and problem was brought up and the work could possibly continue in the future but not as a part of the Energimyndighetens project.

Schools in the area, both in the municipalities of Mölndal and Gothenburg have taken part in the project “På egna ben”, as mentioned before in Section 3.2.4.4. A class in Askimsskolan was the winner in the region of 2015.

### **5.1.2 Analysis of the travel survey**

An analysis of the travel survey from Trafikverket (2015) in Fässbergsdalen, Section 4.4, was made in order to get knowledge about the cycling situation among residents and employees and to find possible target groups where the bicycle use could increase. The reason for not considering the visitors in the analysis was because it is an undefined group and therefore hard to reach.

Of all the trips made by the residents, 10% were by bicycle. This amount is higher than the total bicycle amount in general in Gothenburg and Mölndal, see details in Sections 2.5 and 2.6. Still there is certainly a potential for increase this amount of trips, due to relative close distances further explained and analysed in Sections 0 and 5.1.6.

The median of transport distance by car is seven kilometres one way and there is a notable observed amount of 85% using the car at a distance of four kilometres one way (Trafikverket, 2015). This is a possible number to change; residents who take the car at distance of four kilometres and shorter can be convinced to use bicycle instead. Trips around four kilometres are often made to buy food, leaving and collecting children at pre-school and school and it is possible to make these trips by bicycle instead. The median distances of drop and pick up children at preschool and school are two kilometres.

The median transport distance of transport to work is ten kilometres in Fässbergsdalen (Trafikverket, 2015). It is possible to take bicycle to work at a distance of ten kilometres and shorter, cycling ten kilometres takes about 30 - 40 minutes. Thereby this target group of commuting, i.e. employees in the area, with a maximum distance of ten kilometres to work that is using car today as transport, could consider to changing their transport habit and start using bicycles instead of cars.



### 5.1.3 SWOT-analysis

A SWOT-analysis is one way to do an assessment of the situation of the area. It is a systematic way to analyse the area and it aims to identify strengths, weaknesses, opportunities and threats for a specific area. All data are classified under one of the category and will result in weaknesses that has to be reduced and strength that should be utilized. Strengths and weaknesses are related to the own organization, while opportunities and threats are more related to external systems (Boverket, Trafikverket, & Sveriges Kommuner och Landsting, 2015). Advantages with SWOT-analysis are the simplicity and it let the user have free thought, without specified variables. It could also be a disadvantage; it makes demands of the users to identifying important variables by themselves.

A general SWOT-analysis regarding bicycle for the area Fässbergsdalen was been done (Figure 13). The analysis is based on studies of the area, information in Chapter 4 and from the thesis own investigations.

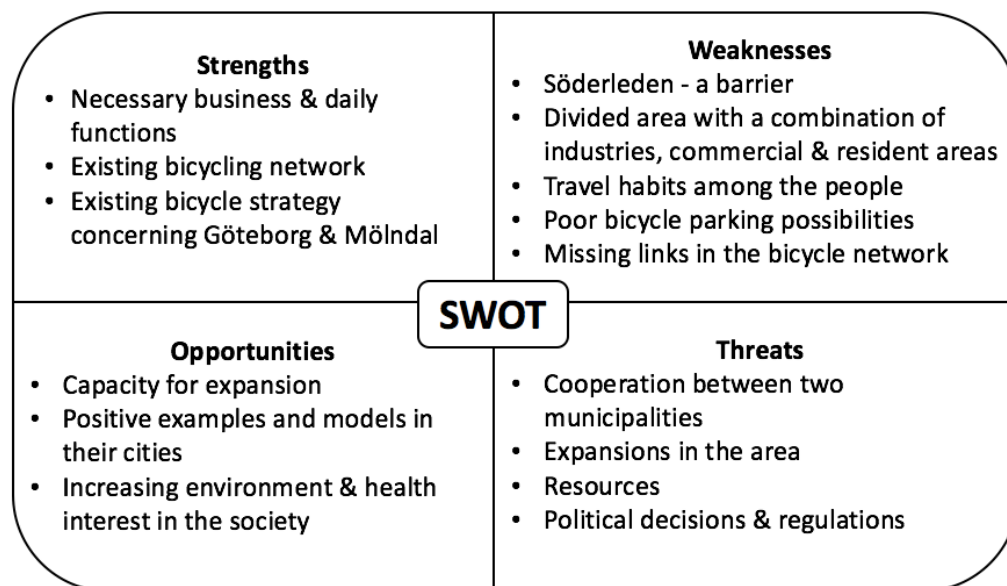


Figure 13 The SWOT-analysis by the thesis of Fässbergsdalen regarding the cycling situation.

### 5.1.4 Web survey about travel habits and bicycle measures

A web survey was performed to receive knowledge and opinions from residents and employees in Fässbergsdalen. The survey where set up with some strict question and some open question so people could answer freely. The form was made in Google Form and send out to different working places/companies, among this Företagarföreningen Högsbo-Sisjön, Pedagogen Park, AstraZeneca, InterSport, ElGiganten, Ica Maxi Högsbo and Plantagen in both Högsbo and Fässberg. The URL, web address, was also distributed on notes at bicycles in Fässbergsdalen. In Appendix II, the web survey is presented in full extension. Some of the questions were more demanding than others; about how people feel about the area and if there are any problems. The survey could though be a bit misrepresentative, because the survey was allocated to cyclists mainly



and only get the perspective on the area from a cyclist point of view. What people think about the area and why they do not bicycle are not analysed, due to few answers.

The result of the survey with comments is more detailed presented in Appendix III. Totally 36 answers of the web survey were received, excluding one answer that did not lived or worked in the area, Fässbergsdalen. This answer is thereby exclusive in some considerations because they did not fulfil all supplementary questions; see the percent distribution in Figure 30. That is because it was only essential for the thesis with comments and opinions from persons with potential to use bicycle in the area since there are delimitations from visitors in the area.

From the result about 74% have answered that they bicycle in Fässbergsdalen respective 14% answered sometime or not regular bicycle in Fässbergsdalen, see the percent distribution in Figure 31. Three persons were not cycling in the area with the reason of too large distance to work. It is obviously crucial with the distances, long distance takes long time and time is important. Notable is that 47% in the survey thinking that there are no problem with cycling in Fässbergsdalen.

Mentioned problems among the comments are the bicycle paths; from the maintenance, missing links and problems with some crossings and roundabouts. Some translated comments from the web survey can be seen below, the original comments are presented in Appendix III.

*“The intersection Jolengatan/Otto Elanders gata would be better with a tunnel and bicycle paths on the north side of Otto Elanders gata.”*

*“The bicycle works well. It is bad that there are not continuous bicycle paths in the entire network, sometimes you have to cycle among vehicles”*

*“It works well most of the time. It is confusing and takes much time when you have to switch side of the road at the intersection Jolengatan /Otto Elanders gata.”*

*“Lacking in a good bicycle path between Toyota and Willys in Sisjön. Now I have to cycle on the horse racetrack (with the risk of collision with horse carriage) through, alternatively via Eklanda to go to Åbro from the Southwest parts of Gothenburg.”*

*“The maintenance of bicycle paths are not good and in many cases poorly signed and they are divided with vehicles.”*

*“Some poor lighting and the bicycle paths around Pedagogen Park is quite bad.”*

*“The bicycle paths crosses the road near traffic circles, which gives bad view for motorists. Better and clearer marking of what is bicycle and what is pedestrian path. The optimal would be differences in colour or similar, now pedestrians crosses the bicycle paths without look around.”*

*“The bicycle paths are mostly good and good maintained. Some parts are less maintained; it feels unclear who are in charge of it, Mölndal or Gothenburg. When new industries are constructed along the road, the bicycle paths are broken and more than 15 crossings has developed, both large and small on my way. All of them are dangerous and people commuting and have not driven there before are not observant if they cross a bicycle path.”*

The most important factor for people to cycling is health, according to the answers in the survey (Appendix III, Figure 31). A third of the answers have mentioned health as “very important”. Most share with “less important” factor have topography/surrounding. The environment/climate, travel time and bicycle safety are also important factors. Some comments of preconditions for cycling are cited as possibilities at the work place, such as changing rooms and showers.

Regarding the question about bicycle measures in the area Fässbergsdalen, there are significant most votes at the specified measures “winter maintenance” and “security- and safety enhancements” (Appendix III, Figure 32). Though, answers in the web survey are in general from persons that already cycling and therefore “push” measures as advocacy, bicycle projects etc. are not current for these persons.

### 5.1.5 Distance to school and every-day facilities

For analysing the area around schools and the possibility to cycling to and from school for residents in the area, the program QGIS was used. Figure 14 shows the schools in the studied area Fässbergsdalen as orange dots and the grey buffer zones with a radius of one kilometre. The chosen schools include all schools; pre-schools, elementary schools and high schools.

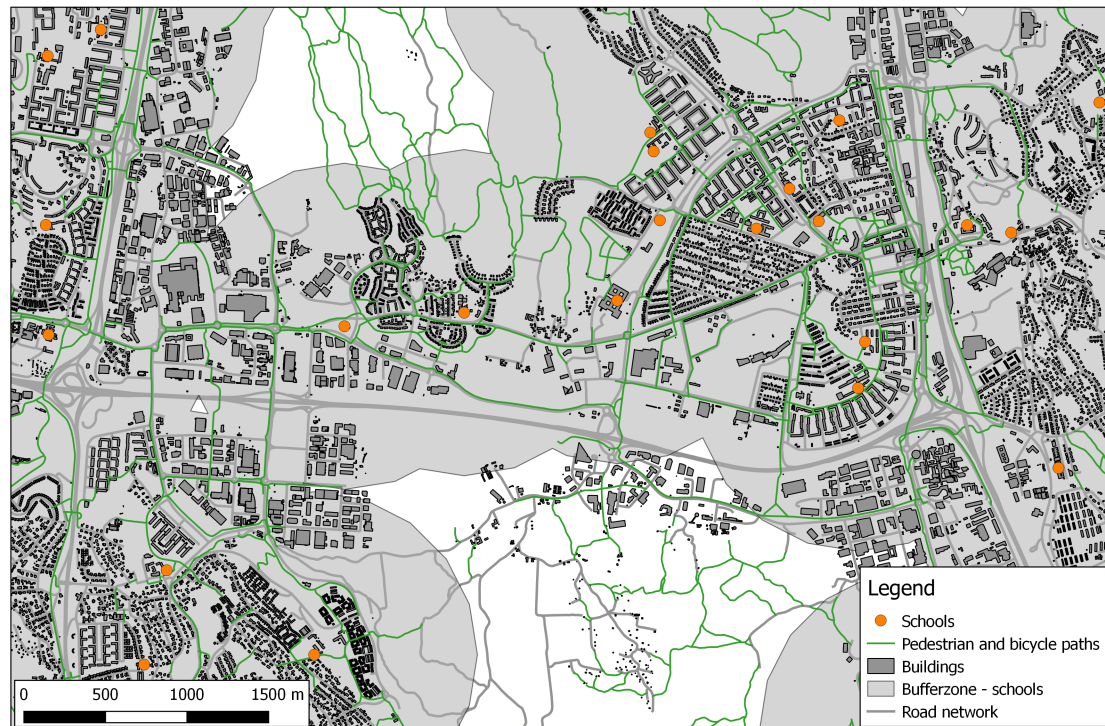
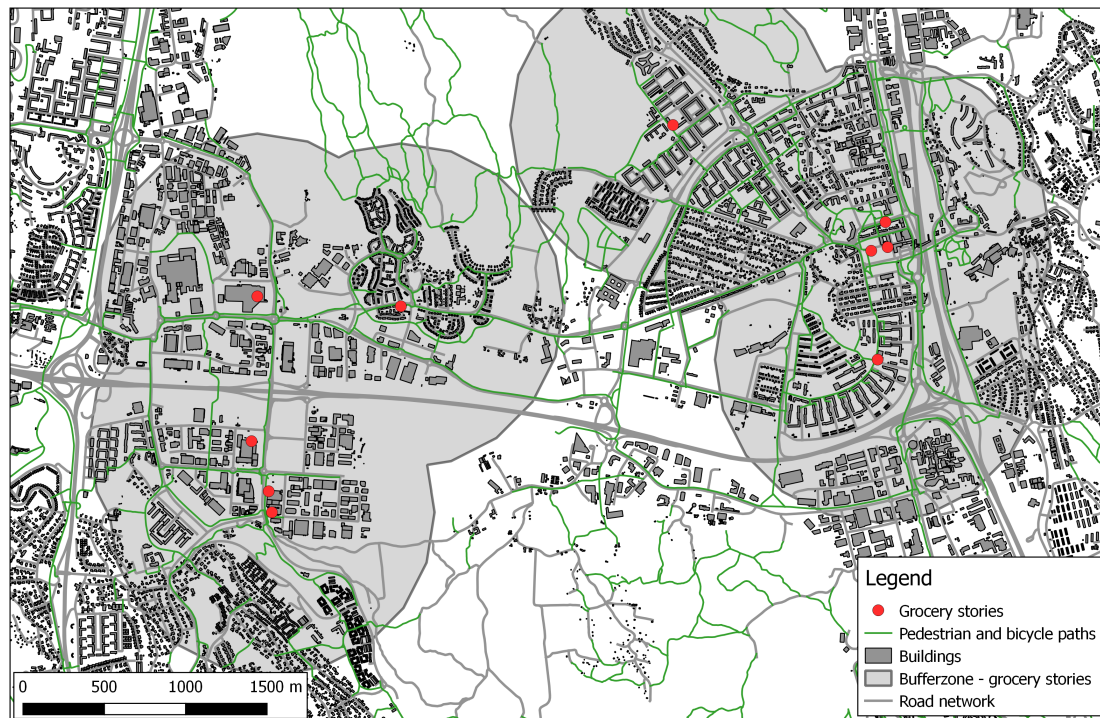


Figure 14 *Buffered zone for one kilometer from school, developed in QGIS by Hanna Nilsson with data from Lantmäteriet (2014).*

By this it is presented that all households in the area are situated in a radius of one kilometre to a school, except from the area in Balltorp, which is mostly a rural area. In this manner the distance to school is no reason for not taking the bicycle as transport mode to and from the school.

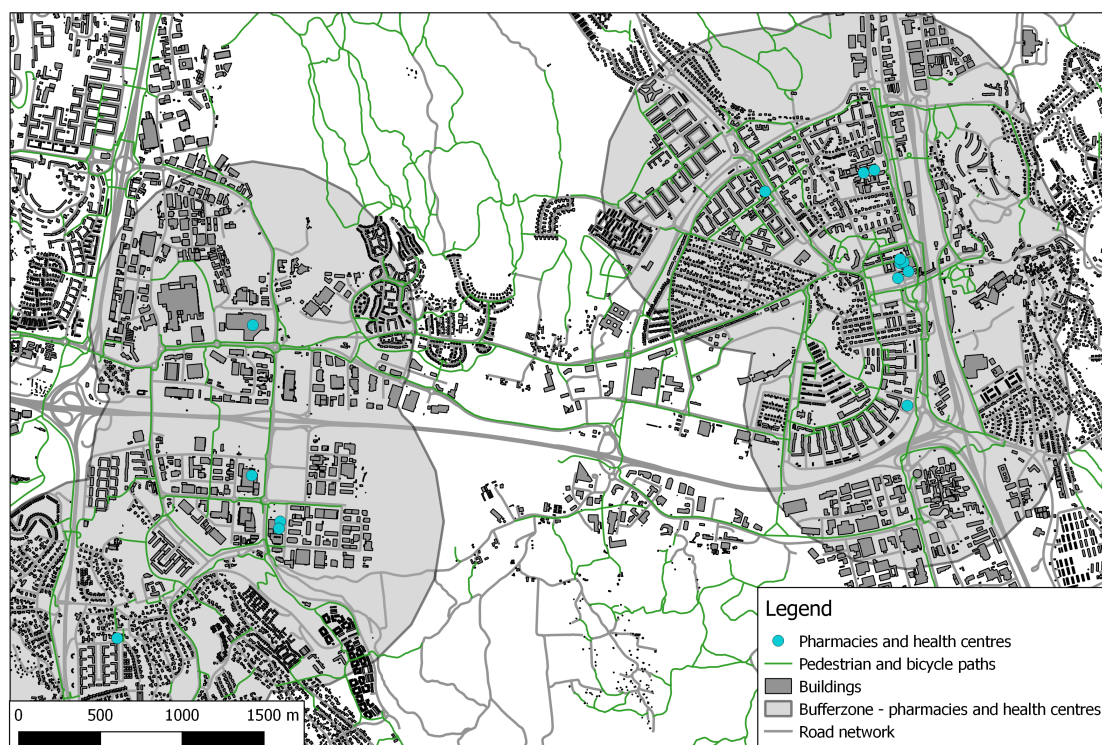
Also analyses have been made in QGIS of the distance to every-day facilities, considered as grocery stores and health centres. These kinds of every-day facilities are chosen with the motive to be necessary to visit daily. The analyses can be seen in Figure 15 and Figure 16, where the grey zones are buffer zones from the every-day facilities with a radius of one kilometre. In Figure 15 the grocery stores are marked with red dots. Totally there are ten shops in varying size in the defined studied area.



*Figure 15* Buffered zone for one kilometre from grocery stores, developed in QGIS by Hanna Nilsson with data from Lantmäteriet (2014).

In figure 16 the pharmacies and health centres are marked with blue dots, including the only hospital in the area; Mölndal's hospital.





*Figure 16 Buffered zone for one kilometer from pharmacies and health centers, developed in QGIS by Hanna Nilsson with data from Lantmäteriet (2014).*

The figure shows that most of the households have a distance of maximum one kilometre to the defined, necessary every-day facilities. Furthermore, the part of households outside the buffer zones has not more than about two kilometres to the facilities, which is well below an appropriate distance for cycling.

### **5.1.6 Travel route comparison between bicycle and car**

Five routes with different start points and destinations points were evaluated and compared in the transport mode by car and bicycle with help of OpenStreetMap (2016). OpenStreetMap has developed a system of free maps and geographical databases in the world in a collaborative project with donors.

The routes were developed for the thesis with the conditions to have a route with starting point and destination point at the same side of Söderleden; one at the north side ("Eklanda skog" – Mölndals torg) and respectively one at the south side (Askim's library – AstraZeneca). Additionally, a route with starting point and destination point at different sides of Söderleden (Eklanda School – Santa Maria) was developed. A short evaluation from Gothenburg Central Station to the company AstraZeneca in Åbro respective the store Jula in Sisjön. This was done to compare a longer distance and therefore the difference in time and possibility to commute to work or shopping.

Between the determined starting- and destinations points there are many possible routes, but only the proposed route at OpenStreetMap has been considered. For cycling the tool GraphHopper was used to calculate the routes and for car OSRM was used.

The routes were evaluated in the criteria travel time, distance and number of stops compared with transporting by car. Travel time by car was assessed without any traffic jams or obstructions, therefore this analyse could be a bit misrepresentative according to travel time for cars. The number of stops refers to valuated stops at traffic signals, crossings and roundabouts. The result is shown in the Table 6 below.

*Table 6 Compared travel routes from evaluation, with data from © OpenStreetMaps (2016).*

Stretch	Travel time [min]		Distance [km]		Number of stops [-]	
	Car	Bicycle	Car	Bicycle	Car	Bicycle
“Eklanda skog” (bus stop) - Mölndals torg	00:06	00:14	4.7	3.7	12	6
Askim's library - AstraZeneca, Åbro	00:06	00:28	7.0	7.6	5	15
Eklanda School - Santa Maria AB, Åbro	00:06	00:16	4.7	4.0	9	7
Göteborg C - AstraZeneca, Åbro	00:10	00:34	10.0	8.5	-	-
Göteborg C - Julia, Sisjön	00:11	00:40	11.0	10.0	-	-

In the following chapters, the determined five routes are presented with the values from Table 6 and further more described by an ocular analysis.

#### **5.1.6.1 “Eklanda skog” (bus stop) – Mölndals torg**

According to OpenStreetMap and Table 6, the proposed route is 3.7 kilometres by bicycle and 4.7 kilometres by car. The direction of the bicycle route is relative straight forward and easy to follow (Figure 17). There are no traffic signals but some roundabouts to pass. The level difference at the stretch is fairly low except from the ending (Figure 18).

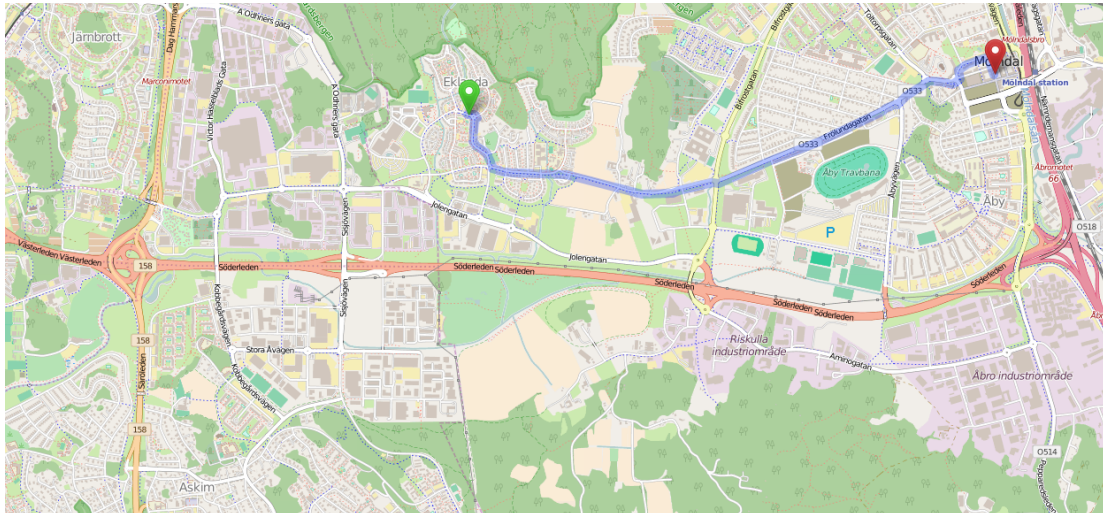


Figure 17 The route from “Eklanda skog” to Mölndals torg by bicycle, © OpenStreetMaps (2016).

Almost the whole stretch the bicycle path is separated from the road; sometimes there is even a specific walking path, i.e. sidewalk, on the other side of the road. In the city centre of Mölndal the bicycle and walking path is divided with a white line. The environment in the area consists of nature and residential areas. Though there is missing of signs at the route.

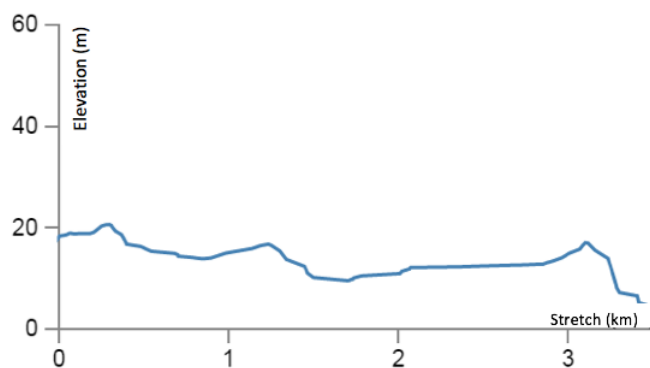


Figure 18 Level differences at the bicycle route from “Eklanda skog” to Mölndal torg (Trafikverket, Västtrafik, & Göteborgs Stad, trafiknu, 2016).

The proposed route by car (Figure 19) is longer and includes more stops than the route by bicycle, but it is the half of the travel time compared to the bicycle route. Another disadvantage by taking the car could be finding a parking space in Mölndal's city and it will be an additional cost.



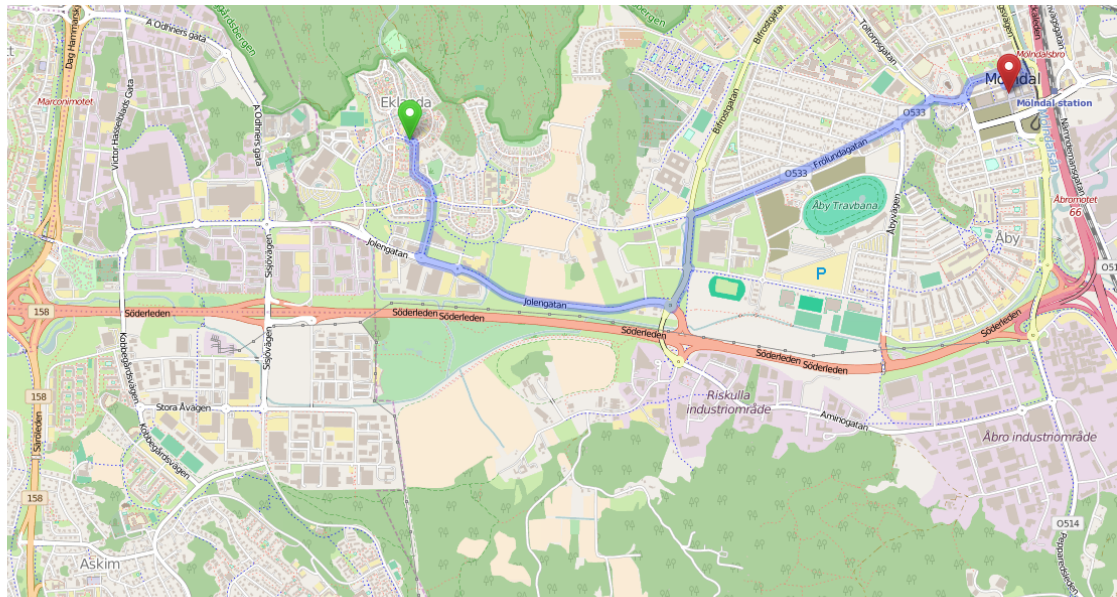


Figure 19 The proposed route from “Eklanda skog” to Mölndals torg by car, © OpenStreetMaps (2016).

#### 5.1.6.2 Askim's library – AstraZeneca, Åbro

The proposed shortest route at OpenStreetMap to cycle between these points is, 7.6 kilometres according to Table 6. The first kilometre is cycling in mixed traffic i.e. not specific bicycle paths. However, it is possible to bike at bicycle paths with a few hundred metres longer route. Along Sisjövägen the bicycle path is relatively thin and combined with pedestrians and it is also beside the road. The numbers of stops are high for a cyclist, there are traffic signals and crossing of roads during the whole stretch, see Figure 20.

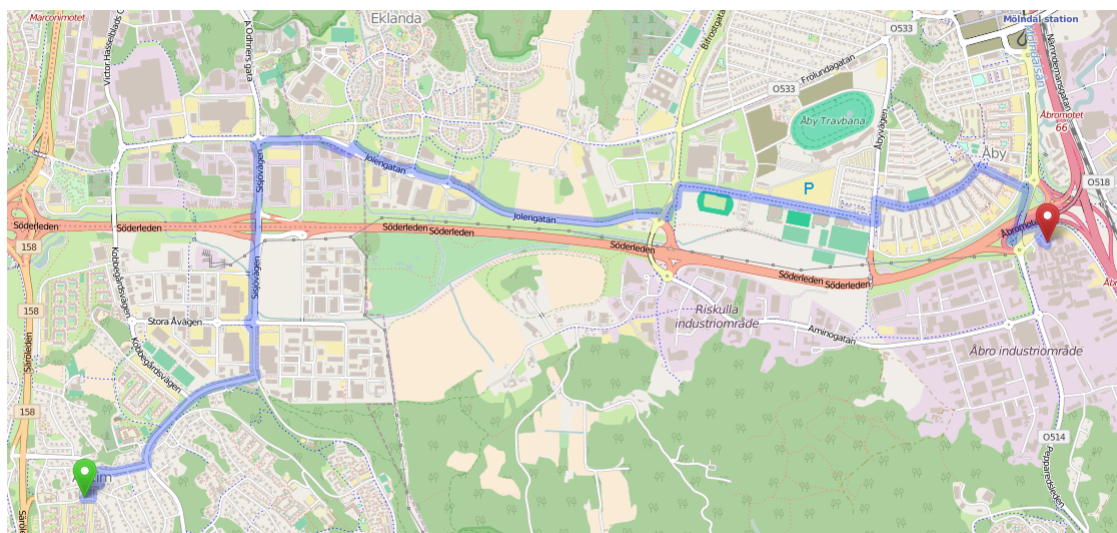


Figure 20 The route from Askim's library to AstraZeneca by bicycle, © OpenStreetMaps (2016).



At the purposed route, Söderleden has to be passed two times over bridges. Pass over a bridge it is a level difference which is a disadvantage and encumbrance for cycling. The level difference for the whole route can be estimated to about 35 metres (Figure 21). It also contains intersections to pass over a bridge, which will slow down the speed.

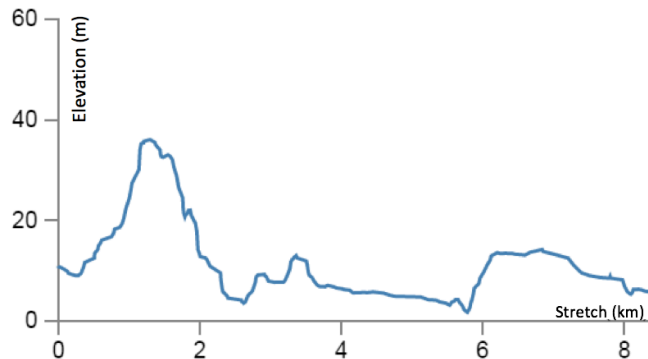


Figure 21 Level differences at the bicycle route from Askim's library to AstraZeneca (Trafikverket, Västtrafik, & Göteborgs Stad, trafiken.nu, 2016)

The proposed route by vehicle is almost completely done at traffic routes; Sisjöleden and Söderleden (Figure 22). It is easy to orient with few stops and turns. Traveling at daytime in peak hours can include a risk of traffic jams, which will result in delays; longer travel time than the estimated value in Table 6.

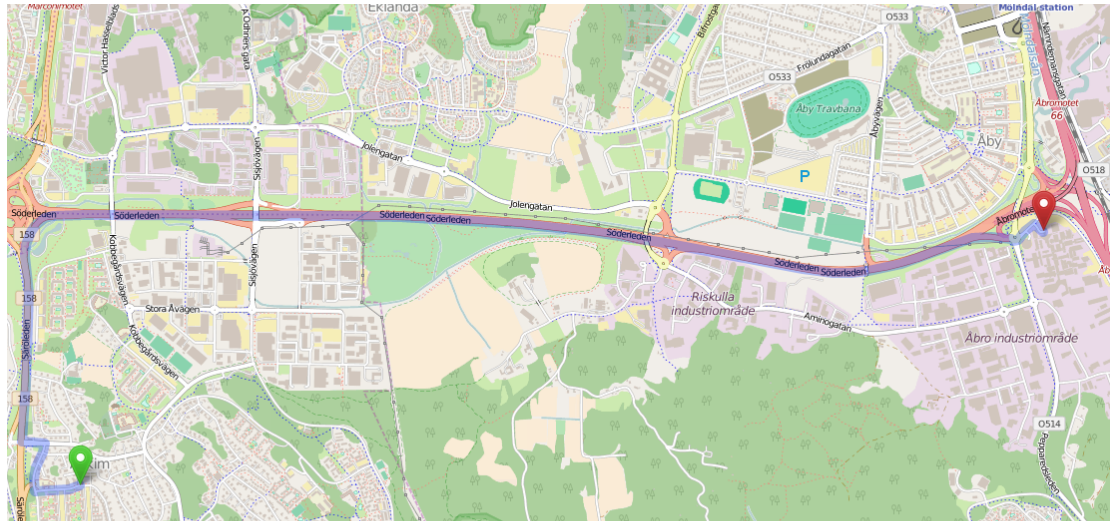


Figure 22 The route from Askim's library to AstraZeneca by car, © OpenStreetMaps (2016).

### 5.1.6.3 Eklanda School – Santa Maria, Åbro

Suggested bicycle route from Eklanda School to Santa Maria (Figure 23), is four kilometres according to Table 6. The stretch are easy to follow in general, there are some intersections where cyclists meet vehicles but they are not dangerous because they are well marked. The whole suggested route is at specific bicycle paths, except the last part towards the parking space at Santa Maria. The change of elevation (Figure 24) throughout the stretch is about a little over ten metres in height, the highest level change is in Fässbergsmotet where the bicycle route are going thru a tunnel under Söderleden.

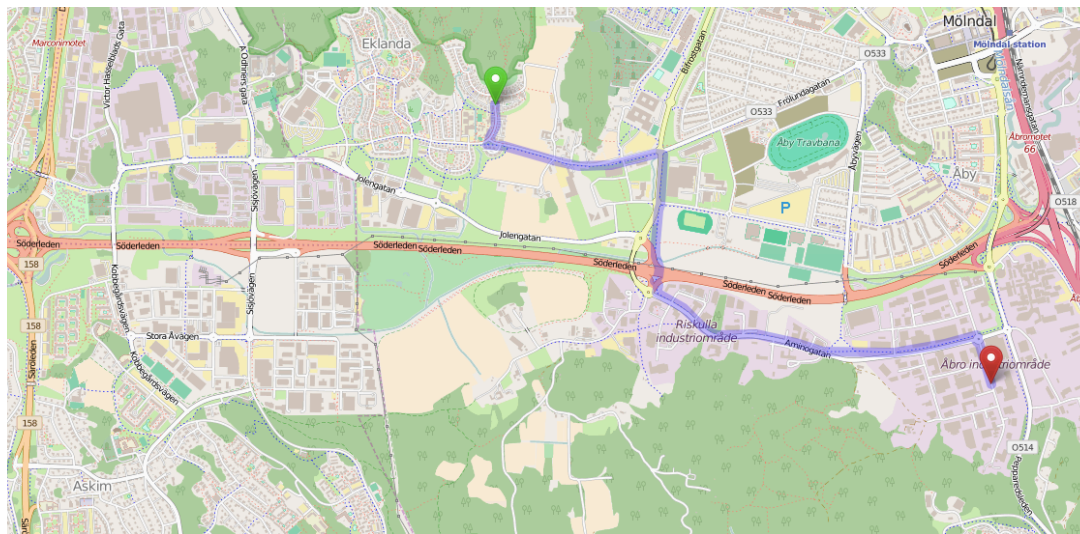


Figure 23 The route from Eklanda School to Santa Maria, Åbro, by bicycle, © OpenStreetMaps (2016).

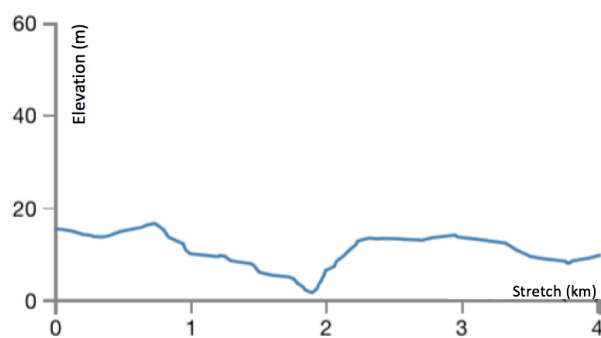


Figure 24 The level differences at the bicycle route from Eklanda School to Santa Maria, Åbro (Trafikverket, Västtrafik, & Göteborgs Stad, trafik.nu, 2016).

To travel the same stretch from Eklanda School to Santa Maria (Figure 25) by car, the purposed route is 4.7 kilometres and crosses Söderleden through Fässbergsmotet. There are more stops and intersections compared to cycling.

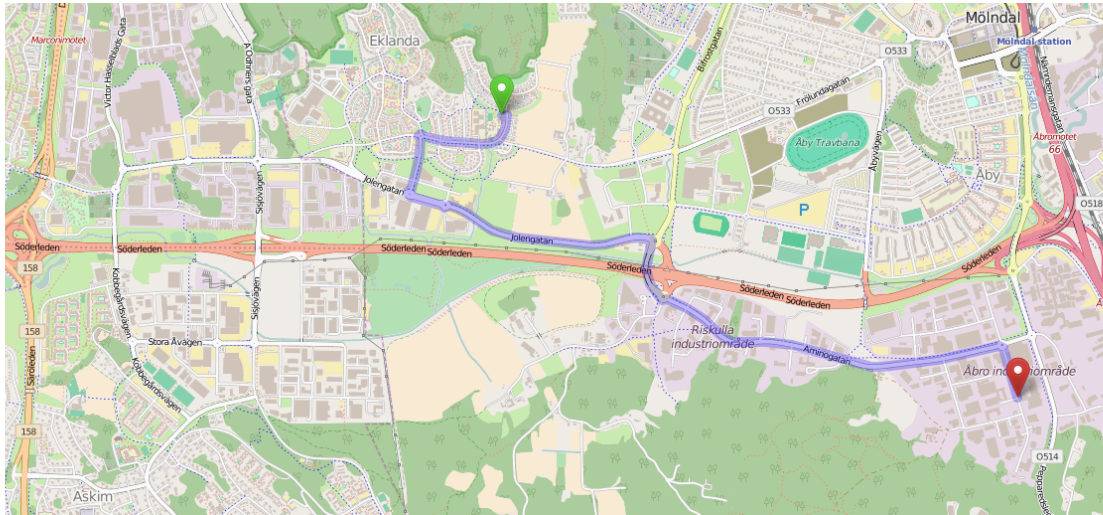


Figure 25 The route from Eklanda School to Santa Maria, Åbro, by car, © OpenStreetMaps (2016).

#### 5.1.6.4 Gothenburg Central station to Fässbergsdalen

An investigation about the length from Gothenburg Central station to Fässbergsdalen, both in the west and east part has been done. According to OpenStreetMap both of the proposed routes by bicycle is ten kilometres or less (Figure 26). A general appreciation is that Fässbergsdalen and Söderleden is far away from the city, but in real case it is not the accuracy. Stated in Section 2.4, the distance of ten kilometres is possible to commuting.

The proposed route by car is longer than for bicycle, but still it takes more than three times as long to go by bicycle. It is a reason for driving the car instead of cycling from and to the city to Fässbergsdalen. Another reason is the nature reserve area Änggårdssbergen, the green area in the middle of Figure 26, could be seen as a barrier to Fässbergsdalen.

The amount of stops is not investigated along this stretch for bicycle or car; it is not essential in this case because the main part of the stretch is outside the defined area for the thesis.



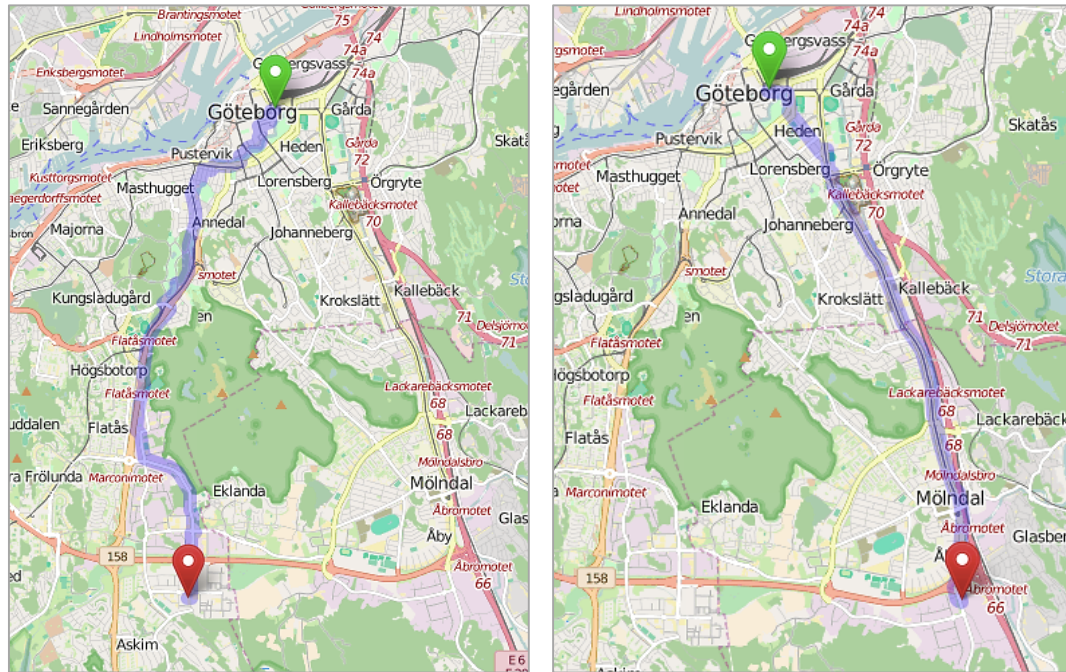


Figure 26 The proposed bicycle routes from Gothenburg Central station, to the left: to Jula in Sisjön in the west. To the right the proposed route from Gothenburg Central station to Astra Zeneca in the east part of Fässbergdalen, © OpenStreetMaps (2016).

### 5.1.7 Analysis of missing links

By an assessment of the map and study visits in the area, some missing links and discontinuities in the bicycle network were identifying. In Figure 27 they are marked with black dots. This missing links are seen as interruption in the bicycle network and therefore preventing continuity. Notable is also that no bicycle paths continues in to the industrial areas, the blue areas in (Figure 27).

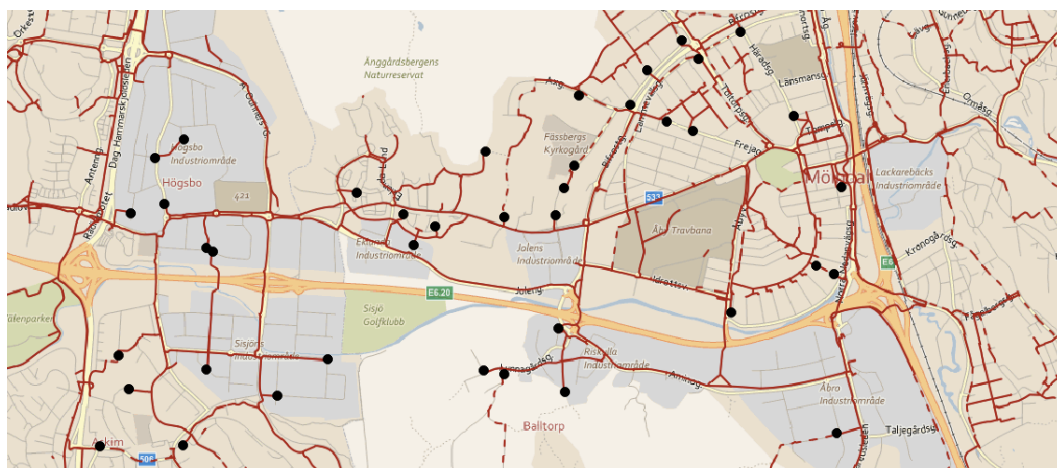


Figure 27 Missing links in black dots, map from Trafiken.nu were the red line are bicycle paths (Trafikverket, Västtrafik, & Göteborgs Stad, trafiken.nu, 2016).

This analysis is done for the main discontinuities, there are more missing links in the area but due to they end up in residential area where the speed limit is constraining they are not seen as vital compare to the rest.

## 5.2 Problems regarding bicycle

From the current assessment situation of the studied area, a problem description was performed with the intention to identify the problem and reasons to not cycling in the area (Figure 28).

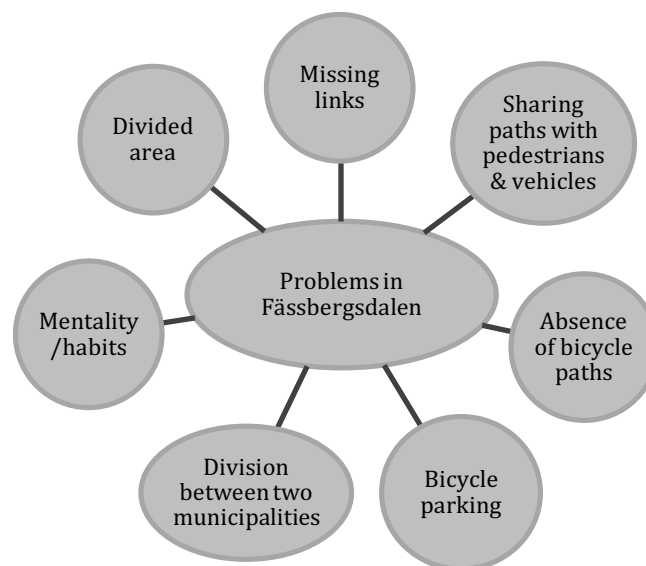


Figure 28 A schematic figure of the different kind of identified problems by the thesis regarding cycling in the area.

The area Fässbergsdalen is in general a **divided area** where mixed industrial areas co-exists with residents and recreation areas. This makes it a complex area to reach one specific target group and satisfied their need of transport mode.

There are a developed bicycle network in the area as mentioned earlier, but there exists several problems that have been identified. Regarding the analysed route from Askim to AstraZeneca in Åbro, Section 5.1.6.2, there is a need to cross Söderleden two times even though both the starting point and the destination point are at the same side of Söderleden. This is a **missing link** of the bicycle network at the south side of Söderleden, between Askim and Balltorp. This is also recognised in the SWOT-analysis, Section 5.1.3, existing of missing links and the point that Söderleden is a barrier. Passing Söderleden will be in several of the cases a level-difference with stops and crossings and this is not beneficial for cycling. Another **missing link** could be identified at the north side of Söderleden, from the residential area Eklanda to Dag Hammarsköldsleden. Comments from the web survey also mentioned connections to Eklanda as a point for improvement (Appendix III, Question 3 and 5). Eklanda is a relatively new residential area and along Dag Hammarsköldsleden there are commute bicycle paths to the city centre of Gothenburg

A large number of the suggested bicycle paths from used maps at trafikenu (Trafikverket, Västtrafik, & Göteborgs Stad, 2016) are narrow and **shared with pedestrians or vehicles**. Shared bicycle paths are a problem for safety and could make it more difficult for fast commute transport by bicycle. The continuity of bicycle paths is sometimes inadequate, for example in Högsbo-Sisjön industrial area the bicycle paths end in the middle according to the analysis of missing links. This also an object with endings and **absence of bicycle paths** at car parking places, when going for visits to a store or a company. As cyclist it feels unsafe to cycle among the cars on the parking places and often in the industrial area there is **no parking places** for bicycles close to the entrance of the shops.

The **division of the area between two municipalities** is also a threat indicated in the SWOT-analysis. This requires good cooperation between Göteborgs Stad and Mölndals stad. A recognised problem is for example in the application “Cykelstaden” by Göteborgs Stad, where the bicycle network abruptly ends at the municipality of Mölndal. Missing collaboration is obvious here. Bicycle path signs are sometimes not complete in the area. An example of misleading signs is at the bicycle paths around Fässbergsmotet in the directions to Sisjön – Askim, at the south side of Söderleden, there is a sign with “Sisjön 1.8 km”. It is unclear; it does not referring to the area Sisjön but the lake Sisjön. Signs are important in the way of feeling secure of finding the way easily. The problem with a division between two municipalities could also be maintenance differences. For example in the winter the municipalities could use different kind of maintenance methods, which can be noted when pass the border between the municipalities when cycling in the area. It can also be vagueness about the responsibility of some parts in the area, which municipality are in charge.

A main problem is **mentality and habits** among the public; residents, employees and visitors. People are in general committed to habits. Persons always have taken the car to work or to every-day activities are more likely to continue to do this if there are any specific reason for not doing it or a leading force for changing transport mode.

### 5.3 Target for the area

The committee for the project with representatives from Göteborgs Stad, Mölndals stad, Trafikverket and Västtrafik has stated targets regarding Fässbergsdalen, which should be achieved in 2035 (Table 7). They are based at the current situation in 2015 and also with partial targets and aims to three different groups in the area; residents, visitors and employees.

Table 7      *The stated targets in the area Fässbergsdalen by the committee.*

Categories	Transport mode	Current situation (2015) [%]	Partial targets [%]	Targets in 2035 [%]
<b>Residents</b>	Car	70	64	40
	Public transport	18	20	40
	Cycling/walking	12	16	20
<b>Visitors</b>	Car	92	87	75
	Public transport	3	5	15
	Cycling/walking	5	8	10
<b>Employees</b>	Car	84	78	60
	Public transport	10	12	25
	Cycling/walking	6	10	15

The targets for Fässbergsdalen are hard, but they are not impossible to achieve, according to concerned persons both involved in the project and not involved. If the change in transport is not satisfied according to the targets, a further exploitation of land will not continue.

To simplify the process identifying measures to achieve the targets, specific parts and kind of travels have been the focus. For example in the travel survey from Trafikverket (2015), a large part of short travels by residents are made by car for shopping, pick and leave kids at school and recreational activities. Thereby this kind of travels could be in interest to change mode of travel. In Section 0, an analysis about the distances to schools and every-day facilities in the studied area was made. The result showed that almost all resident areas have a maximum of one kilometre to school or every-day facilities. Hence there are possibilities of cycling, it is just a matter of changing habits.

Comparing to Gothenburg the amount of 7% trips done by bicycle with the current situation by residents in Fässbergsdalen with 12% trips done by bicycle (Section 4.4), it is concluded already a relative good number. A number of 20% would mean an increase with about 65%, which is a significant increase comparing although there are in a 20 years period. In a historical way the increase in the bicycle use has not increased with that proportion. The group with visitors are supposed to increase their trips by bicycle with 100% which could be hard due to the kind of industrial and shopping area with stores as hardware stores, electronics affairs etc.





## 6 Proposed measures and analysis of the effect

According to the thesis, the potential of cycling in Fässbergsdalen is relatively high. The area has not a big radius; from east to west at Söderleden it is about 5.5 kilometres. Hence it would be possible to increase the number of trips made by bicycle throughout the area. Distances for residents to every-day facilities and schools/pre-schools are well within the possibility to transport by bicycle (Section 0). Furthermore, the area have in general not big differences in elevation, which is an advantage. From the web survey almost half of the questioned (Section 5.1.4) think there are no problems with cycling in the area, which is a positive opinion.

From previous done measures, extensions of the bicycle network i.e. building new bicycle paths in Gothenburg, has not resulted in any significant increased amount of bicycle use. The proposed measures by this thesis are based on the problem description of the studied area. Physical measures, as for example infrastructure measures, create preconditions and possibilities for cycling. Making people start using bicycle requires soft measures as advocacy. To ensure a continued cycling, the experience has to be good, the physical measures are therefore important in this respect. A main point and conclusion is also information about cycling; make people aware of the possibilities and advantages.

The proposed measures aim to reach the set target (Section 5.3), although the effect of measures is difficult to predict. The already planned measures presented in Section 5.4 will probably not meet the targets. As mentioned before, the behaviour and habits are important and it takes time to change it. In the next 20 years to 2035, when the target should be achieved, a continuous work has to be done to change attitudes and increase the bicycle use. A combination of measures and a holistic thinking is necessary to receive a good result. Vision and strategies is a main part for long-term effects, this is seen as one effect for prioritising the planning accordingly to the municipalities' traffic strategy regarding cycling. Both Gothenburg and Mölndal have current strategy documents for the municipalities and this can be applied and used when planning the new expansion in Fässbergsdalen.

Some of the measures are addressed to the thesis target groups that live and work in the area, primarily in the actions in step 1. While other measures aimed for people in general, but can then be addressed indirectly to the target groups due to conditions necessary to perform the action in step 1.

Following proposed measures specified for the studied area, Fässbergsdalen, will be presented in Table 8, in the structure of the Four Step Principle, described in Section 3.1.3.1. In addition, expected or estimated effects of the measures are presented with background in previous implemented projects in other cases and places.

Table 8 The proposed measures according to the Four Step Principle.

Step 1	Potential	Addresses the problem
<b>Bicycle projects in schools</b> <ul style="list-style-type: none"> <li>• Bicycle days</li> <li>• “På egna ben”</li> </ul>	<ul style="list-style-type: none"> <li>○ Short distance in the area</li> <li>○ Affect in early ages</li> </ul>	<ul style="list-style-type: none"> <li>- Mentality/habits</li> <li>- Divided area</li> </ul>
<b>Project at companies</b> <ul style="list-style-type: none"> <li>• Bicycle friendly workplace</li> <li>• Dedicated persons</li> <li>• Rewards</li> </ul>	<ul style="list-style-type: none"> <li>○ Short distance in the area</li> <li>○ Economic conditions</li> </ul>	<ul style="list-style-type: none"> <li>- Mentality/habits</li> <li>- Divided area</li> </ul>
<b>Step 2</b>		
<b>Maintenance</b> <ul style="list-style-type: none"> <li>• Increased cooperation between municipalities</li> <li>• “Sopsaltning”</li> </ul>	<ul style="list-style-type: none"> <li>○ Continue the good existing network</li> <li>○ Keep summer cyclists during wintertime</li> </ul>	<ul style="list-style-type: none"> <li>- Division between two municipalities</li> </ul>
<b>Step 3</b>		
<b>Complementation measures</b> <ul style="list-style-type: none"> <li>• Separation between cyclists and pedestrians</li> <li>• Lightning improvements</li> </ul>	<ul style="list-style-type: none"> <li>○ Existing good network</li> </ul>	<ul style="list-style-type: none"> <li>- Bicycle parking</li> <li>- Sharing paths with pedestrians and vehicles</li> </ul>
<b>Step 4</b>		
<b>Building new links</b> <ul style="list-style-type: none"> <li>• Lunnagårdsgatan between Askim and Balltorp</li> </ul>	<ul style="list-style-type: none"> <li>○ Existing good network</li> </ul>	<ul style="list-style-type: none"> <li>- Missing links</li> <li>- Absence of bicycle roads</li> <li>- Divided area</li> </ul>

## 6.1 Bicycle project in schools

Behaviour and mentality are not changed over-day. Starting in early age with knowledge and awareness of health and sustainability can result in long-term effects, with a possibility to acquire bicycle-habits from the beginning. Children are also a possibility of influence the behaviour among adults. Traffic safety and traffic rules are important to learn from an early age. A continued encouragement to schools in the area is to be a part of the project “På egna ben”. As declared previously, it has given result in form of an increased use of bicycle and walking as transport to school.

Arranging bicycle days at schools is another suggestion to increase the interest in cycling among school children. The school could use expertise from bicycle-experts. An example of experts could be NTF (Nationalföreningen för trafiksäkerhetens

främjande), with information and learning in traffic safety and traffic rules. Exercises and competitions linked to this thesis could make the schoolchildren dedicated and they can receive knowledge through play and fun. Also a good advice is to use bicycle companies for fixing and repairing the schoolchildren's bicycles. Helping children with their bicycles in schools during schooldays gives an opportunity for all to use bicycles. The cities should finance projects like this and encourage the schools to work with the bicycle topic and sustainable transportation.

Positive effects for the schools to motivate bicycle projects are more energetic children during the school days and increased traffic safety around school because less parents are driving their children. This is recognised in a project called “Skolvägar”, translated to “school routes” in the north of Sweden in 2004 (Slutrapport för projektet Skolvägar). Nine schools in municipalities in Västerbotten and Norrbotten cooperated during the fall semester to develop methods for decreasing the amounts of parents driving their children to school. A main part in the project was a travel diary by all school children and a summary of each schools total transported distance by walking or cycling, which was painted in a map of Europe. Schoolchildren's transport to school was also a part in the earlier mentioned “På egna ben”. This will give involvements and inspiration for the schoolchildren and is a good part in a bicycle project in schools. Both the projects “Skolvägar” and “På egna ben” received positive response from parents.

## 6.2 Project at companies

Increasing the commute to work is one of the main target points of increasing the bicycle use in the area. There are a lot of industries, companies and stores in Fässbergsdalen with thousands of employees and people commuting to the area every day. It is not possible to copy one single project, every company is unique and have different pre-conditions. Inspiration and knowledge from different project is however always a good starting point for developing a project.

There are many advantages for the company to have a big share of employees that cycle to and from the working place. Research and examples shows better health with the result of lower absences and that in itself can cause better work performance. This was also stated by Anders Pihl at the case study company CPAC System (Section 3.2.4.5.1), with a high amount of cycling employees. It is also good to profile and marketing the company as a healthy and environmental friendly working place, which cycling contributes to. Today both this subjects, health and environment, are topical and important in the society.

The project “**bicycle friendly working place**” is a suggestion by the thesis to continue working with companies in the area to participate in this project. It is a good beginning of the work with the issues about sustainable transport to work and increase the commute by bicycle to work. The project has clear targets and examples of measures regarding bicycle, which makes it easy for the company. In the thesis, the companies CPAC System and Gryaab has been presented as good examples as companies who work with bicycle issues. Important details for employees to commute by bicycle to work are possibilities of good parking facilities, preferable a bicycle garage with locker and bicycle pump, and also changing rooms with showers. Other good examples of measures for companies are mileage allowance if you use bicycle in job travels or that

the companies have the possibility to share and borrow bicycles. The bicycles for share should preferably be electric bicycles so employees can avoid getting sweaty and can travel fast from A to B.

A significant and important part for working to be a bicycle working place and increasing the amount of commuting trips by bicycle to and from the working place, is having **dedicated persons** that raises the bicycle topic. Both the successful companies Gryaab and CPAC System have this. Gryaab set up a group focusing and working with the bicycle topic with persons from different parts in the organisations. At CPAC System Anders Pihl is an enthusiast that involve the entire company in the health and bicycle topics. Action from these dedicated persons can be for example breakfast meeting to inform about health and environment, a day to repair your bicycle or bicycle challenges involving the companies. Depending on the size and resources of the company, a bicycle group is maybe not appropriate. Collaboration in a network with both the municipality and other companies, as “RAM-projektet” has been given as a good solution in several cases with many advantages as receiving information from the city and exchange of ideas.

Another suggestion for companies in this thesis to increase the commute by bicycle is **rewards**, a kind of a “carrot” measure. There could be a different kind of rewards for employees that not take the car to work, as giving employees that commute with bicycle to work helmets, reflective vests and bicycle clothes with the logotype of the company, salary for not drive your car to work, discount or free bicycle reparation by a collaboration with a bicycle company etc.

### 6.3 Maintenance

Operation and maintenance of bicycle paths is very important for a development and assuring of safe and attractive cycling. Investments in the operation and maintenance is a way to raise the status of cycling, both during summer and winter. In order to increase the number of full-time cyclists, the maintenance of bicycle path is an important measure. Safety increases with improved operation and maintenance since a large part of all bicycle accidents can be attributed to single vehicle accidents where rolling gravel, poor paving and slipping are some of the reasons.

From the problem description one of the difficulties is that **two municipals** have responsibility of the maintenance of bicycle road in Fässbergsdalen and it is essential that this cooperation functions. Continued work with maintenance is a measures to increase the bicycle use. For road network of the regional state roads operation and maintenance is the Trafikverket's responsibility, unless the special agreement with the municipality have agreed otherwise. Funding is provided through a separate appropriation in Trafikverket's budget.

A positive change and effect in maintenance is “**Sopsaltning**”, many people feel that this has made commuting by bicycle during winter time easier. This was also one of the top prioritising from the web survey of conditions and were thought to have great impact to increase the bicycle use in the area of Fässbergsdalen.

Good service and support for the cyclists are also important. This is done for example by IT-services like application “Cykelstaden” and the possibility to report damage and error about the infrastructure. Another example is placing service station in the Fässbergsdalen so it is possible to keep bicycles in good conditions.

## **6.4 Complementary measures**

To ensure good quality of the bicycle network it is important with some complementary and physical measures. As mentioned before, the experience of cycling have to be satisfactory to keep cyclists to continue use bicycle. This was also commented in the web survey. Security enhancements are essential in this. Proposed enhancement measures are the already planned development of lightning at the bicycle network, but also separation of cyclists and pedestrians.

There existing experience of insecurity among cyclists in the area from the web survey, both with pedestrians and vehicles. Today in the existing bicycle network a separation of cyclists and pedestrians only exists at minor stretches. For example along the commute path along Jolengatan at the north side of Söderleden there are no existing separations. Especially at commute routes it is essential to separate cyclists due to high speeds among cyclists. The separations could be done in different kind of designs, as separation with curbsides, level differences, colors and different material at the two sides.

The evaluation and measurement after separations with white lines between cyclists and pedestrians in Mölndal by Viscando showed an improvement. Before the division with lines and marks cyclists and pedestrians was moving overall the path. While afterwards there were a notified improvement with cyclist at one of the sides and pedestrians at the other. The result indicated that this is a simple and cheap measure with good effect.

Another identified problem are complementary measures for a higher quality of cycling. One solution here could then be bicycle parking. As mentioned before it is a crucial part and precondition for an appropriate cycling. For example, in the industrial areas in Fässbergsdalen, there is a lack of good bicycle parking, preferable under a roof with possibilities to secure locking, according to the analysis of missing links. The municipalities should ensure good parking possibilities adjacent to facilities such as grocery stores and at schools. At pre-schools it should be possible to leave bicycles and bicycle trailers, to simplify for parents to cycle with their children to pre-school.

## **6.5 Building new links**

Good and safe bicycle infrastructure is a prerequisite for getting more people to cycle. Building new is the fourth step in the Four Step Principle. To get the full effect of the investments, it is essential with information and knowledges of the benefits of cycling. By combining physical measures with mental measures, advocacy, increases the benefit of the investments. Evaluations from various projects shows that the effect of an investment may be doubled if it also includes an information campaign.

To solve the problem of the divided area in Fässbergsdalen, land use and the analyses of travel route comparison must be used. The aim is to get continuity in the bicycle network without any interruption and difficult intersection. Now there are some identified missed link in the area, one that is planned to be built is **Lunnagårdgatan** which also many people according to the web survey regarded a good measure. Another missing link is the connection between the residential area and to the city, which is identified in the problem description of the area. Strengthen this would be preferable for commuting from and to the city center of Gothenburg. This would create higher continuity in the bicycle network.

## 7 Discussion

This chapter will discuss the result as the proposed measures in thesis. A general discussion about increasing bicycle use will additionally be featured.

The result in the thesis is basically five varieties of proposed measures organised by the Four Step Principle. They are suggested from a number of measures or actions that could be implemented with the aim to increase the bicycle use in Fässbergsdalen. Although, it is difficult to predict the effects and impacts of a measure, there exists no clear correlation of measures and the effects. Evaluations about previous actions and measures are hard to find, since they are a scarce commodity. Therefore, evaluations and follow ups after actions should be implemented and further developed.

One of the questions in the thesis was to examine the positive and negative aspects with respect to cycle in the studied area. This was evaluated through different kind of analysis to receive a wide-ranging approach and to find existing potential and problems. From the analysis, the general view of Fässbergsdalen is that it is a well functionally and feasible area to cycle in. Positive characteristics are that there is no large elevation change or large distances in the area at the existing bicycle network. From excursions in the area no specific observations about preconditions as paving and maintenance could be found. The bicycle network is developed, especially among main routes. Approximately half of the responses from the web survey indicates that there are no problems when it comes to cycling in the area. Nevertheless, Söderleden is perceived as a barrier and it creates detours. Some enhancements are considered to be suitable to increase the conditions for cycling. In general, the opinion is that Fässbergsdalen is not different from other similar areas. The main reasons for people not cycling in the area are habits and behaviour. Therefore, breaking habits and change of patterns has to be prioritised. Behaviour and habits are connected to lifestyles and choice of life and could therefore be deep-rooted.

Student cities like Lund, Linköping and Umeå have a large share of cyclists which maybe can be explained by the low cost of transport by bicycle. Although mentality has a great impact, young people that move to previous mentioned cities for studying use bicycle to transport themselves everywhere with no excuses of weather or physical challenges. Everybody does it and this approach rubs off on other people. It is not the same in Gothenburg or Stockholm if a young person moves here for studying, students and the public are not cycling in the same extent here. One reason could be the public transport network, which is easy to use. Another reason for not use bicycle is complications with busy traffic in city centres, as in Gothenburg and Stockholm.

The Four Step Principle is an easy method to show the possibilities of rethink and finding other solutions than only building new. In many cases, there exist other, cheaper and more appropriate improvements than building new paths. Trafikverket are involved in the project in Fässbergsdalen and they used this method in general, which was the reason why it was suitable to use it for the proposed measures in the thesis. Whereas dividing of measures according to the steps in the four step principle could be difficult. The organising in the thesis could be different in other cases. It is generally hard to draw a fine line between step 1 and 2 as well as between 2 and 3.

One of the proposed measures regarding advocacy is bicycle project in schools, as one example continued work with "På egna ben". It is suggested because it is a long-term process and research shows that habits are established in young age. Furthermore, children are considered to be more positive to a change of behaviour. The parents have to support their children, but in return the children could influence their parents to cycle and not drive them to school. It is important from a security point of view that the schools have guidelines or influence of the transportation to and from school. A result from an insecure environment is that parents are unwilling to let their children cycle or walk to school. The consequence is a vicious circle of large share of cars around the schools and even more unsecure environment. The distance between home and school is a problem for encouraging children to bike to school. Previously years children went to the nearest school, but after the reform of school choice children may go to school in another district. The consequence is longer distances to school with reduced possibility to travel by bicycle or walking.

The other specific advocacy measure is specified at companies. This is proposed due to the large share of commuting people in Fässbergsdalen where a large amount of companies is established. The main traffic problem at Söderleden appears during peak hours when people are commuting to and from work. There could be a reduction of traffic if employees choose bicycles instead of cars. The potential is to change to cycle some day during the week, one day every week is better than nothing. The companies benefit from higher share of employees commuting by bicycle is increasing health and work performances. The studies and the case studies of companies in the thesis working with the bicycle topic indicated positive feelings in the company and high attraction. For most of the companies it is a relative low cost to implement improvements to encourage bicycle use. Examples are good parking facilities, agreement with a bicycle repair company and changing rooms with showers. Involving employees in bicycle groups and arranging of activities, as proposed, could make an increase in socially cohesive at the company. A good appraisal for the company is to measure the progress in term of the numbers of employees using bicycle to work or by health examinations. Working with increase of bicycle use and plan for cycling, needs resources, both means and personnel. Successful working places have been found to have dedicated and interested persons, willing to push the topic and establish ideas in the management of the company. While working with the project "Bicycle friendly workplace" it is vital to continue the encouragement even if fulfilling all the requirements to establish the reward. It is also important to promote commuting by public transport and walking as alternative.

The physical conditions for cycling have to be appropriate and suitable. It is important for people that are already cycling but also for people testing to use bicycle and will continue cycling. If the conditions are not adequate, the experience will be negative and they will probably not continue cycling. It is difficult to measure the effect that specific physical measures provide, for example setting up signs or draw lines for separation. The public assume good maintained bicycle paths. If it is functional and existing, the public do not reflect about it. On the other hand, if it does not exist or is insufficient, the public would not bicycle in the same extension. To see an effect, it is required to have an interaction of all different measures for keeping the positive feeling. To keep a continued cycling during the wintertime the maintenance is essential, this why the thesis proposed "Sopsaltning" as a method of maintenance. Proposed missing links in the current situation is requested and estimated to receive most effect of improved



continuity in the bicycle network. It is always room for improvements regarding building new paths or expanding and adapting to existing infrastructure. Sweden's Planning and Building Act gives possibilities to set requirements at the developer when expansions and constructions of new areas. Which is a good opportunity to frame the zoning plane to favour bicycle use in new areas. However, the resources are limited and it is hard to design the infrastructure because of different pattern in the bicycle flow. There exist numerous measuring methods and some are rather new and have not found any standards, comparing to measurements of vehicle use.

There are several measures and actions regarding bicycle that has not been considered or prioritised. For example, the indirect measure to apply parking fees in the area is not feasible because of large parking places with a low value of the land use. In other areas this could be an option to convince people not taking the car. Another possible measure could be priorities for cyclists as green ways, i.e. extra-long green signals to receive a good flow in the journey. This is profitable in the city centres due to higher possibilities to a lower flow in vehicles traffic but it is not possible in Fässbergsdalen where the traffic has to have a constant flow. Also bike-share system is not applicable in these parts, it is too far from the city centre of Gothenburg where there exists a bike-share system.

Bicycle has been under-prioritised since its beginning and still it is not having the same importance in the city, as vehicles in the urban planning process. It needs to receive higher status and have to be taken for granted in all stages of planning and construction. A result of this can be seen when bicycle paths ends in connection to enter of car parking places. The thesis aim was to increase the bicycle use in Fässbergsdalen and overall is that it has to be prioritised as an obvious choice of transport mode. The planning should include dedicated persons with knowledge and interest in cycling to raise the bicycle topic. Both Gothenburg and Mölndal have the advantage with a current strategy regarding cycling and statements about increase the existing cycling situation. In addition, higher competence and knowledge about cycling are important. Even if the cycling thinking has been more and more involved in the cities, administrations and at companies and high targets are set, no money or a just small part is budgeted for it. Actions and measurements cannot be implemented without resources.

Additional analysis of the bicycle connections to hubs for public transports could have been done and analysis of similar cities that have same cycling situation. Also deeper studies about implemented physical measures in the area and their effect could have been performed. The web survey is in some points insufficient because of low response rate and a specific target group. From the beginning the thesis aimed to do interviews with both employees and residents in the area. During the project it was found that it was difficult to reach out and find appropriate persons. Therefore, a web survey became more relevant and easier to maintain. Although it is misrepresented, as mentioned before, due to no opinions from people that not cycling. Still it was useful, with good comments and adequate inputs for the thesis. It also verified proposed measure and gave indications of the current situation. The proposed measures can be interpreted to address the general public and not the specific target group or Fässbergsdalen. Proposed measures could be suitable for similar areas or cities. Residents and employees need the same the measures in terms of advocacy and improvements in physical environment everywhere.

Finally, the delimitations of the thesis were necessary, but could have been more specific to have more detailed measures. Nevertheless, the delimitations are preventing a holistic view. In the set targets for Fässbergsdalen the group of visitors are aimed to decrease the trips by car, but in the thesis they were not evaluated. This is a weakness to reach the set targets. Overall, the thesis considers that continued work with bicycle measures will be required, not only selective measures occasionally. Campaigns needs a regular basis to different kind of target groups and the infrastructure and conditions for cycling has to be reviewed regularly. It is a main part in the constructions and expansions nowadays to have a clear strategy and planning regarding cycling.

## 8 Conclusion

The conclusion of this thesis is that increase of bicycle use is a complex problem and plan for cycling needs a holistic approach during the entire process.

Improvements of the infrastructure regarding bicycle does not make people start cycle, preconditions have to be done in the whole city. From the current situation, assessment of problems of missing links and enhancements of the current infrastructure could be identified and constructions to eliminate identified missing links were proposed. The area Fässbergsdalen is in general not missing a functioning bicycle network and preconditions for cycling exist. Comparing to Gothenburg in general, the area has a relative high share of bicycle trips.

Habits and behaviour has to change and it is a process that will take time. Therefore, proposed measures in the thesis were campaigns in companies and schools. A main conclusion was to have a devoted person driving this advocacy measures. Proposal of physical measures to ensure satisfied cycling regarding maintenance and complementary measures as separation between cyclists and pedestrians and lightning enhancements were also important in order to increase travel by bicycle.

It is difficult to predict and evaluate the effect of the proposed measures; there is a lack of studies and evaluations of the correlation between implemented actions and their effect. Following up and monitoring are important to discover of how to make people choose bicycle as a transportation mode. To achieve the targets an important part is a continuous work during the time and prioritising bicycle, not only selective measures, to preserve a good sustainable environment.

## 9 Further studies

The bicycle topic is a complex problem, which has been followed in this thesis. The thesis has been general developed and no deeper details regarding specific measures has been made, as mentioned in the delimitations. Therefore, there existing several directions of future studies.

In the forthcoming years Fässbergsdalen will expand and the area will be a construction place. During the construction process is important to ensure a safe and secure possibilities for cycling. The constructions areas and processes in Mölndal centre at the moment was mentioned as problems in the comments from the web survey (Appendix III).

Also of course more detailed descriptions about the proposed measures for the area, Fässbergsdalen, is a possible subject for further studies. How should the measures be designed and who should be in charge of this?

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## APPENDIX I      Cost comparison

Calculations and estimations for the cost comparison between car, public transport and bicycle in section 2.3.1 are presented in this appendix.

### Car

The transport mode private car has both been considered in the way of private leasing and purchase of a new car. The estimated costs are according to a comparison made by Råd&Rön (2015). It is in general and not associated to any specific car model or company.

#### Private Leasing

A small car in charge of three years, included 45 000 kilometres, service and insurance is assessed to a monthly cost of **2 199 SEK**. The monthly cost will significantly increase for a bigger car with extra equipment or extra kilometres to drive per year.

#### Purchase of a new car

In the comparison by Råd&Rön (2015), the new price of a small car is estimated to 130 000 SEK. A loan of 104 000 SEK is expected and a down payment of 26 000 SEK (20% of the price).

The value after three years are assumed to be 45% of the new price; 58 500 SEK. The remaining amount, 45 500 SEK, will thereby be amortized over three years. Debt after three years is therefore equal to the estimated can calculated value of the car in that time.

- Amortization: 1 264 SEK/month (average).
- Interest with a rate of 5.7%: 392 SEK/month (average).
- Down payment: 722 SEK/month.
- Service: 236 SEK/ month.
- Half Insurance: 292 SEK/month.
- Interest deduction: 30%: - 118 SEK/month (average).
- Tire cost 2400 SEK /year = 200SEK /month (average).

Monthly total cost will thereby be assessed to **2 988 SEK**.

#### Operating cost

In both of the examples above the tax, fuel, parking and snow tires is not included in the calculations. According to a test from web site Bilsvär (2016) a service-site where you can value and compare different car models, the estimated costs for a car is shown in table Table 9 (Konsummentverket & DN, n.d.). Unexpected costs, as reparations or accidents are not included.

Table 9 Estimated costs for tax, fuel, consumable etc.

Services charges	Costs/year [SEK]
Parking (600 SEK month)	7 200
Fuel (12 SEK/litre, about 7 litre per 100 km, 15 000 km per year)	14 700
Tax & inspection	1 600
Consumable material	800
Total yearly cost	26 800
Total monthly cost	1850

## Public transport

The cost for public transport is calculated for Göteborgs kommun and Göteborg+ (e.g. two municipality) because the studied area in the thesis includes two municipalities. The prices of a monthly card and yearly card (Table 10) are referred to Västtrafik (2016) for an adult, from the age of 20.

Table 10 Cost for public transport tickets according to Västtrafik (2016).

	Cost [SEK]	Cost for three years [SEK]
Göteborgs kommun 30 days	600	21 600
Göteborgs kommun 365 days	5 720	17 160
Göteborg+ 30 days	1 055	37 980
Göteborg+ 365 days	10 550	31 650

## Bicycle

Investment for a bicycle can variate between 5 000 SEK - 20 000 SEK, depending on model and material according to CykelGuiden (2016). An investment of an electric bicycle can cost from 10 000 to 25 000 SEK. In the calculations we have suggested to invest 12 000 SEK, to get a good bicycle or an electric bicycle that will last for three years without any bigger deficits. The cost for maintenance is estimated for fix the bicycle once a year with a suggested cost of 1 000 SEK, it could for example be fix flat or spare tire, washing, invest in lights and cloths etc.

## Total

A total calculation per month and during a three years period for each transport mode is shown in s can vary a lot.

Table 11. The cost is summarised from previous stated and estimated costs, then they are rounded down to closest hundred because the numbers can vary a lot.

Table 11      *Total approximately cost per month and for three years.*

	<b>Monthly cost [SEK]</b>	<b>Total cost for three years [SEK]</b>
Car (leasing)	2199+1850 $\approx$ 4 050	145 764 $\approx$ 145 000
Car (buying)	2988+1850 $\approx$ 4 840	174 168 $\approx$ 174 000
Public transport	600	21 600
Public transport (two municipality)	1 055	37 980
Bicycle (Investment + yearly cost)	12 000 + 1 000	15 000

## APPENDIX II                      The form of the web survey

The web survey was performed in Swedish and then it was sent out to companies and distributed in the area between 8 and 27 April 2016. Below a translated version can be seen and then the original Swedish version is presented right after.

### English translation

1. Do you live in Fässbergsdalen?  
Which area do you live in? (Specify in "other")  
  
YES  
NO  
Other:
2. Do you work in Fässbergsdalen?  
Which area do you work in? (Specify in "other")  
  
YES  
NO  
Other:
3. Do you bicycle in Fässbergsdalen?  
*How is your experience of it? What is good and what is bad?*
4. If you do not bicycle in a greater extent, what are the reasons for that?
5. Do you think there exist problems in Fässbergsdalen regarding cycling?  
What kind of? (please specify)?
6. What conditions do you/would you prefer to use the bicycle as a mode of transport?
7. Bicycle action - select 3 measures with the greatest impact with the aim increase the bicycle use in the area?  
*If other measures (please specify in "other")*
  - Improved quality of existing bicycle paths.
  - Security-enhancing measures, for example separation of pedestrians and bicycle paths, lighting, etc.
  - Expansion of pedestrian and bicycle path along Jolengatan - Otto Elanders gata
  - Expansion of pedestrian and bicycle path from Sisjön to Lunnagårdsgatan.
  - Expansion of pedestrian and bicycle paths from Eklanda to Dag Hammarskölds leden.
  - Improved connections between Kobbegården and bus stops on road 158.
  - Advocacy and campaigns, as for example participating in bicycle projects - borrow a bicycle based on travel needs, bicycle expert

when choosing the bicycle, personal consulting and coaching and medical examination before and after the test period in exchange for replacing everyday trips by car to trips by bicycle at least three days a week for a trial period.

- Rewards in the form of bonuses, bicycle information, bicycle service, health check from the employer, etc.
- Winter maintenance – for example “Sopsaltning”.
- Other:

8. Bicycle usage - how important are the following factors for your motivation to cycle?

*Other factors that motivate you? Write in "other comments".*

- Health
- Environment /Climate
- Good bicycle paths
- Weather
- Topography /Surroundings
- Bicycle Safety
- Travel time
- Travel Length
- Economy

9. Other comments:

If there is an opportunity to contact you for any further comments, write address/phone number:



## Original Swedish version

# Undersökning om cykelanvändning i Fässbergsdalen

Vi är två studenter från Chalmers som skriver examensarbete om cykelåtgärder i området Fässbergsdalen. Examensarbetet syftar till att ta fram möjliga åtgärder och eventuella effekter av dessa för att öka cyklingen i området. Därför är vi intresserade av era åsikter och erfarenheter.

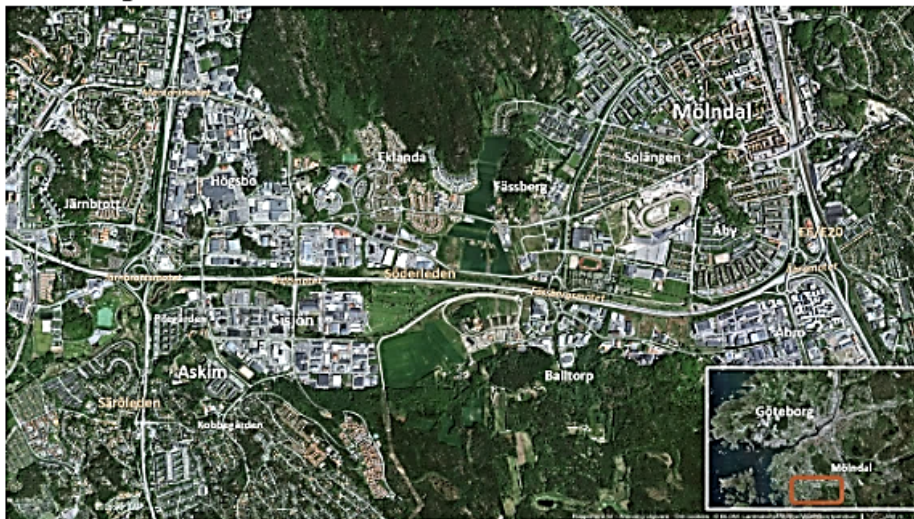
Enkäten tar ca 2-3 min, nedan finns en karta över Fässbergsdalen.

Undersökningen är anonym och vi kommer behandla svaren som underlag för att ta fram en nulägesanalys över området.

Tack för att ni tar er tid med att besvara våra frågor och vill vara till hjälp för vårt examensarbete!

**\*Obligatorisk**

## Fässbergsdalen



1. Bor ni i Fässbergsdalen? \*

Vilket område bor ni i? (skriv in på övrigt)

- ☐ JA
- ☐ NEJ
- ☐ Övrigt: \_\_\_\_\_

2. Arbetar ni i Fässbergsdalen? \*

Vilket område arbetar ni i? (skriv in på övrigt)

- ☐ JA
- ☐ NEJ
- ☐ Övrigt: \_\_\_\_\_

3. Cyklar ni i Fässbergsdalen? \*

Hur upplevde ni det? Vad fungerar bra respektive mindre bra?

Ditt svar

---

4. Om ni inte cyklar i större utsträckning, vad är anledningarna till detta?

Ditt svar

---

5. Anser ni att det finns problem i Fässbergsdalen angående cyklinganvändning? Vilka (specifika gärna)? \*

Ditt svar

---

6. Vilka förutsättningar behöver ni/skulle ni behöva för att använda cykel som färdmedel? \*

Ditt svar

---

## 7. Cykelåtgärder - välj 3 åtgärder med störst påverkan att öka cykling i området? \*

Vid andra åtgärder ( specificera gärna, skriv in under övrigt)

- ☐ Förbättrad kvalitet på befintliga cykelbanor.
- ☐ Trygghetshöjande åtgärder exempelvis separering av gång och cykel, belysning etc.
- ☐ Utbyggnad av gång- och cykelbana Jolengatan-Otto Elanders gata
- ☐ Utbyggnad av gång- och cykelbana från Sisjöområdet till Lunnagårdsgatan
- ☐ Utbyggnad av gång- och cykelbana från Eklanda bostadsområde till Dag Hammarsköldsleden
- ☐ Förbättrad koppling mellan Kobbegården och hållplatser på väg 158
- ☐ Vara med i Testcykelprogram - Får Låna en cykel baserat på resebehov, cykelexpert i att välja rätt cykel, personlig rådgivning och coachning och hälsoundersökning före och efter testperioden i utbyte mot att ersätta vardagsbilresor med cykling minst tre dagar i veckan under en testperiod
- ☐ Få exempelvis belöning i form av bonus, cykeldata, cykelservice, hälsokontroll från företaget etc
- ☐ Vinterväghållningen - sopa och salta, istället för plogas och sanda
- ☐ Övrigt: \_\_\_\_\_

## 8. Cykelanvändning - hur viktiga är nedanstående faktorer för er motivation till att cykla? \*

Andra faktorer som motiverar er? - skriv in under övriga synpunkter

	Mycket viktig	Mindre viktig	Inte alls viktig	Vet inte
Hälsa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Miljö/Klimat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bra cykelväg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Väder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Topografi/omgivning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cykelsäkerhet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Restid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reslängd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ekonomi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 9. Övriga synpunkter

Ditt svar

---

## 10. Om det finns möjlighet att kontakta er för eventuellt ytterligare förtydligande skriv mailadress /telefonnummer:

Ditt svar

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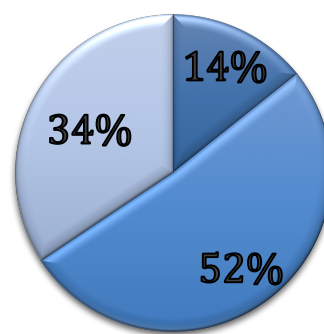
## APPENDIX III      Result of the web survey

The result from each question are presented in following Appendix with selected comments from open-answer questions. Totally 36 answers in the web survey, one person did not work or live in Fässbergsdalen and thereby picked out from the answers.

### Question 1 and 2

**“Do you live and/or work in Fässbergsdalen?”**

Choice, mandatory questions with yes or no, with a merged result, see below Figure 30. Totally amount of answers is 35.



- YES, I live in Fässbergsdalen and YES I work in Fässbergsdalen
- YES, I live in Fässbergsdalen and NO I don not work in Fässbergsdalen
- NO, I don not live in Fässbergsdalen but YES I work in Fässbergsdalen

*Figure 30      The share of the questioned relation to Fässbergsdalen.*

### Question 3

**“Do you bicycle in Fässbergsdalen? How did you find it? What works well and less well?”**

An open-answer, mandatory question with 35 answers, see Figure 31. There was three persons, equal with approximately 9%, answered that they did not bicycle in the area and their result are further in the following question cancelled out.

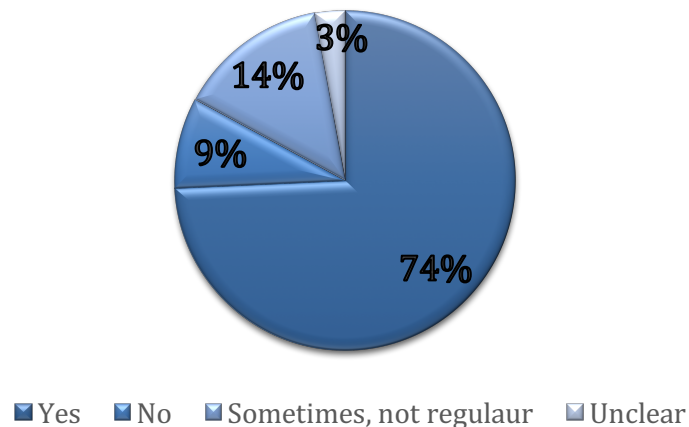


Figure 31 The share of the questioned relation to Fässbergsdalen.

Some of the comments are presented below:

*“Cykelbanan är fint och för det mesta bra underhållen. Några ställen sköts mindre bra, känns som det är oklart vem som ansvarar, Mölndal eller Göteborg. Då man bygger ny industri längs vägen bryter man cykelbanan och det har uppstått mer än 15 korsningar, större o mindre på min väg. Alla är farliga och då de som skall till sin industri inte har kört där förut är de inte vaksamma på att de korsar en cykelbana.”*

*“Saknar en bra cykelväg mellan Toyota och Willys i Sisjön. Får nu cykla på travbana (med risk för krock/bråk med hästetäppling) alt via Eklanda för att nå Åbro från Sydvästra Göteborg.”*

*“Bra cykelvägar norr om Söderleden sämre möjligheter mellan Aminogatan och Sisjöns industriområde.”*

*“Inte regelbundet, men till tider under sommaren. Om man kommer från Sahlgrenska, ner mot Bifrost, känns det hotfullt att cykla tillsammans med bussarna längs vägen. Det samma på sträckan mot Pedagogerna från Bifrost. Det känns inte naturligt att behöva korsa Bifrostvägen mot söder för att cykla mot Åby, för sen igen att korsa Bifrostvägen till Pedagogerna. Därför cyklar jag hellre längs kyrkogården.”*

*“Ja nästar varje dag. Cyklar från Frölunda till Fässberg och den vägen är farlig då den korsar många bilvägar samt i Eklandaområdet använder barnen cykelbanan som lekplats.”*

*“Ja. Behövs en cykelbana väster om dalen mellan Eklanda och Axcgatan.”*

*“Fungerar bra. Dåligt är att det på flera ställen inte finns sammanhängande cykelbanor utan att man måste cykla vissa sträckor bland bilar osv.”*

*“Ja på fritiden. Bra GC-banor mellan Mölndal centrum och Radiomotet Frölunda Torg. Viktigt ha låg växtlighet i rondellerna för sikten och säkerheten, ex vid (Frölundagatan/Bifrostgatan) Önskvärt att säkrare och snabbare kunna komma över Söderleden till Sisjöbadet o Sandsjöbackaterrängen. Sisjö Handelsområde är inte cykelanpassat, ej heller kollektivtrafikanpassat.”*

*“Lite dålig belysning och cykelbanor runt Pedagoger är rätt dåliga.”*

*“Nu är det helt kaos vid Mölndals station samt centrum. Känns väldigt otryggt att korsa vägarna.”*

*“Ombyggnation av Mölndals Centrum försvårar cykling.”*

*“Snöplogningen är inte helt optimal på vintern, tycker att ploga och sanda är det bästa för sanden ligger kvar när det fryser och hindrar halka, salta måste man göra hela tiden och det fungerar inte när det är för kallt, salta, ploga eller grusa vilket man än gör måste det ske så fort det kommer snö och vara klart tidigt på morgonen För övrigt tycker jag att cykelbanorna fungerar bra i de områden jag cyklar och jag cyklar dagligen.”*

*“Ja. Stora cykelvägarna funkade bra förutom vid snö. Sen snöröjning. Överfart för cyklar i korsningen efter Eklanda skola (mot Plantagen) har skydd sikt på grund av plank runt tomt. Stor olycksrisk, spegel hade varit bra.”*

## **Question 4**

**“If you do not bicycle in a greater extent, what are the reasons for that?”**

Open-answer question, not mandatory, with 18 answers. The main reason, with six of 18 notes, is the time and distances. Weather is the second most important factor with four notes.

## Question 5

**“Do you think that there are problems in Fässbergsdalen regarding bicycle use?”**

An open-answer question with totally 35 answers, but only 32 are counted, three is not included for the reason they are not living or working in the area as mentioned earlier in question 3. Of these, 15 persons, around 47%, think there are no problem with cycling in Fässbergsdalen. Some of the comments are presented below:

*“Ja, dåligt skyltade korsningar. Dåligt byggda cykelöverfarter i rondellerna, med del som har kantsten som inte syns i modd och vid snöfall. Sly vid en del korsningar i Riskulla som skymmer sikten för både cykel och bil. Dåligt belysta cykelbanor och dåligt underhållen belysning där det finns. Plogning och grusning vintertid istället för saltning, vilket inte håller lika bra.”*

*“Det behövs en viltövergång samt cykelbro mellan Mölndal och Sandsjöbacka naturen.”*

*“Förbättra cykelvägen från Sahlgrenska, via Bifrost till Pedagogen - typ skapa en ”autostrada” som går längs Ängårdsbergets fot/kant, så man håller sig undan biltrafiken helt.*

*“Mycket är bra. Befintliga grusvägar strax öster om Eklanda bostadsområde är charmiga med lite knixiga att ta sig fram på med cykel. Önskar GC-koppling och belysning mellan Eklanda och Sahlgrenska sjukhuset den mörka årstiden. Även positivt för dem som går och springer. Bättre GC-koppling Eklanda Toltorpsgatan via Axxgatan. GC-Koppling mellan Eklanda och A Odhners gata norr om Kriminalvårdsanstalt. Söderleden är ett hinder att nå Sandsjöbackarerrängen.”*

*“Korsningen A Odhners gata och Ingela Gathenhielems gata Gångare och långsamma cyklister som ändrar riktigt utan att vända sig om samt utan att ”blinka” hålla ut armen.”*

*“Korsning Jolentagatan/Otto Eklanders gata. Skulle vara bättre med tunnel och cykelbana på norra sidan av Otto Eklanders gata.”*

*“Cykelvägarna är dåligt underhållna och i många fall dåligt skyltade samt att de går i samma körbanor som bilarna.”*

*“Svårt att synas i rondellerna, borde salta istället för att sanda på vintern.”*

*“Farliga rondeller för cyklister.”*

*“Rondellen vid Pedagogen Park/Jolen ganska farlig.”*



*“Cykelväg korsar bilväg nära rondeller som skymmer sikt för bilister. Bättre och tydligare markering vad som är cykelväg och vad som är gångväg Det ultimata skulle vara skillnad i färg eller liknande som det är i dag korsar gående cykelväg utan att se sig om.”*

## **Question 6**

**“What conditions do you/would you prefer to use the bicycle as a mode of transport?”**

Mandatory, open-answer question with some of the comments presented:

*“Arbetsgivaren stöttar cykling på ett bra sätt.”*

*“Bättre luft och mindre biltrafik där cykellederna går.”*

*“Bättre väder, bättre mental stryka/vilja för att orka cykla uppför berget varje dag.”*

*“Möjlighet att duscha på jobbet.”*

*“Dusch- och omklädningsrumsmöjlighet på jobbet.”*

*“Att äga en cykel, eller se till att ha tillgång till hyrning samt lite bättre cykelväg från mitt hem till mitt jobb (via Toltorpsdalen).”*

*“Bättre flyt i cykelvägarna - dvs. färre korsningar, klarare markeringar av cykel versus promenadvägar. Ta en resa till Köpenhamn för att se till ex hur de markerar cykelvägarna i klart blått, det gör det visuellt tydligt för de gående och bilar/bussar att här får jag inte vara.”*

*“Arbeta färre timmar på min arbetsplats - jag vill komma hem snabbt för att hämta barn på dagis och skola. Jobbar man full tid värderar man tiden man sparar i transporten. (min miljökompensation = jag kör biogasbil).”*

*“Använder el-cykel. Det var nyckeln för mig som har drygt 1 mil till jobbet och vill slippa tid för att duscha och byta om flera gånger per dag.”*

*“Sommartid sopade gator, vintertid plogade gator, helst sop-saltade och inte grusade.”*

*“Har i dag alla förutsättningar men allt som ökar säkerheten är önskvärt.”*

*“Tydligare cykelbanor där barnen kan cykla tryggt.”*

*“Bättre säkerhet!”*

“Bra cykelbanor.”

“Bra cykelbana, ny cykel.”

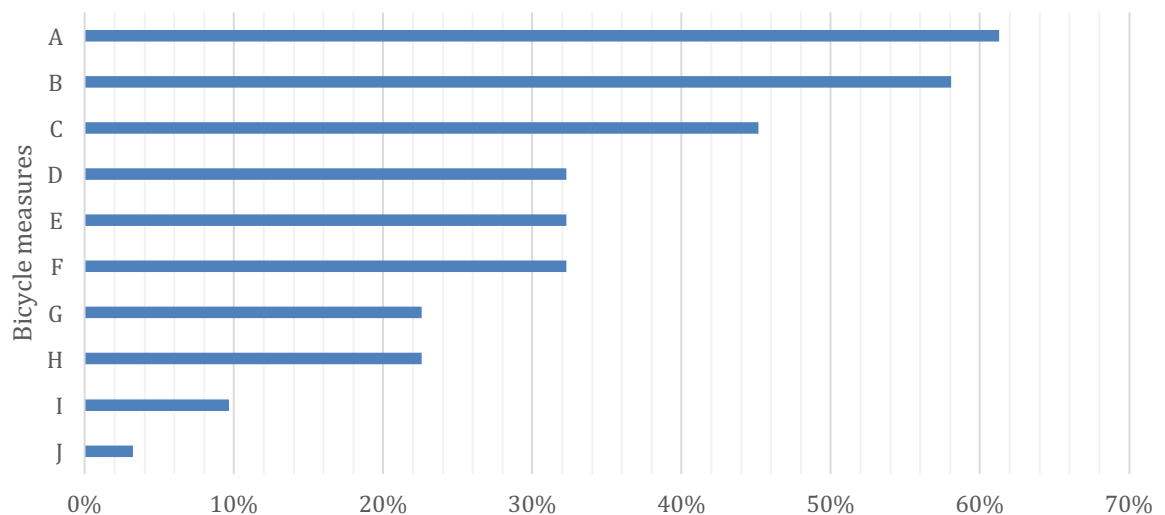
## Question 7

**“Bicycle measures - select three measures with the greatest impact to increase cycling in the area”**

A choice question with the requirement of choose three options. The summary of the answers can be seen in *Figure 32*, with legends to the figure with the different options in Table 12. Below comments from the option other measures” are presented.

*Table 12 Legend to the previous figure with the bicycle measures.*

<b>A</b>	Security enhancing measures; separation of pedestrians and cyclists, lighting, etc.
<b>B</b>	Winter maintenance;”Sopsaltning” for example.
<b>C</b>	Improved quality of existing bicycle paths.
<b>D</b>	Get rewards in the form of bonuses, cycling information, bicycle service, health check from the company, etc.
<b>E</b>	Expansion of pedestrian and bicycle path from Eklanda to Dag Hammarskölds leden.
<b>F</b>	Other (see Swedish comments).
<b>G</b>	Expansion of pedestrian and bicycle path from Sisjön to Lunnagårdsgatan.
<b>H</b>	Expansion of pedestrian and bicycle path in the intersection Jolengatan/Otto Elanders gata.
<b>I</b>	Participating in Test Cycle Programs/campaigns, for example borrow a bicycle based on travel needs, bicycle expert in choosing the right bicycle, personal counselling and coaching and medical examination before and after the test period in exchange for replacing everyday tips by car to go by bicycle at least three days a week in a trial period.
<b>J</b>	Improved linkage between Kobbegården and stops at route 158.



*Figure 32 Measures with greatest impact from the answers in the web survey.*

“Inte salta eller sanda. bara sopa Tack!! Vill kunna åka skidor också när tillfälle ges.”

*“Bygger man klart i Mölndals centrum blir det bättre förutsättningar.”*

*“En spark i baken.”*

*“Skapa kommunala välfärdssystem som ger bonus för de som tar sig till jobbet med eget färdmedel, eller springer.”*

*“Information om ”blinkers”-användning plus att se sig om.”*

*“Vinterväghållning i rätt tid.”*

*“Bättre korsning cykelväg bilväg.”*

*“Cykelparkeringsplatser vid kollektivtrafik hpl. GC-koppling över Söderleden från Eklanda till Sisjön/Sandsjöbackaterrängen. Bygg fler bostäder så underlaget för kollektivtrafik blir bättre.”*

## Question 8

**“Bicycle usage - how important are the following factors for your motivation to ride a bicycle?”**

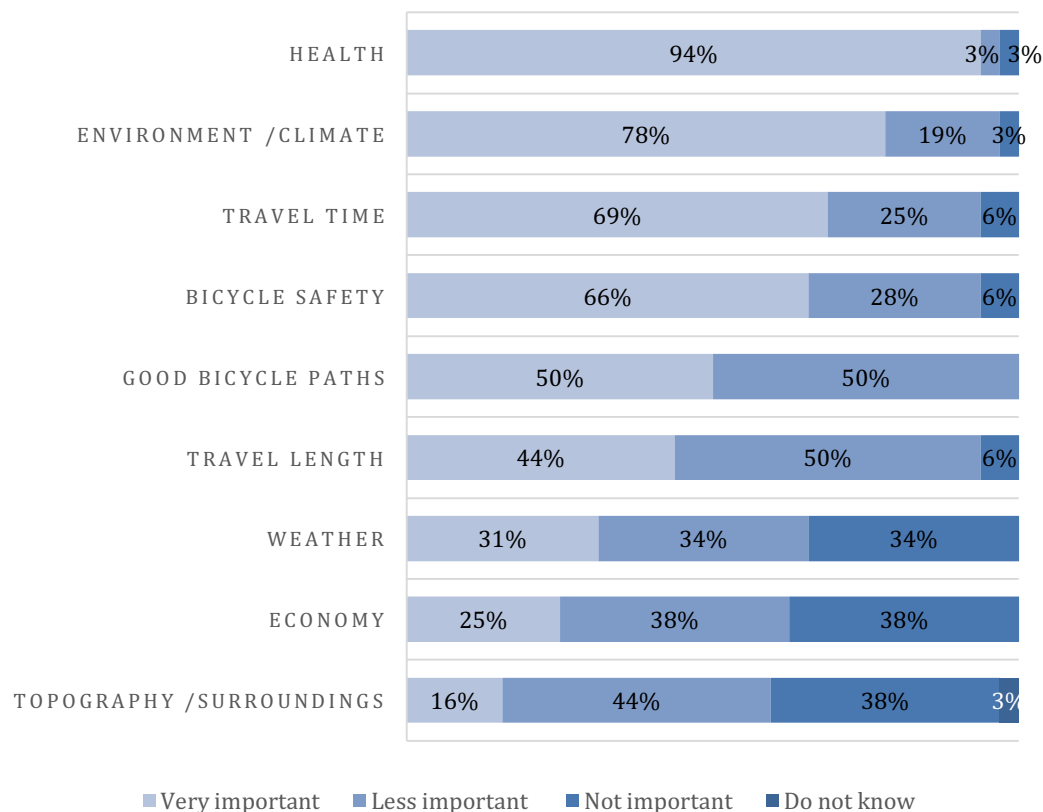


Figure 33     *The importance among the questioned regarding some parameters for cycling.*

## Question 9

### “Other comments”

Three comments were received and they are presented below:

*“För mej är resans längd/tidsåtgång viktigt, därefter att det är en säker cykelväg. Cykla är ett utmärkt sätt att komma fram smidigt och få gratis motion på köpet.”*

*“Det ger mig en känsla av frihet att cykla.”*

*“Om man cyklar 10 månader om året, kan kommunen sponsra 2 månaders busskort. Skapa en tag som per automatik loggar vart man har cyklat - som små portar där man taggar sin dagliga träning; frivilligt, men positivt!”*