Universitetet i Stavanger

FACULTY OF SCIENCE AND TECHNOLOGY

MASTER´S THESIS

Study programme/specialization: Master of Science (siv.ing) City and Regional Planning	Spring semester, 2022 Open / ~~Confidential~~
Author: Marta Obi	
Supervisor(s): Daniela Müller-Eie	
Title of Master´s Thesis: **Fostering sustainable travel behaviour through physcial environment**	
Credits: 30	
Keywords: travel behaviour sustainable travel behaviour cycling, walking, public transport physical environment	Number of pages: 91 Appendix: A, B, C Stavanger, 15/06/2022

Fostering sustainable travel behaviour through physical environment.

Physical and socio-psychological influences
of the physical environment on travel behaviour.
Comparative case study of
Stavanger and Linköping universities.

preface.

With this thesis I mark the graduation of my two years master study programme in City and Regional Planning at University of Stavanger. It was an incredible two years of rich learning experience, new perspectives, friendships and self-development. During the studies, I had the opportunity to expand my knowledge about buildings, cities and people, (which I first gained in my architecture studies) to a wider scale, gaining a more holistic perspective on the complex systems of cities and the people influenced by them.

As an architect I have always been interested in undersranding the relation between the physical environment and humans, and how the physical environment influences our decision thus shaping our life.

My recent interest in cognitive psychology taught me how little part of our everyday decisions are conscious, and how complicated and dependent on so many internal and external factors, human decision making is. The thesis is an expression of those interests and curiosuíty to find out and explore how the physical environment around us affect our travel choice, our travel behaviour both on the physical and socio-psychological level.

I would like to thank Daniela Müller-Eie, my supervisor of this thesis, for the knowledge and good advice, and encouragement on this assignment and throughout the studies.

Special thanks to my family, my husband and kids, for their support and patience during the work on this paper.

Stavanger, 15.06.2022

Marta Obi

abstract.

Growing public awareness about the negative impacts of cities dependent on cars as a major means of mobility on ecological issues, public health and monetary cost have pushed government policies for the search of urban mobility alternatives based on the promotion of active transportation mode like walking, cycling and public transport all around the world.

Universities are large employers, thus are an important generator of travel demand on the transportation network. On the other hand, it puts them in a good position to advocate and help foster an active and sustainable lifestyle. This thesis aims to find out how sustainable travel behaviour among University of Stavanger students can be fostered through the physical environment. The thesis approach was through a case study of University of Stavanger (UiS) with Campus Ullandhaug in Norway and Linköping University (LiU) with Campus Valla in Sweden that have similar characteristics to UiS but very different travel behaviour.

Different literature were retrieved and reviewed to form the bases for this thesis, the reviews form the foundation and dictate the direction that this thesis followed. It highlighted the variables that were examined in the data collection and questions that were asked in the survey chapter. These variables that influence sustainable transport choice were found to be either objective or subjective factors or variables.

For the Objective variables, spatial analysis was carried out on two different universities (LiU and UiS) with similar land mass and student population but very different travel behaviour.

Furthermore, a survey was carried out on both universities. Questionnaires were formulated to capture the subjective variable and were distributed online and in person at both universities. The survey aimed at investigating students' attitude towards the three sustainable travel choices.

The spatial analysis shows more hilly terrain in UiS while LiU is a more or less flat surface. Less connectivity in UiS (especially for cycling) with few roads leading to dead-end while LiU is well connected especially for cycling.

Most student dormitories are situated within 2km cycling distance in LiU while UiS sees most of its dormitories located outside this range.

The research from this study is in line with a lot of other findings on the relationship between sustainable transport mode (cycling, walking and public Transport) and characteristics of the built environment.

Land use mix and quality of the transport infrastructure determines how, where and what modal choice students use when commuting.

Reducing cycling distance to within 2km for example, locating student dormitories within 2km cycling distance and 500m walking distance to campuses was found to motivate cycling and walking. Connections to transit or bus stations and combining different sustainable transport modes, (for example cycling and public bus, or walking and public bus) on those student dormitories more than 2km distance can encourage sustainable transport behaviour.

introduction

introduction

Travel demand exacts a great deal of pressure on the transportation network. Universities are an important generator of travel demand on the local transportation network, meaning that commuting is one of the largest impacts a university has on its premises (Shannon et al., 2006; Rotaris & Danielis, 2015).

Thus many universities are looking at a way to create more sustainable campuses that will not only relieve pressure on the transport network, play its own part in saving the climate, but also bring about overall healthy living of its students and employees in general. One of the ways to achieve this is by encouraging sustainable active transport mode, for example walking, cycling and public transport, while serving as transport mode, participants also get the health benefits of physical activities involved with using these modes.

Studies have shown that most cities indeed universities main travel mode is personal car (Langeland, 2019; Fasan, Tight, & Evdorides, 2021), despite all the policy efforts, including fees (toll fees), rules, restrictions (closing parking places, parking access) etc, aimed at discouraging personal car use, personal car still proves to be one of the major and in some case the preferred transport mode, even for university students. Thus, the focus by policy makers on understanding what actually makes people drive and what facilitates personal them, using that to introduce barriers aimed at discouraging them from using personal cars.

Perhaps, instead of focusing on barriers and what discourages personal car use, the focus should instead be on what fosters sustainable travel mode. Presenting a better sustainable alternative may help form new habits, then behaviour (that is, sustainable travel behaviour) (Willuweit, 2009), this will require studies into why people behave the way they do. As such, travel behaviour studies present a key towards changing societies current unsustainable travel behaviour to more sustainable travel behaviour.

Travel behaviour is complex and there are many underlying factors that influence a person's travel decision and travel mode choice, therefore understanding these complex determinants of travel behaviour is a prerequisite. To change a persons travel behaviour, one either needs to change the conditions under which the individual operates (physical contest) or try to change the person's attitude (subjective) towards travel behaviour, that is changing the person's perception of the condition, on the other hand, one can change the individuals physical condition which will in turn cause the individual to change his/her perception or attitude towards the physical condition in this case travel behaviour.

The latter seems more plausible and can gain more consensus; changing travel behaviour by changing the physical condition the individual operates in, and this in turn will change the individuals attitude towards travel behaviour. Over the past decades, there have been many studies proving the impact of the physical environment on travel behaviour (Ding, Wang, Liu, Zhang, & Yang, 2017; Ewing & Cervero (2001); Limtanakool, Dijst, & Schwanen, 2006).

The study by Langeland (2019) found amongst others that the travel mode in the UiS is car-based, meaning that is unsustainable. Thus the need to investigate it with the aim of finding sustainable travel alternative, hence the importance of this thesis, this leads to the thesis research question:

How to foster sustainable travel behaviour among the UiS students through the physical environment?

The thesis aims to find out how sustainable travel behaviour among university students can be fostered through the physical environment. To answer this research question, comparative case study will be used as a main method.
Comparison as a method is about comparing two or more cases, objects with each other by looking at the similarities, differences and patterns. Both quantitative and qualitative methods for data collection are usually used for comparative case studies (Holt & Turner, 1970).

"Thinking without comparison is unthinkable. And, in the absence of comparison, so is all scientific thought and scientific research." (Swanson, 1971, p.145)

In comparative case study of a few cases (min. two cases), the cases shouldn't be either too different (with too many differences) or too similar in variables because it is hard then to find any commonalities or differences. Although the cases need to be comparable "in respect of the phenomenon or theory that is the primary interest in the study" (Lor, 2011). "Sartori (1991, p. 246) has stated that entities to be compared should have both shared and non-shared attributes. They should be at the same time "similar" and "incomparable" (Lor, 2011).

For this research two case studies are chosen: University of Stavanger with Campus Ullandhaug in Norway and Linköping University with Campus Valla in Sweden. The two universities share many similarities, both are universities in large Scandinavian cities, with geographical location of similar latitude, location in the city, size of the campus, urban density and other.

During the preliminary data collection it has been found that, despite the general spatial similarities of both campuses, the travel behaviour of the students in each university is of significant difference thus the outcome variable is different. While only 5% of students at the University of Stavanger choose to cycle to and from campus (Langeland, 2019), at the Linköping University, cycling is a primary mode choice of the majority of the students (Linköping University, 2022). Therefore comparing those two cases can help to highlight and understand what factors and elements in the physical environment are important and influential when fostering sustainable travel behaviour among students.

The thesis will try to identify spatial factors and indeed corresponding non-spatial factors which through their integral relationship will help identify potential enablers that can be focused on to help form new behaviour, that is sustainable travel behaviour.

In light of this, the following research subquestions are identified, to serve as a compass when scanning through literature for clues and as a guide throughout the rest of the thesis in search of answers to the research question.

Research questions:

1. What factors influence sustainable travel behaviour?
2. What are the physical and socio-psychological influences of the physical environment on travel behaviour?
3. How is the physical environment in Stavanger and Linköping?
4. How is the travel behaviour in these cases?
5. Why is the behaviour like this?

The first question aims at finding out what fosters and influences the different types of sustainable travel behaviour. The second question aims at finding out what physical factors influence different travel behaviour. Questions 1 and 2 will be answered through literature. Findings from the literature review about the relation between the physical environment and the travel behaviour will form the basis for the next part of the thesis, which is data collection and analysis.

Question number 3 and 4 will be answered through different data collection methods and analysis and aim at finding out what is the status quo of the current travel behaviour and the physical environment at both campuses with confrontation of the findings with literature. The question number 5 aims at finding out and explaining why the travel behaviour is like this and what are the physical factors that influence the travel behaviour at the different campuses. Together the questions will constitute a better understanding of the fenomena and will help to answer the main research question for how to foster sustainable travel behaviour through the physical environment.

Different data collection methods, both spatial and non-spatial, are chosen for the thesis in order to answer the research questions.

Spatial data collection

The main aim of the spatial data collection is to find out how the physical environment of the chosen campuses is, by examining and analysing the identified, through the literature review, objective measures of the physical environment and physical factors influencing travel behaviour.

Based on the findings from literature, accessibility analysis for walkin, cycling and public transport are conducted.

Analysis area is chosen as follows: 500m isochrones from the campus for walkability analysis and 2,3 and 5km isochrones for bikeability analysis. For the walkability and bikeability analysis, the pedestrian and bike network data is retrieved from sources such as Open street Map and Google maps, Google street view for both cases. Additionally, site visits and observations are conducted, as complementary to the available open source data, in Stavanger.

For the accessibility of public transport, only bus routes with bus stops within 500m walking range from the destination points are considered and the accessibility of these buses are analysed. For the accessibility analysis of the public transport at University of Stavanger data from Kolumbus and moovitapp is used to analyse the direct routes connecting the ullandhaug campus and the different student houses and the region. For the public transport analysis in linköping, data from ostgotsrtraffiken.se is used about the routes, schedules and frequency.

The average travel time for the different transport modes, walking, cycling and bus, is calculated with the use of GoogleMaps.

Non- spatial data collection

In order to find out how the current travel behaviour in the two universities are, an online student travel survey is conducted. The main aim of the survey is to collect data regarding student travel behaviour but also the reasons and motivations for choosing different transport modes by students.

The student travel survey was conducted as an online based survey with use of SurveyXact. Two identical surveys were shared at the two chosen universities (UiS, LiU), in languages: at UiS Norwegian and English, at LiU Swedish and English.

The survey was distributed through different channels. In the University of Stavanger the survey was shared with students both by emails, posted on different students platforms, student associations platforms, and social media groups. Additionally flyers with QR codes to the survey were distributed at the university directly to the students and pasted as posters on student information boards.

At Linköping University the survey was shared through several posts on student social media groups, student closed groups on WhatsApp and Telegram and flyers with QR codes were distributed to the students directly and pasted on the student information boards at the campus.

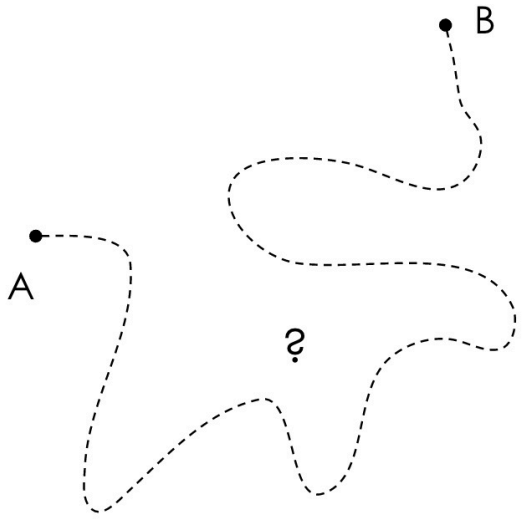
The survey consists of 34 questions, both closed and open-ended questions, that can be divided into three main categories of data: household information, personal information and activity or travel information (Stopher, Wilmot, Stecher, & Alsnih, n.d).

Questions about household information collects data about the respondent's physical household such as location of residence, type of dwelling in this case student housing or private. The second category, personal information, consists of questions about socioeconomic and personal characteristics (age, gender, etc), employment and schooling. Activity or travel information questions asked about details regarding activities and trips, such as travel frequency (days per week at the university), transportation mode to job/school - primary and secondary transport modes, most viable alternative transport mode and travel distance. Students were asked several open questions about the reasons, motivations and challenges/ obstacles for different transport modes to and from campus.

Additionally, several questions about factors influencing travel mode choices of students are asked. These are structured as likert scale questions where respondents mark the importance of each given factor on a scale from 0-5, where 0-do not know, 1-very little, 2-little, 3- neutral, 4-much, 5- very much.

Additionally several questions about attitude towards, car, cycling, walking and public transport, structured as likert scale questions with scale 1-5, where: (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) are asked.

Results from the analysis are confronted with the findings from the literature regarding physical environment and travel behaviour and conclusions will be made after comparing the results.



travel behaviour

- definition
- travel behaviour models
- reasoned and unreasoned action

travel behaviour

Travel behaviour can be defined as a set of practices which are realisable in response to the availability of transportation resources and the things that support and enable travel. It is complex decision making when one wants to make a trip, regarding route choice, travel mode, departure time, destination choice and so on (Barajas, 2021; Li, Zou, & Li, 2019).

There are different forms of travel such as travel for transportation, recreation, commuting purposes and general etc. The thesis is going to focus on the travel behaviour for commuting purposes, which is defined as a regular travel to and from work or school (Yang, Wu, Zhou, Gou, & Lu, 2019)

The complexity of forming travel behaviour can not be overestimated, the determinants of travel behaviour enablers are diverse and complex, scholars put it down mainly to economic rationality (Barajas, 2021). Travellers choose transportation modes, travel routes and destinations that will cost them the least amount of money or time or cost. According to Barajas (2021), studies have shown that economic rationality is not the only way and certainly not the best way to characterise travel behaviour. Scholars from psychology and public health have shown that there are many other factors and attributes that plays role in making this decisions: attitudes, socio-cultural relations, individual perceptions and characteristics, subjective norms, and of course the built environment and natural environmental (weather, e.g rain, sun) features have all been used as various travel behaviour enablers (Barajas, 2021).

There are many models that has been used to explain travel behaviour, (Etminani-Ghasrodashti & Ardeshiri, 2015; Hamidi & Zhao, 2020; Van Acker & Witlox, 2009), but the model by Van Acker and Witlox (2009) is much more detailed and compelling. They described travel behaviour as part of a decision hierarchy consisting of short term decisions on daily activities, medium term decisions on residential and workplace locations and long term decisions on lifestyle, and incorporating that aspect of psychological perspective which explains travel behaviour as reasoned and unreasonable actions.

A very important deduction from this model is how lifestyle plays an important role in shaping individuals' travel decisions and behaviour. Choice of lifestyle is the longest decision while the short activity decisions and medium term spatial decisions were made to satisfy the individual's lifestyle. In this way, the individual's travel decisions are influenced by his or her lifestyle (Van Acker & Witlox, 2009).

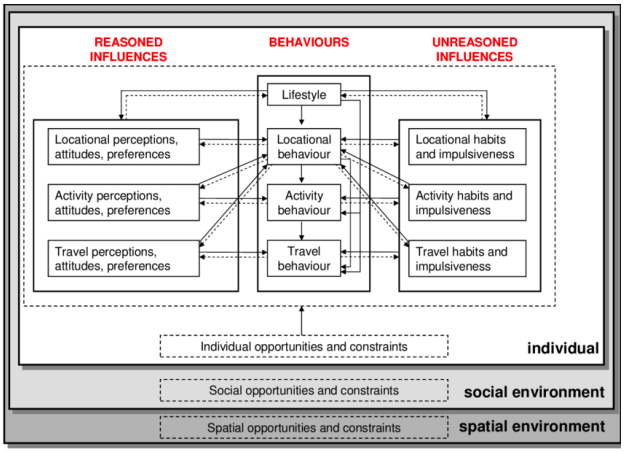


Fig. 1. Conceptual Model for Travel behaviour (Van Acker & Witlox, 2009)

Lifestyle in itself is influenced by many variables which manifest itself in different dimensions. One dimension is social status, economic positions, capital (both economic and socio-cultural), education, knowledge, skills, social capital like relations and network.

Another dimension includes external influences like rules and regulations, stage in life, opinions, motivations, beliefs, interest and attitudes.

While all these can influence a person's lifestyle and travel decisions, lifestyles are internal to an individual, thus can not be observed. Nevertheless, it can be observed by a person's behaviour (e.g. travel behaviour) or lifestyle expressions, in this way, opinions and orientations can explain the person's travel behaviour (Van Acker & Witlox, 2009).

Travel behaviour as a reasoned and unreasoned action

There is no one model or dimension that can unarguably explain an individual's travel behaviour, thus different models, dimensions, variables all inclusively can help to some extent explain travel behaviour. One dimension that is important is psychology, social psychology focuses on how people think, feel and behave and how these can be influenced by other people, moreover, some social psychology theories argue that behaviours can not be well-reasoned only through perception, attitudes and preferences, thus there is other reasoned and unreasoned variable to it (Van Acker & Witlox, 2009).

Travel behaviour as a reasoned action

Rational Choice Model

Behaviour is a rational decision, we behave in such a way to maximise our benefits. While the importance of this model cannot be denied, it is based on partly unrealistic assumptions, namely that choice is always rational, that the individual is the unit of analysis, and that choices are purely made in the pursuit of individual self-interest (Jackson, 2005). Factors such as habits, attitudes, emotions and social context have a limited place in this model.

Theory of Planned behaviour (TPB)

The Theory of Planned Behaviour (TPB) was developed by Icek Ajzen and predicts an individual's intention to perform a behaviour. According to the theory, individual behaviour is driven by behaviour intentions and the stronger the intention, the more likely the behaviour will occur. The behaviour intentions are influenced by three determinants: an individual's attitude toward behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991).

Attitude are beliefs of the outcomes and evaluations of the outcomes, positive or negative feelings about (performing) a particular action. Subjective norms are beliefs about what other people think or would do; perception of social environment and perceived behavioural control refers to the individual's perception of the extent to which performance of the behaviour is easy or difficult. It increases when individuals perceive they have more resources and confidence (Ajzen, 1991). The latter one, according to Ajzen (1991), has a great impact on actual behaviour and can alone motivate and result in a behaviour.

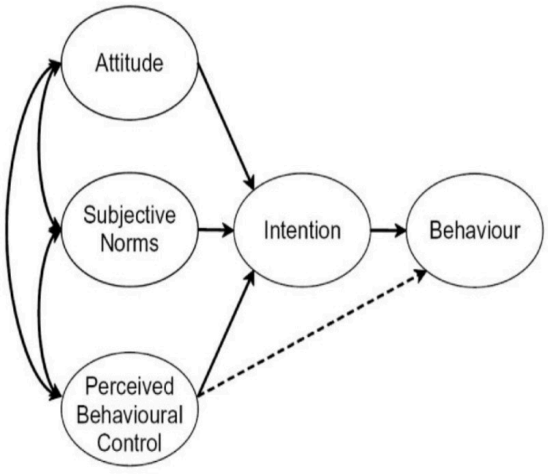


Fig. 2. Theory of Planned behaviour (Ajzen, 1991)

Travel behaviour as unreasoned action

While the above mentioned models (Rational Choice, TPB) have been shown to predict behaviour quite well in many circumstances, there is one important shortcoming to them – the fact that they seem to assume that decisions are always made consciously (Aarts, Verplanken, & Knippenberg, 1998). This is not always the case, particularly in the case of habits. Depending on the type of behaviour, habits play a significant role and should be targeted by policies aimed at changing behaviours (Willuweit, 2009).

Habit: Under the same physical setting and social environment, a person's behaviour can be predicted by studying his/her past actions.

According to Wood and Rünger (2016) habits are the fundamental basis for one's daily actions and can also be a barrier to change, furthermore, once acquired they take place without much thought and discussions. Ronis, Yates and Kirscht (1989) formulated the theory of repeated behaviour, they argued that initial behaviour is as a result of attitude and beliefs. And if this behaviour is repeated, it then becomes a habit thus repeated behaviour is, therefore, assumed to be mainly influenced by habits rather than by attitudes.

Aarts et al. (1998) argue that habits allow us to perform our actions in a rather without cognitive, characterising it as an automatic behaviour. Furthermore, they argue that habit can be seen as behaviour that is repeated over and over again, i.e behaviour performed on a regular basis. In this respect, they highlighted three characteristics of habits:

Firstly: the automaticity of habits are goal-directed, that is, habitual behaviour is triggered by a specific goal. Example are driving, typing, taking a bike to school e.t.c - these are all triggered by specific goal one wants to achieve, but once they are repeated, they become habits, and one does them efficiently, effortlessly, and unconsciously - without cognitive (Aarts et al., 1998).

Secondly: to help form habit, the more one is satisfied with the experience, the more one wants to repeat the behaviour and then the behaviour is now associated with the original goal one wants to achieve. On the other hand, the more one is dissatisfied with the experience of reaching the goal through that process (habit), the more the link between the goal and the habit is weakened, thus decreasing the probability that the person will continue with that behaviour (Aarts et al., 1998). In the previous example of taking bike to school; by taking bike to school regularly one forms the habit of associating school and bike therefore behaviour is formed, on the other hand, negative experiences while riding to school can break this link, thus the original goal of getting to school is intact but the means will most likely change.

It is important to note that repeating an action or behaviour every now and then (weekly or monthly) does not necessary turn it into a habit, thus habit is formed when an action or behaviour with a positive experience is repeated frequently, although, according to Aarts et al. (1998), it still is very difficult to say how often and frequently a behaviour is repeated to become a habit.

However, Linder, Giusti, Samuelsson and Barthel (2021) argue that not all experiences that result in habit formation are necessarily what we like or intend to do. One may want to ride to school but does not have a bike and ends up commuting or using public transport.

Thirdly, cognition plays a role in direct control of environmental signals over habitual behaviour (Aarts et al., 1998). When goal-oriented behaviour is performed over and over again, there is an association that

is formed between the mental representation of that situation and the representation of the goal-directed choices. Furthermore, frequent repetition of the situation and the choices taken to achieve the goal, strengthens this association, thus making it easily accessible when the situation arises (Bargh, 1990). That is, frequently repeating a behaviour in a specific situation enhances the ease of activating the mental representations of that behaviour (hence the behaviour is carried out) by situational or environmental cues (Aarts et al., 1998).

In general, habit can be thought of as a goal-oriented automatic behaviour (with most of the time positive experiences) which are mentally represented, and as it is repeated over and over again in a similar situations, the mental representations and the actions required to achieve it are automatically activated by environmental cues (Aarts et al., 1998).

To illustrate, if we continue our example in the contest of sustainable travel behaviour. A student who wants to attend lectures at school decides to ride a bike to school (it may or may not be his only choice as a result of unavailable public transport e.t.c), his/her decisions are deliberate and based on attitudes and intentions.

As this behaviour is frequently repeated, it becomes a habit and the school is then associated with travelling by bike, thus the goal "attend lecture at school" will automatically activate travel mode choice "bicycle" in his/her memory. Moreover, when this habit is rooted, every similar trip within a similar distance will automatically activate the travel mode choice bicycle. For example, visiting friends, going to shopping malls, grocery stores e.t.c thus in this case, a sustainable travel habit is developed through this frequent repeated travel behaviour.

physical environment

- definition
- physical influences
- socio-psychological influences

physical environment

"One's physical environment is one's surroundings." (Holland, 2019)

Physical environment can be defined as all the objects, conditions e.t.c that surrounds an individual. i.e physical environment is one's surroundings and consists of any element that one can experience, sense, feel, touch, smell, sight, hear and taste (Holland, 2019).

"The physical environment includes elements such as land, air, water, plants and animals (natural environment), buildings and other infrastructure (man-made or built environment), and all of the natural resources that provide our basic needs and opportunities for social and economic development " ("Physical environment," 2003).

"One's physical environment shapes one's life." (Holland, 2019)

Physical environment and its influences on travel behaviour

Land use and travel behaviour

The study of land use has long been gaining ground in understanding travellers' modal choice of travel. Mixed land uses are thought to yield much benefit in terms of transportation to city planners where shops, offices, banks, recreation activities, restaurants, schools e.t.c. are intermingled among one another, people are less likely to drive and more likely to walk or cycle as travel mode (Cervero, 1996). This study tries to understand the influence of different urban forms in travel modal choice. Several studies exist about the effect of land use patterns on travel behaviour (Ewing & Cervero, 2001; Van Wee, 2002) where various land use characteristics like density, diversity, and urban features and their effects on travel behaviour were closely studied. Researches have shown that there is a relationship between modal choice of transportation and the spatial configuration of land use (Limtanakool et al., 2006; Van Wee, 2002; Van Acker & Witlox, 2009; Ewing & Cervero, 2001). According to Van Acker and Witlox (2009), key variables from this study point to three components that influence modal choice of transport: (i) Spatial Component, (ii) Socio-economic and (iii) Personality Component.

Land Use Mix: compact, densed and coherent land use are seen to provide good accessibility, while scattered land use creates greater need for car use as mobility means. A study in Denmark shows that short distance or proximity to shops, diversities and densities e.t.c have positive influence in increasing cycling share (Nielsen, Olafsson, Carstensen, & Skov-Petersen, 2013). Presents of green space have shown to give positive experience among cyclists and increase cycling time (Frank et al., 2006).

Spatial Component of the Land use

Spatial component of land use and travel behaviour highlights four important areas; density, diversity, design and later accessibility was added (Van Acker & Witlox, 2009). The so-called 3D's was first used by Cervero and Kockelman (1997), to describe the influence of built environment on travel mode choice before later destination accessibility and distance to transit was added (Ewing & Cervero, 2001, 2010).

Density: measured in per unit area where variable of interest can be population, job, dwelling unit e.t.c People in high density areas tend to use more sustainable mode of transport, i.e public transport, cycling and walking.

A dense city or high concentrated urban area helps to increase bicycle share. Localisation of activities and destinations within cycling distances has a positive influence on strengthening cycling competitiveness (Hagen & Rynning, 2021). According to Börjesson and Eliasson (2015), a well-planned dense land use provides short distances between different destinations. High density corresponds to less driving and lower transport energy consumption (Næss, 2015).

Diversity: relate to the number of different land uses and the extent to which they are represented in a given land area (Ewing & Cervero, 2010). Entropy is used as a measure of diversity (Ewing & Cervero, 2010), (Van Acker & Witlox, 2009) where higher values represent varied land uses and low vary represents single land use. Higher densities usually correspond to more diverse land uses and diverse travel behaviour.

Design: two standard extreme characteristics stud out; standard suburban neighbourhood mostly made up of low densities, limited diversity and car-oriented design, and the other neo-traditional neighbourhood (new urbanism) characterised by enhanced walkability, mixed land uses (diversity), ease of access to public transit, high density residential area, mixture of housing types (Ewing & Cervero, 2010; Van Acker & Witlox, 2009). This form of urbanism employs different strategies to reduce car use and VMT, promote sustainable travel behaviour (STB) as most basic and daily needs are accessible within a few kilometres (the so called 5 (walking) or 15 (walk/cycle or public transport) minutes city) (Groch, 1996).

Designs can sometimes be measured in terms of physical or built structures that differentiate car-oriented cities and pedestrian oriented one like sidewalk coverage, building setbacks, street widths, number of pedestrian crossings, streets trees, number of intersections e.t.c (Ewing & Cervero, 2010).

Distance

Destination accessibility and distance to transit: accessibility has become an important characteristics of land use and describe as the ability of the traveller to reach its destination (activities, locations, points e.t.c) by means of (or combination) travel modes available (Van Acker & Witlox, 2009). Studies show that good accessibility to public transport results in more use of public transport as a modal transport choice (Van Acker & Witlox, 2009). Another land use measure is distance to transit route, measured as an average of the shortest streets routes travellers' location (e.g residences, job places, activity places e.t.c) to the nearest bus stop, rail stations e.t.c (Ewing & Cervero, 2010).

Furthermore, distance to destination is another measure that has been known to encourage different sustainable travel modes. For example, much literature recommends cycling distance to be within 5km (Zacharias, 2005; Yang & Zacharias, 2016).

On the other hand, Southworth (2005) suggests that stations should be put within 400 to 800 m walking distances to allow pedestrian access. Some researchers put 500m as distance pedestrians are willing to walk (Campisi et al., 2020), while Christian et al. (2011) put walking within 10-15 minutes as the distances pedestrians are willing to walk at "moderate intensity".

Socio-economic component of the land use

Socio-economic component is another way of explaining travel behaviour by looking at the socio-economic variables of travellers. One variable that can easily be thought of is car use. People who own a car will use it. Nonetheless, car ownership in itself is influenced by income (Van Acker & Witlox, 2009). Women tend to travel more by public transport, bike or walking whereas men do more by car. Some of these gender travel differences might be due to the fact that women generally earn less or work a different job than the male counterpart (Van Acker & Witlox, 2009).

There are other variables that affect socio-economic components; educational level, employment status, household size e.t.c. higher educated persons tend to obtain a specialised job and a higher paid job means more income and more car use and more long distance commute and household size has a positive influence in car use (Van Acker & Witlox, 2009), and correspondent increase in VMT as household who owns a car will use.

Physical environment influence on personal component: socio-psychological influences

This is how different physical environment features can affect an individual perception of his/her physical surroundings.

The study of perceptions and attitudes towards spatial, built or physical environments of cities are very important in understanding travel behaviour. Perceptions and attitudes towards urban design add an interesting perspective towards understanding travel behaviour especially that **perception** and **attitudes** are a result of individual lifestyle (Van Acker & Witlox, 2009).

Perception depends both on internal (individual) and external factors. For this thesis, the view of perception employed is that from the external influences (the physical environment), that that can be observed and explained e.g based on the spatial or built environment.

Distance perception

Distance perception is how an individual perceives the trip distance from start point to destination point (Yamamoto N., 2017).

Distance information is very important in travel mode and travel behaviour in general. It is important in cost travel cost evaluation, and helps utilise resources efficiently (time, money, food). According to Montello (1997), knowledge of distances affects decisions about if to stay or go, where to go and what route (which modal choice) to take, thus highlighting the importance of distance perception in predicting travel choice of spatial behaviour.

The perception of distance differs in different urban scale/context and the travel distance may be recognized or perceived as shorter in a proportionally smaller urban environment, than the same distance in a bigger scale environment (Crompton & Brown, 2006).

Montello (1997) discusses the impact of physical environmental features during trip travel on trip distance perception. He argues that the more the number of environmental features on a travel route (e.g turns, intersections, connections and other barriers), the longer the distance is perceived. In addition, travel routes/distances that are segmented by physical/environmental features, are perceived as longer - the higher

the segmentation the longer the distance is perceived. These features are barriers that segment the travel route and at the same time they "increase the number of features, influence visibility, and have implications for travel time and effort" (Montello, 1997), which can additionally affect and influence the distance perception and further travel behaviour.

Another distance perception variable is "travel effort", the amount of effort or energy a person expends while travelling through the environment (Montello, 1997). indirectness of trip route and presence of barriers, hills, slopes and even the need to carry weight or perform some kind of streneouse task while travelling have all been used as a measure of travel effort Montello (1997). The more the indirectness of the route increases(e.g due to turns, detours, hills, bad weather, e.t.c), the more the trip time increases and more effort needed to complete the trip.

Terrain typology, weather conditions are some of the travel barriers and increased travel effort needed to complete the trip e.g going from home to school and vice versa. This is important in explaining why travel behaviour differs in different settings even when other variables are similar.

Perception of safety

Perception of safety is another very important variable that can affect travel decision and mode choice. There has been research in this area, e.g Riggs (2019), which shows that travellers' perception of travel mode safety and trip safety can persuade them to engage or not the active transportation especially of walking or cycling.

This subjective perception can be affected by variables such as cycling or walking path typology, vehicle speed, number of barriers e.g intersection with major road etc.
It's important to point out that perception is subjective and it's basically influenced by both individuals' internal perception and understanding or grasping of the physical environment. Nevertheless, there are physical features which are measurable and can negatively or positively be attributed to different variables of perception.

sustainable travel behviour

- definition
- walking
- cycling
- public transport
- e-bike

sustainable travel behaviour

This chapter focuses on sustainable travel behaviour, literature about sustainable travel behaviour will be reviewed aimed at defining sustainable travel behaviour, types and factors influencing it.

Sustainable transportation more precisely is understood as one that is accessible, safe, environmentally friendly and affordable (TDM Encyclopedia, 2017).

This thesis will focus on active (since they involve some form of physical activity) transportation mode, and in this light three sustainable travel modes are identified and which are: Walking, Cycling and Public Transport.

Walking

Walking is perhaps the most sustainable mode of transportation, we can all reduce our carbon emission by walking those short trips, to shops, schools, activities e.t.c. In the contest of sustainability, there are many studies that show gains from different interventions that promote walking while discouraging motorised transportation. For example; the study done by Neves and Brand (2019), in London United Kingdom, showed that almost 42% of short car trips that are less than 5m could instead be done by walking or biking, they estimated the CO2 reduction to be in the range of 2.8kg CO2e per person per week, amounting to about 10.9% of all car travel. Furthermore, the study showed that a realistic shift from carbon intensive motorised transport to walking and cycling was estimated to have reduced short trips by 41% reducing about 1.15kgCO2e (Baobeid, Koç, & Al-Ghamdi, 2021).

Also, a case study in New Zealand in 2018 on reducing carbon emission from intervention to promote walking and cycling, showed a reduction of 1.6% in average distance travelled per passenger vehicle after 3 years of the intervention, and a decrease in the number of cars per household (Keall, Shaw, Chapman, & Howden-Chapman, 2018).

Studies have shown that there are many health benefits from walking short trips or using walking as a form of transportation in general.

In the contest of the current wave of encouraging sustainable travel behaviour, walkability is perhaps at the forefront along with cycling, in parts for its zero addition of carbon to the environment but also for its health benefits. Like cycling, walking is a form of exercise thus there are many health benefits of walking, furthermore unlike cycling, walking requires zero investment, anyone can benefit from it.

As the push for sustainable transport mode is gathering attention with different government policies and city planners employing hard measures like closing streets for motorists, restricting access and removing entirely car parking spaces, perhaps physical activity and health benefits from walking and cycling are the best incentive to motivate people to shift towards sustainable transport behaviour.

There are many benefits from walking, it contributes to lower rates of obesity, diabetes and cardiovascular disease (Gregg, Gerzoff, Caspersen, Williamson, & Narayan, 2003; Hu et al., 1999; Smith, Wingard, Smith, Kritz-Silverstein, & Barrett-Connor, 2007). There are many other studies that associate walkability with a whole lot of health benefits including but not limited to; reduce

mortality rate, serves as physical activity for those in rehabilitation from injury or sickness, recommended for elders suffering from osteoporosis, physical activity for those recovering from chronic musculoskeletal pain, help cancer patients sleep, improve mental health, helps in reducing depression symptoms in older adults, walking comfortably for small and medium distance helps in improve quality of life and livability (Baobeid et al., 2021).

In this contest, walkability can be defined according to Southworth (2005), as the extent to which built environments facilitate and encourage walking by providing pedestrian comfort and safety, and connecting people to their different destinations in a reasonable amount of time and effort, while making available visual interest throughout the journey.

Factors influencing walkability

There are many factors that influence persons or city walkability, ranging from external factors like weather, climate, topology etc, and physical factors like infrastructures to personal or individual factors like age, health, exercise, socio-economic class or status, habits, attitudes etc.

This thesis focuses on examining how the physical factors influence travel behaviour in this case walkability behaviour of students in UiS and LiU, however, since understanding persons travel behaviour is much more complex than just the physical influences, some of the other influences will be looked at also.

Personal Factors

Like cycling, walking as a moderate intensity physical activity can contribute positively to one's health, moreover as a form of travel behaviour, the decision to go, where to go, how and what means is influenced by many factors. One of these factors is personal or individualised to one. This personal factors includes age, sex, health, social-economic status, education level, profession, safety and distance perception, attitude, habits, preferences etc.

Sex and age plays an important role in a cities walkability, some studies have found that women feel more unsafe on the street (Solli, Wergeland Haug, Malmin, & Ellis, 2016; Van Cauwenberg et al., 2012) and this can result in less women walking. While Delclòs-Alió et al. (2019) suggest that men under the age of 75 tend to walk more especially for transportation purposes.

Socio-economic status of people can lead to different walkability. King and Clarke (2014), argue that residents of disadvantaged neighbourhoods tend to walk more, given that their lack of cars and social statues allow the design of the walkable neighbourhood that access to jobs, recreational activities etc accessible by walking.

Motivation to walk depends on a lot of things, for example income, profession and education. A high income earner who has a car may have a different motivation to walk than a low income earner. While the latter may walk for transportation purposes, the former may walk for physical activities or be influenced by nature etc.

An educated person may walk because he or she knows the benefit of that, on the other hand, another may walk as a necessity rather than the benefits. The factors separating motivation or reason to walk in different socio-economic scene is fluid, one may decide not to walk because time or other activities like child care, another may actually be motivated to walk to playgrounds or other activities provided time and other factors permit (Shay, Spoon, & Khattak, 2004).

Built Environmental Factors Affecting Walkability

Built environment has a big influence on travel mode choice, it can have a positive influence on residents' walkability both for transportation purposes or for leisure. Baobeid et al. (2021) defined walkability as the quality of which built environment enables pedestrians to reach their different destinations; Lo (2009) includes those pedestrians using wheelchairs or other assistive devices and not only walking on foot.

Pedestrian Facilities

Presence of walking facilities is positively associated with walking (Baobeid et al., 2021), according to Rohrer, Pierce, and Denison (2004), an area is walkable if it is convenient to walk, regardless of if it has other walkable facilities like sidewalk or crosswalk. In essence the most important pedestrian facilities are those that make walking convenient. Litman (2003) went a little further, arguing that a walkable environment should be safe, comfortable and convenient (SCC). Putting all these pieces of information together, that is, a walkable environment should be safe, comfortable and convenient, thus meaning separation from any other environment that does not feel or give it those elements of safety, comfort and convenience. In essence one can only imagine walking paths, sidewalk, crosswalk etc.

Rodriguez and Joo (2004) found a positive relationship between walking and sidewalk or walking paths. Whilst the presence of sidewalks are the most important walking facilities, the quality of this sidewalk is very important too. Given that a walkable environment should be safe, comfortable and convenient (SCC), means that sidewalk or pedestrian paths should be safe, comfortable and convenient, thus the quality of the sidewalk comes into question.

In general, one can then say that the quality of the sidewalk can be evaluated on how pedestrians feel about safety, being comfortable and convenient when walking on it. Baobeid et al. (2021) argue that sidewalks should be accessible, direct, connected, safe, comfortable, shaded, and well maintained for all pedestrian use. It should also be continuous, without gaps, have a relatively smooth surface without pits, bumps, or other irregularities that could make walking and wheelchair access difficult or hazardous (Southworth, 2005).

The width of the sidewalk is also very important for the SCC, it should be wide enough to allow all the pedestrians mobility without compromising the SCC. Southworth (2005) puts it wide enough to allow 2-3 people to pass one another or walk together in groups and much wider when in urban situations, while according to Shay et al. (2004), it should be at least 5 feet (1.5) wide. Considering that most pedestrians and cyclists share a path, then this path or sidewalk should be wide enough to allow this mixed use without compromising the SCC.

Other quality factors include: terrain (steep hills or slope may require steps or railings to assist pedestrians) , limit or avoid completely encroachment (mail boxes, sign poles etc) into pedestrian pathway as they can block crossings and compromise walkability, high pavements or planted verges to help isolate and insulate pedestrians from moving traffic, streets trees protect from sun and define walking path, lighting can enhance nighttime walking and feeling of safety for pedestrians (Southworth, 2005).

Accessibility and Connectivity

Many studies suggest that the major determinant of walkability is the ability to reach different destinations by the pedestrian(Southworth, 2005; Shay et al., 2004; Baobeid et al., 2021), thus accessibility for pedestrians can then be thought of as convenient with which pedestrians are able to access or reach different destinations, that is, the proximity of multiple destinations (Shay et al., 2004).

In this then the placement of university buildings, lecture halls, dormitories, shops and recreational activities should then be thought of and planned in a way to facilitate walking, that means students should be able to walk to their different destinations instead of using other mobility choices. Even inside the campus, lecture halls and basic student facilities should be placed in a walking distance from each other.

The study by El-Geneidy, Grimsrud, Wasfi, Tétreault, and Surprenant-Legault (2013) highlighted several distances that pedestrians are comfortable walking in different cities including 292, 327, 450, 649 and 840m. According to Shay et al. (2004) distance between trip origins and destination should not exceed 0.5mile, about 800m, furthermore they argue that all public spaces be located within 800 feet (about 244m) from 90% of homes, dedicating 15% of lawns to landscaping and block lengths within 400 to 600 feet (122 to 183m). In essence to improve walkability of students, not only the in-campus destination distances be looked at but also destinations to different locations within where the students live, especially since most students in UiS live in the Stavanger region in general.

Apart from in-campus destinations accessibility by walking, and in-residential living area accessibility, it is important to provide connections with the larger Stavanger city in general and the region through safe, convenient and accessible links to other modes such as train stations, bus stations, shops, recreational activity places, work places, campuses, schools, parks, services and various other urban amenities. These places should be connected and accessible within reasonable time and distances for pedestrian access.

Connectivity and Accessibility go hand in hand, a connected place is usually an accessible place. The seamless blending of these two will allow students and other pedestrians access to all the important locations on foot or other sustainable travel mode. Optimal locations of the pedestrian destinations will depend on different factors including how often they are accessed, number of pedestrians accessing it at a time etc. Southworth (2005) suggests that stations be spaced frequently between 400m to 800m or 10 to 20 minute walking.

In general, as we pointed out here, several studies have been carried out investigating convenient walkable distances to destinations for pedestrians, those studies have pointed to different distances mainly between 400m to 800m walking range (Southworth, 2005; El-Geneidy et al., 2013; Shay et al., 2004), though difficulty having consensus on a particular distance, nevertheless, the simplest rule here is that especially for in-campus and to campus from the dormitories should be no more than 800m, but the less the distance the better for pedestrians and more encouraged to walk thus distances as close to 400m typically 500m or less should be optimal for walking.

Mixed Land Use

Another factor that influences pedestrians' willingness to walk is Land-Use Mix. Different land use mixes affect different walking purposes, that is, Utilitarian and Non-Utilitarian purposes. For example, if the target is for those walking for Utilitarian (destination-focused e.g work, school) then land-use for exercises are then not attractive to them and vise-versa. This presents a dilemma for city planners and alike. How do one make a particular land attractive and beneficial for both destination-focused pedestrians and non-destination focused pedestrians?

Students need not only go to school, lectures and alike, they also need to go for exercises, shops, different activities, church, entertainment centres, or even visiting parks to relax and enjoy nature.

Communities with well mixed land use increase walkability of its residents (Baobeid et al., 2021; Shay et al., 2004).

In view of utilitarian and non-utilitarian trips, land-use inside campus should then be different from land-use outside, that is within residential areas. While inside campus focus should be more on different student destinations, (not forgetting staffs and others) outside including student dormitories and other residential areas will focus more on general including utilitarian, and non-utilitarian for example, aesthetic, open space, street-orientation, elements that improve visual quality and outdoor experiences (Shay et al., 2004; Zhang, Fisher, & Feng, 2020).

Green Spaces and Parks, Aesthetic

Another important feature of the built area is its green places ; parks, lawns, trees etc. to encourage outdoor activities including walking planners should aim at improving the quality of the outdoor spaces including greenness, parks, walking path trees and grasses or green fields etc. those green features in addition of its aesthetic look, reduce temperatures and improve air quality.

The presence of greenneries should be seen and felt both in campus and around student living areas; Hipp, Gulwadi, Alves, and Sequeira (2016), found that a high level of campus green space can improve students' quality of life. Walking through paths or sidewalks with greenes like parks or beautiful trees along the path will surely encourage more students walking to campus on foot.

In the campus, Lawns, parks with benches for sitting and nicely cut grasses will encourage more walking, improve air quality, and increase outdoor activities (Baobeid et al., 2021).

Apart from that, aesthetic or attractiveness of the outdoor space have been found to be one of the major factors influencing not just walking but general outdoor activities (Baobeid et al., 2021; Shay et al., 2004; Zhang et al., 2020). A pleasant atmosphere, attractive architecture, street trees on walking paths, well-lit public areas, outdoor seating both in campus and residential living areas will cause more students to engage in outdoor activities including walking (Shay et al., 2004).

Safety-Traffic Volume and Speed

Safety is one of the major concerns of pedestrians, especially from motorists. There have been many studies which suggest that the perception of safety influences the levels of walking and cycling (Baobeid et al., 2021; Shay et al., 2004; Zhang et al., 2020; Southworth, 2005; Liu, Zhou, & Xiao, 2021). The increasing motorised cities have in turn made pedestrians and cyclists feel less safe, especially at intersections (Liu et al., 2021; Baobeid et al., 2021). Wider roads, increased number of lanes, and higher speed limits are all linked to higher accident rates and less feeling of safety (Baobeid et al., 2021).

On the other hand, there have been several majors designed for pedestrian safety. One of them is traffic calming measures, a technique designed to reduce traffic speed using a variety of devices like chokers, chicanes, speed bumps, raised crosswalks, narrowed streets, rough paving, traffic diverters, roundabouts, landscaping, and other means (Southworth, 2005).

Other majors that increase safety and introduce pedestrian friendly path includes, signs and crossing markings on pedestrian paths, having pedestrian only route (shared routes can increase conflict between pedestrians and cyclist) when possible, education (e.g lectures) on safety rules and individual behaviour including use of reflex vest, street or path lighting etc.

Weather and Climate

Weather and climate due affect pedestrians willingness to walk especially to distance destinations. In cold weather, pedestrians might be faced with unpleasant weather conditions in addition with health risks such as hypothermia and frostbite, and in hot weather heat exhaustion (Baobeid et al., 2021).

In hot weather, walkability increases during the early morning and evening, and decreases during the day, whereas in cold weather it increases during the day and decreases during the cold night. Some studies suggest that people walk more and longer in nice or pleasant weather especially in summer (Southworth, 2005; Delclòs-Alió et al., 2019,) while walking less in rainy weather (Delclòs-Alió et al., 2019).

Although the effects of weather and climate are rarely looked at as potential deterrent of pedestrian walkability, they can actually pose a threat towards achieving the walkable campus we all crave for, thus should be considered alongside other factors when designing, improving or encouraging walkability of campus and the region in general.

Topography

Topography can be an obstacle to walking and cycling. Sloping terrain has been found to be negatively associated with walking (Rodríguez & Joo, 2004).

The effect of terrain can be made worse on places with snow and ice (Southworth, 2005). In this regard the quality and maintenance of the path is very important if pedestrians are to be encouraged to walk on them. Winter maintenance and summer maintenance will definitely be different, in winter will be removing the snow and salting while summer can be trimming the grasses and trees and flowers and generally cleaning the path.

Cycling

Cycling has recently gained attraction as both a common way of exercise and sustainable mode of transportation. Just like walking, cycling has many health benefits, studies have shown that people who form cycling behaviour can reduce the risks of premature death, obesity, heart disease, stroke, type II diabetes, metabolic syndrome, colon cancer and breast cancer among adults (Yang et al., 2019).

The health benefits of cycling are enormous. A study by Fishman, Schepers, and Kamphuis (2015), shows that, the average dutch cyclist 74 minutes a week as a result lives about 6 months longer thereby saving about 6500 deaths per year. The financial gains were estimated at 19 billion Euros per year, given that a life year gained was worth 2.8 million Euros (Fishman et al., 2015).

There has been much research on the relationship between built environment and cycling behaviour. Some of the research has shown that there is a relationship between built environmental factors and cycling behaviour of different cities (Yang et al., 2019).

For transportation purposes, cycling enablers e.g presence of dedicated routes, cycle path separation from other lanes especially car lanes, high urban density, short travel distances and close to green space, have proven to be positively influencing cycling behaviour (Zhao, Lin, Ke, & Yu, 2020).

Factors influencing cycling

Research from 2016 shows that natural conditions such as topography, weather and climate can be potential barriers towards cycling (Solli et al., 2016). According to that study, increased altitude on the cycling path can reduce the probability of cycling just as warmer temperatures increase cycling probability.

There are many factors that influence cycling, the factors that will be discussed here are dimly important for this thesis but there are others which may influence cycling behaviour which will not be discussed here for example: government policy, role of voluntary organisation, traffic training e.t.c.

Cycling Culture Factor

It is very important to highlight the importance of the culture of a place in shaping individual behaviours of people living there. Cycling culture is often seen as a part of the sociocultural factors and important influencer because individual choices are greatly influenced by what those around him/her do (Solli et al., 2016). A person who moves to a cycling city more often than not ends up cycling, just as another in a car city ends up using a car as basic transport mobility.

Individual Factors

Individual factors are those factors that are personalised and play a part in the decision of which mobility mode that person chooses. These factors include age, gender, sex, health, education level, access to car, income, safety perception e.t.c.

Sex and age are very important factors when checking cycling activities, in many countries women cycles more than men especially young women, and in another men cycles more especially those with low cycling activity. In Norway, Kristiansand with most cycling activities sees more women cycling than men and with wide age diverties, in Urban areas with low cycling activities like Oslo and Bergen fewer women cycle than men, and there are like one age group cycling and fewer older and younger cyclists (Solli et al., 2016)

Another personal influence is access to other travel mode choices, families who have access to a car will most likely use it and this increases in a case for long distance travels. A survey done by Urbanets in 2014, people were asked why they do not bike, most people answered that it is because they have a car and it's easier to use (Loftsgarden, Opheim Ellis, & Øvrum, 2015), other reasons are long distance and poor bicycle infrastructure. Access to a car is very important in choosing a travel mode and forming a travel habit. In 2013/2014, studies show that about 88 percent of Norway households have at least one car (RVU 2013/2014).

Safety and security can also be understood as an individual factor and is closely linked to the built infrastructure. This safety here is the individual's perception of safety, it's not to be confused with the general safety (objective safety) that's inherent in or as a result of the infrastructure itself, but the way the individual views the safety that the infrastructure presents (subjective safety).

The individual must perceive the travel mode as safe both in terms of crimes and accidents, the subjective risk of accident and crime can cause the individual to use a car as mobility means rather than bike.

Findings from a case study by Andrade, Jensen, Harder, and Madsen (2014) covering the perception of safety where Copenhageners were interviewed on the street on how they perceive biking safety of three different infrastructure, highlights that fast bike lanes and fast connectivity can encourage users to bike more, and also that when shared-use spaces (i.e the lanes a mixed for bikers, pedestrians, cars and other road users) perception of safety decreases, thus purpose-built bicycle lanes are perceived as most safe by bikers.

Loftsgarden et al. (2015) show that those who cycle rarely have a higher emphasis on safety as a motivator than those who cycle often. They tend to put safety higher than fast connectivity or separate bike lanes.

Infrastructure Availability

Perhaps one of the main factors that influence travel mode is the availability of infrastructure (Marqués, Hernández-Herrador, Calvo-Salazar, & García-Cebrián, 2015; Pucher & Buehler, 2016). In a study carried out by Fasan et al. (2021) on the Factors Influencing Cycling among Secondary School Adolescents in an Ethnically Diverse City, a number of concerns were raised by the participants on not good infrastructure for cycling. The infrastructure highlighted by the participants includes cycle lanes, road markings and signs, cycle parking facilities and safe road crossing.

Most studies found out that there is a direct positive relationship between bike lanes and levels of cycling, infrastructure availability is one of major cycling interventions that may determine choice of route for commuters as is seen as important for safety and comfort (Sener, Eluru, & Bhat, 2009).

Several studies suggest that cyclists put separated bike lanes from motorists as a major influential factor (Marqués et al., 2015; Pucher & Buehler, 2016; Pereira Segadilha & Penha Sanches, 2014). Yang et al. (2019) argue that the presence of dedicated cycle routes or paths (separated from motorist and pedestrian) for cyclists are seen as positive, especially cycling for transportation. Apart from that, it's important that the bike lanes are continuous (Pereira Segadilha & Penha Sanches, 2014), roads with continuous cycle paths are much more attractive to cyclists than that were the cyclist infrastructures are constantly interrupted or that leads to dead-end.

This street connectivity and continuity is so important that Pereira Segadilha and Penha Sanches (2014) suggest that bike lanes with interrupted infrastructures are rarely used by cyclists. It is also important that the cyclist lanes are maintained in the winter, Bergström and Magnusson (2003) found that winter maintenance of bike lanes can increase cycle trips by 18 percent. It found that snow clearance is the most important winter maintenance measure. Lea (2012) found out that highly quality maintenance of the cycling infrastructure is another key factor in encouraging bikers.

Fast connectivity was also amongst the list of cyclist influential factors, the study in Denmark by Andrade et al. (2014), where a new fast cyclist lane was built connecting two sides of Copenhagen Harbour showed an increase in the number of commuter trips by bike and significant increase in the number of cyclists.

In most cities, pedestrians and bikers share one lane which are usually separate from motorist lanes. Sometimes this shared used lane presents major challenges for bikers as they try to negotiate their way in between pedestrians (Andrade et al., 2014).

Other infrastructural factors that influence cycling

Crossings and Intersections:

Having to stop on intersections and crossings while riding for bikers is a major disadvantage and stressful with each stop adding up to three minutes extra to the overall travel time experience (Opheim Ellis & Øvrum, 2015). Furthermore, in each intersection there is a potential danger of accident (Solli et al., 2016).

Bike parking, shower and wardrobe facilities

Access to comfortable bicycle parking space was found to be another motivator for cycling. This includes parking both at the start and end of journey, thus students this represents bike parking facilities at the hostels and also at the school facilities. Important is how the bike parking space is perceived, whether safe or not, with or without a roof.

In a survey in Oslo municipality, out of 2000 participants, 42 percent said the risk of having their bike stolen made them cycle less, 55 percent said they not satisfied with the bike parking facilities at the Oslo centre (Solli et al., 2016)

A study on bicycle parking in Trondheim city by Tran (2021), found that not only stolen bicycles contribute to less desire to cycle, but it's a major problem in many cities, furthermore it discourages new cyclists from using it as a major transport mode. Also, roofed parking or having a wall encourages cycling especially as a transport mode for work or school as it requires parking for long hours (Tran, 2021).

Marqués et al. (2015) highlighted many factors that should be considered when locating and designing bike parking facilities, including along the cycle network, with emphasis in the main nodes of public transport, as well as the main trip attractions, such as schools, workplaces, commercial areas, public transport nodes, parks, recreational facilities, pubs, fun places etc. Furthermore, they argued that providing bike parking infrastructures not just at the origin and destinations of journey, but also at the different transport nodes, especially at different important, attractive nodes during the transport journey were found to attract cyclists.

Also, Marqués et al. (2015) discussed the importance of promoting indoor parking facilities for cyclists, that is parking infrastructures inside residential, public, school buildings, as well as shops, companies, etc.

Cycling being an exercise can result in cyclists sweating, smelling and not feeling comfortable in the workplace or school. Therefore it is very important that they refresh themselves before work or enter classrooms. Shower and access to wardrobe at the workplace (school in this case) was found to be very important and can persuade more bikers especially for those who cycle long distances to school (Solli et al., 2016).

Land Use Mix

There have been many studies on land use mix influence on cycling share, for example, green land (e.g parks, green spaces and fields) has been shown to be positively associated with bicycle usage (Frank et al., 2006), and proximity of green space increases the cycling time (Fraser & Lock, 2010). Other land use favourable to cyclists and attracts cyclists includes; commercial land use, business land use, land use for educational purposes like universities e.t.c (Zhao et al., 2020).

Land use can define transport behaviour (Christian et al., 2011) and non-auto commuting can be encouraged by mixed land use, residents are more likely to cycle if grocery stores and other services are in the range of three hundred feet (Cervero, 1996).

Land use connections, for example bicycle-friendly physical conditions and street connectivity, is essential for cycling progress (Zhao et al., 2020). Infrastructures such as cycle paths, network density, accessibility have all been found to have a positive effect on cycling time.

Bicycling can easily cover walking distance and has the potential to cover some of the distances personal cars can. In essence some trips done using personal cars can be replaced by cycling.

Having mixed use of the land resources where a variety of functions are accessible by bike will greatly encourage and increase cycling time. High level land use mix and diversity indicate the greater access to services and facilities which can be easily covered by cycling. Communities with higher land use mix are reported to have more social engagement and outdoor activities. More information about land use and its influence can be found under Physical environment and its Influence on travel behaviour.

Topography

Studies show that there is a direct relationship between bicycle share and slopes or hills in urban areas. The more sloppy or hills, the less the bicycle share (Solli et al., 2016). Height difference is shown to be the most suited measure for distance travelled by bike, Nielsen et al. (2013) list flat terrain as one of four factors that explain cycling in a neighbourhood within a distance of 1.5 kilometres. Others include short distance to retail concentration, population density and network connectivity. According to Solli et al. (2016), those who live in areas where the height difference to the centre is over 50 metres make 40-50 percent fewer bike rides than those who live in areas where the height difference to the centre is less than 15 metres.

Weather and climate

Christensen and Jensen (2008) (on short car journeys, and on the possibilities of getting motorists to walk or bike instead of driving on shorter trips), looked at what factors influenced means of transport or mobility on shorter trips. They found out that temperature has a significant influence on the choice of car over bike for a shorter distance. Their result showed that at a temperature of 20°C, the share of kilometres driven by bike increased from 17 to 21 percent, but for 0°C, it dropped to 14 percent. Also, there was almost a 50 percent increase in cycling in the city in the summer than in the winter. Wind also was found to influence cycling slightly as cycling increased from 17 to 18 percent when there was no wind.

Another weather factor was rain, the study found that rain has a small effect on bicycle share with only 0.2 percent of the kilometres travelled on short journeys was moved from car to bicycle. It's important to note that these studies concentrated only on the percentage of motorists who used bikes as means of transport in the different scenarios.

Bergström and Magnusson (2003) conducted a survey checking the attitude of Swedish towards cycling during winter in general, and in relation to winter maintenance of cycleways in particular. The study showed a clear difference in mobility choice between different seasons. There was an increase of 27 percent in car trips from summer to winter while the travel by bike decreased by 47 percent in winter. Furthermore, the study found that increasing travel distance corresponds to decreasing travel made by bike and this decrease was much more in the winter than in summer.

There were also different opinions on factors that influenced the cyclist's modal choice for different seasons, while temperature, precipitation and road condition were most important factors to those cycling in summer, exercise was the main reason for those who cycle in winter.

The study found out that it is possible to increase the number of cyclists in the winter (by up to 18 percent) by improving winter maintenance service levels on cycleways, with a corresponding decrease in the number of car trips by 6 percent. To increase cycling during winter, snow clearance was found to be the most important maintenance measure.

Public transport

Public transport is perhaps the single transport mode that can have the biggest impact of motorised transport among students, especially for medium and long distances which is usually associated with car travel.
Some of the benefits of public transport are:

- Reduces travel on private cars and reduces emissions of Co2
- Reduce congestion
- Is energy efficient

Factors influencing the use of public tranport

There are many factors that affect the use of public transport (PT) as mobility choice including distance to work or school, distance to bus stop, frequency of PT, travel time, bus ticket prices, car ownership, car parking, age, gender, education, etc.
They can be grouped into two main categories: Accessibility and Socio-economic/habit.

While one has to do with the bus infrastructure, the other seems more likely about the individual than the external factors.

Accessibility and other built factors

Accessibility of Public Transport (PT) is the main factor influencing PT use. Poor PT connections and accessibility are associated with less use of PT for mobility purposes.

Many studies have shown that distance to destination is one of the main reasons for motorised travel (Sam, Adu-Boahen, & Kissah-Korsah, 2014; Rasca & Saeed, 2022; Wang & Liu, 2015) including use of PT (Rasca & Saeed, 2022).
The travel distance begins from the origin (e.g one's home) to the final destination (e.g workplace, school), it is not from the bus stop or station, thus the traveller considers the whole distance it will take him/her to get to the final destination. Furthermore, there is the time involved. PT environment is more or less dynamic, involving passengers or travellers that are diverse, requiring different services, different travel time, different travel purpose, frequencies, patience, satisfaction etc, thus very challenging to fulfil everyone's demand, satisfaction and purpose.

Wang and Liu (2015) found out that distance and cost are the two most influential factors on decisions to use PT or not. Furthermore, Rasca and Saeed (2022) found out that bus ticket cost and increase in frequency of the PT can influence modal choice.

There is no doubt that reducing bus ticket prices will have a positive impact on PT use by the student and the public in general, as will the frequency of the buses. Wang and Liu (2015) suggest a minimum every 15-20 minute interval arguing that a larger interval will present a negative impact.

On the other hand, PT is time-dependent, there are pick-time (rush hour) usually in the morning and evening, when there are many passengers and the rest of the day when there is a significant reduction in passengers. Thus, it is understandable to have different frequencies or time intervals for the PT in the pick or rush hour and another for the rest of the day, moreover, since PT service is for everyone, bus ticket price may be adjusted according to the different passenger's situation. For example, students might have reduced ticket prices, so also the young people under 18 and yearly ticket holders have different prices from single tickets (Wang & Liu, 2015; Sam et al., 2014).

There are many other factors that influence PT use. Polat (2012), highlighted some of the PT demand determinants including fare, travel time, service quality, comfort, reliability, availability and cost of alternative mode (e.g car) etc. the important variables to highlight here amongst others are service quality, comfort, availability and reliability of PT.

Quality of PT service is very important if we are to convince more to use PT, it's important that waiting time, travel time, service frequency, operating speed, reliability and comfort are all addressed to meet the passengers expectations.

Socio-economic and habit

One major socio-economic factor affecting patronage of PT is car ownership, a person who has a car will most likely use it and high household car ownership rate is proportional to reduced PT use. On the other hand car ownership and maintenance is related to income status of the individual. Furthermore, it is also influenced by availability of parking space or high parking ticket price. Lower income and lower car ownership, along with less parking space can be associated with more PT use and vice versa (Rasca & Saeed, 2022).

Christiansen, Engebretsen, Fearnley, and Usterud Hanssen (2017) suggested that reducing access to parking is the single most effective way of reducing car use for work trips. Furthermore, they argued that the workplace parking fee will also cause people to change from personal cars to PT, although they highlighted that it is mostly effective in densely populated cities as opposed to low dense areas.

On the other hand, policy making aimed at forcing car users to abandon their car by reducing car parking and increasing parking tickets whilst not providing a better alternative, does not seem to be the best, and may affect freedom to mobility instead of achieving the desired goal.

Other personal factors include age, gender education etc. Some studies suggest that young people under the age of 25 and elderly tend to use PT more than the age in between who are more car dependent (Ding et al., 2017; Coogan et al., 2018; Ha, Lee, & Ko, 2020). The reason for this may be because of the shift from being single and young to parenthood and adulthood, as parenthood are much more associated with car ownership (Rasca & Saeed, 2022).

Other factors include gender, women tend to use PT more than men, while men tend to drive more than women (Rasca & Saeed, 2022).

E-bike and bike sharing

Another important trend that is gaining ground and accolades around the world now is E-bike, boosted by the fact that it can be shared, that is users can borrow and return anytime to any of the available docking stations that is safe and convenient for them. Electrically assisted bikes (E-bike) have higher speed and are easier to pedal, requiring less effort to ride, solving two issues that plagued the conventional bike (Hasnine, Dianat, & Habib, 2020), making them handier for long distance travel. They are relatively good for dense cities and can be seen as better alternatives to private cars, especially because electric bikes are more environmentally friendly.

There are 3 types of E-bike:

- E-bikes with throttle mode or "power-on-demand" mode. Scooter-Style bike which does not require pedalling but instead relies on the motor and battery for movement. The motor can be turned on and off by the user.

- E-bikes with assistance mode. Pedal assisted bike, usually called "pedelecs". The individual still needs to pedal the bike, but a small electric motor helps to speed up or climb hills. The individual can control its power, the motor only assists making pedalling easier.

- E-Bike with both throttle mode and assistance mode. The individual pedal alongside the electric motor to increase distance per charge. But these bikes are quite rare. (Hasnine et al., 2020; Clark, 2020)

There are both advantages and disadvantages in E-bike use, for one traditional bike is an active transportation mode, beneficial to both cyclist health (form of physical activity) and the environment, on the other hand, with E-bike cyclist can loose the physical activity part except for the "assisted pedal" one albeit relatively less effort. However, one disadvantage can be advantage for another, thus this disadvantage makes it possible to be used as a transport mode even for the ones who are not energetic or riding on hills where more effort is needed.

E-bike has a potential to become one of the main modes of transport because of its ability to go long distances at relative speed with moderate effort. The E-bike market share in Norway and Stavanger in general is growing, according to (Ray Pritchard & Lovelace, 2022) the findings from Rogaland County Municipality's new bicycle survey show that 22% of the population in Nord-Jæren had an electric bicycle at the end of 2021 while 7% have an intention to buy during 2022. Furthermore, observations of 1558 rush-hour cyclists in the summer of 2021 in Stavanger showed that as many as 39% had electric bicycles, of which 36% were privately owned.

E-Bike Sharing

Bike sharing plays a very important role nowadays in the public transport system with its evolution dating back to three generations (DeMaio, 2009; El-Assi, Salah Mahmoud, & Nurul Habib, 2017). The sharing aspect of it is very important since users do not worry about charging, cost of purchasing it, parking ticket, maintenance e.t.c thus encouraging cyclists.

Among the two common E-bike mostly available in Stavanger, the pedal assisted one needs to be returned to a docking station, while the scooter-like style does not actually

need a docking station and can be returned anywhere safe and convenient for the cyclist. The emergence of free floating bike sharing (FFBS- E-bikes without docking or charging stations) powered by ICT (cashless payment, on board GPS tracking etc) have revolutionised cycling. The smart features and no docking requirement on the new E-bike makes renting and returning more convenient and effective (Karki & Tao, 2016; Shen, Zhang, & Zhao, 2018).

Zhao et al. (2020) highlighted many factors that facilitated the use of E-bike, the embedded GPS sensor that is used to report real-time locations to help potential riders find the bike using their smartphones. In addition, they can with the app on their phone unlock the bike by scanning QR code, make payment, complete renting and log-off e.t.c.
In general, both the pedal assisted and scooter-like e-bike are very good alternatives to personal car transport mode, in that they are efficient for long distance travel with little or no effort.

The second E-bike (pedal assisted) will be discussed in this thesis because just like the other sustainable transport mode discussed in this thesis it is an active transportation mode.

Literature review summary

As seen from the literature review, there are a lot of factors that influence travel behaviour ranging from personal or individual (subjective) factors, to built or physical environment around an individual.

From the personal factors/socio-economic factors (age, gender etc); where individual factors are example individual perceptions of physical events around him/her, including perceptions of safety, distance etc, to habits and attitudes, all have been shown to influence individuals behaviour towards travel choice. Also there is the Socio-economic factor for example gender, age, income, social status etc which can influence the individuals decision on travel mode choice.
What's more important is that almost all of these individual factors are as a result of how the individual interpretes the physical events surrounding him/her. While it's very difficult to analyse individuals' factors from a distance, questionnaires or survey questions answered by the individual can shed light to some extent on what the individual thinks about the events around him/her and from there, interpretations and assumptions can be made about the physical events' influence on the individual.

On the other hand, examining the influence of the physical environment (built) is somewhat straightforward. The literature has revealed a lot of physical factors that can potentially influence different travel behaviour. This thesis aims to find out what physical factors influence travel behaviour and how it does it. Therefore , through spatial analysis, the next chapter will concentrate on analysing the physical factors based on the findings from literature, plus survey questions to understand how the individual perceives these physical factors. These influence variables highlighted (Fig. 3). form the base and guide to the spatial analysis in the next chapter.

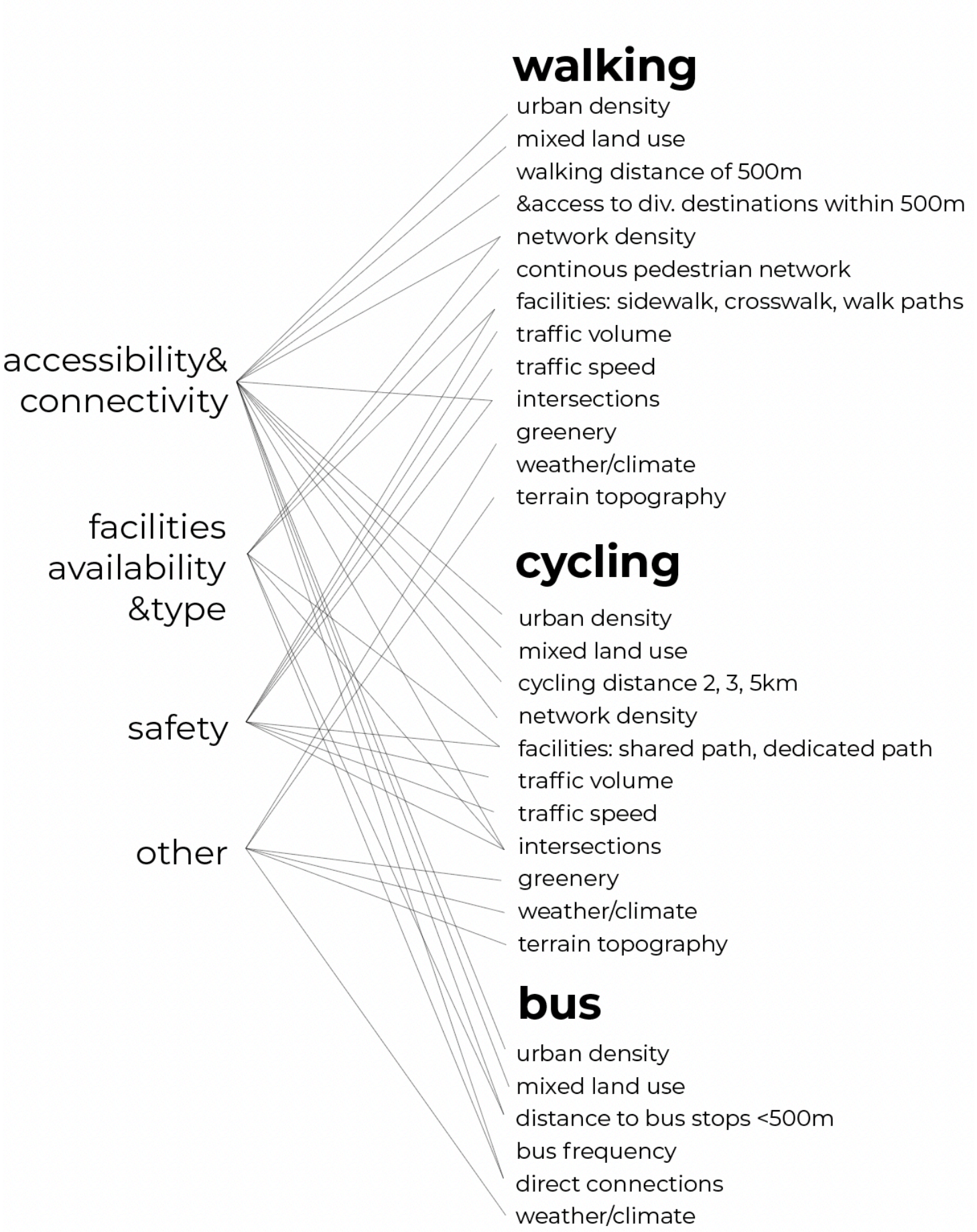


Fig. 3. Physical factors influencing walking, cycling and public transport, literaure review summary

case studies

- spatial analysis UiS
- spatial analysis LiU
- student travel survey

case studies

In this chapter the thesis will focus on spatial and non-spatial analysis of University of Stavanger and Linköping University.

The aim with the spatial analysis is to find out how the physical environment of both case studies is, and how the different settings and physical factors influence the travel behaviour of the students at both universities.

The first part of the analysis consists of general introduction to the case studies, including background information and location, followed by analysis of terrain topography, climate and weather conditions.

Second part of the analysis focuses on analysis of the conditions for mobility between the chosen universities and the student residential locations, by identifying the walkability and bikeability patterns. The walkability analysis examines the accessibility, connectivity, pedestrian infrastructure and type, as well as other facilitators and obstacles for walking to and from campus and within a 500m distance from the university area. For the bikeability analysis, accessibility and pedestrian facilities within distances of 2, 3 and 5km are analysed together with campus analysis.

Next, through accessibility analysis of public transport, the aim is to examine and analyse the direct routes connecting university areas with the different student living locations.

In the non-spatial analysis, the results from the student travel survey/questionnaire will be analysed. The aim of the analysis is to find out how the travel behaviour of the students at both universities is, try to understand why it is like this, what are the motivations, attitudes and barriers. The findings will be confronted with the literature in order to understand why the behaviour is the way it is.
At the end of the chapter, the results from both spatial and non spatial data analysis will be evaluated together in relation to the literature findings. The aim is to identify the similarities and the differences between the two universities regarding the physical environment and student travel behaviour. By looking at the relation between the physical environment and the travel behaviour, the thesis aims to answer the question about what fosters sustainable travel behaviour among Liu students and try to find what can possibly foster sustainable travel behaviour at UiS.

In the next chapter, the findings, analysis and results, understandings and explanations will be used to propose a set of recommendations for how to foster sustainable travel behaviour among UiS students.

spatial analysis UiS

Stavanger

Stavanger is a city and a municipality in Rogaland county, located on the south west side of Norway (fig.). It is the fourth largest city in Norway, with 144 877 inhabitants and population density of 563 inhabitants per square kilometre (inn./km2) (Statistisk sentralbyrå, n.d.). The municipality area accounts for 262,53 square kilometres (Statistisk sentralbyrå, n.d.). Almost all the people (96%) residing in Stavanger live in urban settlement areas that are located along the railway and main axis connecting Stavanger and the neighbouring city and municipality - Sandnes, from north to south (Fig. 5) (Statistisk sentralbyrå, n.d.).

Land use

Stavanger Municipality can be divided into following land use categories: residential, commercial, transport, recreational, educational and others. Largest parts of the municipality consist of agricultural land (35,4%), forests (30,7%) and the built areas that accounts for 20% of the stavanger land use (Statistisk sentralbyrå, n.d.). Of the built areas, the residential area is the largest and account for almost 20km2, followed by transport and technical infrastructure areas 14,5km2, industrial areas 4,85km2, educational areas 1,27km2, built areas for agriculture and fishing 3,51km2, non classified built areas 3,21km2 and others (Fig. 4)(Statistisk sentralbyrå, n.d.).

There are concentration points of industrial and commercial functions in the central parts of the Stavanger city such as the city centre, on the east side of the city - Hillevåg, and in the biggest industrial and commercial area in the region - Forus (Fig. 1. appendix on page 105). Such location and distribution of different functions, where there is one dominating function and different concentration points for singular functions such as commercial and industrial, result in long distances to different destination points in the city from the residential areas. This might discourage use of sustainable transport modes and result in increased car use among people (Van Acker & Witlox, 2009; Ewing & Cervero, 2001;Cervero, 1996).

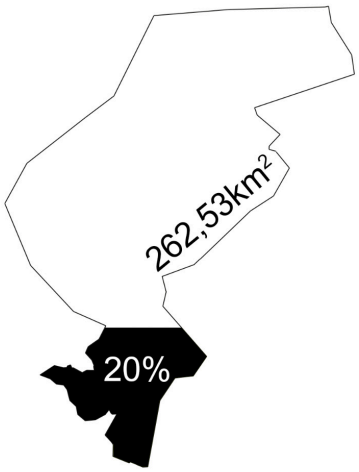


Fig. 4. Stavanger Municipality´s built area

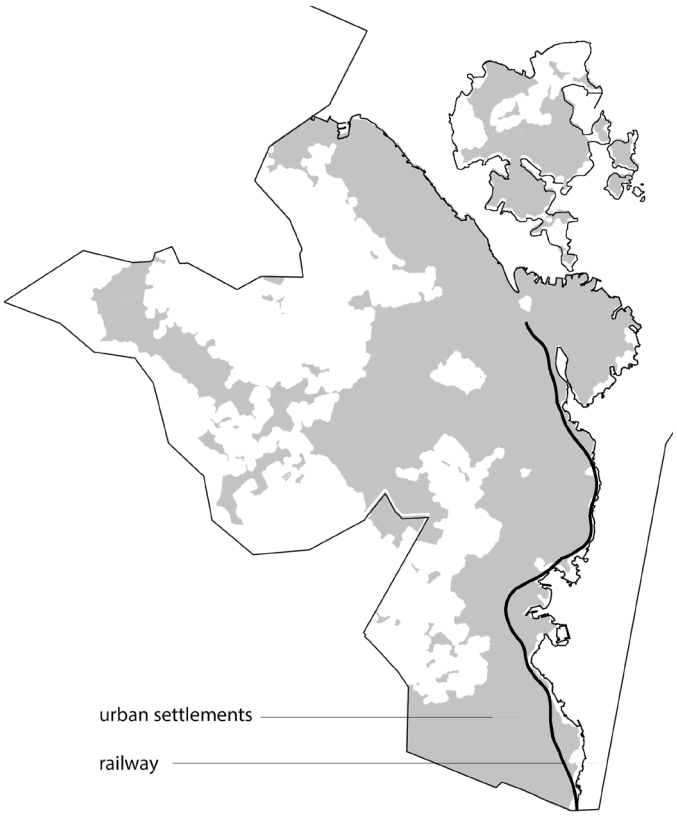
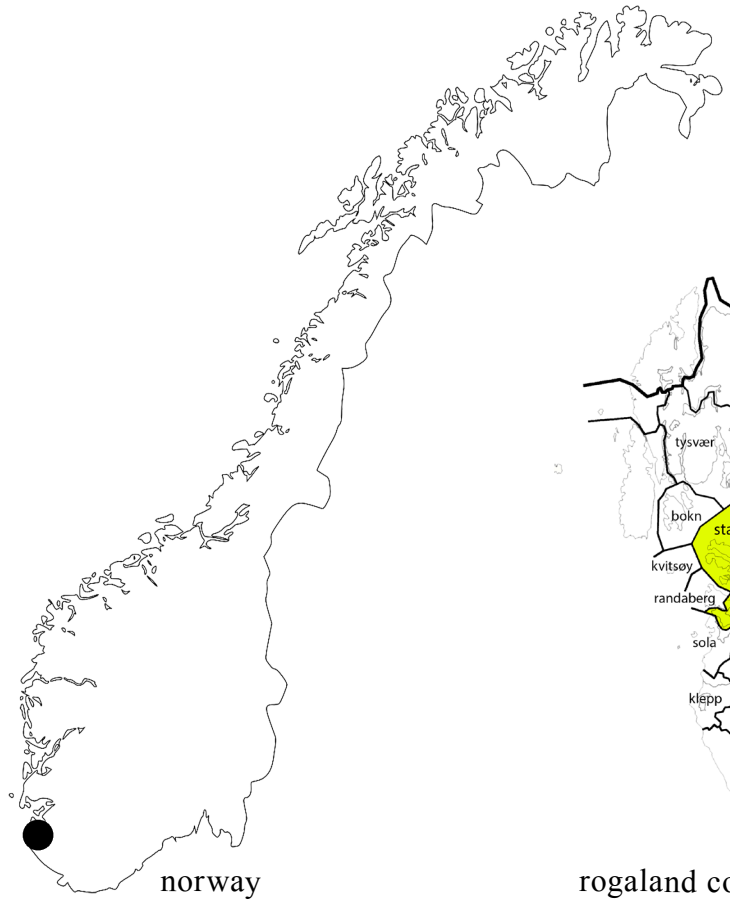
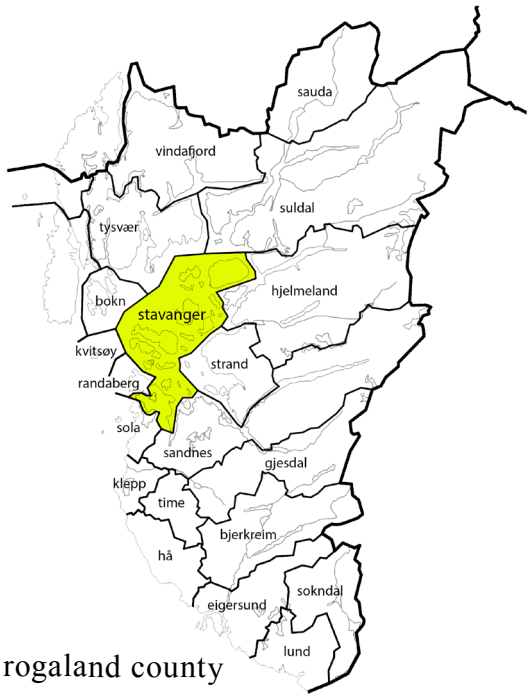


Fig. 5. Concentration of urban settlements in Stavanger

location





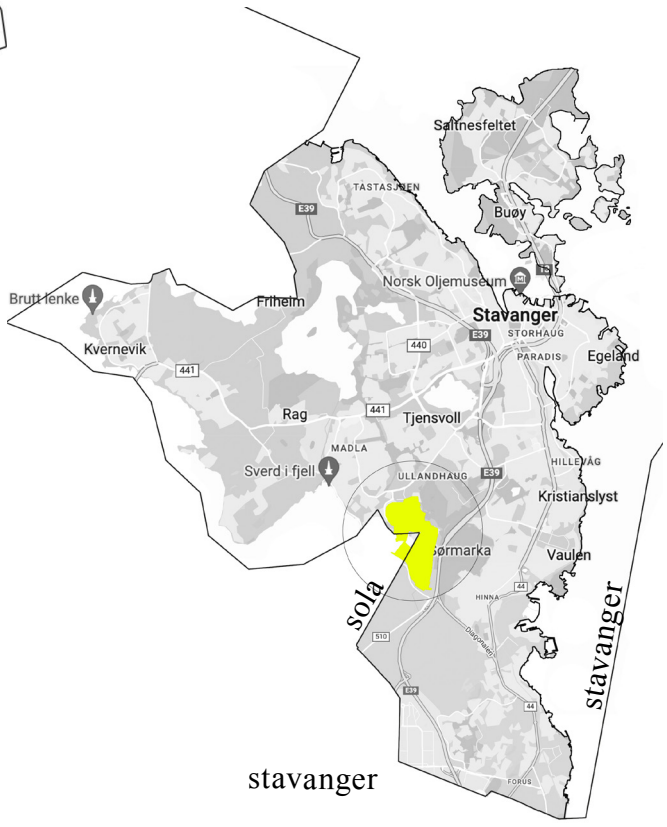


Fig. 6. University of Stavanger, Campus Ullandhaug - location

University of Stavanger (UiS)

University of Stavanger is located in the city of Stavanger, on the south west coast of Norway. The university has three campuses: Ullandhaug, Bjergsted and the Museum of Archeology in Våland. There are more than 12 000 students and about 2000 employees including academic, administrative and staff (Universitetet i Stavanger, n.d.). Ullandhaug Campus is the largest campus of the University of Stavanger, with the largest number of students, staff and buildings (Grande, Husebø, Kolstrup, Strand Rangnes, & Haniffa, 2019). It is situated in the Ullandhaug neighbourhood in the southern part of the city, on the border of two municipalities - Stavanger and Sola, with its biggest areas within Stavanger Municipality borders (Fig. 6 on page 41).

Student residential locations

The University of Stavanger provides, through Studentsamskipnaden (Sis), in total 1693 student accommodations within 16 residential areas: Starevein, Ugleveien, Misjonsmarka, Jernaderveien, Red Boxes, Badehusgata, Madlamarkveien, Sörmarka, Rennebergstien, Gosenmyrå, Novvegen, Gulaksveien, Bjergsted, Sandnes, Mosvangen, Norvald Frafjordsgate (Studentsamskipnaden i Stavanger, n.d.). Based on the numbers, it can be assumed that the majority of the students, approximately over 10 000 students, do not live in student houses since the university student accommodations have capacity to house about 14% of the university students. That means the other students live in other areas within the city.

According to data from the survey about living conditions ("Levekårundersøkelse") from 2018 (Tableau public, 2021) over 40% of young people of age between 20-34 reside in the central parts of the Stavanger city: in the city centre - Sentrum (44,50%) and in Badedammen (45,83%). Over 30% of young people in Stavanger live in Bergeland (34%) and Lervig (34%), Bjergsted (32%), Kannik (31%) and Lagård (31%). Over 25% in areas such as: Emmaus, Tastaforen, Smiene, Gramstadhaugen, Madlaforen, Kiellandsmyrå, Saxemarka and 20% and less in other parts of the region (Tableau public, 2021) (Fig. 2. appendix on page 105).

Fig. 7. Campus Ullandhaug, UiS (Aftenbladet, 2014)

Terrain topography

The Stavanger region is a part of a coastal area called Jæren or Låg-Jæren (Thorsnæs, 2022). The city is bordered on the west by the sea and on the east by Byfjorden and Gandsfjorden. The landscape of Jæren is categorised as a plain landscape called "Slettelandskapet", and among Norway's landscape, Jären is seen as the largest region with such landscape (Helle-Olsen, Worsøe, & Frøyland Pallesen, 2009) (Fig. 3. appendix on page 106). The landscape is characterised by relatively flat topography, and very little descent towards the sea (Fig. 9), making it potentially a good and favourable landscape for sustainable transport modes, especially for cycling and walking. (Pereira Segadilha & Penha Sanches, 2014).

Although this region has a relatively flat landscape and the terrain level is mostly between 0 and 50m (Fig. 4. appendix), there are few dominant points in Stavanger, with the highest mountain Jåttånuten of 139 masl (Thorsnæs, 2022).

The following analysis focuses on the terrain analysis within a 5km distance from the university area (Fig. 9 on page 45). Here, the terrain is characterised by a large number and density of terrain contour lines, which indicate that the elevation and level of the terrain are changing rapidly over short distances (Fig. 9). This means that the terrain, within the analysed area, is steep and somehow differs from the overall relatively flat character of the Jæren landscape. Knowing that the difference between the highest and lowest terrain levels, within the analysis area, is 120 metres, we can assume that the terrain can be a potential obstacle for cycling and walking (Rodrıguez & Joo, 2004; Solli et al., 2016).

Additionally, there are two main dominant hills on the terrain. The first one is Ullandhaug hill, measuring 136,8 metres above sea level (masl) and the second is Hinnabeget measuring 112,1 masl (Fig. 9). Both of the hills are located very close to the Ullandhaug university campus and surround the campus from the north and northeast. Thus, all the university dormitories, (except for the one in Sandnes and those located closest to the university area or at the campus and within walking distance from the university) are located further on the north and east, "behind" the Ullandhaug and Hinnaberget hills. In this way the hilly terrain acts as a physical barrier, separating the campus area from the northern parts of the city and student residential areas

Fig. 8. View at Ullandhaug hill (Aftenbladet, 2009)

and might serve as an obstacle to cycling and walking, for example, it might increase the perception of travel effort (Montello, 1997) that can discourages potential cyclist.

The analysis of the terrain on the different bike routes between the dormitories and the university shows that the average terrain altitude on those routes is about 56,7 metres, with the highest altitude of 89 metre, on the route from Misjonsmarka, and 67m to 68m on the routes from Mosvangen, Ugleveien and Stareveien student houses, with the lowest altitude of 9 m on the route from Jernaldervein to the university area (Fig. 10).

The Stavanger landscape, although relatively plain compared to others in Norway, will most probably pose a challenge to cyclists both on their distance perception due to the effort they need to put to overcome the distance (Montello, 1997) and the actual effort to cycle it (Pereira Segadilha & Penha Sanches, 2014). The route between campus to Jernaldervein is only about 9m altitude, and should encourage cyclists. However, there is no consensus on how much of the hills or slope cyclists are willing to overcome thus some routes even with the hills will be ok to cycle, especially for the experienced cyclist (Pereira Segadilha & Penha Sanches, 2014).

Weather

Stavanger is a city located inside a fjord, on the south-western coast of Norway and the area with mildest climate. The climate is oceanic, with cold, cloudy, rainy winters and cool summers.

In the winter, the climate is cold, cloudy and rainy. Temperatures in the mildest days in the winter can reach 8- 10 °C (46/50 °F), are humid and rainy as well, and sometimes windy. There are colder days when it can snow, then the temperatures can drop below freezing. The coldest night can see temperature drop uptil -10 °C (14 °F), but can sometimes drop lower. The coldest on record was in 1987, when it dropped to -20 °C (-4 °F).

In summer it is mild or cool, with fairly frequent rains. The days are very long too. When it's not raining, there is nice weather, and temperatures can rise up to 21-22 °C (70/72 °F). At times, there can be warmer days, in which the temperature exceeds 25 °C (77 °F). On rare occasions, there may also be short hot periods, which are becoming more frequent in recent years, and in those periods, temperature can reach or even exceed 30 °C (86 °F). However, the hottest day at Stavanger-Sola airport was in August 1975 with a temperature of 33.5 °C (92.3 °F).

Precipitation amounts to 1310 mm (51.6 inches) per year: thus quite abundant. It ranges from 65 mm (2.6 in) in the driest months (April, May) to 150 mm (5.9 in) in the wettest one (October) (Climates to travel, n.d.).

The different weather seasons in Stavanger means that it might be associated with different attitudes to cycling, walking and public transport, higher cycling and walking in summer warmer temperatures, less in winter (Christensen & Jensen, 2008; Bergström & Magnusson, 2003) and higher use of public transport in winter (ref) and less in summer.

There is also the effect of rain and wind, rainy windy seasons will most likely see a drop in cycling and walking (Christensen & Jensen, 2008) while potentially increasing public transport use (Bergström and Magnusson,2003).

Although winter seasons, winters a relatively warmer in Stavanger with temperatures barely going below freezing and can encourage cyclist, also maintenance of cycling infrastructures in the winter will be viewed with a positive attitude by cyclist (Bergström & Magnusson, 2003), nonetheless, cycling and walking hours lost in winter can be substituted by relatively hours gained in public transport.

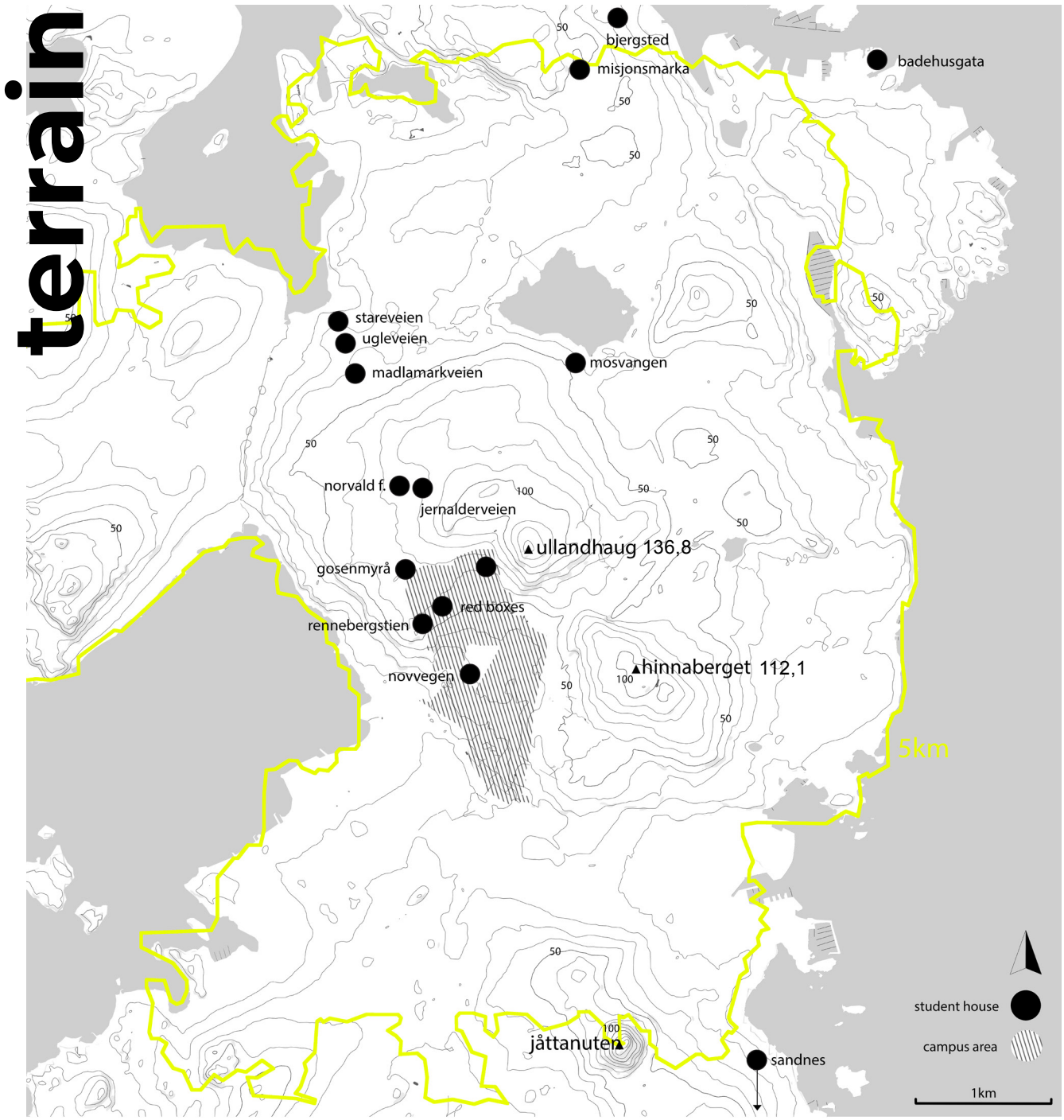


Fig. 9. Terrain topography analysis within 5km cycling distance from the campus, Stavanger

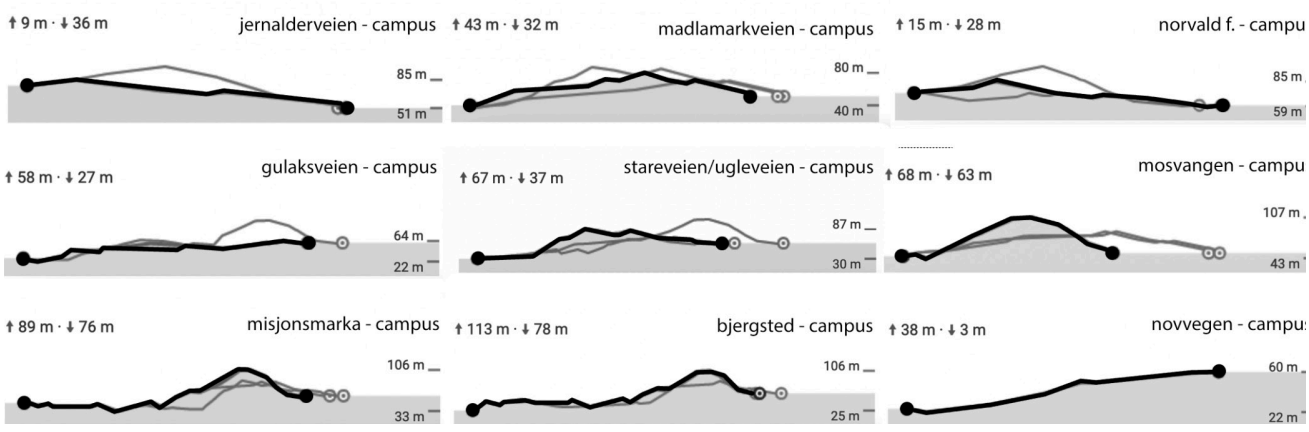


Fig. 10. Level of altitude on the bike routes between the student houses and the UiS

Walkability analysis

For the walkability analysis, two starting points (A, B) are identified, at both ends of the longest campus axis (Fig. 11). The analysis examines the accessibility, pedestrian infrastructure and type, as well as other factors and obstacles that can affect walkability to and from campus within a 500m distance from the two predefined starting points.

Access - proximity & connectivity

Five of the sixteen student housing areas can be reached by foot within 500m distance from the Ullandhaug campus (A, B). These are Sørmarka, Red boxes, Gosenmyrå, and Rennebergstien. The average time for travel by foot to and from campus from these dormitories is calculated to be about 7,6 min (A) and 11,4 min (B).

The students living at the five dormitories have good access to the various places on campus through diverse pedestrian paths and routes, thanks to the dense network. However, the large size of the campus and long distances between buildings may make walking around the campus challenging and lead to the use of other transport modes.

Pedestrian facilities

An effective walking infrastructure allows for continuous movement through the provision of walking paths. Additionally to being primarily used for mobility, pedestrian infrastructure for example bus stops serves also as waiting places for pedestrians.

The pedestrian infrastructure at the university area and within 500 m distance from the defined starting points consists of pedestrian paths, sidewalks/pavers along streets, sidewalks physically separated from the streets by green infrastructure, pedestrian trails, sidewalks and pedestrian paths dedicated for both walking and cycling, and pedestrian zones where cars, pedestrians and cyclists can share.

The majority of the pedestrian movement between the student houses and the campus avoid crossing the Kristin Bonnevies road, which is considered as a major road within the analysed area, with speed limit of 50km/h and lots of traffic in peak hours. The only route that intersects with Kristin Bonnesvies street is the route between the student housing Gosenmyrå and the campus (Fig. 11), but it is an underground crossing, thus not a barrier since it allows for safe and continuous flow of the pedestrians.

There are several traditional street crossings on the same level with roads on the other routes for example from Sørmarka and some crossings with speed reducing measures (e.g street bumps) on the route from Novvegen. There are no crossing traffic lights at the different crossings but there are pedestrian crossing signs and the roads that the pedestrian routes intersect which are of low speed, about 20-30km/h, so the crossings and routes can be considered as pedestrian friendly and safe.

Some of the routes go through parks and other green spaces (e.g. Sørmarka, Novvegen) which can add positive experience to the walking and encourage it. One of the routes, from Rennebergstien student housing area, goes through the campus car parking where pedestrians share the lane with cars, which can discourage walking.

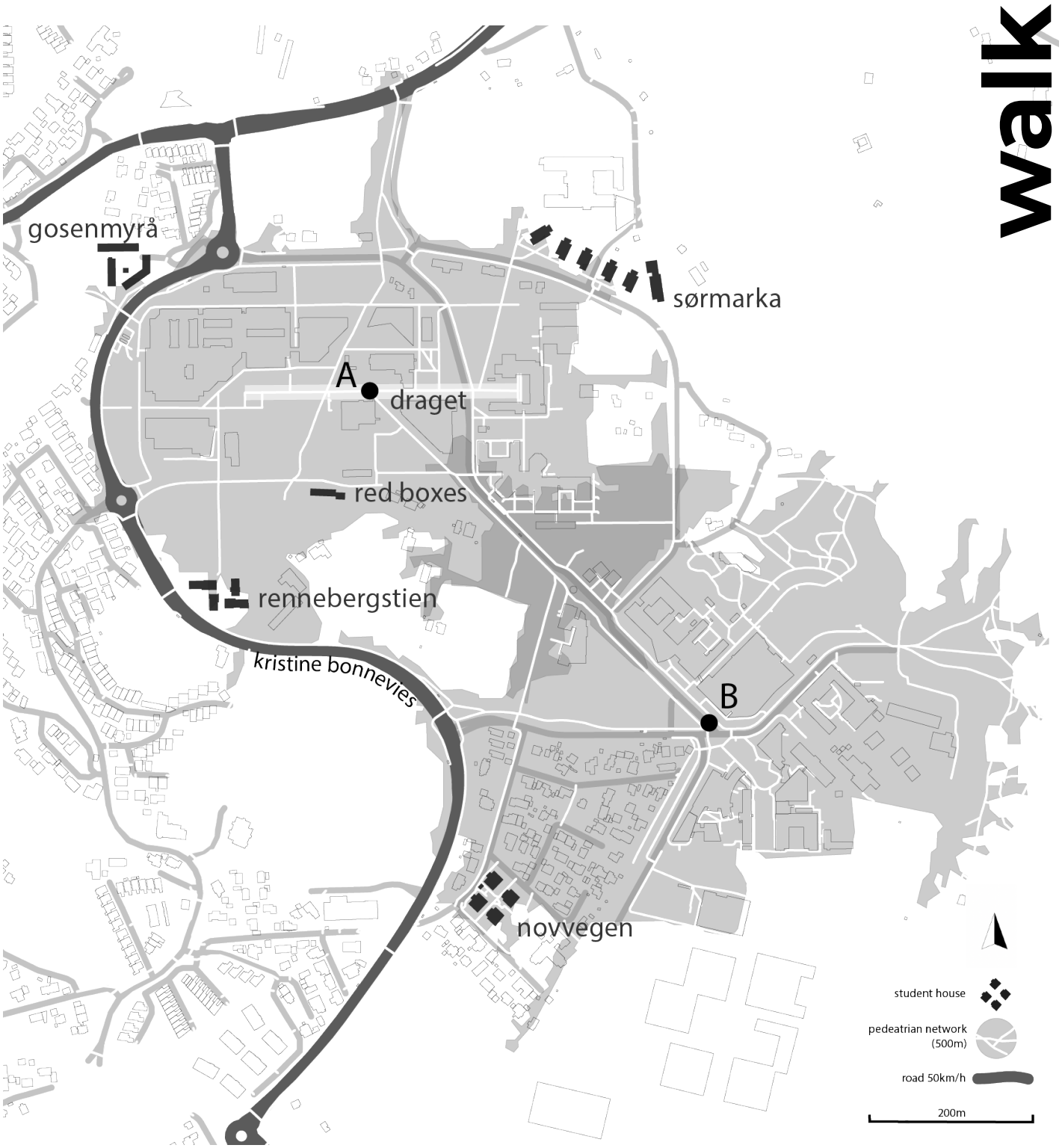


Fig. 11. Pedestrian network analysis, UiS

Bikeability analysis

The analysis will focus on the area within 2, 3 and 5km distance from the campus.

Access and connectivity

The university area, campus Ullandhaug is located on the south west side of the Stavanger city, about 5km from the city centre (Fig. 12).

Nine dormitories are located within 2km radius distance from the campus area, from which five (Gosenmyrå, Red Boxes, Rennebergstien, Novvegen, Sørmarka) are located at the campus and within 500 walking distance
Three student housing areas (Stareveien, Ugleveien, Madlamarkveien, Mosvangen) are located within 3km radius and three (Gulaksveien, Misjonsmarkam Badehusgata) within 5 km cycling radius distance from the campus. The student house in Sandnes, is located further and is characterised by the longest distance (12km) to the campus (Fig. 12).

The time it takes to travel from the different student housing areas (excluding the ones at the campus, within 500m distance to the campus) to the university is 13min from Stareveien, 12min from Ugleveien, 10min from Madlamarkveien, 7min from Jernalderveien, 12min from Mosvangen, 13min from Gulaksveien, 7min from Norvald Frafjordsgate, 22min from Bjergsted, 20min from Misjonsmarka, 27min from Badehusgata and 45 min from Sandnes (minsis, nd). The calculated average travel time by bike from the dormitories to the campus is 17min.

The student housing at the University of Stavanger, Sis provides accommodation for about 14% of the students. Considering that the majority of the students at the University of Stavanger do not live in student houses, it is important to analyse the bike accessibility of the campus in relation to the different residential locations with focus on the areas where most young people between 20 and 34 years reside.

The areas with the highest population of young people (Fig. 2. appendix), the central parts are within 5km (the recommended cycle distance) radius distance from the university (ref.). Some of the areas with over 25% (fig. appendix) of young people residing are areas further away and not within the 5km distance from the campus area, for example: Smiene and Tastaforen and others populated by about 20% young people. The areas that are located within 2km distance to the campus are: Tjensvoll, Ullandhaug, Madla are populated by up to 24% of young people. This shows that a great part and majority of the young population live in areas located within cycling (5km) distance from the campus.

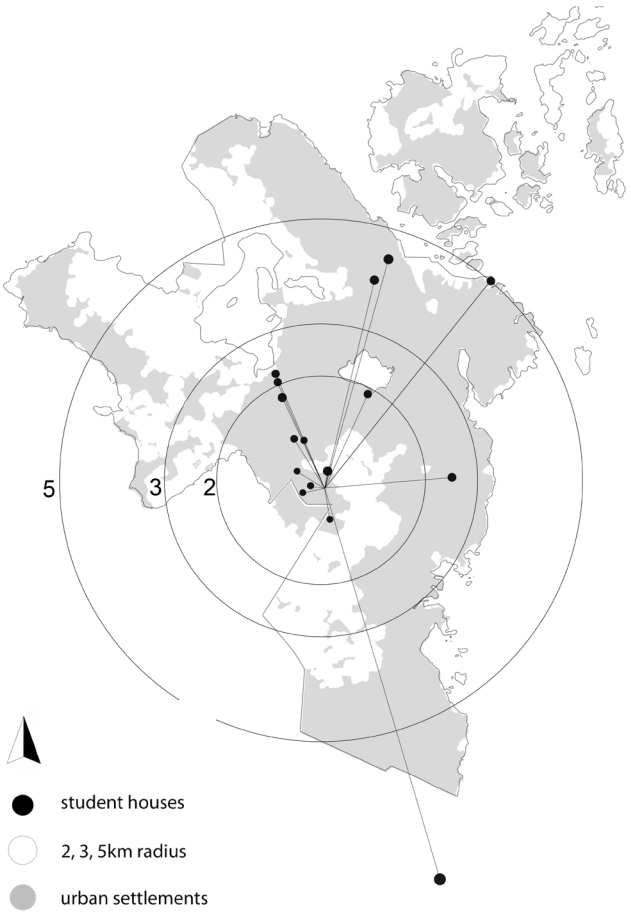


Fig. 12. Distances between the student houses and the campus

Majority of the areas where students and young university age people live in Stavanger are accessible by bike, however, the varying distances will pose different challenges for different locations of the cyclists. Those within 2km range to the campus are relatively in a better position to cycle to school, while those as far as 5km will have it the hardest if they are to use bikes as means of transport because of the effort to overcome the hilly terrain (Solli et al., 2016). Those living beyond 5km will most likely use other means for example car or public transport because of the distance (Loftsgarden et al., 2015).

Bike facilities

The bike infrastructure in Stavanger consists of two types of cycling lanes: bike/pedestrian paths and dedicated bike lanes (Fig. 13; Fig. 14).

The bike/pedestrian paths are the most popular type of bike infrastructure in and also in Stavanger, within the analysed area. These are usually footpaths located next to the street or physically separated from the street with green infrastructure like lawns or trees, and located parallel to the street.

The bike/pedestrian network within the analysed area is often fragmented and with several dead ends on the routes (Fig. 15). In some cases, sidewalks work as complementary paths to these bike paths, for example the lane from Hillevåg leading to the university. The bike/pedestrian paths do not allow for fast speed for the cyclists and cyclists perceive the path mostly as unsafe as they are forced to navigate their way carefully through the pedestrians while avoiding accidents (Andrade et. al., 2014).

Additionally, the dead ends, poor connectivity and accessibility is known to discourage cyclists, as it makes cycling inconvenient and may increase the travel distance (Pereira Segadilha & Penha Sanches, 2014; Southworth, 2005).

There are few dedicated bike lanes, that are located along and on the streets, where the cycling lane is defined and separated from the motorists by colour on the road, for example along Revheimsveien street in Madla borough and along Henrik Ibsens street (Fv440) in Tjensvoll. Nevertheless these lanes are often fragmented and cyclists often need to complete the trip with a bike/pedestrian lane and/or sidewalks.

Fig. 13. Bike/pedestrian lane, Stavanger

Fig. 14. Dedicated bike path, Stavanger

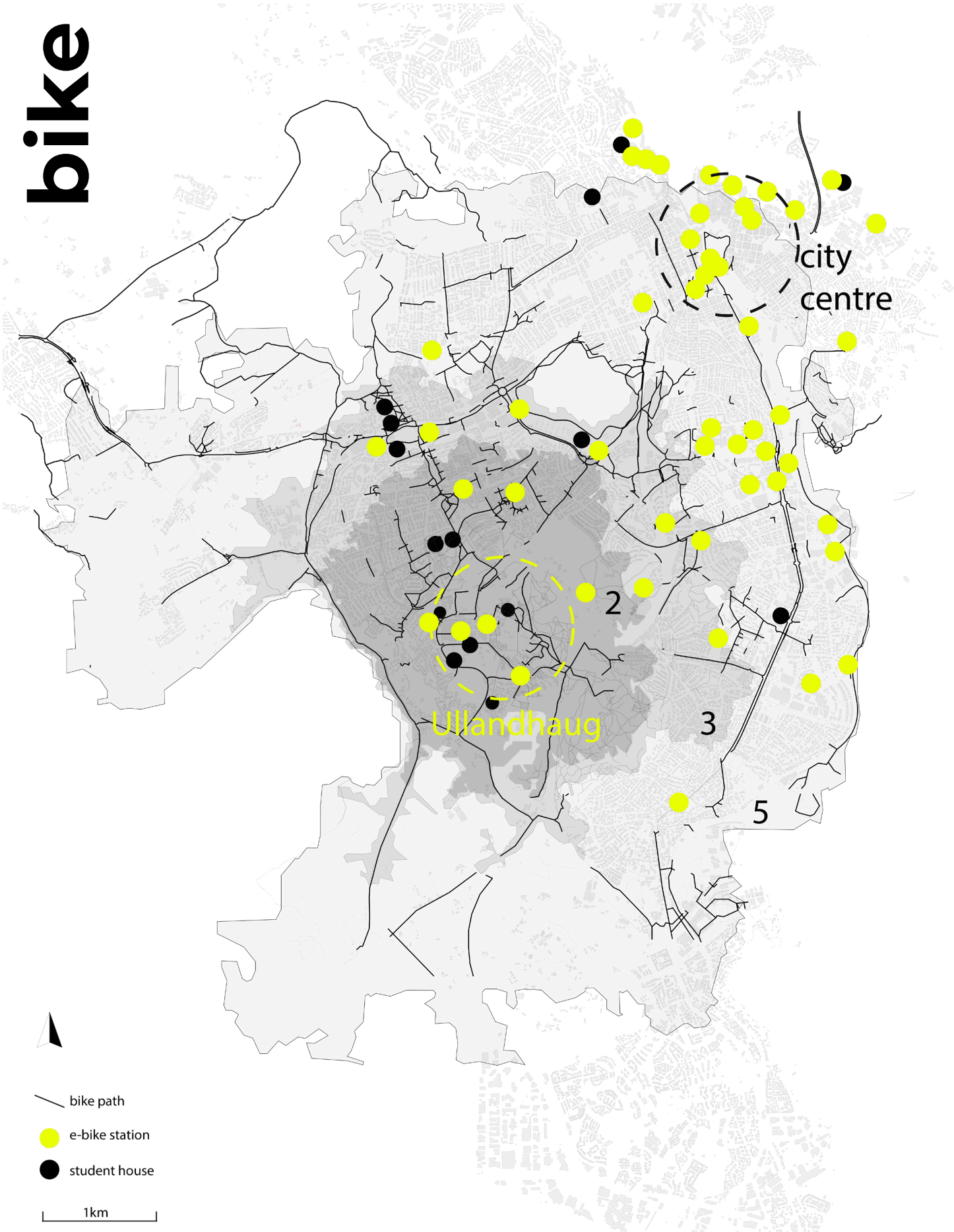


Fig. 15. Bike network analysis within 2, 3 and 5km distance from the campus, UiS

Bike routes

The following analysis examines the different bike routes between the student houses and the campus area, within 5km distance from the university.

The dormitories Stareveien, Ugleveien, Madlamarkveien, Jernalderveien and Norvald Frafjordsgate share the same bike route that consist of mainly bike/pedestrian paths that are often separated from the street with greenery and there is a lot of green spaces such as parks, forests and lawns on the route (Fig. 16).

Fig. 16. Bike route between the student houses (Stareveien, Ugleveien and Madlamarkveien) and the campus

The bike route between the Mosvangen student house and the university also is surrounded by diverse green spaces (lawn, fields, etc.). Again, most of the paths on the route are bike/pedestrian paths with some parts of the route with dedicated bike lanes located on the street.

Route from Gulaksveien consists of bike/ pedestrian paths and in some parts of the route the cyclists share the road with cars and pedestrians (Sørmarkveien). There are many green spaces also on this route.

The green spaces and presence of nature on the routes might foster cycling as they are associated with positive cycling experience and often increases cycling time (Frank et al., 2006), nevertheless the low connectivity and fragmented routes might discourage cycling (Pereira Segadilha & Penha Sanches, 2014; Southworth, 2005).

Intersections on the routes

There are several street crossings and intersections with other roads on the cycling routes to and from campus.

There are considerably many turns, crossings and intersections on all the bike routes, the lane from Stareveien, Ugleveien, Madlamarkveien, Jernalderveien and Norvald Frafjordsgate have less and go through green spaces.

Misjonsmarka - campus is the longest route, have biggest number of crossings and intersections both with street light crossing signals and without, it goes through different paths including beside houses, sidewalk, partly bike/pedestrian paths, shared road with motorist, bridge crossing with the street Øvre Stokkave, and underground crossing where the route intersects with Adjunkt Hauglands street.

The route from Gulaksveien to campus has many traditional street crossings and intersections with bridge crossing over E39 express road.

In general, the presence of separate bike lanes, dedicated lanes, green spaces, bike signs and markings should add elements of safety and generally positive experience for cyclist, however, the density of intersections and crossings, shared use (both with pedestrian and motorist), fragmented bike paths, low connectivity and accessibility, dead ends, present a major challenge for cyclist in terms of safety, negative experience, distance and time (Zhao et al., 2020; Frank et al., 2006; Pereira Segadilha & Penha Sanches, 2014; Southworth, 2005; Andrade et al., 2014).

Furthermore, the latter (turns, intersections, crossings, fragmentation, segmentation e.t.c) can cause cyclists to perceive the route's distance as being longer, and the more the number of occurrences, the longer the distance is perceived (Montello, 1997).

E-bikes

Students living in dormitories, Mosvangen, Ugleveien, Madlamarkveien, Bjergsted and Badehusgata have access to the electric bike stations within walking distance of 500m.

Bike facilities at the campus

There are in total 21 bike parking facilities at the university area, including seven under roofed parking (Fig. 17; Fig. 18; Fig. 19). The bike parking facilities are close to the university buildings with some close to building entrances (Fig. 5. appendix on page 106). The bike parking facilities are located on the outer edge of campus and not mostly along or within the main axis between the buildings, however, cyclists still have access to all the sidewalks and pedestrian zones including the main axis at the campus.

There are no bike service and maintenance facilities available on the campus or in the close surroundings. There are in total 139 showers available at the campus (Fig. 5. appendix on page 106). The biggest number of showers located in Ke building - 43, Hagbard Line building - 40 and 43 showers available in the SiS sport centre hall. Additionally, there are 11 drying cabinets and 5 wardrobes available on the campus. The presence of the shower and wardrobe facilities are important for long distance cyclists and can encourage cycling (Solli et al., 2016).

There are three e-bike stations, "bysykkel" stations, in the campus area, one located in front of the KE building (Fig. 20), one in front of the Hagbard Line building and one in the Innovation park on the south side of the campus. The e-bike stations are located strategically in a way that they are accessible from every important part of the campus for students.

Bike facilities at the student houses

Few of the dormitories in Stavanger have dedicated bike parking zones and facilities (e.g. Madlamarkveien) and some have single bike racks where students can lock their bikes (Ugleveien). There are some student houses, e.g. Starveien, that are without bike parking facilities and students park their bikes in front of their houses (Fig. 23). At Sørmarka student house, at the campus, there is dedicated roofed bike parking (Fig. 21).

The lack of the bike parking facilities at the student housing areas does discourage the use of bike (Tran, 2021).

Fig. 17. Roofed and open bike parking, UiS

Fig. 18. Roofed bike parking, UiS

Fig. 19. Roofed bike parking, UiS

Fig. 20. E-bike stations, UiS

Fig. 21. Bike parking at Sørmarka student house

Fig. 22. Bike parking at Ugleveien student house

Fig. 23. Bikes at Stareveien student housing

Accessibility analysis of public transport

Kolumbus is a local transportation company in charge of city buses and trains in Stavanger. Students can buy tickets through several ways, although the easiest is through the kolumbus app on the mobile phones. They have two apps, one is for travel and the other is for buying tickets. Students are able to buy both single and periodic tickets in the app and in most cases, they are able to buy with cash on the public transport also.

There are in total seven (6, 7, X60, X73, X76, N86, E90) direct bus routes that connect the university area with different parts of the city and region. There are several bus stops located at the university area along the Kristine Bonnevies and Kjell Arholms roads and within walking distance to most of the university buildings (Fig. 24 on page 55).

Bus route number 6 (Stavanger - Madlakrossen - UiS - Gausel - Lurahammaren - Sandnes) connects the university area with other destinations in the city including neighbouring cities like Sandnes city. The bus drives through Eiganes/Våland, Tjensvoll/sandal, Madla, Madlamark, Ullandhaug, Jåten/ Gausel, Varatun, Trones. The bus goes every 15 minutes weekdays, between Monday and Friday, between 05:41 AM - 19:56 PM.

Bus route number 7 (Madlakrossen - UiS - Sola - Skadberg) connects the university area with other destinations in the city including neighbouring city Sola, with a final stop in Skadberg, Sola. The route goes through Eiganes/Våland, Tjensvoll/sandal, Madla, Madlamark, Ullandhaug, Grannes, Røyneberg, Sande. The frequency of the bus is every 30 minutes during the week (Monday-Friday) between 8:15 AM - 19:45 PM.

Bus route number X60 (Sandnes - Kvadrat - Forus - UiS - SUS - Stavanger - Hundvåg) is a connecting bus between Stavanger Hundvåg, Stavanger city centre, University of stavanger and Sandnes city. The route goes through Våland, Tjensvoll, Ullandhaug, Grannes/ jåtten, Forus, Stokka, Varatun and Trones. The frequency of the bus on weekdays, between 07:43 - 13:28 and 13:43 - 15:58 is every 15 minutes and between 17:43 - 19:43 is every 30 minutes.

Bus route number X73 (Stokka – Tjensvoll – UiS – Forus – Kvadrat) connects the university with important destinations in the city and neighbouring cities. It goes every 30 minutes in peak hours from 6:37 to 8:37 in the morning and 15:15 to 17:45 in the evening. The bus drives through Stokka, Sandal, Madlamark/Tjensvoll, Ullandhaug, Grannes/ Jåtten, Godeset, Forus.

Route number X76 (Randaberg – Viste hageby – Kvernevik – UiS – Forus – Kvadrat) connects the university with the north west side of Stavanger, Randaberg and Forus. The frequency of this bus is every 20 mins between 05:55 - 07:55, every 30 minutes between 08:25 - 14:25. The route goes through: Randaberg, Kvernevik, Rag, Tjensvoll and Forus.

Route number N86 (Stavanger – Madlakrossen – UiS – Sola – Skadberg – (Sola sør)) is a night bus that connects the university area with Stavanger city centre and Sola city on weekends, Saturday and Sunday.

Route number E90 (Hauge i Dalane – Egersund – Vikeså – Ålgård – Sandnes – Stavanger) connects the university of Stavanger with Stavanger city centre and the city of Sandnes and Hauge Dalane. The bus drives approximately every two hours on this route.

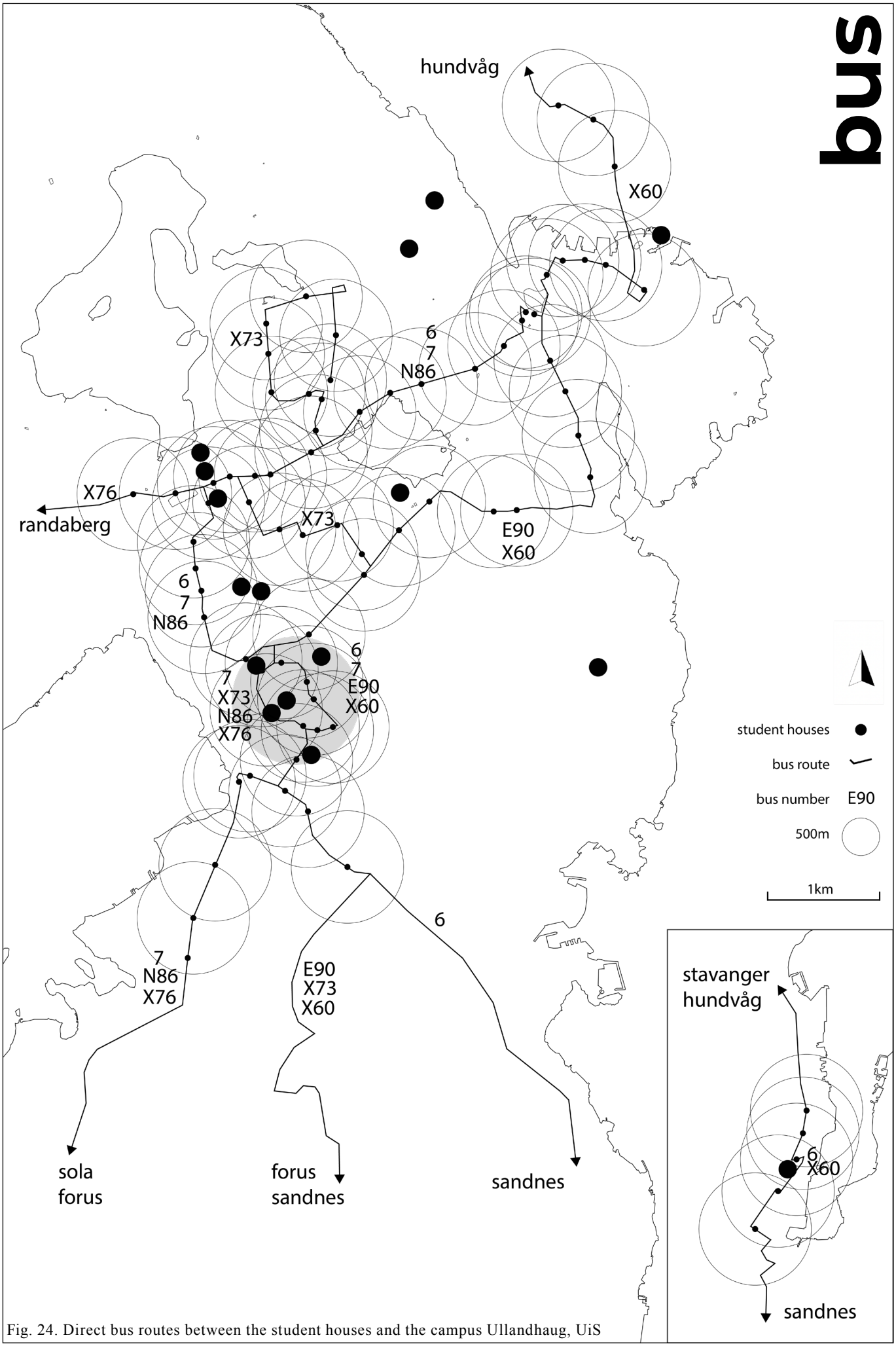


Fig. 24. Direct bus routes between the student houses and the campus Ullandhaug, UiS

Connection between student houses and the campus

Eleven of the sixteen dormitories have good access to public transport and direct connection to the university by bus. Student houses such as Gulaksveien (in Hillevåg), Bjergsted, Misjonsmarka do not have direct bus connection to the campus and these dormitories are the ones that are characterised by the longest distances to the university (Fig. 24 on page 55), thus lack of access to public transport might potentially encourage use of other transport modes such as car (Polat, 2012; Sam et al., 2014; Rasca & Saeed, 2022; Wang & Liu, 2015). The other two student housing areas, Jernalderveien, and Norvald Frafjordsgate, also do not have direct bus connection to the campus but these are located within 2km cycling distance to the university so the distance might enables and encourage use of other alternative sustainable transport modes for example cycling (Wang & Liu, 2015).

The calculated average time used to travel to and from campus by the direct routes from the dormitories is 15,8 minutes. The longest time is 34 minutes on the route from Badehusgata (city centre) to the campus by bus number FB40. The shortest route of 7 minutes is from Madlamarkveien by bus number 6.

The analysis shows that most of the dormitories have direct bus connections to the university and are located within walking (500m) distance to the bus stops (Fig. 24 on page 55) and this should encourage the use of public transport as a main travel mode to and from campus (ref). However the students living in the dormitories located furthest from the campus and without access to public transport, like Gulaksveien, will most likely be using cars as basic means of transport.

Connection with the city

Considering that the majority of the university students in Stavanger do not live in dormitories, it makes a good argument to analyse the bus connections from the campus to the different residential areas where young people of university age live.
According to the analysis of the residential locations of young people on page 42, .44% of young people live in central parts of the city and they have bus connections with bus number X60 which goes directly to the campus every 15 minutes during weekdays. Lervig with 34% has partly bus connections by the bus number X60. Lagård (32%) and Kannik (32%) have direct bus connections with the university by buses 6,7, N86, X60, E90. However, other areas such as Bjergsted (31%) have no direct bus connection to the UiS (Fig. 25 on page 57).
Additionally, there are many other parts of the city with population of young people above 20% that does not have a direct bus connections to the university area, for example: Bakkeland, Smiene and Emmaus (27%), Tastaforen, Tastarustå, Søra Bråde (about 25%) etc.

In general, the student population in UiS is spread in the city, with considerably less number living in student dormitories while the majority lives elsewhere in the city.

For those living elsewhere in the city, the majority live in the city centre with good bus connections like X60 that has a frequency of 15 minutes, 6 and 7 also with 15 minutes and 30 minutes frequency. That means those students will be encouraged to use public transport especially considering the long distance to the campus (Rasca & Saeed, 2022). On the other hand, there are still large parts of the city that are not covered by good bus connections, thus a large number of students might be encouraged to use cars as their main travel mode to and from the campus (Polat, 2012).

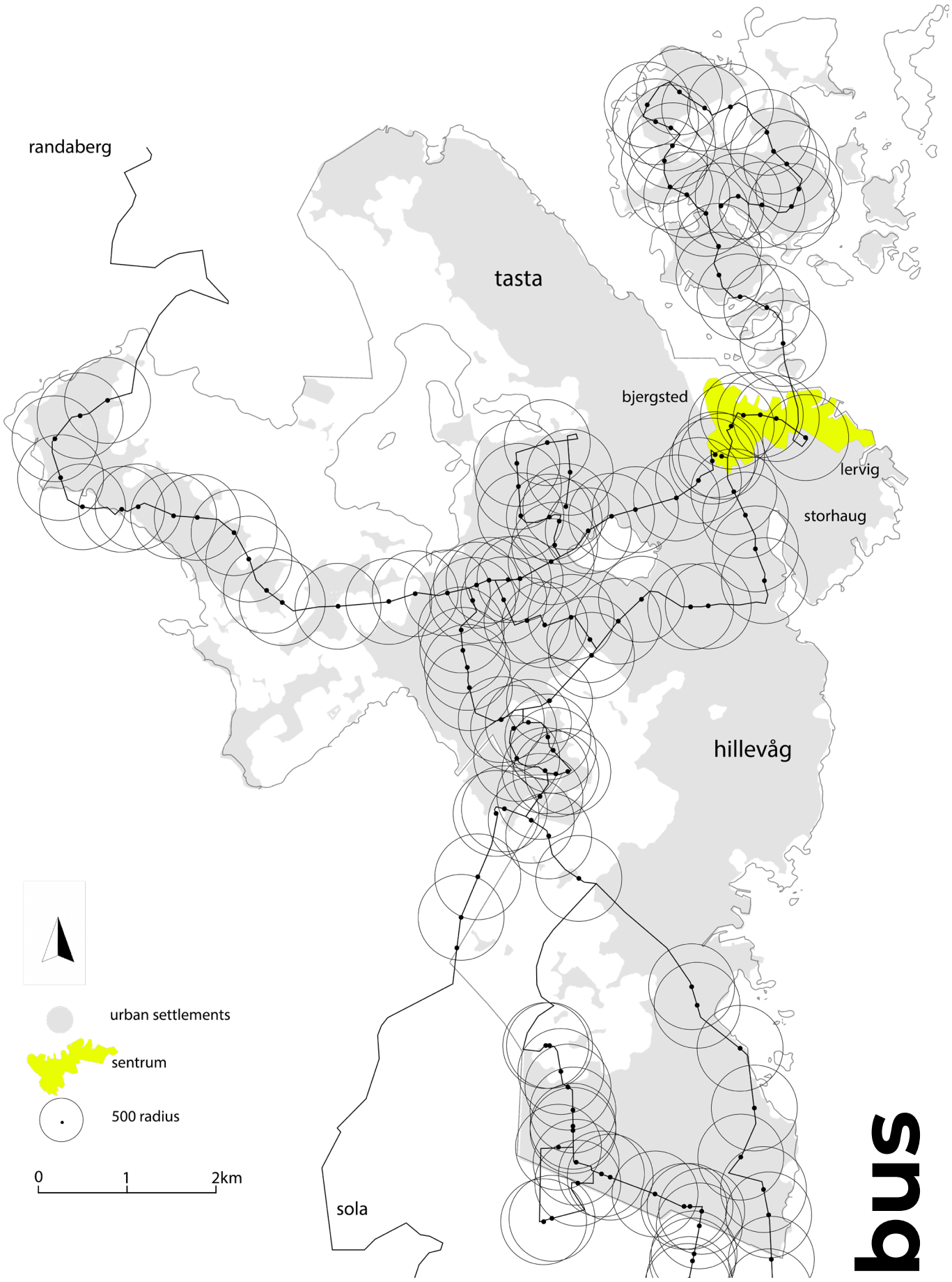


Fig. 25. Accessibility analysis of the direct bus routes to the UiS, Stavanger

spatial analysis LiU

Linköping

Linköping is a city and a municipality located in the middle part of Östergötland county (Mæhlum, 2020). Located in southern Sweden, Linköping is the fifth largest city in Sweden with 165 527 residents and population density of 115,9 inhabitants per square kilometre (2021) (inn./km²) (Linköping, 2022; City population, 2022).

The municipality area is 1428 square kilometres large including about 140km2 of water (Linköping, n.d.). Over 90% of the municipality population live in urbanised areas (Kommuner i siffror SCB, n.d.) and the urban settlements in Linköping are concentrated along the Stångån river that goes through the city from north, from the Roxen lake to south (Fig. 28).

Fig. 26. Linköping location, Sweden

Land use

The municipality area is over 1440 square kilometres and the biggest parts of the land consists of forests 48,6%, followed by agricultural land use 35,8% and others 8,1%. The urbanised and built land accounts for little over 7% of the total land area in Linkoping municipality (Kommuner i siffror SCB, n.d.) (Fig. 27).

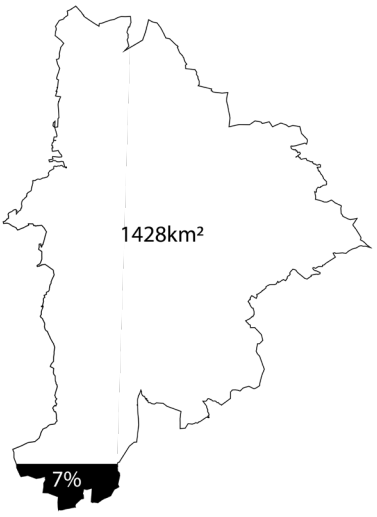


Fig. 27. Linköping Municiplaity´s built area

According to the data from 2012, about the land use in built up land distribution in Östergötland county, almost half of the land use is for transport infrastructure which is about 42% of the total built land use. About 27% of the built land use is residential land use, holiday homes 10%, agricultural building about 8%, manufacturing industry 5,5%, public services and facilities 4%, commercial activities and services 2% and technical infrastructure 1,5% (Statistiska centralbyrån, 2013).

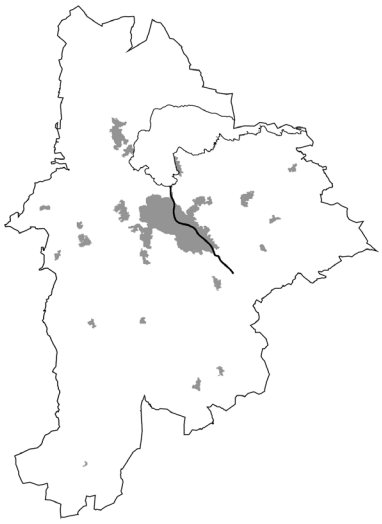


Fig. 28. Urban settlements in Linköping

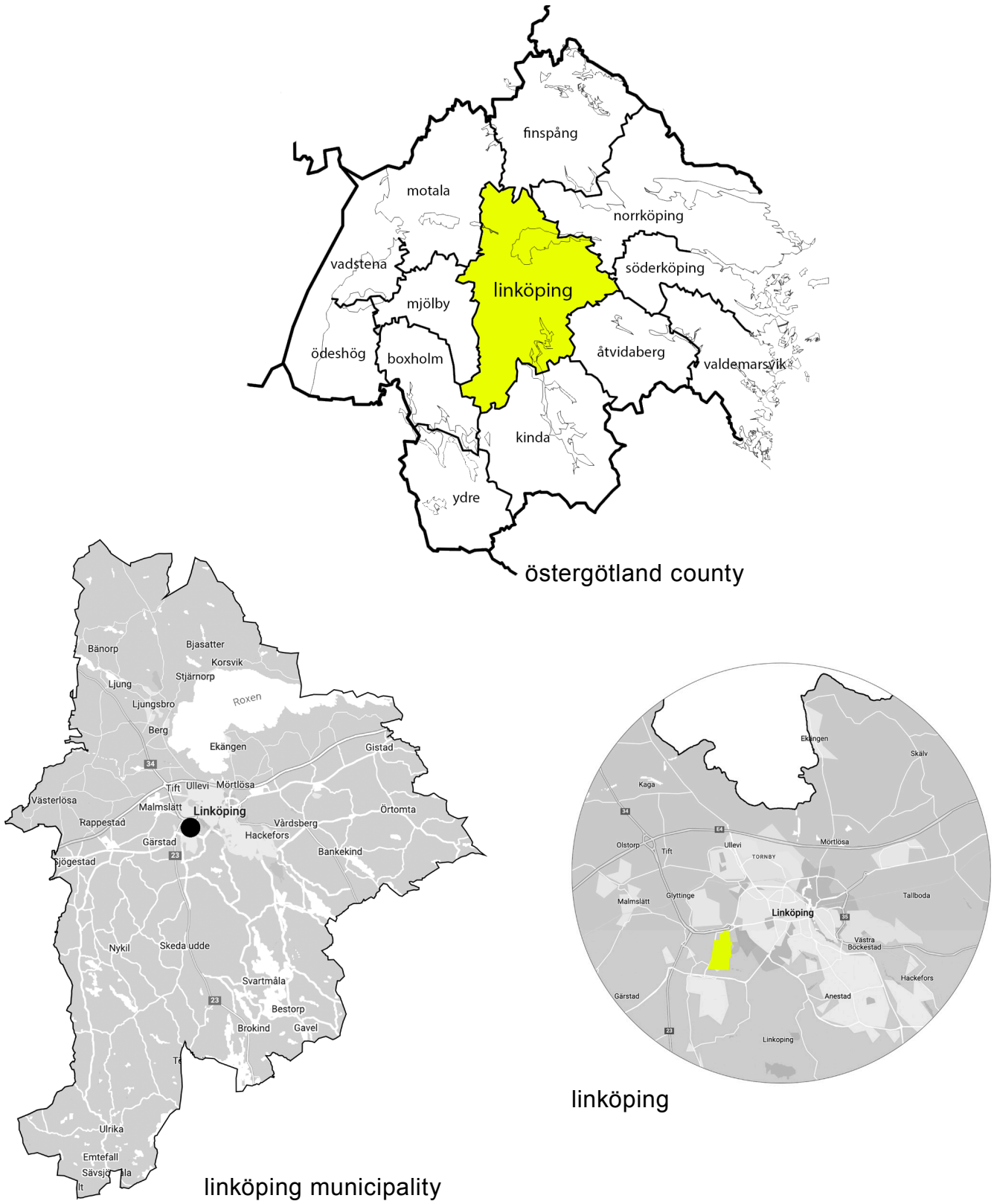


Fig. 29. Linköping University, Campus Valla - location

Linköping University (LiU)

The Linkoping University was established in 1970 (Mæhlum, 2020) and, per today, has over 35 000 students and 4 300 employees in four different campuses located in three different cities: Campus Valla and the University Hospital Campus both located in Linköping, Campus Norrköping located in Norrköping city and Campus Lidingö located in Stockholm (Linköping University, n.d.).

The analysis focuses on Campus Valla, the oldest and largest campus of Linköping University with over 20 200 students from different programmes and research within a large number of fields (Linköping University, 2022).

The university area - campus Valla - is located in Linköping Municipality, around 200km southwest from Stockholm and 3km southwest from Linköping city centre. On campus there are several cafés, restaurants and shops (Linköping University, 2022).

There are in total eight student housing areas: Ryd, Lambohov, T1, Colonia, Irrblosset, Flamman, Fjårilen and Gnistan. Ryd is the town's largest area of student housing, which is located on the northside from the university area and provides accommodation for more than 3000 students at Linköping University (Studentbostader, n.d).

Fig. 30. Campus Valla, LiU (Akademiska Hus, nd)

Weather

Located inland in southern Sweden, in the Östergötland county, Linköping has a Baltic climate, that is, moderately continental, with cold winters, when the average temperature is a few degrees below freezing, and mild summers.

In winter, the temperature can drop below -20 °C (-4 °F) during cold periods. The coldest record is -32 °C (-25.6 °F) and was set in January 1942.

In summer, it can go up to 28-30 °C (82/86 °F) on the hottest days. The highest record was set in August 1992 when it reached as high as 34.6 °C (94.3 °F).

There are about 169 rainy days in Linkoping which accounts for 664mm of rainfall yearly. The rainfall ranges between 33mm in the driest months to 81mm during the wettest months (June, July, August).

The average yearly wind speed in loínkoping is 2,5m/s with strongest wind of 2,7 and weakest of 2,3m/s. Throughout the year the wind in linkoping is on the same level of strength between 2,3 and 2,7m/s (Climates to travel, n.d.).

The moderately continental climate in Linkoping with less rain and wind will most likely encourage cycling (Christensen & Jensen, 2008; Bergström & Magnusson, 2003), summers with relatively hot temperature will increase cycling and cycling time (Christensen & Jensen, 2008; Bergström & Magnusson, 2003), however, winters with temperatures up to -20 °C will be challenging to cyclist (Bergström & Magnusson, 2003), nonetheless, with good maintenance of cycling infrastructure in the winter like snow clearance and salting (refer to it), coupled with less or no rain and wind, cycling will still be competitive to other transport mode.

Terrain topography

The Linköping Municipality area consists of two main landscape types, plain landscape (flat landscape, also known as Slåttlandskapet) and the transitional landscape (Julin, Hennius, Hermansson, Gunnarsson, & Olsson, 2016).

The plain landscape stretches across the middle part of the Östergötland county and north part of the Linköping Municipality (Fig. 7. appendix), and is characterised by low lying, relatively flat terrain topography with fertile agricultural soils. There are few large lakes in the plain landscape.

The transition landscape is the area between the plain landscape on the north and the hilly landscape on the south of the county (Fig. 7. appendix). It is a landscape that is flat in the north towards “Slätten” and that is becoming more and more hilly to the south with a variety of open land and forest. The landscape type is characterised by a hilly and varied landscape. There is a gradual diffusion from the plain to the hilly transition landscape in the boundaries where they meet (Julin et.al, 2016).

The analysed area, within 5km from the campus, is located in the area covered by the plain landscape. Low density of terrain contours shows that the landscape within the area is flat. The highest point is about 100 metres above sea level, and the lowest is 80 metres, thus the average difference in height is approximately 20 metres (Fig. 31 on page 62).

The analysis of the terrain altitude on the bike routes between student houses and campus area, shows that the terrain is mostly flat with an average altitude of 6,4m and the highest altitude of 13 m on the routes from Ryd and Fjärilen student houses (Fig. 32 on page 62).

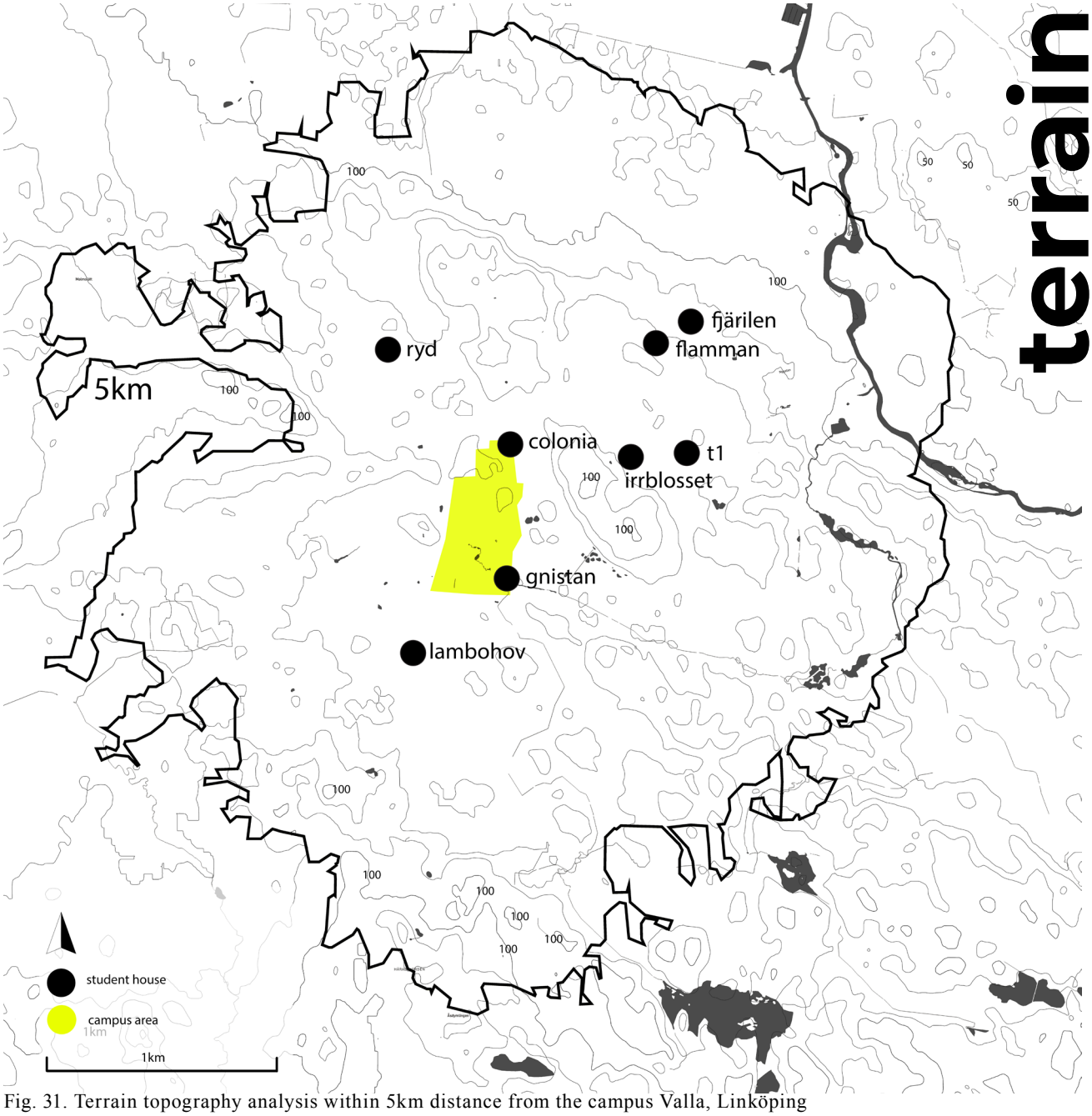


Fig. 31. Terrain topography analysis within 5km distance from the campus Valla, Linköping

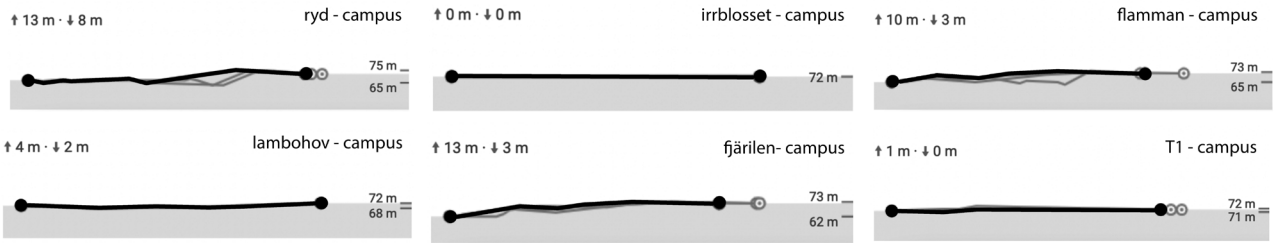


Fig. 32. Terrain altitude on bike routes between the student houses and the campus, LiU

Fig. 33. The plain landscape in Östergötland county

Walkability analysis

As in the analysis of walkability at University of Stavanger, two starting points (A, B) are identified, at intersections along the main axis (Fig. 36 on page 64).

The analysis examines the accessibility, pedestrian infrastructure and type, as well as other factors and obstacles that can affect walkability to and from campus within a 500m distance from the two predefined starting points.

Access - proximity & connectivity

Two student housing areas are located within 500m distance from the university area, these are Colonia and Gnistan. There is good accessibility for students from the two dormitories to different places at the campus. The calculated average time to walk to campus from the two dormitories is 6min (A) and 9min (B).

The long distances between campus buildings may discourage walking around the campus and lead to the more use of other transport modes, for example cycling.

Pedestrian facilities

The walking infrastructure at the university area and within 500 m distance from the defined starting points (A, B) consist of a diverse type of pedestrian paths and trails, shared lanes for pedestrians and cyclists, sidewalks and other zones for both cycling and walking. The network is dense and of various path types and gives good access to different destinations.

The main axis connects different parts and buildings of the campus from north to south. It consists of both shared pedestrian/bike zones as well zones with dedicated pedestrian lanes that are marked with signs on the ground and are separated from other traffic e.g. cycling (Fig. 34). It takes about 15 minutes to walk from one end of the campus to another through the main axis.

The two dormitories have good accessibility to the different destinations at the campus, without major intersections and crossings thus the routes from the student houses to the campus can be considered as safe and thus encourage walking.
In general, LiU has good connectivity and accessibility for pedestrian transport from the campus Vala, the route is within walking distance of 500m, with marked pedestrian friendly paths, all these features are known to encourage walkability.

Fig. 34. Pedestrian path at the main axis, LiU (Google Maps, 2009)

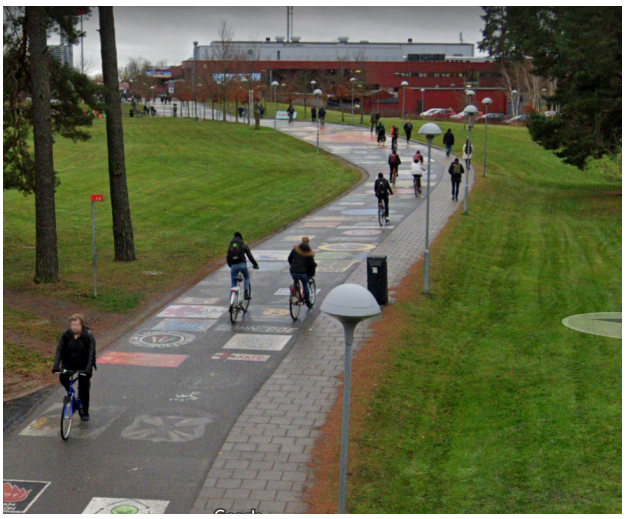


Fig. 35. Pedestrian path at the main axis, LiU (Google Maps, 2021)

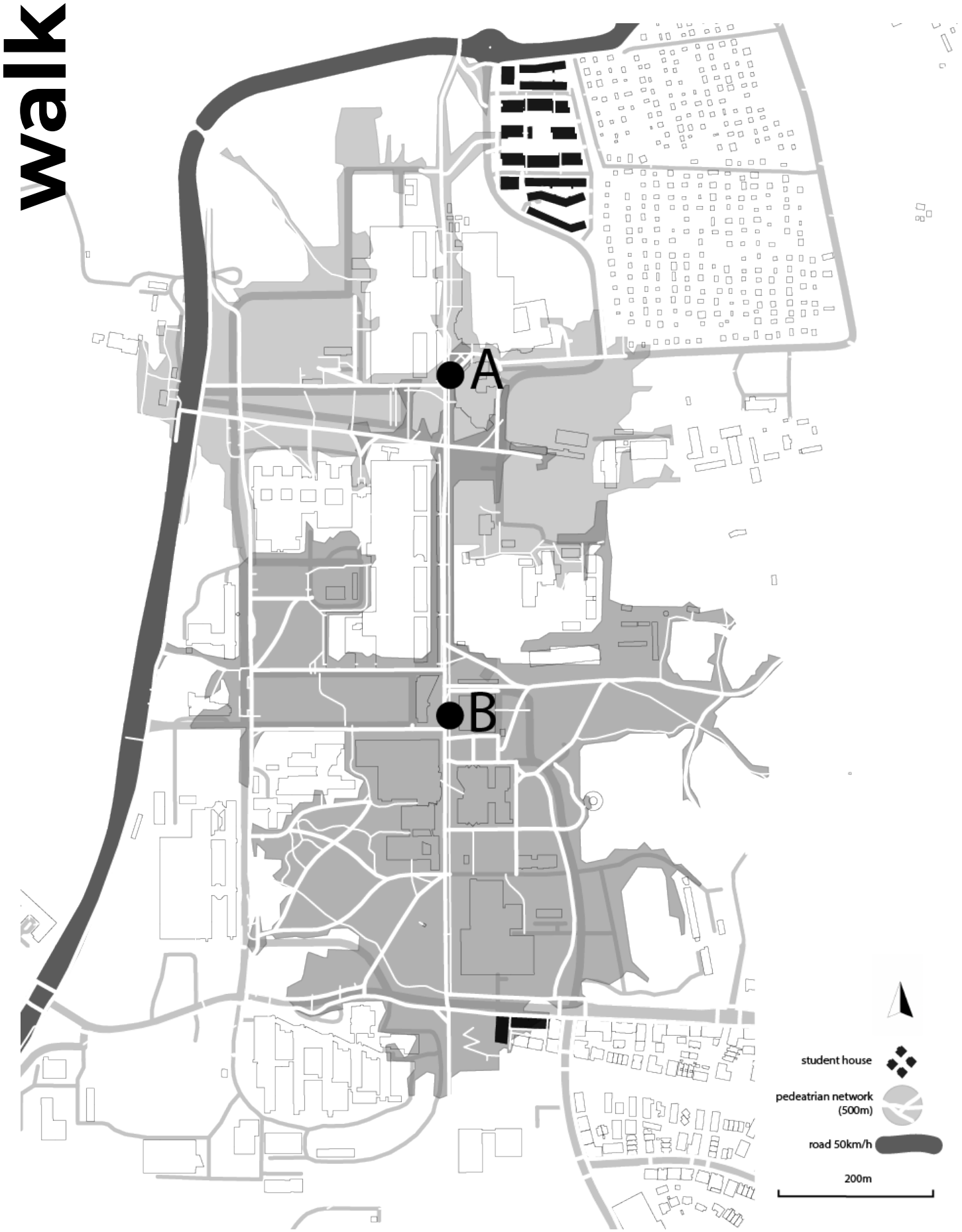


Fig. 36. Pedestrian network analysis wthin 500m distance from the campus, Linköping

Bikeability analysis

Access - proximity & connectivity

The university area with campus Valla is located on the southwest side of Linöping city, approximately 3km from the city centre.

All the student housing areas at Linköping University are located within cycling distance to the campus. Six dormitories are within the 2 km cycling radius from the university area including the biggest student housing Ryd located on the north of the university area and two student houses are within the 3km cycling radius which is still well within recommended cycling distance (Fig. 37) (Zacharias, 2005; Yang & Zacharias, 2016).

The average time to travel by bike to the university from all the student housing areas (except the dormitories that are located at the campus) is 7.3 minutes. The shortest route takes 5 minutes i.e from Irrblosset student house, and the longest is 10 minutes from Fjärilen to the campus Valla.

The bike network in Linköping is continuous and evenly distributed in the city with its highest density in the city centre. There are few or no dead ends on the routes and the different paths connect important destinations (such as university, museums, airport, hospital, city centre) with the rest of the city and region (Fig. 38 on page 66).

Bike facilities

The cycling infrastructure in Linköping consists of diverse types of bike paths. Among them, the majority of the lanes are shared lanes for both cyclists and pedestrians with some good number of dedicated bike lanes. These types of lanes are often separated from the roads with green infrastructure like lawns and trees.

Both the shared paths and dedicated paths are signposted with signs (bike or pedestrian signs) and the dedicated bike lanes are marked or separated by lines painted on the ground. Additionally, cyclists are also allowed to use sidewalks together with pedestrians if necessary.

Some of the routes are located along the roads but a good number of routes go through green areas such as parks, green fields and forests, and other natural areas such as Nature Reserve Park.

There are other bike facilities for example air compressor stations, electric bike stations and bike maintenance workshops located along the bike routes.

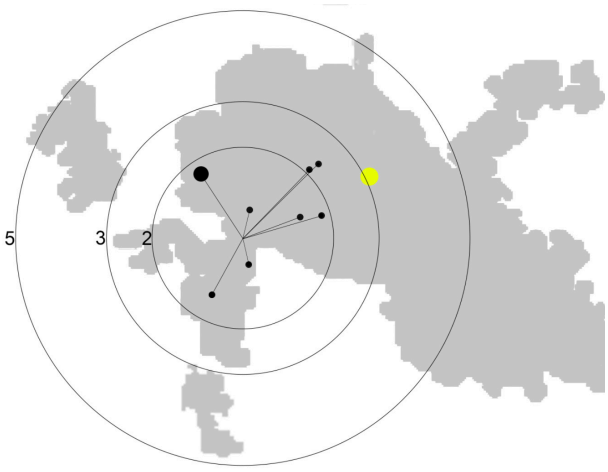


Fig. 37. Distances between the student houses and the campus, Linköping

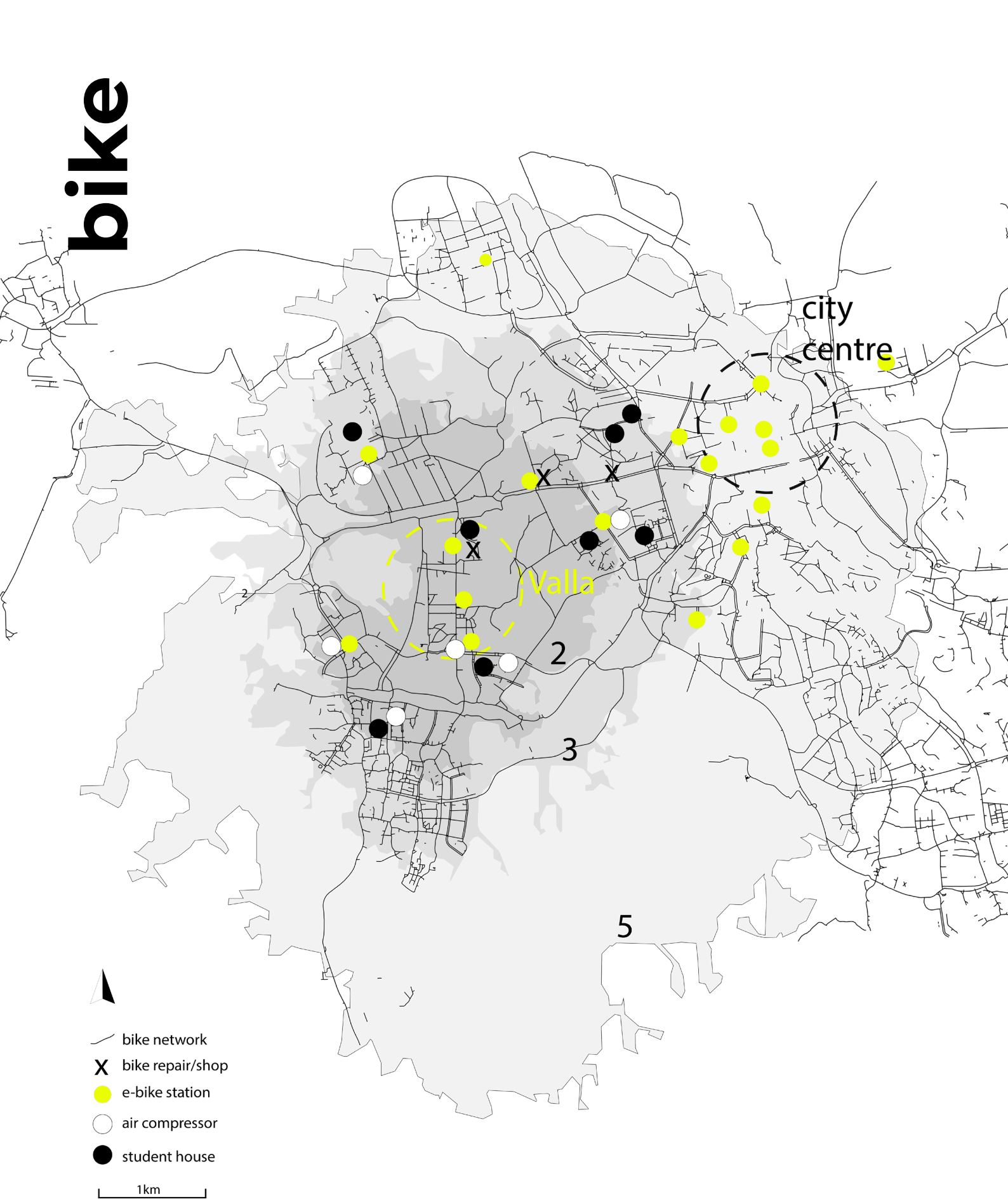


Fig. 38. Bike network within 2, 3 and 5km distance from the campus Valla, LiU

Bike routes between the student hoses and the campus

The bike routes between student houses and the university area vary. The bike route from Ryd and Lambohov student housing consists mainly of shared use, that is bike/pedestrian paths located parallel to the streets and separated from them by wide green lawns and rows of trees (Fig. 39).

The bike routes that connect Flamman and Fjårilen with the university consists partly of paths dedicated to bikes alongside pedestrian paths separated and with signs on the ground. The routes often go parallel to the car road (car speed limit 30km/h) and are separated from the roads. Some parts of the routes go through green areas in the city and parks such as Lektorshagen and Fridshemsparken.

Student houses: Irrblosset and T1 share the same bike route which goes away from the street traffic and mainly through green areas, through "Vallaskogen" Nature Reserve Park and green fields and Vallamasivet (Fig. 40).

There are several intersections with other roads of different speeds (30, 50, 70, 90km/h). Most of the intersections with high speed roads are underground crossings which allow for continuous safe and unobstructed movement for cyclists (Fig. 41). Other crossings are traditional street crossings but those are mainly in intersections with lower speed limits (30km/h) but marked with crossing signals.

This bike network analysis showed that there is a presence of good bike infrastructures that facilitate cycling in LIU. The dense bike network, good connectivity and accessibility should encourage biking (Pereira Segadilha & Penha Sanches, 2014). Minimal influence of intersections, crossings and turns on most routes seen as positive for distance perception (Montello,1997), and cyclists have fewer accident and safety issues (Solli et al., 2016) as there are fewer of them.

Majority of the bike paths go through green spaces, parks and trees planted along the bike routes, these are known to have a positive impact on cycling and increase cycling (Fraser & Lock, 2010; Frank et al., 2006).

Fig. 39. Bike route from Ryd student house, Linköping (Google Maps, 2011)

Fig. 40. Bike route from Irrblosset, through Valla Forest (Google Maps, 2017)

Fig. 41. Underground crossing on the route from Ryd (Google Maps, 2021)

Another important bike facility is bike path maintenance, according to the information from linköping municipality website, major or most used bike paths are normally broomed and salted in the winter and other bike paths are plowed and gravelled (Linköping kommun, nd).
Bike lane maintenance especially in the winter like snow clearance and salting should help to maintain bikers confidence and biking all year round (Bergström & Magnusson, 2003; Lea, 2012). Presence of dedicated bike paths, fast connectivity paths should encourage biking for work or school e.t.c However shared used lanes will pose a challenge for cyclists as they have to negotiate the road with pedestrians (Andrade et al., 2014).

The presence of these positive biking infrastructures (good connectivity, accessibility, fast connection, dedicated route, green spaces and parks, less obstruction, biking maintenance and facility) will make bikeability in LiU very competitive to other transport modes, especially car use, however the few negative ones will still pose a challenge to cyclists, although weighed against the positive will still put cycling on much more favourable ground.

Bike facilities at the campus

The university buildings at Linköping University are located along the main axis that connects different parts of the campus from north to south. The axis is designated for cyclists and pedestrians with some parts of the axis having clear definition and separation of zones for the two groups in form of signs on the ground/paths (Fig. 34 and Fig. 35 on page 63; Fig. 42).

The axis allows for bike movement and also facilitates most of the bike parking. There are many designated bike parking facilities at the campus located both within and along the main axis and on the outer edge of the buildings and in between the different buildings and close to the entrances. Nevertheless most of


Fig. 42. Main axis at Campus Valla (Instagram, 2019)


Fig. 43. Bike parking at the main axis, LiU (Linköpings Universitet, 2017)


Fig. 44. Bikes at the main axis; LiU (Linköpings Universitet, nd)

the time students park their bikes in places that are not officially marked as bike parking, usually along the axis, near classrooms and lecture rooms, near main entrances and basically where they deemed safe, free and allowed.

Most of the bike parking is open bike parking with few roofed parking areas. Some of the bike parking facilities are located also close to the bus stops.
There is one air compressor station and three electric bike (linbike) stations located at the campus area along the main axis (Fig. 45)

The presence of bike parking infrastructure will be welcomed by cyclist (Marqués et al., 2015; Pucher, Dill, & Handy, 2010), furthermore, the possibility to park in different locations in the campus giving the student the freedom to park closest to their destinations, and presence of bike maintenance facilities including pump station, will encourage new cyclists and persuade more students to cycle (Pucher et al., 2010; Tran, 2021).

Bike facilities at the student houses

Most of the student housing areas have bike parking facilities located close to the dormitory buildings and at the building entry zones, entrances. (Colonia, Ryd, T1, Irrbloset). Ryd, has roofed bike parking facilities located close to the entrances to the buildings (Fig. 46). At Gnistan, Lambohov and Flamman dormitories, there are several bike racks where students can lock their bikes. The Irrblosset dormitory allows for both open and underroof bike parking.

Some of the dormitories have access to bike shops and bike service or maintenance facilities or shops within the student dormitory areas (Lambohov, Irrblosset).

In general, there are a lot of bike parking spaces around and within all the student dormitory areas encouraging cycling (Marqués et al., 2015), and with some of them roofed, adds even more encouragement for its use as a transportation mode (Tran, 2021).

Fig. 45. Air compressor station, LiU (Linköpings Universitet, nd)

Fig. 46. Roofed bike parking facilities at Ryd, LiU (Studenbostäder, nd)

Fig. 47. Roofed bike parking facilities at Lambohov, LiU (Studenbostäder, nd)

Accessibility analysis of public transport

The city of Linköping has centrally located travel centres with many bus connections. The local transportation company Östgötatrafiken is in charge of city buses, trams, county buses and trains, both in Norrköping and Linköping cities. Students can buy tickets through several ways although the easiest is through the Östgötatrafiken app on the mobile phones, they have two apps. Students of LIU are to choose the one with a red background. They are able to buy both single and periodic tickets in the app. and they are not able to buy with cash on the public buses, trams or trains (Linköping University, 2022).

There are in total seven bus routes (4, 12, 20, 26, 75, 540, 543) that stop at the campus Valla and connect the university area with different parts of the city including different student housing areas. The buses have different schedules and routes. The university also has a bus line, Campus Bus (Campussbussen), that connects the three different campuses of Linköping University i.e Valla, Norrköping and the University Hospital. The bus is free for students and goes every 1h (liu, nd).

The route number 4 connects the university and the city centre (Linköping central station) with frequency of the buses between 12-20 minutes, between 7:40-21:43 on weekdays Monday to Friday.

Buses on route number 12 connect the university campus Valla, Lambohov district and the Linköping city centre. The buses go every 15, 20 and 30 minutes with the majority of the buses departing every 20 minutes during the week, from Monday to Friday.

Route number 20 connects the university with the city centre (resecentrum), but not the student housing areas; the bus goes every 15-30 minutes on weekdays.

Buses on route number 26 connect the campus, Lambohov district and Tornby district. The bus has the lowest frequency and departs every one hour between 9:10 and 18:10 during weekdays, from Monday to Friday.

The bus number 75 connects the university campus Valla in Linköping with the other city of Norrköping and has 4 departures from Valla between 15:15-17:15.

Buses 540 and 543 connect the university and the city centre but have few departures everyday, during weekdays. The bus number 540 has about ten departures and bus 543 has three departures per day.

Fig. 48. Campus Bus connecting the three different campuses at LiU (Linköpings Universitet, nd)

Connection between the student houses and the university

Lambohov student housing area has 3 direct connections by bus (4, 12, 26) with the campus Valla and the bus stop Linköping isberget is located within 350m and busstop Slettsdadskolan (bus number 12) within 500m walking distance from the student hostels (Fig. 49 on page 72).

Flamman student house has direct connection with the university by buses numbers 12, 540 and 543. Fjårilen student house has access to the buses 540, 543.
The largest student housing area, Ryd has one direct bus connection, by bus number 26, with the university, but the bus has a low frequency of departures which is every one hour. Students in Ryd hostels can get to the nearest bus stop for this route that is within 500m walking distance (Fig. 49 on page 72).

Student housing areas Irrblosset and T1 do not have direct bus connection with the university.
In four of the six student housing areas, that are located outside of the campus, students have access to the public transport within 500m distance from their respective dormitories, and they have direct bus connections to the university (Fig. 49 on page 72).

The travel time by bus from the different dormitories is: 14 minutes from Lambohov, 25 minutes from Ryd, 21 minutes from Flamman and 21 minutes from Fjärilen. The average calculated time is 20 minutes.

Although the analysis concentrated more on connections between the campus and the different student hostels, it is important to mention that there are good bus connections between the hostels to important destination nodes in the city and from the campus to important destinations in the city e.g train station, city centre, shops etc.
Results from the bus analysis shows that while there are good accessibility and bus connectivity in the city, within the student hostels and within the university area, there is low connectivity by bus or public transport from the different student hostels to the campus; with some hostels not have any or 1 bus connection with very low frequency.

While there are buses with high frequencies in peak hours, they seem to connect either the dormitories to important destinations in the city or connect the campus with important destinations in the city.

In general, students are able to travel by bus to and from the universities albeit using different bus connections and or involving walking that are usually above the 500m recommended walkability range thus discouraging for public transport users.

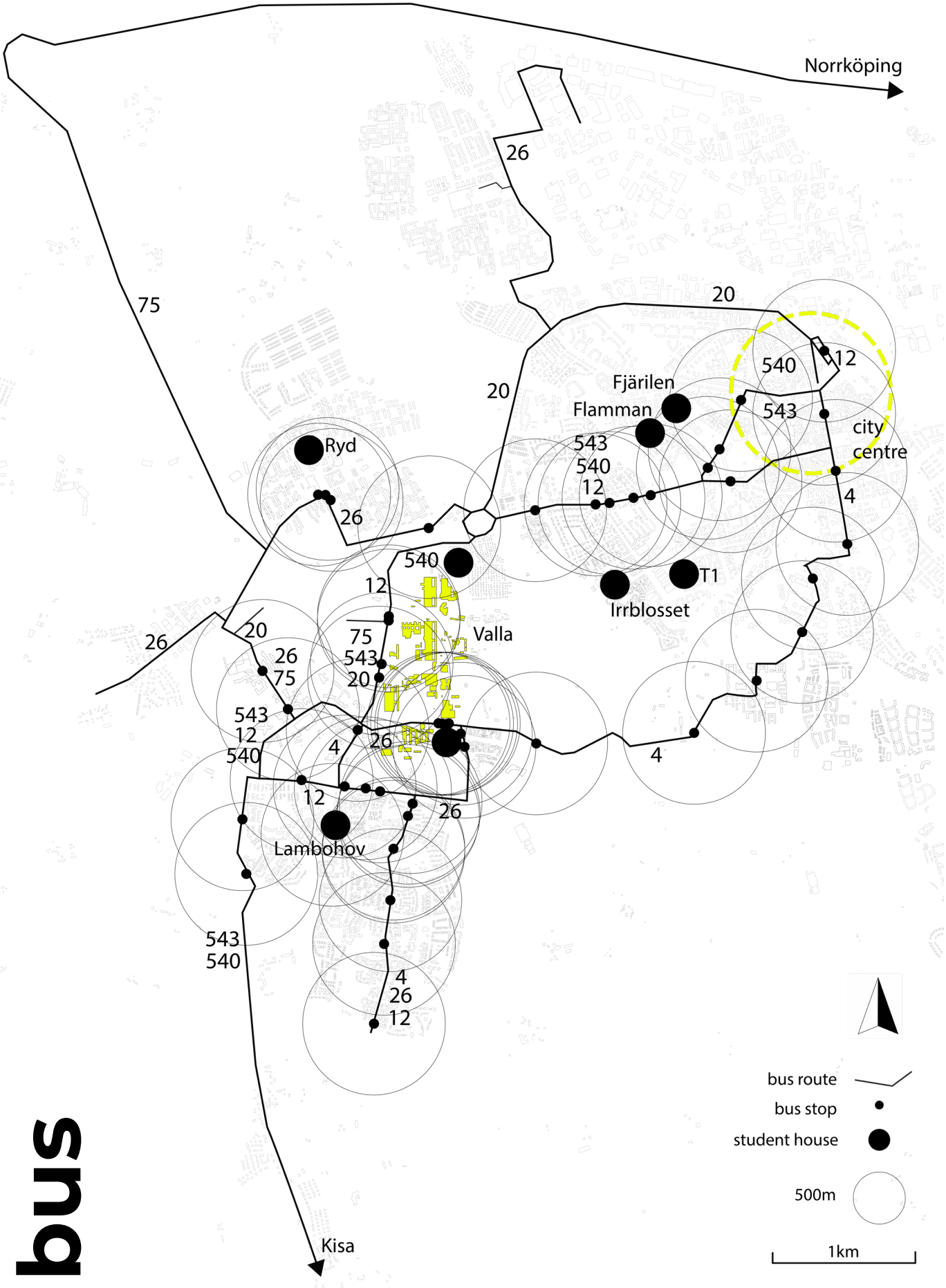


Fig. 49. Analysis of the direct bus routes between the student houses and the campus Valla, LiU

student travel survey

There are 333 respondents on the survey conducted at UIS of which 62% are women and 38% are men. The average age of the respondents is 32. Majority of the respondents at UiS, 74% live in Stavanger Municipality, and some live in neighbouring municipalities Sandnes (11%), Sola (4%) and Randaberg (1%) and in other municipalities (10%) located further on the south from Stavanger for example: Egersund, Time, Klepp, Hå, Gjesdal, etc. This means that about 9000 students live in Stavanger Municipality and over 3000 students live outside of the Stavanger Municipality. It can be assumed that a substantial number of these 3000 students will most likely use cars as their main transport mode to travel to and from campus due to the long distances (Loftsgarden et al., 2015).

Furthemore, 32% of the respondents at UiS live in student houses and among the students living in student houses, 30% of them live in Sørmarka dormitory, which is located within 500m distance from the campus and 17% live in Ugleveien dormitory located within 3km distance from the campus. Students living in Sørmarka will most likely walk to the university (Southworth, 2005), and the distance of 3km from the university will most likely encourage the students in Ugleveien to cycle to the campus (Zacharias, 2005; Yang & Zacharias, 2016).

The survey conducted at Linköping University has in total 82 respondents. The number is relatively lower than the number of respondents at the University of Stavanger due to limited access to online student platforms and students in Linköping in general. Amongst the respondents, 56% are women and 44 % are men. The average age of the respondents is 23 (23,5) at LiU. Majority of the respondents at LiU, about 93% live in Linköping Municipality, some of the respondents live in neighbouring municipalities Nörrköping (2%) and 5% live much further. This means that out of more than 20000 students at Liu, almost 19000 live in the Linköping Municipality. Additionally, about 70% of the respondents at LiU live in student houses and among the students living in student houses, the majority of the respondents (93%) live in Ryd, which is the biggest student accommodation area in Linköping, located about 2km on the north from the campus Valla. Additionally, all the other student houses are located within 3km distance from the campus area. In essence, the short distances to the campus should encourage the students to use sustainable transport modes, especially cycling (Zacharias, 2005).

It is important to mention that age might play some role in student choice of travel mode (Solli et al., 2016). The age difference might mean different socioeconomic status between the students. That means at UiS the students might be more established and may own a car which means they will most probably drive a car to campus (Van Acker & Witlox, 2009).

Primary & secondary transport modes of students

The primary travel mode choices of the students at the two universities are of significant difference. In UiS, 39% of students use public transport (bus) to travel to and from campus, 26% of the respondents walk and 18% use car as their mode of transport. About 4% of respondents at UiS cycle to campus. Others take train (2%), sit as passengers in a car (2%), ride electric bike (1%), motor bike and others (1%). The 26% that walk probably are students living in Sørmarka dormitory, within 500m walking distance from the campus.

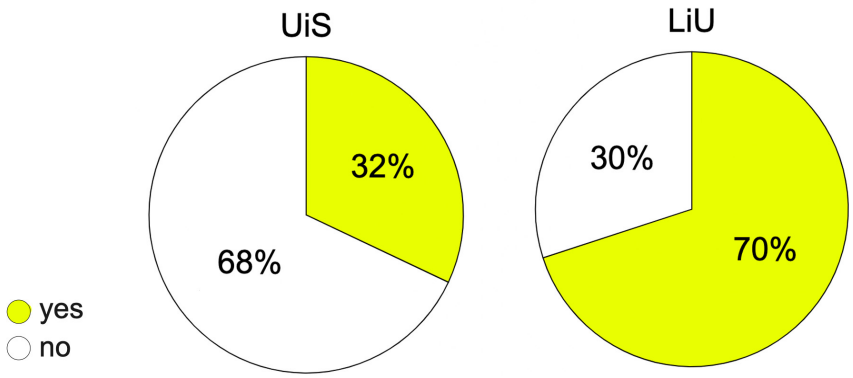


Fig. 50. Percentage of students living in student houses, UiS&LiU

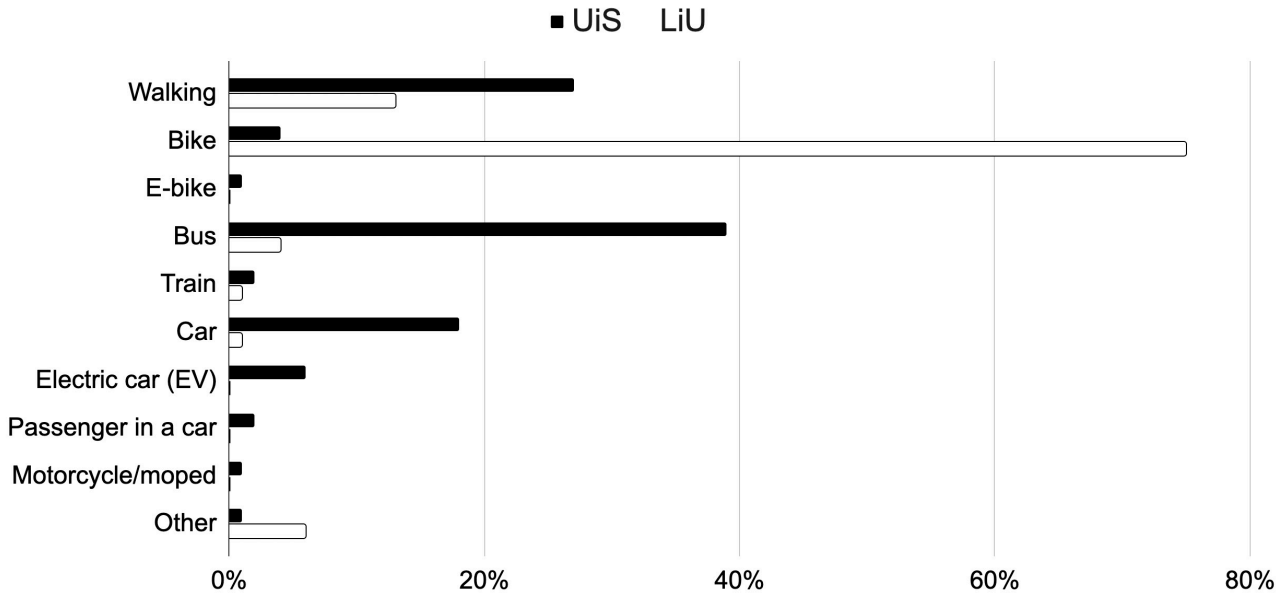


Fig. 51. Primary transport mode of students, UiS&LiU

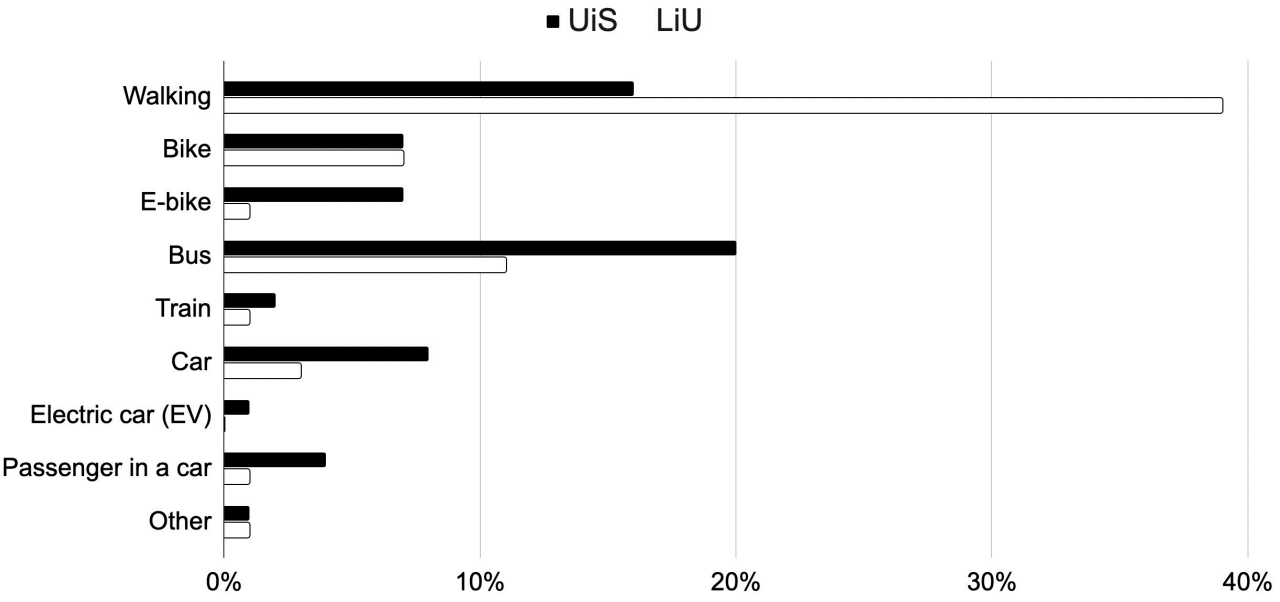


Fig. 52. Secondary transport mode of students, UiS&LiU

The students using bus (39%) most likely live further away than the 2, 3, 5km distance and where there is good access to public transport (Rasca & Saeed, 2022), whereas those 18% using car may live far and do not have good access to public transport or have access to car. The 4% cycling most likely live within the 2, 3 or 5km distance from the campus (Zacharias, 2005).

Majority of students at LiU, about 77%, choose cycling as their primary transport mode, another 12% walk, 4% use bus, 1% use train and 1% use car and others like escooter (5%). This confirms the assumptions from the earlier information, student housings located within 2 and 3km distance facilitate and encourage cycling. Additionally, this may be because of the good accessibility and connectivity (Andrade et al., 2014) of the bike network in Linköping. It can also mean that the cycling culture among the students in Linkoping is strong(Solli et al., 2016).

The striking data is that only 1% of the respondents (1 person) at LiU drive car which might indicate that the sustainable travel modes are well facilitated. It means that cycling is competitive to car travel i.e the travel time might be similar or shorter, better connectivity and accessibility, etc.

As a secondary travel mode, students at the University of Stavanger choose to take a bus (19%), walk (16%) and drive a car (8%) and different types of bike riding - traditional and eclectic bikes (7%).
As a secondary transport mode, students at Linkoping University choose walking (38%), taking the bus (11%) and other such as bike and electric bike (7%).

Factors influencing students travel mode choice

For this question, students were asked to choose on a scale from 0 to 5 how much different factors influenced their travel mode choice, where 1 is very little and 5 is very much, and 0, do not know. The factors given were flexibility, comfort, travel time, price, environmental impact and health.
For the respondents at UiS, flexibility and travel time are the most important factors for their choosing travel mode with flexibility 70% and travel time 73%.

Price is the third important factor with 55% choosing it as influencing them, followed by travel comfort 42%, health 35% and finally environmental impact with 26%.

For LiU, 78% of the students answered that flexibility influenced their choice the most, price 72% and 65% for travel time. Others are environmental impact 44%, health 39% and comfort 38%.

In essence, flexibility, price and travel time are the three most influential factors for both universities and should be prioritised when looking at changes that can be implemented to change the students' travel behaviour. For UiS, travel time was the most influential factor, this can be due to the long distances from the university (Zacharias, 2005). We can assume that the longer the distance, the more the travel time matters for students. Another reason why time, could be socioeconomic status, the average age of UiS students is 32 and might indicate that they have more responsibilities such as family and work, and therefore might want to maximise time.

In Linköping, flexibility scored the most. This can be because the students live close to the university so they are not concerned so much about the travel time, and the flexibility

enables them to go wherever and whenever they want to go. Given the flexibility that comes with cycling, it might be that LiU students might prefer to use it to cycle through the green spaces (Zhao, Lin, Ke, & Yu, 2020), especially knowing from the spatial analysis that most of the cycle lanes to the university goes through parks, forest and aesthetic places. It (can be assumed) might also allow them to change the route spontaneously to explore the city and the nature around (Frank et al., 2006).

The difference in price as a factor affecting their travel mode choice is also very important to analyse. It seems to affect more in LiU than in UiS. For UiS, it may be because of their socio-economic status, they may be settled enough and in a more stable state to afford the travel cost especially since they are older. Another reason may also be that they are used to the cost of travel already and that it makes no difference for them especially when faced with other factors like flexibility and travel time.

LiU might be also because of their socio-economic status, younger age means that they might be at that state that they prefer to save more on travel cost than time especially knowing their age, and economic status.

Also, since cycling is very competitive in LiU compared to other travel mode, and being able to save even more on travel cost, it makes then more sense choosing it over other travel modes.

Also, students' travel choices at UiS are influenced by travel comfort much more than health and environmental impact whereas in LiU environmental impact influenced them more than health and travel comfort. This might be because for many reasons, UiS students use mainly cars and buses as their main travel mode, these travel choices are much more comfortable than cycling, especially car travel. Being used to this, they might have developed a habit because of the positive experience it brings (Aarts et al.,1998). While LiU chose environmental impact in this position not just because of the positive experience from cycling and other benefits of that, but also having been more informed on the negative environmental impact of personal cars. Also, weather might influence UiS students' choice, the climate condition in Stavanger might discourage (Delclòs-Alió et al., 2019) students from cycling and instead push them towards personal cars and public transport as they try to avoid the rainy and cold weather in Stavanger most of the year.

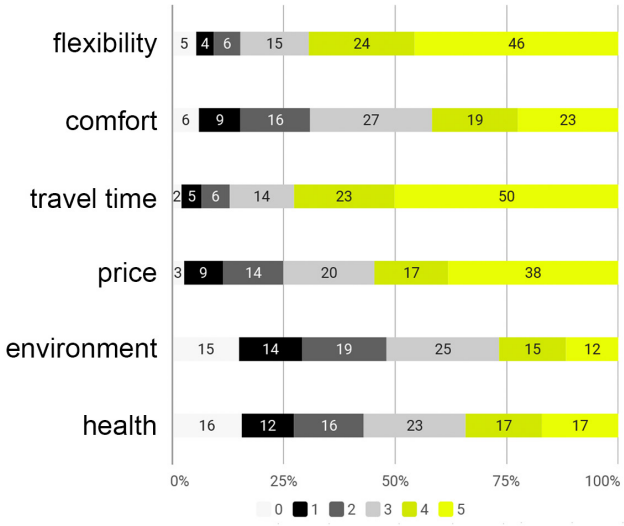


Fig. 53. Factors influencing travel mode choice of UiS students

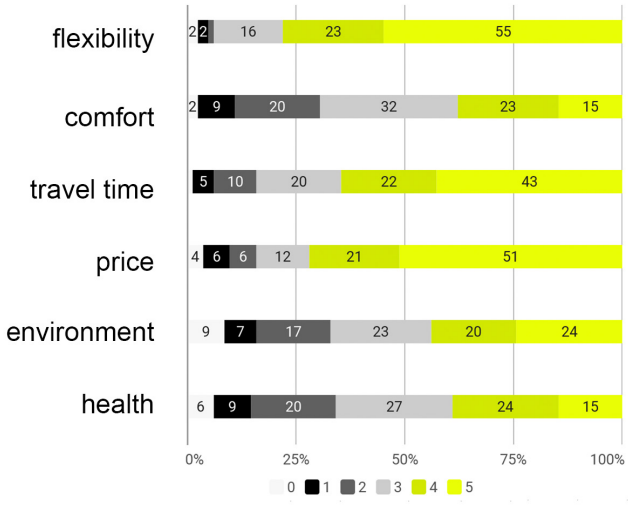


Fig. 54. Factors influencing travel mode choice of LiU students

For health, 35% of the respondents in UiS chose health as influential and 39% in LiU. That shows that they both put health as having big influence when making their choice, this is important because having known that students in LiU cycle more than in UiS, they still prioritise physical activities assumably because of its health benefits (Yang et al., 2019), while UiS that personal car and bus are predominantly the modal choice still will prioritise health even though they chose transport mode that offers less physical activity.

Attitude toward travel modes

In this part, respondents at both universities were asked about their attitude towards driving cars, cycling, walking and public transport. They were asked to rate their agreement to different statements regarding conveniency, time efficiency, affordability and safety of the different modal choice.

Attitude to driving car

For UiS, 80% said that driving cars are convenient, 8% disagreed and 13% neutral, 84% said that driving car is time efficient 5% disagreed and 11% neutral, 54% said driving is not affordable, 30% neutral and 16% agreed, 22% said driving is safe, 44% chose neutral or do not know and 35% said driving car is not the safest mode of transport.

For LiU, 58% said it is convenient with 22 % disagreeing, 58% said it is time efficient with 22% also disagreeing, 3% said it is affordable while 70% disagreed with 27% staying neutral. On safety, 11% said it is safe, while 64% said it is not safe with 24% staying neutral.
To understand their (UiS and LiU respondent) different attitudes towards cars, it is important to recall that almost all respondents cycle in LiU with only 1% (1 respondent) using personal cars as travel mode. On the other hand, a substantial number use personal cars as major transport means in UiS. Thus, the respondents personal experiences with cars are very different, in UiS it can be assumed that most respondents have personal experience with cars while the opposite is the case in LiU.

The high number saying that it is convenient perhaps means good accessibility and connectivity by car, most likely better access and connection than other modal options even while admitting that it is not the most affordable and most safe mobility choice, also there answers might reflect the long distance to the campus, it is more convenient to drive car when the distance is more than 5km than for example cycle or the climate. Furthermore, the 84% agreeing that car driving is time efficient at UiS most likely is because of the distance, with many students living in dormitories and houses situated outside the cycling range from the universities, this agrees with their other answers that seems to support car use.

In LiU, there answers seems to not only match those with little or no personal experiences with driving car, but it also shows that they feel more confident with their current modal choice (cycling) for example 64% saying that car driving is not the most safe and 70% disagreeing that it is the most affordable mean of transport for them. Nevertheless, with 58% answers in both convenient and time efficient, it shows that they believe that car driving is both convenient and time efficient (perhaps it has to do with good access and connectivity of car roads (Fasan et al., 2021), their answers in the other questions shows that they not only feel quite good with their current mode of transport but also prefers it when compared to car.
Both answers seem to show positive experience with car driving in both universities, however, LiU respondents still prefer their current mobility mode (cycling) over car driving.

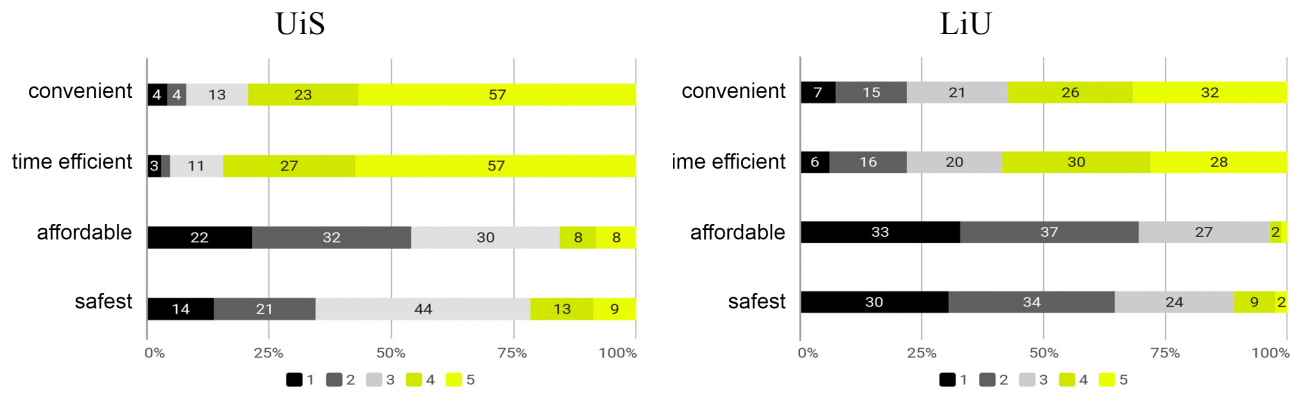


Fig. 55. Attitude towards driving car, UiS&LiU

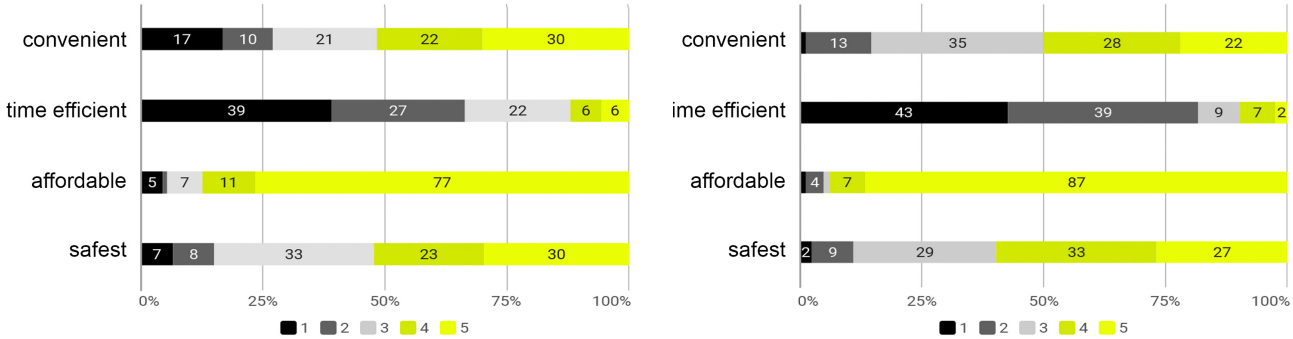


Fig. 56. Attitude towards walking, UiS&LiU

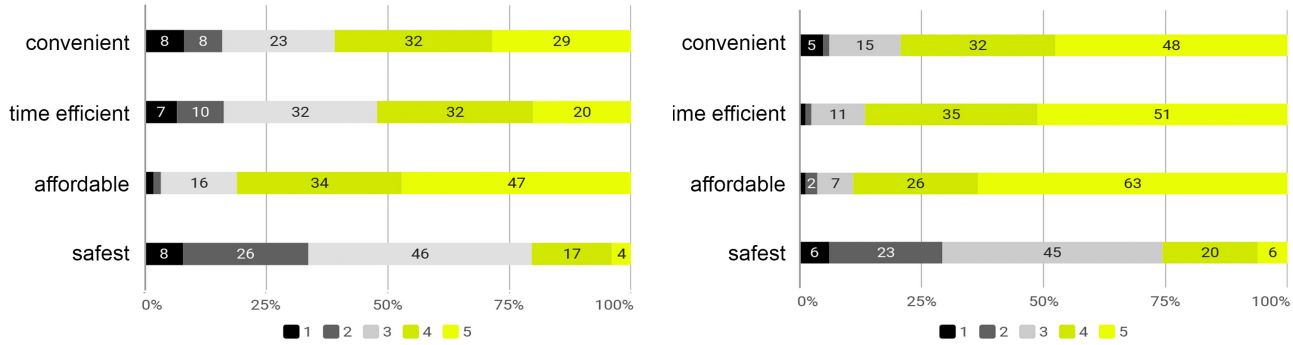


Fig. 57. Attitude towards cycling, UiS&LiU

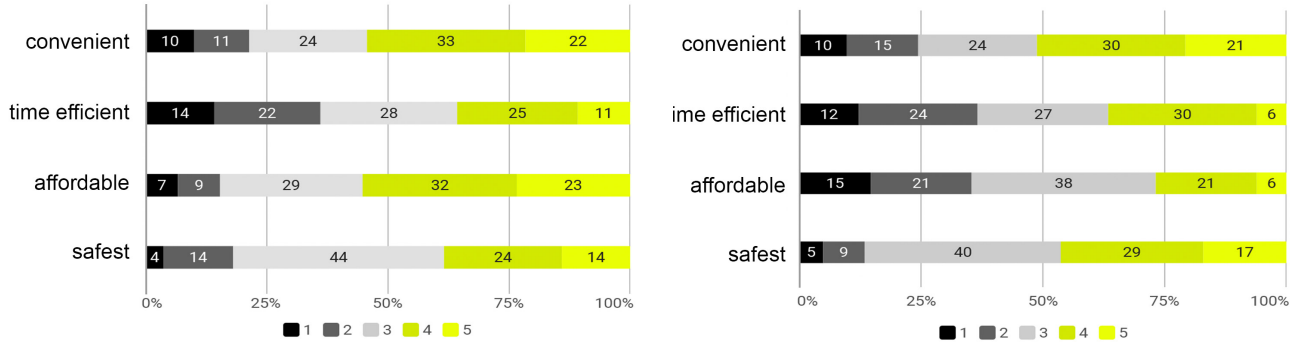


Fig. 58. Attitude towards public transport (bus), UiS&LiU

Attitude to walking

For this questions, the answers are as follows: For UIS, 52% said that walking to campus is convenient, 27% disagreed and 21% neutral; 12% said walking is time efficient 66% disagreed and 22% neutral; 5% said is not affordable, 7% neutral and 88% agreed; 53% said is safe walking to school, 33% chose neutral or do not know and 15% said it is not safe to walk to the campus.
For LiU, 52% said it is convenient with 13% disagreeing and 35% neutral; 9% said it is time efficient with 82% disagreeing and 9% neutral; 94% said it is affordable while only 4% disagreed. On safety, 60% said it is safe, only 11% said it is not safe with 29% staying neutral.

The respondents answering that walking is convenient in both universities is the same, this may be because of good accessibility and connectivity of pedestrian lanes especially the ones leading to the campuses from the dormitories and student living areas that are within the 500m walking range.
Furthermore, it might also be because the majority of the students in both universities do not use walking as their main mode of transport, this reason seems to tally with other answers for example, 66% and 82% disagreeing on walking being time efficient in both campuses showing that majority view their other transport mode (most likely car and public transport in UIS and cycling in LiU) as being more time efficient than walking, even though both see it as being safe and affordable.

Attitude to cycling

For this questions, the answers are as follows: For UiS, 61% said that cycling to campus is convenient, 16% disagreed and 23% neutral; 52% said cycling is time efficient 17% disagreed and 32% neutral; 3% said is not affordable, 16% neutral and 81% agreed; 21% said is safe cycling to school, 46% chose neutral or do not know and 34% said it is not safe to cycle to the campus.

For LiU, 80% said it is convenient with 5% disagreeing and 15% neutral; 86% said it is time efficient with 3% disagreeing and 11% neutral; 89% said it is affordable while only 4% disagreed. On safety, 26% said it is safe, 29% said it is not safe with 45% staying neutral.

The high percentage of respondent answering that its convenient to cycle to school in LiU shows that majority use this modal means of transport or are familiar with it, this can be confirmed in their latter answers on time efficient (86%) and affordability (89%), although some other factors might affect affordability, for example high bus ticket, free or subsidised bike maintenance and service, presence of pumping stations, free (used bike give away) or cheap bikes sale, high cost of car and maintenance cost, car parking ticket compared to free parking for bike etc.

Furthermore, assuming that the majority cycle to school, based on this result, we can confidently say that, either they can get to school quicker, faster by bike than any other modal choice, or the time taking to bike to school is about the same with other modal choices.

On the other hand, it seems like majority of students in UiS are familiar with this modal choice (with 61% saying its convenient, 81% affordability), but unlike LiU, seems sceptical to using it or have other modal choice in mind (since only 52% said it's time efficient compared to 86% LiU). This might be for other reasons, for example distance to their hostels or residence place, as this can encourage other time efficient transport modes like car and public transport.

Attitude to public transport (bus)

For this questions, the answers are as follows: For UiS, 55% said that public transport to campus is convenient, 21% disagreed and 24% neutral; 36% said public transport is time efficient 36% disagreed and 28% neutral; 16% said is not affordable, 29% neutral and 55% agreed; 38% said is safe taking public transport to school, 44% chose neutral or do not know and 18% said it is not safe to with public transport to the campus.

For LiU, 51% said it is convenient with 25% disagreeing and 24% neutral; 36% said it is time efficient with 36% disagreeing and 27% neutral; 27% said it is affordable while 36% disagreed and 38% neutral. On safety, 46% said it is safe, 14% said it is not safe with 40% staying neutral.

From their respective answers to public transport attitudes, it is safe to say that students from both campuses have similar attitudes towards it, as seen from the closeness of their answers. However, it seems like they are both using or prefer other modes of transport which is why the 36% on time efficiency from the students of both campuses.

Furthermore, this assumption is probably the reason for their answers on the question about affordability, in the case of UiS, 55% said it's affordable, it might be because they compare the cost of public transport to the cost of owning a car for example since that's the only other transport means in this survey that is most likely costlier than public transport ticket price.

On the other hand, for LiU with 27%, they may have compared it to cycling or walking for the reason that it's only the cheaper (cycling) and the cheapest (walking) option among the other modes of transportation in this survey, although, with their answers about cycling and walking, it can be concluded that they have in mind cycling.

Reasons and motivations for travel mode choices

Students were asked open ended questions about the reasons, motivations and obstacles for their choice of primary transport mode. These questions require in most cases detailed answers, therefore for proper representation and presentation, their answers were grouped under various categories. The categories and the answers vary depending on the primary transport mode, therefore detailed classification will be explained separately under analysis of each transport mode.

Why car

The first question is about the reason for driving a car. 18% of the respondents at UiS and 1% (1 person) at LiU drive cars as a main transport mode to and from campus.
Answers for this question are classified under the following categories: bad public transport, comfort, convenience, distance, flexibility, health, weather, price, time and other.

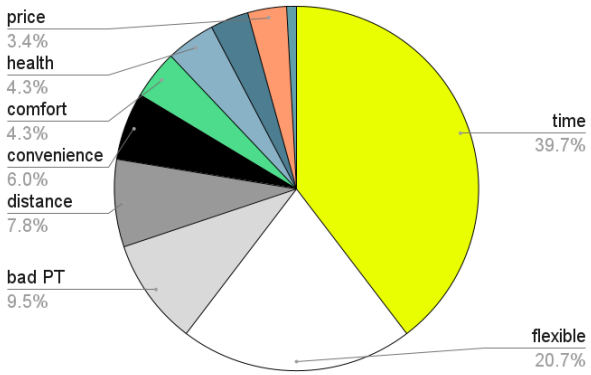


Fig. 59. Reasons fro driving car, UiS

Category bad public transport consists of answers such as bad public transport, no direct bus connection, low frequency, full bus, lack of bus connection, long distance to the bus stop, no buses available. Answers such as time, time efficient, quickest, shorter time than by other transport modes are categorised under time category. Answers such as flexibility, doing other things on

the way, going to work after the school or delivering kids to kindergarten are classified under flexibility. Cost category consists of the following answers: cheap, cost, costs same as bus. Answers such as distance, long way, long distance and live far are categorised as a distance category.

Others include Convenient, Easy, Health (health problems, health conditions), and Weather.
About 40% of the students at UiS choose to drive a car because it is time efficient. The second reason is flexibility (20,7%). Some of the respondents (9,5%) choose to drive a car due to bad public transport connection, long distances (8%), convenience (6%), comfort (4%), health (3,4%) and price (3,4%) and others (Fig. 59).

Again, consistently students identified travel time as the main reason behind their transport mode choice. This is consistent with their earlier answers in this survey, thus cementing the importance of time in determining travel mode choice especially for UiS students.

But time on its own is not complete because travel time is proportional to travel distance in most cases, thus it's important to dig deeper on why the students have chosen time as their most influential reason for car transport. There can be many reasons for this, it can be due to the long distances between the campus and students living locations, the study by Carse et al., (2013), found out that travel distance and work place car parking showed the strongest association with using a car to travel to work.
Furthermore, Carse et al., (2013) study also found that socio-demographic (including age, income etc) is next strongly associated with car commuting for both long and short trips to work, followed by access to car. Considering that the average age of students in UiS is 31, their socioeconomic status, they may have the means to own a car, and if there is parking space available at school, with their obligations and responsibilities, they will most likely use a car (Van Acker & Witlox, 2009).

Next on the list is flexibility, this answer denotes the ability to do other things during trip travel. Their socio-economic status means that they have a lot of other things to do and car use gives them that flexibility to do other things while maximising time.
Next is bad public transport, this category includes all the students' answers concerning public transport infrastructures. Some of the students' houses and residential living places are still not covered by any direct bus to the university as seen from the spatial analysis. Poor bus connections is seen as one of the reasons for car use as transport mode choice.

Knowing how important having good public transport access, connections and bus frequencies (especially in the rush hours) is, we can assume that those students who cite bad public transport as a reason for driving a car, might be persuaded to switch to public transport if the infrastructures are there.

The one person who drives a car at LiU answered that he/she drives a car to motivate him/her to study more at school than at home. The answer does not indicate any negative or positive aspects of any transport modes in this case.

Why walking

There are 26% walking to school in UiS and 12% in LiU.
For this question, the following categories are: distance, time, bad public transport, health, no bike, environment, convenience, practicality, cost and other.

Majority of the respondents at the UiS (78%) say they choose to walk to and from campus due to the short distance to the campus, this shows that living within 500m walking distance encourages walking.
Among other reasons for why students

chose walking are: bad public transport (4,6%), health benefits (4,6%), cost (3,4%), convenience, and other such as route quality.

At LiU, the main reasons for why students walk is that either they do not own/have a bike or do not know how to ride a bike (38,5%). There are many who do walk for health benefits and daily activity (23%), others walk because it is affordable (23%) and time efficient (15%).

The different motivations for walking at both universities are noticeable. The connection of walking to unavailability of the other transport mode (cycling) at LiU is striking.

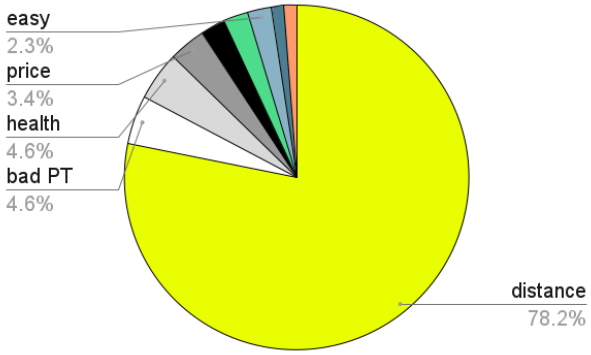


Fig. 60. Reasons for walking, UiS

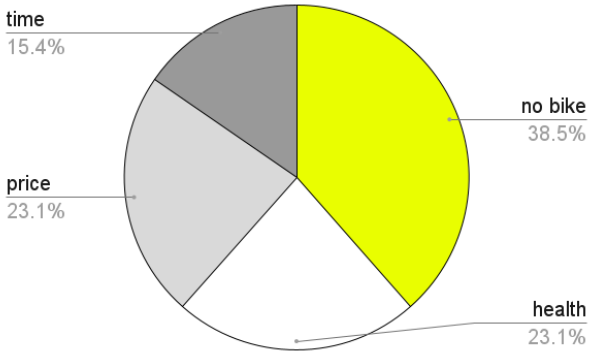


Fig. 61. Reasons for walking, LiU

At UiS walking is strongly dependent on the distance, while students at LiU believe that cycling would be a better option for them. This shows that cycling remains one of the top choices among the students in Linköping probably because of the cycling infrastructure (accessibility, connections etc) in Linköping.

Why cycling

There are 4% students cycling at UiS and 77% at LiU.

Following categories were defined for the question about reasons for choosing cycling as a main transport mode: time, cost, flexibility, habit, no car parking, environment, distance, health, convenience and other.

The main reasons for why students at UiS cycle are time efficiency (27%), affordability (15%), flexibility (12%) and others such as cycling being practical and comfortable. Almost 12% of the respondents have developed cycling as a habit, others choose cycling due to environmental impact (8%), distance to the university (8%) and unavailability of car parking facilities either at the places they live and at the campus (8%). It can be assumed that those who cycle because of time efficiency, live close to, or within 2, 3, 5km cycling distance from the university.

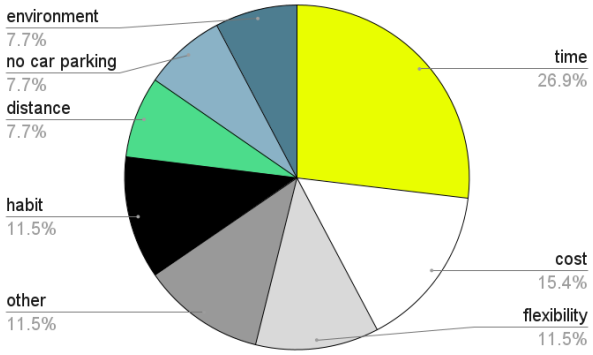


Fig. 62. Reasons for cycling, UiS

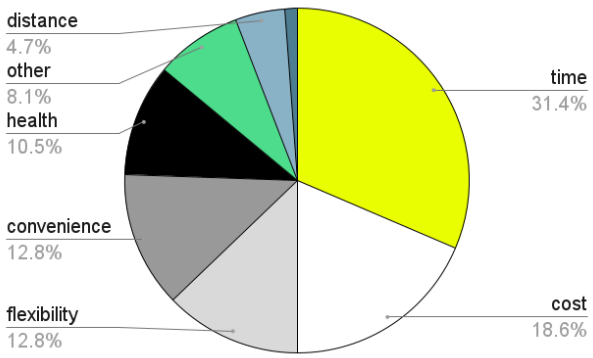


Fig. 63. Reasons for cycling, LiU

For the students at LiU, time (31%), affordability (19%) and flexibility (13%) are the main reasons for why they choose cycling as their main transport mode to/from campus. Among other reasons for cycling students mention: convenience (123%), health benefits (11%), distance (5%) and others such as good bike infrastructure, cycling being the best option, 1% of the respondents ride a bike to school as a habit.

Time efficiency, Affordability and Distance were the main reasons for cycling at both campuses, these are also listed as influencing cycling by therefore, should be concentrated on by planners to encourage cycling.

Why bus

There are 39% of students taking the bus at UiS and 4% at LiU.

The following categories are defined for this question: cost, time, the only option, convenience, good public transport, distance and other (safety, environment, no problems with car parking).

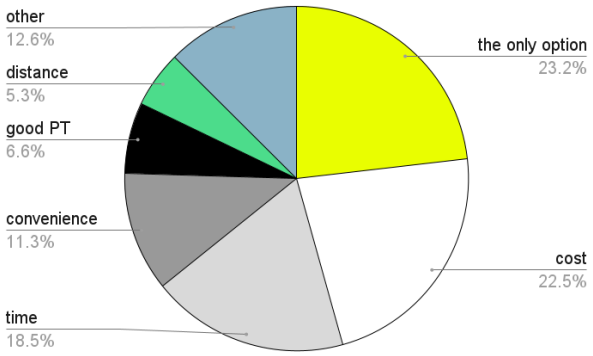


Fig. 64. Reasons for taking bus, UiS

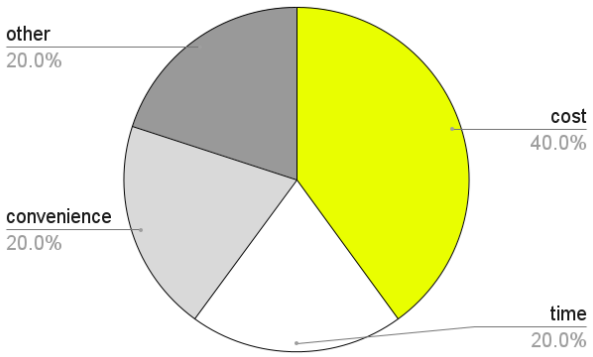


Fig. 65. Reasons for taking bus, LiU

At UiS, respondents said it is "the only option (including: no car, no driving licence, only option etc)" with 23.2% as the main reason. It can be assumed that these respondents live far from the school and there is a probability that they will switch to other modes of transport (especially cars) if they can.
The other reasons are 22.5% price and time with 18.5%, showing that public transport is competitive when it comes to costs compared to cars.
Among other reasons: it is convenient (11,3%), there is good public transport connection (6,6%) regarding the availability and frequency of the buses where the respondents live, distance (5,3%) and others (12,6%).

Reasons in LiU include, cost (40%), time 20%, convenience (20%) and bus being the only option available (20%).

Again, cost and time appear among the top favourites for choosing public transport as transportation

.

Reasons for not choosing sustainable tranport modes

In this part of the survey, students were asked why they do not use a particular sustainable travel mode.

Why not walking/cycling

Students (those who do not walk/cycle) from both universities were asked why not using walking/cycling as means of transport to and from campus.
Based on their answers, the following categories were defined: distance, time, no bike, effort, weather and other (own car, health issues).

The main reason why students at UiS do not walk or ride a bike to and from campus is due to the long distances (49,1%), followed by cycling being not time efficient (20,9%), and the effort of walking/cycling (9,1%)(Fig. 66).

Distance proves to be a strong obstacle for both walking and cycling at UiS, since many of the student residential locations are far away from the campus, it discourages these travel behaviours among students. Due to the distances and low connectivity of the bike network, cycling is not time efficient and requires a lot of effort from the user since there are other obstacles such as terrain topography, significant altitude on the bike routes and harsh weather conditions. Students mention they do not want to feel uncomfortable feeling sweaty during the day at school.

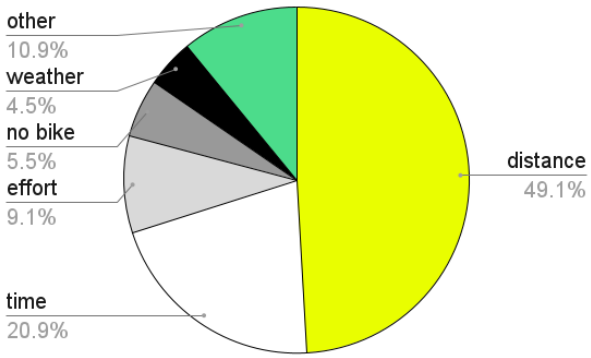


Fig. 66. Reasons for not walking/cycling, UiS

At LiU, the one respondent, who does not walk/cycle, said it is due to the weather and time. This could indicate that the person lives far from the campus and therefore neither walking nor cycling is efficient and difficult.

Why not bus

Students from both universities were asked why not using public transport as means of transport to and from campus.

Based on their answers the following categories were identified: time, bad public transport, cost and others (health, own car, weather, not flexible, not practical).

Almost half of the respondents at UiS do not take the bus because of time, meaning it is not time efficient (46,7%). Over 27% say there is not good bus connection, no direct bus connection and low frequency of buses and there are long distances to the bus stops from the place where they live (Fig. 67).

Almost 6% of the respondents resign from taking the bus due to the cost (5,7%), or because they own a car (3,8%), weather (1,9%) and other reasons such as health issues.

According to the only respondent at LiU, taking the bus takes a longer time meaning that he/she would consider the bus had it been competitive to car in terms of time.
Once again the overwhelming respondents saying time efficiency is the main reason

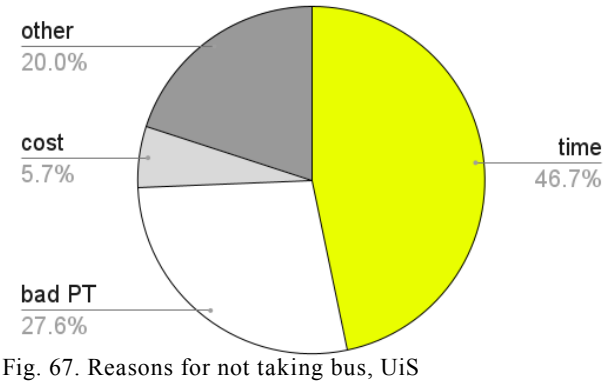


Fig. 67. Reasons for not taking bus, UiS

why they chose other transport mode (car) over bus. But time is directly proportional to distance, there can be many reasons for this, for example no direct bus connection, low frequency of buses, etc.

Most preferable travel mode choice instead of driving car

In this part, students were asked about their most preferable transport mode.

According to 37% of the respondents at UiS, public transport is their most viable and preferable travel mode. It might be because many of the respondents live far and would prefer bus as opposed to car travel, showing that long distances affect the mode choices of students and that public transport has the potential to be a competitive transport mode to car.

Other preferable transport modes are cycling with 17% respondents, and walking with 5%.

In LiU, according to the one respondent driving car, cycling is the most viable/ preferable travel mode, showing that cycling is seen as one of the best alternative and top transport mode among the students, this can be due to the high density and quality of the bike network in Linköping that gives high accessibility and connectivity. Bikes appear to be the most time efficient and convenient transport mode, and additionally cycling is cheaper and allows for maximum flexibility.

Other

Also, 100% of the respondents at UiS, who currently ride a bike, confirm that there is a possibility to park a bike at the university area within an average distance of 48,9m from the university buildings. 37% have access to the wardrobe facilities at the campus, 16% do not have the access and 47% do not know. (The total number of respondents that ride a bike to travel to and from campus is 4%, which is a minority of the respondents). According to the respondents, there is no access to bike maintenance stations at the university area and in the closests surroundings (37%), and 47% of the respondents do not know whether such facilities are present at the campus.

158m is an average distance that students need to walk to the closest bus stop from the university area.

At LiU, 100% of the respondents who ride a bike say they have the possibility to park at the university area within an average distance of 23,8m from the university buildings.
11% have access to the wardrobe facilities at the campus, 37% no and 52% don’t know.

findings

findings

The analysis shows both differences and similarities regarding travel behaviour, motivations, attitudes, obstacles etc, as well as the differences and similarities of the physical environments in both cases.

In this chapter, discussions on main findings from the analysis, confronting them with the literature to try to understand the influence of the physical environment on the current travel behaviour.

Walking, factors fostering walking as travel mode choice

Walking is one of the sustainable travel behaviours with potential to reduce car use especially on short trips. Short distances to destinations were found to encourage walking, with recommended walking distance being 500m (Campisi et al., 2020; Christian et al., 2011; Southworth, 2005). Short distance to campus was also highlighted in the survey as the main reason for walking at UiS thus confirming the strong dependence and influence of distance on walking. From the spatial analysis, 5 of the 16 dormitories in UiS and at LiU 2 of the 8 dormitories are located within 500m walking distance from the campus so it can be assumed that students living in those locations will most probably choose walking as the main transport mode to and from campus.

One of the factors that fosters walkability is accessibility and connectivity. Spatial analysis shows that pedestrian accessibility and connectivity at both universities are good and similar and should otherwise foster walkability.

Cycling, factors fostering cycling as students travel mode choice

Perhaps cycling is the most competitive sustainable transport mode that has the potential to replace car travel for short trips, especially those within 5km range, because of its flexibility.

The survey shows that 4% of the UiS students cycle to school while 77% of the LiU use bikes to commute to campus. According to Ellis et al., 2017, topography, weather and climate can foster or hinder cycling. The hilly terrain in Stavanger (within the analysed area), can be a potential barrier to cycling and can discourage cycling, as also confirmed from the UiS students answers in survey questions that travel effort discourage them from cycling to campus. The average altitude on the bike routes to the universities is about 60m with one route having 90m altitude. Additionally, the two dominant hills that surround the campus present a physical barrier for cycling. On the other hand, the terrain in LiU is mostly flat with average altitude on bike routes of about 6m, with highest altitude of 13m. The flat terrain is attractive for cyclists .

Another important factor that affects cycling is distance, distance to destinations and facilities are known to encourage willingness to cycle and distance of 2, 3 and 5 km have all been said to be within cycling range (Zacharias, 2005; Shen et al., 2018; Yang & Zacharias, 2016).

In UiS, the majority of the 16 students dormitories are within 5km cycling distance range, 7 are within 2 km, 4 are within 3 km and 2 are within 5km. There are 2 dormitories that are outside the 5km cycling range with one located about 12km from the campus. Although most of the dormitories are within 5km cycling range, most students, they only house less than 2000 students of the almost 12000 students at UiS, thus majority living nearby in the city. Spatial analysis of residential areas with the most populated student age group shows that most of them are not accessible by cycling. Thus, most of the 12000 UiS students live in areas not accessible by bike. This was also confirmed in the survey with more than 70% of the UiS students saying that distance and time are the reasons why they choose not to cycle to school.

This is not the case in LiU, almost all the students of about 20000 live in the student dormitories with all the dormitories within 3km cycling distance. Thus facilitating cycling.

Also, cycling infrastructure was another factor that can encourage cyclists, infrastructure availability was found to have influence on travel mode choice (Marqués et al., 2015; Pucher & Buehler, 2016).

In most routes to the campus and in the stavanger city as a whole, there are presence of cycling infrastructure, most routes have separate bike/pedestrian lanes, however most lanes seem to be fragmented and there are many signs of discontinuity and according to Pereira Segadilha and Penha Sanches (2014) are rarely used by cyclist.

On the other hand, the bike network in LiU seems to be very dense and continuous, probably one of the reasons cycling is popular among the students.

There were many other differences and similarities in available infrastructure at both campuses that were found to have or have contributed to the cycling culture. For example, the presence of dedicated bike lanes, found to facilitate travel for work or school (Andrade et al., 2014), were found less in Stavanger but much more in LiU. Intersections and crossings on the bike lanes were also found to be another factor that can discourage cycling (Solli et al., 2016; Opheim Ellis & Øvrum, 2015), the presence of a more dedicated cycle lane in LiU allows for less intersections and crossings, giving the perception of a safe cycle route.

It was found that presence of greenery along cycle lanes are welcomed by cyclist (Fraser & Lock, 2010; Frank et al., 2006), and are present on some of the routes to UiS campuses but much more in LiU with some route even going through nature reserve (Vallaskogen Nature Reserve Park) which will be highly appreciated for students going through that route every day to campus.

Furthermore, it was found that there are many bike parking facilities in LiU and students are allowed to park near their lecture room, along the axis and as close to their destination as possible while in UiS there are few parking spaces at the campus and most seems to be at the outer edge of the buildings. Also, there are good number of parking facilities at each of the dormitories in LiU than in UiS, there many marked dedicated parking spaces and presence of bike service and maintenance facilities including pumping stations at LiU, in UiS seems to be scarce and unmarked unplanned with no service or maintenance facility/ies around, although some of the newer dormitories in UiS do have dedicated bike parking place like as in Sørmarka with roofed parking.

Public transport, factors fostering bus travel as students travel mode choice

One of the sustainable travel modes with the capacity of reducing personal car use is public transport. One of the factors affecting choice of travel mode is distance to destination, both personal car and public transport have the potential to satisfy long distance travellers, and while the former is associated with long vehicle miles travelled and increased C02 emission, the latter result in fewer vehicle miles travelled and reduced emission.

The spatial analysis showed that public transport demand at both campuses is also time dependent with many buses more frequent during the rush hours (early morning and evening). However, for both campuses, some of the students' dormitories and residential living areas are still not covered or not accessible by bus. However, unlike UiS, almost all the dormitories in LiU have good bike coverage since they are within 3km. Bad bus connections were amongst the many reasons students at UiS highlighted as reasons they chose other transport modes instead of buses.

Time and flexibility were two most important reasons UiS students answered motivated them to choose personal car for transport, since time is proportional to distance to destination, and flexibility close to convenient, if bus transport can provide these features then there is a high chance that personal car travellers might be persuaded to switch to public transport.

According to Polat (2012), travel time includes for example walk (access) time, waiting time and in journey time. Distance to the bus stop (access time) should be less than 500m or about 10 minutes. Polat (2012) argues that reliability is another measure of public transport patronage, longer waiting times due to late arrival of bus and excessive in-vehicle waiting time cause mainly by traffic stops, bus stops (to let in and let out passengers) and system failures reduce reliability of the public transport (Sam et al., 2014).

Another point that was raised in the survey was cost, a good number of the respondents said cost is the reason for choosing public transport. Bresson et al. (2004) argue that the relationship between cost and public transport patronage is inversely proportional. It is obvious that for example free public transport or considerably reduced ticket fees will ultimately persuade a lot more students to switch to public transport.

The survey also showed that personal car travellers love the comfort they get, this is one of the major obstacles public transport has to overcome to win over personal car travellers. Comfort affects public transport demand (Polat, 2012), amongst others overcrowding, seating arrangements, leg room, waiting time etc (Sam e al., 2014) should all be addressed to increase public transport demand.

The answers from the survey from UiS students showed among others that there is an overwhelming preference for personal cars over sustainable travel modes in general including public transport.

Although public transport has the potential to displace personal car travel among UiS students, from the survey it is pretty clear it has a lot to overcome in order to compete with personal car travel.

conclusions

This thesis set out to find how to foster sustainable travel behaviour among UiS students through the physical environment. To answer the research question, several sub questions were identified which guided the research and structure of the thesis.
The methodology was comparative case study of two similar university with different behaviour to transport mode choice.
It was found through spatial and non-spatial analysis that there are some similarities as well as differencies regarding factors influencing travel behaviour and that helped answer the reseach question on how to foster sustainable travel behaviour at UiS.

In this chapter, a guideline or set of recommendations for how to foster sustainable travel behaviour among UiS students will be proposed. This consists of both short term and long term recommendations. Apart from recommendations about improvement of bike and bus accessibility it proposes multimodal transport mode of bus-bike mobility as well as suggests more focus on electric bikes.

Public transport proved to be the main transport mode of the students at uis (39%) and also the most viable transport mode instead of car. This shows that there is a big potential in public transport becoming the primary sustainable transport mode of students in Stavanger.

There are many advantages of public transport that make it potentially competitive to cars.
It allows travel over long distances the same as a car and often for a relatively lower price. Travelling by bus is convenient and students do not need to worry about availability of parking spaces at different destinations, safety or weather. However there are still many aspects of travelling by bus that need to be addressed to make it the most preferred transport mode rather than car. This is for example low availability and connectivity of public transport due to low frequency of the buses and lack of direct bus connections at some of the students' residential locations including dormitories.

Below are recommendations for public transport improvement:

Direct bus connection to all the student houses and with bus stops located within max. 500m walking distance from all the dormitories.

- Direct bus connections to other currently uncovered location such as Tasta, Madla Kvernevik, Hillevåg and especially to all the central parts of the city where over 40% of young people reside
- Increased frequency of buses connecting central parts of the city with campus
- Higher frequency on all the buses connecting campus with the city, with minimum frequency of 15min.
- Incentives for students e.g cheaper ticket or student price that much cheaper
- Quality, especially reliability of bus time, in-bus service should be improved.

In Stavanger the transport mode that enables for high flexibility, time efficiency as of today is the car. The flexibility of public transport is limited to the routes and frequency of the buses. Bike is another flexible transport mode but it has limitations when it comes to distances and hilly terrain and weather. Electric bikes allow for travelling over longer distances with little or no effort and gives similar flexibility to traditional cycling as far as there is good availability of e-bike stations both at hostels, campus and on the routes.

Cycling is one of the most important sustainable transport modes which is first of all affordable and allows for similar flexibility of travel as cars do, however there are many limitations for cycling, especially in Stavanger. These are for example long distances between the different destinations and the campus and hilly terrain with significant altitudes. Therefore it is concluded that electric bikes are a more preferable version of traditional cycling to be fostered in Stavanger and with potentially better results of adaptation and higher use. Although in order to foster electric bike use, there is need for general improvements in bike network in Stavanger:

- Need for more continuous bike network that is intuitive and accessible with minimum of barriers in form of crossings and dead ends, especially the routes between the campus and dormitories and route between the city centre and the campus
- Parking places at the campus within the axis, Close to the main entrances to enable door to door trip
- Denser network
- More dedicated paths located on the streets
- Localisation of more statations (docking stations for e-bike) and bikes available at the student houses and at the campus
- Localisation of the ebike stations along the routes
- Situations of e-bike docking stations at as many bus stop, transit stops as possible

Multimodal transport modes

The low flexibility of public transport can be improved by combining cycling and bus as multimodal transport modes. This enables the user to get quickly to the closest bus stop, take a bus and travel for longer distances than he would with a bike and still gives him the flexibility during the trip to go other places by bike.

Synchronisation between e bike stations, bus stops, possibility to take bike by buses, free of charge especially for students.

Other

Future location of dormitories should be strategically planned to be within walking and cycling distance to the campus (for walking - 500m distance, for cycling - 2 and 3km), given the hilly terrain on the north of campus, the preferable location of dormitories is on the south of the campus to minimise terrain barriers for traditional cycling.

references

Aarts, H., Verplanken, B., & Knippenberg, A. (1998). Predicting Behavior from Actions in the Past: Repeated Decision Making or a Matter of Habit? *Journal of Applied Social Psychology*, *28*(15), 1355-1374. doi:10.1111/j.1559-1816.1998.tb01681.x

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211. doi:10.1016/0749-5978(91)90020-T

Andrade, V., Jensen, O. B., Harder, H., & Madsen, J. C. O. (2014). Bike Infrastructures and Design Qualities: Enhancing Cycling. *Danish Journal of Geoinformatics and Land Management*, *46*(1), 65-80. doi:10.5278/ojs.tka.v119i46.593

Baobeid, A., Koç, M., & Al-Ghamdi, S. G. (2021). Walkability and Its Relationships With Health, Sustainability, and Livability: Elements of Physical Environment and Evaluation Frameworks. *Frontiers in Built Environment*, *7*. doi:10.3389/fbuil.2021.721218

Barajas, J. M. (2021). The roots of racialized travel behavior. *Advances in Transport Policy and Planning*, *8*, 1-31. doi:10.1016/bs.atpp.2021.06.007

Bargh, J. A. (1990). Auto-motives: Preconscious determinants of thought and behavior. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (pp. 93-130). New York: Guilford Press.

Bergström, A., & Magnusson, R. (2003). Potential of transferring car trips to bicycle during winter. *Transportation Research Part A: Policy and Practice*, *37*(8), 649-666. doi:10.1016/s0965-8564(03)00012-0

Börjesson, M., & Eliasson, J., (2015). The benefits of cycling: Viewing cyclists as travellers rather than non-motorists. In Parkin, J. (Ed.), Cycling and sustainability (pp. 247-268). Retrieved from https://books.google.no/books?hl=en&lr=&id=udHnhvyutykC&oi=fnd&pg=PP1&dq=cycling+and+sustainability+parkin&ots=32ELnw3_8H&sig=OX5w7DtuR9kP9aJ025MfjCo-AfA&redir_esc=y#v=onepage&q=cycling%20and%20sustainability%20parkin&f=false

Campisi, T., Basbas, S., Tesoriere, G., Trouva, M., Papas, T., & Mrak, I. (2020). How to Create Walking Friendly Cities. A Multi-Criteria Analysis of the Central Open Market Area of Rijeka. *Sustainability*, *12*(22), 9470. doi:10.3390/su12229470

Carse, A., Goodman, A., Mackett, R. L., Panter, J., & Ogilvie, D. (2013). The factors influencing car use in a cycle-friendly city: The case of Cambridge. *Journal of Transport Geography*, *28*, 67-74. doi:10.1016/j.jtrangeo.2012.10.013

Cervero, R. (2002). Built environments and mode choice: Toward a normative framework. *Transportation Research Part D: Transport and Environment*, *7*(4), 265-284. doi:10.1016/s1361-9209(01)00024-4

Cervero, R. (1996). Mixed land-uses and commuting: Evidence from the American Housing Survey. *Transportation Research Part A: Policy and Practice*, *30*(5), 361-377. doi:10.1016/0965-8564(95)00033-X

Cervero, R., & Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design. *Transportation Research Part D: Transport and Environment*, *2*(3), 199-219. doi:10.1016/s1361-9209(97)00009-6

Christensen, L., & Jensen, T. C. (2008). *Korte ture i bil, Kan bilister ændre adferd til gang eller cykling* (3 2008). Retrieved from DTU Transport website: https://backend.orbit.dtu.dk/ws/portalfiles/portal/3201868/rapport_endelig.pdf

Christian, H. E., Bull, F. C., Middleton, N. J., Knuiman, M. W., Divitini, M. L., Hooper, P., … Giles-Corti, B. (2011). How important is the land use mix measure in understanding walking behaviour? Results from the RESIDE study. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 55. doi:10.1186/1479-5868-8-55

Christiansen, P., Engebretsen, Ø., Fearnley, N., & Usterud Hanssen, J. (2017). Parking facilities and the built environment: Impacts on travel behaviour. *Transportation Research Part A: Policy and Practice*, *95*, 198-206. doi:10.1016/j.tra.2016.10.025

City population. (2022). Linköping (Municipality, Östergötland, Sweden) - Population statistics, charts, map and location. Retrieved from https://citypopulation.de/en/sweden/admin/%C3%B6sterg%C3%B6tland/0580__link%C3%B6ping/

Mæhlum, L. (2020). Linköping – Store norske leksikon. Retrieved from https://snl.no/Link%C3%B6ping#-Kommunen

Clark, J. (2020). Types of electric bikes a beginner's guide L Velospeed. Retrieved from https://www.velospeed.co.uk/different-types-of-electric-bikes/

Climates to travel. (n.d.). Climates to travel. World climate guide. Retrieved from https://www.climatestotravel.com/

Coogan, M., Spitz, G., Adler, T., McGuckin, N., Kuzmyak, R., & Karash, K. (2018). *Understanding changes in demographics, preferences, and markets for public transportation* (201). Retrieved from National Academy of Sciences website: doi.org/10.17226/25160

Crompton, A., & Brown, F. (2006). Distance estimation in a small-scale environment. *Environment and Behavior*, *38*(5), 656-666. doi:10.1177/0013916505281571

Delclòs-Alió, X., Marquet, O., Vich, G., Schipperijn, J., Zhang, K., Maciejewska, M., & Miralles-Guasch, C. (2019). Temperature and rain moderate the effect of neighborhood Walkability on walking time for seniors in Barcelona. *International Journal of Environmental Research and Public Health*, *17*(1), 14. doi:10.3390/ijerph17010014

DeMaio, P. (2009). Bike-sharing: History, impacts, models of provision, and future. *Journal of Public Transportation*, *12*(4), 41-56. doi:10.5038/2375-0901.12.4.3

Ding, C., Wang, D., Liu, C., Zhang, Y., & Yang, J. (2017). Exploring the influence of built environment on travel mode choice considering the mediating effects of car ownership and travel distance. *Transportation Research Part A: Policy and Practice*, *100*, 65-80. doi:10.1016/j.tra.2017.04.008

El-Assi, W., Salah Mahmoud, M., & Nurul Habib, K. (2017). Effects of built environment and weather on bike sharing demand: A station level analysis of commercial bike sharing in Toronto. *Transportation*, *44*(3), 589-613. doi:10.1007/s11116-015-9669-z

El-Geneidy, A., Grimsrud, M., Wasfi, R., Tétreault, P., & Surprenant-Legault, J. (2013). New evidence on walking distances to transit stops: Identifying redundancies and gaps using variable service areas. *Transportation*, *41*(1), 193-210. doi:10.1007/s11116-013-9508-z

Etminani-Ghasrodashti, R., & Ardeshiri, M. (2015). Modeling travel behavior by the structural relationships between lifestyle, built environment and non-working trips. *Transportation Research Part A: Policy and Practice*, *78*, 506-518. doi:10.1016/j.tra.2015.06.016

Ewing, R., & Cervero, R. (2001). Travel and the built environment: A synthesis. *Transportation Research Record: Journal of the Transportation Research Board*, *1780*(1), 87-114. doi:10.3141/1780-10

Ewing, R., & Cervero, R. (2010). Travel and the built environment. *Journal of the American Planning Association*, *76*(3), 265-294. doi:10.1080/01944361003766766

Fasan, E., Tight, M., & Evdorides, H. (2021). Factors influencing cycling among secondary school adolescents in an ethnically diverse city: The perspective of Birmingham transport stakeholders. *Sustainability*, *13*(22), 12400. doi:10.3390/su132212400

Fishman, E., Schepers, P., & Kamphuis, C. B. M. (2015). Dutch cycling: Quantifying the health and related economic benefits. *American Journal of Public Health*, *105*(8), e13-e15. doi:10.2105/ajph.2015.302724

Frank, L. D., Sallis, J. F., Conway, T. L., Chapman, J. E., Saelens, B. E., & Bachman, W. (2006). Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality. *Journal of the American Planning Association*, *72*(1), 75-87. doi:10.1080/01944360608976725

Fraser, S. D., & Lock, K. (2010). Cycling for transport and public health: A systematic review of the effect of the environment on cycling. *European Journal of Public Health*, *21*(6), 738-743. doi:10.1093/eurpub/ckq145

Grande, I. T., Husebø, D., Kolstrup, G., Strand Rangnes, B., & Haniffa, M. F. (2019). *Campusutviklingsplan for Universitetet i Stavanger*. Retrieved from https://docplayer.me/143158918-Campusutviklingsplan-for-universitetet-i-stavanger.html

Gregg, E. W., Gerzoff, R. B., Caspersen, C. J., Williamson, D. F., & Narayan, K. M. (2003). Relationship of walking to mortality among US adults with diabetes. *Archives of Internal Medicine*, *163*(12), 1440-1447. doi:10.1001/archinte.163.12.1440

Groch, R. (1996). *Neotraditional Neighborhood Development: A Critical Look*. (Master Thesis, University of Rhode Island). doi:10.23860/thesis-groch-roberta-1996

Ha, J., Lee, S., & Ko, J. (2020). Unraveling the impact of travel time, cost, and transit burdens on commute mode choice for different income and age groups. *Transportation Research Part A: Policy and Practice*, *141*, 147-166. doi:10.1016/j.tra.2020.07.020

Hagen, O. H., & Rynning, M. K. (2021). Promoting cycling through urban planning and development: A qualitative assessment of bikeability. *Urban, Planning and Transport Research*, *9*(1), 276-305. doi:10.1080/21650020.2021.1938195

Hamidi, Z., & Zhao, C. (2020). Shaping sustainable travel behaviour: Attitude, skills, and access all matter. *Transportation Research Part D: Transport and Environment*, *88*, 102566. doi:10.1016/j.trd.2020.102566

Hasnine, M. S., Dianat, A., & Habib, K. N. (2020). Investigating the factors affecting the distance travel and health conditions of E-bikE users in Toronto. *Transportation Research Interdisciplinary Perspectives*, *8*, 100265. doi:10.1016/j.trip.2020.100265

Helle-Olsen, K., Worsøe, O. I., & Frøyland Pallesen, P. F. (2009). *Vakre landskap i Rogaland*.

Hipp, J. A., Gulwadi, G. B., Alves, S., & Sequeira, S. (2016). The relationship between perceived greenness and perceived Restorativeness of University campuses and student-reported quality of life. *Environment and Behavior*, *48*(10), 1292-1308. doi:10.1177/0013916515598200

Holland, P. (2019). What is a simple definition of the physical environment? - eNotes.com. Retrieved from https://www.enotes.com/homework-help/what-simple-deffinition-physical-environment-thank-369776

Holt, R. T., & Turner, J. E. (Eds.). (1970). *The methodology of comparative research: A symposium from the center for comparative studies in technological development and social change and the Department of Political Science, University of Minnesota*. Free Press.

Hu, F. B., Sigal, R. J., Rich-Edwards, J. W., Colditz, G. A., Solomon, C. G., Willett, W. C., … Manson, J. E. (1999). Walking compared with vigorous physical activity and risk of type 2 diabetes in women. *JAMA*, *282*(15), 1433-1439. doi:10.1001/jama.282.15.1433

Jackson, T. (2005). *Motivating sustainable consumption: A review of evidence on consumer behaviour and behavioural change : a report to the sustainable development research network*. Retrieved from https://timjackson.org.uk/wp-content/uploads/2018/04/Jackson.-2005.-Motivating-Sustainable-Consumption.pdf

Julin, E., Hennius, M., Hermansson, Å., Gunnarsson, G. M., & Olsson, C. (2016). *Regional landskapsanalys för Östergötland* (2016/17). Retrieved from Länsstyrelsen Östergötland website: http://ext-dokument.lansstyrelsen.se/Ostergotland/Planeringskatalogen/Regionallandskapsanalysforostergotland.pdf

Karki, T. K., & Tao, L. (2016). How accessible and convenient are the public bicycle sharing programs in China? Experiences from Suzhou city. *Habitat International*, *53*, 188-194. doi:10.1016/j.habitatint.2015.11.007

Keall, M. D., Shaw, C., Chapman, R., & Howden-Chapman, P. (2018). Reductions in carbon dioxide emissions from an intervention to promote cycling and walking: A case study from New Zealand. *Transportation Research Part D: Transport and Environment*, *65*, 687-696. doi:10.1016/j.trd.2018.10.004

King, K. E., & Clarke, P. J. (2014). A disadvantaged advantage in Walkability: Findings from socioeconomic and geographical analysis of national built environment data in the United States. *American Journal of Epidemiology*, *181*(1), 17-25. doi:10.1093/aje/kwu310

Kommuner i siffror SCB. (n.d.). Kommuner I siffror. Retrieved from https://kommunsiffror.scb.se/?id1=0580&id2=null

Langeland, P. (2019). *Frå bilavhengige byar til berekraftig mobilitet* (Master's thesis, University of Stavanger, Stavanger, Norway). Retrieved from https://uis.brage.unit.no/uis-xmlui/handle/11250/2625279

Lea, R. (2012). *Klimaeffekt av økt sykling og gåing, og suksesskriterier for økt sykling*. Retrieved from https://www.regjeringen.no/globalassets/upload/sd/vedlegg/sykling_rapport_130222_civitas.pdf

Li, M., Zou, M., & Li, H. (2019). Urban travel behavior study based on data fusion model. In Y. Wang & Z. Zeng (Eds.), *Data-driven solutions to transportation problems* (pp. 111-134). doi:10.1016/C2018-0-01303-1

Limtanakool, N., Dijst, M., & Schwanen, T. (2006). The Influence of Socioeconomic Characteristics, Land Use and Travel Time Considerations on Mode Choice for Medium- and Longer-distance Trips. *Journal of Transport Geography*, *14*(5), 327-341. doi:10.1016/j.jtrangeo.2005.06.004

Linder, N., Giusti, M., Samuelsson, K., & Barthel, S. (2021). Pro-environmental habits: An underexplored research agenda in sustainability science. *Ambio*, *51*(3), 546-556. doi:10.1007/s13280-021-01619-6

Linköping. (n.d.). Fakta och statistik. Retrieved from https://www.linkoping.se/businesslinkoping/naringslivet/fakta-och-statistik/

Linköping. (2022). Befolkning. Retrieved from https://www.linkoping.se/kommun-och-politik/fakta-om-linkoping/statistik/linkoping-i-siffror/befolkning/

Linköping. (2022, February 28). Vintercykla. Retrieved from https://www.linkoping.se/stadsplanering-och-trafik/cykel/kampanjsidor-cykel/vintercykla/

Linköping University. (n.d.). Visit Linköping University. Retrieved from https://liu.se/en/article/visit-linkoping-university

Linköping University. (2022, April 4). Campus Valla. Retrieved from https://liu.se/en/article/campus-valla

Litman, T. A. (2003). Economic value of Walkability. *Transportation Research Record: Journal of the Transportation Research Board*, *1828*(1), 3-11. doi:10.3141/1828-01

Liu, J., Zhou, J., & Xiao, L. (2021). Built environment correlates of walking for transportation: Differences between commuting and non-commuting trips. *Journal of Transport and Land Use*, *14*(1), 1129-1148. doi:10.5198/jtlu.2021.1933

Lo, R. H. (2009). Walkability: What is it? *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, *2*(2), 145-166. doi:10.1080/17549170903092867

Loftsgarden, T., Opheim Ellis, I., & Øvrum, A. (2015). *Målrettede sykkeltiltak i fire byområder: Resultater fra et Transnovaprosjekt* (55/2015). Retrieved from Urbanet Analyse website: https://s3.eu-west-1.amazonaws.com/rr-urbanet/Filer-Dokumenter/UArapport_55_2015_Hovedrapport_Transnova-sykkel.pdf

Montello, D. R. (1997). The perception and cognition of environmental distance: Direct sources of information. In S. C. Hirtle & A. U. Frank (Eds.), *Spatial information theory: A theoretical basis for GIS* (pp. 297-311). doi:10.1007/3-540-63623-4_57

Marqués, R., Hernández-Herrador, V., Calvo-Salazar, M., & García-Cebrián, J. (2015). How infrastructure can promote cycling in cities: Lessons from Seville. *Research in Transportation Economics*, *53*, 31-44. doi:10.1016/j.retrec.2015.10.017

Neves, A., & Brand, C. (2019). Assessing the potential for carbon emissions savings from replacing short car trips with walking and cycling using a mixed GPS-travel diary approach. *Transportation Research Part A: Policy and Practice*, *123*, 130-146. doi:10.1016/j.tra.2018.08.022

Nielsen, T. A., Olafsson, A. S., Carstensen, T. A., & Skov-Petersen, H. (2013). Environmental correlates of cycling: Evaluating urban form and location effects based on Danish micro-data. *Transportation Research Part D: Transport and Environment*, *22*, 40-44. doi:10.1016/j.trd.2013.02.017

Næss, P. (2015). Built environment, causality and travel. *Transport Reviews*, *35*(3), 275-291. doi:10.1080/01441647.2015.1017751

Opheim Ellis, I., & Øvrum, A. (2015). *Parkering som virkemiddel. Trafikantenes vektlegging av ulike parkeringsrestriksjoner* (65/2015). Urbanet Analyse.

Pereira Segadilha, A. B., & Penha Sanches, S. D. (2014). Identification of factors that influence cyclists route choice. *Procedia - Social and Behavioral Sciences*, *160*, 372-380. doi:10.1016/j.sbspro.2014.12.149

Physical environment. (2003). Retrieved from https://socialreport.msd.govt.nz/2003/physical-environment/physical-environment.shtml

Polat, C. (2012). The demand determinants for urban public transport services: A review of the literature. *Journal of Applied Sciences*, *12*(12), 1211-1231. doi:10.3923/jas.2012.1211.1231
Pucher, J., & Buehler, R. (2016). Safer cycling through improved infrastructure. *American Journal of Public Health*, *106*(12), 2089-2091. doi:10.2105/ajph.2016.303507

Pucher, J., Dill, J., & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventive Medicine*, *50*, S106-S125. doi:10.1016/j.ypmed.2009.07.028
Rasca, S., & Saeed, N. (2022). Exploring the factors influencing the use of public transport by commuters living in networks of small cities and towns. *Travel Behaviour and Society*, *28*, 249-263. doi:10.1016/j.tbs.2022.03.007

Ray Pritchard, R., & Lovelace, R. (2022). *Sykkelpotensial og bysykler. En beregning av potensialet for økt hverdagssykling og evaluering av bysykkelordningene på Nord-Jæren, i Trondheim og i Bergen* (14-2022). Retrieved from NORCE Helse og samfunn website: https://norceresearch.brage.unit.no/norceresearch-xmlui/bitstream/handle/11250/2994058/Sykkelpotensial+Bysykkel+Rapport+Endelig_korr.pdf?sequence=1

Riggs, W. (2019). Perception of safety and cycling behaviour on varying street typologies: Opportunities for behavioural economics and design. *Transportation Research Procedia*, *41*, 204-218. doi:10.1016/j.trpro.2019.09.039

Rodriguez, D. A., & Joo, J. (2004). The relationship between non-motorized mode choice and the local physical environment. *Transportation Research Part D: Transport and Environment*, *9*(2), 151-173. doi:10.1016/j.trd.2003.11.001

Rohrer, J., Pierce, J., & Denison, A. (2004). Walkability and self-rated health in primary care patients. *BMC Family Practice*, *5*(1). doi:10.1186/1471-2296-5-29

Ronis, D.L., Yates, J.F. & Kirscht, J.P. (1989). Attitudes, decisions, and habits as determinants of repeated behavior". In A. R. Pratkanis, S. J. Breckler, & A. G. Greenwald (Eds.), *Attitude Structure and Function* (pp. 213-239). Retrieved from https://www.taylorfrancis.com/books/mono/10.4324/9781315801780/attitude-structure-function-anthony-pratkanis-steven-breckler-anthony-greenwald

Rotaris, L., & Danielis, R. (2015). Commuting to college: The effectiveness and social efficiency of transportation demand management policies. *Transport Policy*, *44*, 158-168. doi:10.1016/j.tranpol.2015.08.001

Sam, E. F., Adu-Boahen, K., & Kissah-Korsah, K. (2014). Assessing the factors that influence public transport mode preference and patronage: Perspectives of students of University of Cape Coast (UCC), Ghana. *International Journal of Development and Sustainability*, *3*(2), 323-336. Retrieved from https://www.researchgate.net/publication/265407953_Assessing_the_factors_that_influence_public_transport_mode_preference_and_patronage_Perspectives_of_students_of_University_of_Cape_Coast_UCC_Ghana

Sartori, G. (1991). Comparing and Miscomparing. *Journal of Theoretical Politics*, *3*(3), 243-257. Retrieved from https://www.academia.edu/15276248/Comparing_and_Miscomparing_-_Giovanni_Sartori_1991_

Sener, I. N., Eluru, N., & Bhat, C. R. (2009). An analysis of bicycle route choice preferences using a web-based survey to examine bicycle facilities. *Transportation*, *36*(5), 511-539. Retrieved from https://www.researchgate.net/publication/229006754_An_analysis_of_bicycle_route_choice_preferences_using_a_web-based_survey_to_examine_bicycle_facilities

Shay, E., Spoon, S. C., & Khattak, A. J. (2004). *Walkable Environments and Walking Activity*. Retrieved from https://www.researchgate.net/publication/228954384_Walkable_Environments_and_Walking_Activity

Shen, Y., Zhang, X., & Zhao, J. (2018). Understanding the usage of dockless bike sharing in Singapore. *International Journal of Sustainable Transportation*, *12*(9), 686-700. doi:10.1080/15568318.2018.1429696

Shannon, T., Giles-Corti, B., Pikora, T., Bulsara, M., Shilton, T., & Bull, F. (2006). Active commuting in a university setting: Assessing commuting habits and potential for modal change. *Transport Policy*, *13*(3), 240-253. doi:10.1016/j.tranpol.2005.11.002

Smith, T. C., Wingard, D. L., Smith, B., Kritz-Silverstein, D., & Barrett-Connor, E. (2007). Walking decreased risk of cardiovascular disease mortality in older adults with diabetes. *Journal of Clinical Epidemiology*, *60*(3), 309-317. doi:10.1016/j.jclinepi.2006.06.013

Solli, H., Wergeland Haug, T., Malmin, O. K., & Ellis, I. O. (2016). *Transportstandard for Sykkel: Vurdering av ulike faktorer* (Rapport 75/2016). Retrieved from https://vegvesen.brage.unit.no/vegvesen-xmlui/bitstream/handle/11250/2679910/Transportstandard%20for%20sykkel.pdf?sequence=1&isAllowed=y

Southworth, M. (2005). Designing the walkable city. *Journal of Urban Planning and Development*, *131*(4), 246-257. doi:10.1061/(asce)0733-9488(2005)131:4(246)

Statistisk sentralbyrå [ssb.no].Retrieved from https://www.ssb.no/

Statistiska centralbyrån. (2013). *Markanvändningen I sverige: Land use in Sweden* (6th ed.). SCB.

Stopher, P. R., Wilmot, C. G., Stecher, C., & Alsnih, R. (n.d.). Household travel surveys: Proposed standards and guidelines. *Travel Survey Methods*, 1-58. doi:10.1108/9780080464015-002

Studentbostader. (n.d.). Studentbostäder I Linköping AB. Retrieved from https://www.studentbostader.se/en/

Studentsamskipnaden i Stavanger. (n.d.). Bolig – MIN sis. Retrieved from https://minsis.no/bolig

Swanson, G. E. (1973). Frameworks for comparative research: structural anthropology and the theory of action. In I. Vallier (Ed.), *Comparative methods in sociology: Essays on trends and applications* (pp. 141-150). Retrieved from https://books.google.no/books?hl=en&lr=&id=_vywXn8xcf0C&oi=fnd&pg=PA141&dq=Frameworks+for+comparative+research:+Structural+anthropology+and+the+theory+of+action.&ots=PDkHVtItHv&sig=E-91B8pdZIqfti4BhZ8tP-emDC8&redir_esc=y#v=onepage&q=Frameworks%20for%20comparative%20research%3A%20Structural%20anthropology%20and%20the%20theory%20of%20action.&f=false

Tableau public. (2021). Befolkningssammensetning: 20-34 åringer i % av befolkningen, 2017. Retrieved from https://public.tableau.com/app/profile/stavanger.statistikken/viz/Levekrsunderskelsen2018/Innhold

TDM Encyclopedia. (2017). *Sustainable transportation and TDM*. Retrieved from https://www.vtpi.org/tdm/tdm67.htm#:~:text=European%20Conference%20of%20Ministers%20of,environmentally%2Dfriendly%2C%20and%20affordable

Thorsnæs, G. (2022). Stavanger – Store norske leksikon. Retrieved from https://snl.no/Stavanger

Tran, P. V. (2021). *Will implementation of high-quality bicycle parking facilities make cycling more attractive in city central areas. A study about the relationship between high-quality bicycle parking facilities and bicycle share in Trondheim* (Master's thesis, NTNU). Retrieved from https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2824639

Universitetet i Stavanger. (n.d.). Om UiS. Retrieved from https://www.uis.no/nb/om-uis

Wang, D., & Liu, Y. (2015). Factors Influencing Public Transport Use: A Study of University Commuters' Travel and Mode Choice Behaviours. In *State of Australian cities conference 2015*. Retrieved from https://www.researchgate.net/publication/301749275_Factors_Influencing_Public_Transport_Use_A_Study_of_University_Commuters'_Travel_and_Mode_Choice_Behaviours

Willuweit, L. (2009). *Promoting Pro-Environmental Behavior: An Investigation of the cross-cultural environmental behavior patterns. The Case of Abu Dhabi* (Master's thesis). Retrieved from Digitala Vetenskapliga Arkivet

Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology*, *67*(1), 289-314. doi:10.1146/annurev-psych-122414-033417

Van Acker, V., & Witlox, F. (2009). Why land use patterns affect travel behaviour (or not). *Belgeo*, (1), 5-26. doi:10.4000/belgeo.8777

Van Cauwenberg, J., Clarys, P., De Bourdeaudhuij, I., Van Holle, V., Verté, D., De Witte, N., … Deforche, B. (2012). Physical environmental factors related to walking and cycling in older adults: The Belgian aging studies. *BMC Public Health*, *12*(1). doi:10.1186/1471-2458-12-142

Van Wee, B. (2002). Land use and transport: Research and policy challenges. *Journal of Transport Geography*, *10*(4), 259-271. doi:10.1016/s0966-6923(02)00041-8

Yamamoto, N. (2017). Distance perception. In B. Caplan, J. J. DeLuca, & J. Kreustzer (Eds.), *Encyclopedia of clinical neuropsychology* (2nd ed., pp. 1-5). Retrieved from https://eprints.qut.edu.au/98328/19/98328a.pdf

Yang, M., & Zacharias, J. (2016). Potential for revival of the bicycle in Beijing. *International Journal of Sustainable Transportation*, *10*(6), 517-527. doi:10.1080/15568318.2015.1012281

Yang, Y., Wu, X., Zhou, P., Gou, Z., & Lu, Y. (2019). Towards a cycling-friendly city: An updated review of the associations between built environment and cycling behaviors (2007–2017). *Journal of Transport & Health*, *14*, 100613. doi:10.1016/j.jth.2019.100613

Zacharias, J. (2005). Non-motorized transportation in four Shanghai districts. *International Planning Studies*, *10*(3-4), 323-340. doi:10.1080/13563470500378911

Zhao, Y., Lin, Q., Ke, S., & Yu, Y. (2020). Impact of land use on bicycle usage: A big data-based spatial approach to inform transport planning. *Journal of Transport and Land Use*, *13*(1). doi:10.5198/jtlu.2020.1499

Zhang, Z., Fisher, T., & Feng, G. (2020). Assessing the rationality and Walkability of campus layouts. *Sustainability*, *12*(23), 10116. doi:10.3390/su122310116

list of figures

Figures, tables, maps and photos are self-produced where nothing else is specified.

appendix A - spatial analysis UiS and LiU

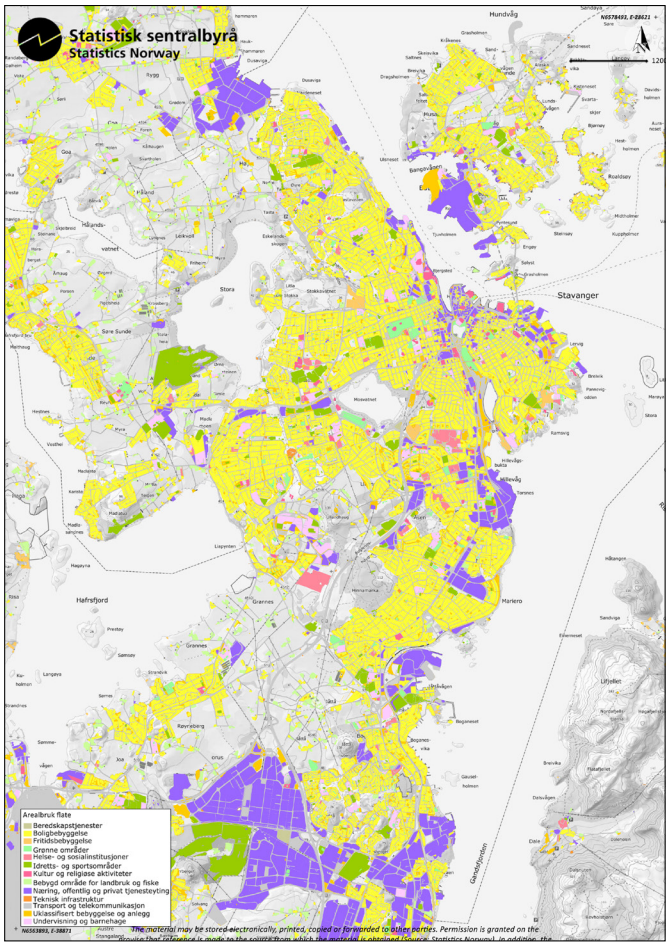


Fig. 1. appendix Land use Stavanger. (Statistisk sentralbyrå, n.d.)

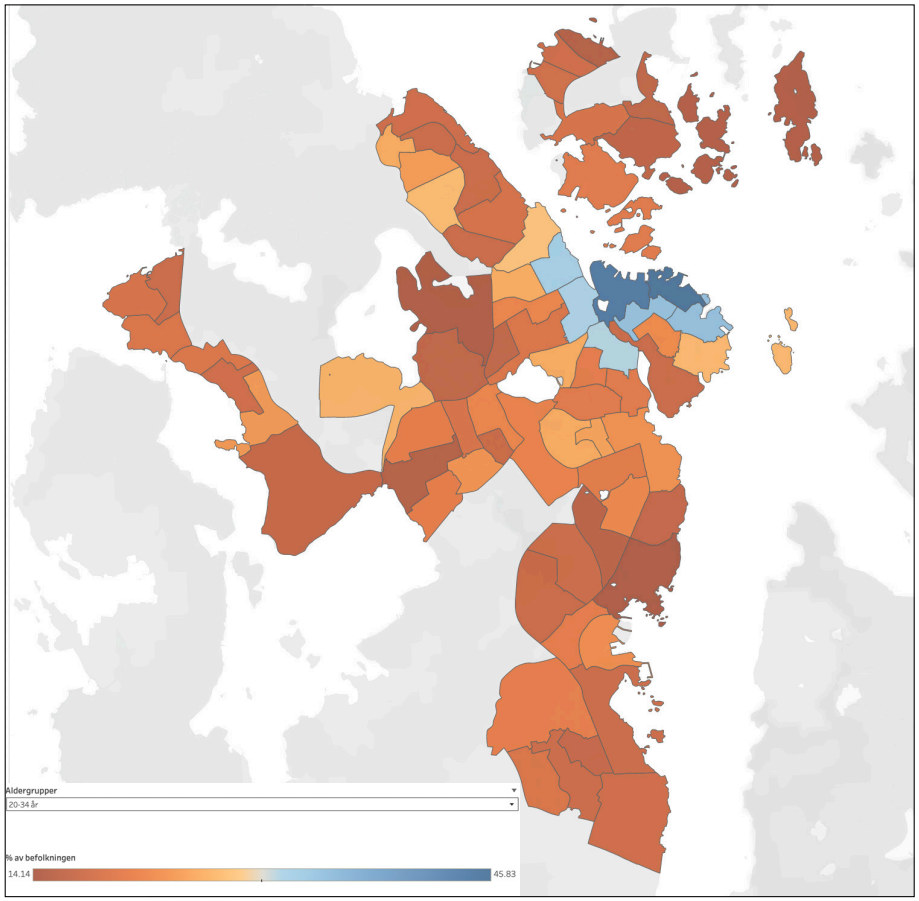


Fig. 2. appendix. Young people population, Stavanger. (Tableau public, 2021)

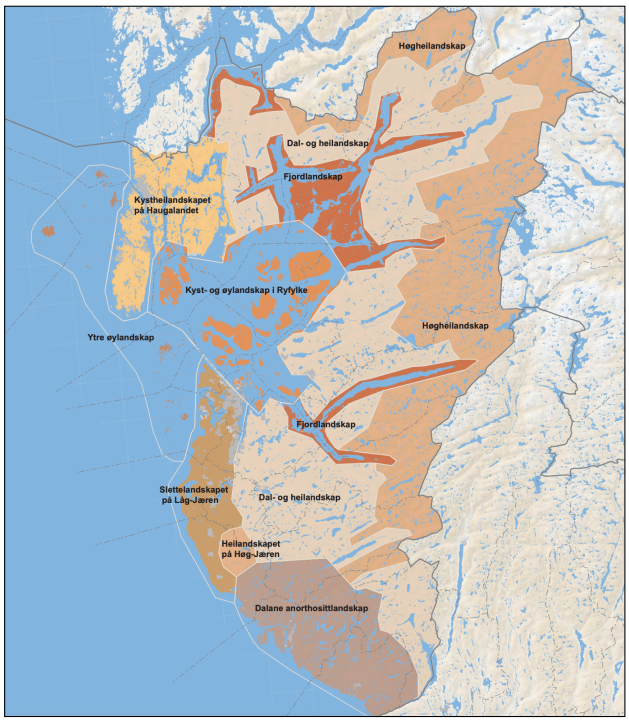


Fig. 3. appendix. Landscape types in Rogaland (Helle-Olsen, 2009)

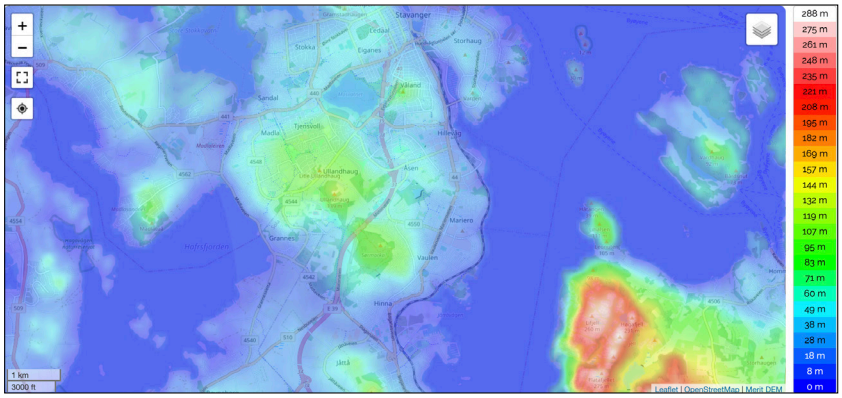


Fig. 4. appendix. Terrain topography in Stavanger, Norway (Topographic-map, n.d.)

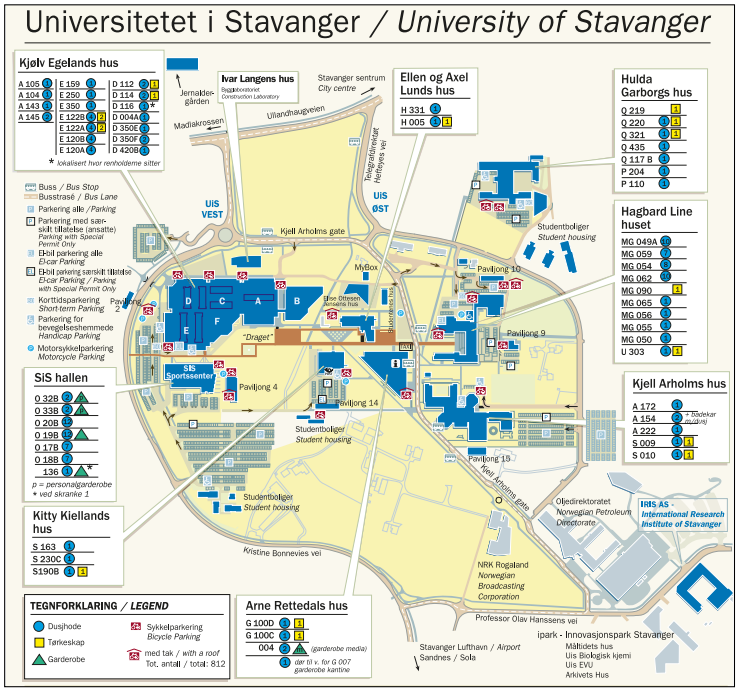


Fig. 5. appendix. Bike facilities at UiS (Universitet i Stavanger, 2022)

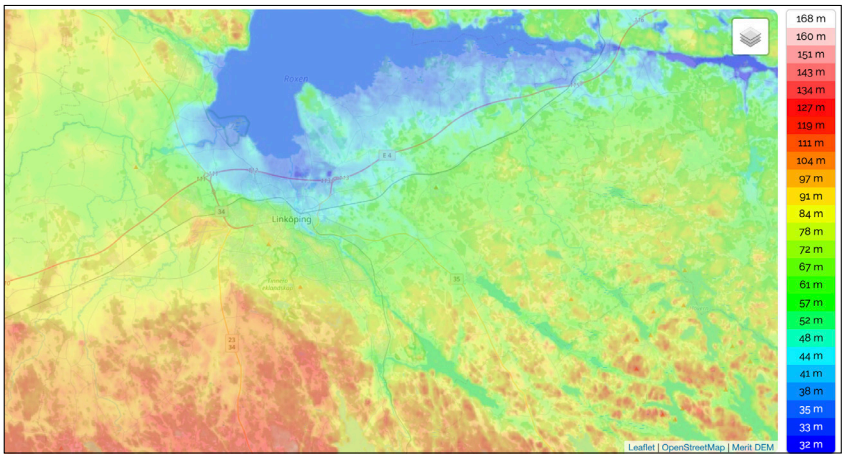


Fig. 6. appendix. Terrain topography in Linköpings, Sweden (Topographic-map, n.d.)

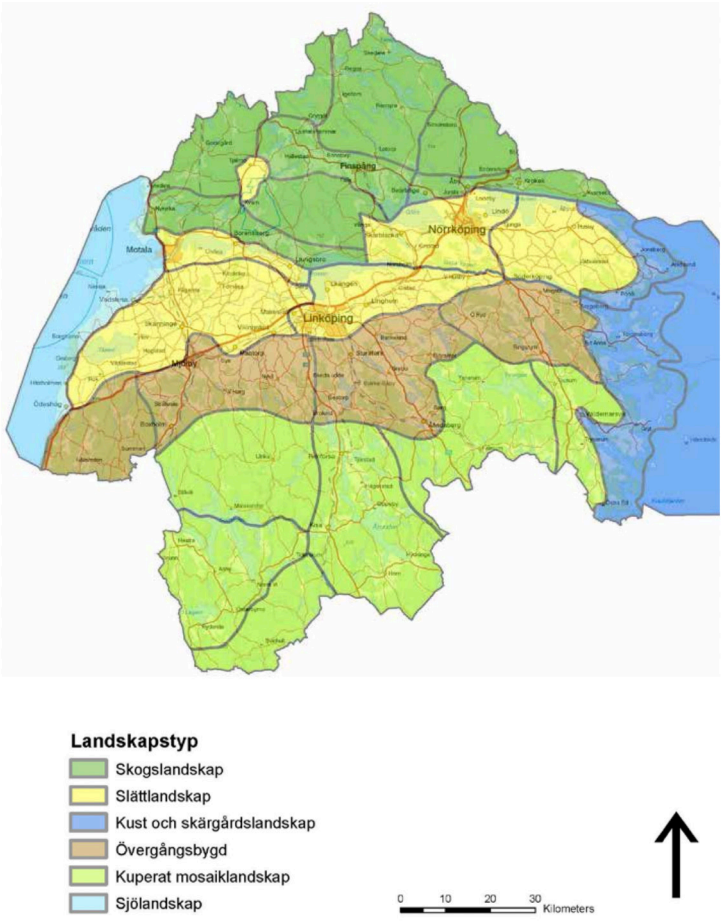


Fig. 7. appendix. Plain landscape (Julin et al., 2016)

appendix B - student travel survey UiS

Gender:

	Percent	Respondents
Female	61.6%	205
Male	37.5%	125
Other	0.9%	3
Total	100.0%	333

	Observed minimum	Observed maximum	Average	Respondents
Age:	18.00	1,992.00	31.98	333

Which municipality do you live in?

	Percent	Respondents
Stavanger	73.6%	245
Sandnes	11.1%	37
Sola	4.2%	14
Randaberg	0.9%	3
Other (please specify)	10.2%	34
Total	100.0%	333

Which municipality do you live in? - Other (please specify)

- Gjesdal
- Klepp
- trondheim
- Skien
- Eigersund
- Karmøy
- Eigersund
- Time
- Hå
- Karmøy
- Strand kommune
- Klepp
- Bjerkreim
- Time
- Time
- Klepp
- Hå
- klepp
- Hå
- Halden
- Klepp
- Gjesdal
- Hå
- Vigrestad
- Hå
- Sirdal

- Klepp
- Sogndal
- klepp
- Klepp
- time
- Gjesdal
- Strand
- Strand

Do you live in student housing?

	Percent	Respondents
Yes	31.2%	104
No	68.8%	229
Total	100.0%	333

Which student housing do you live in?

	Percent	Respondents
Badehusgata 41	0.0%	0
Bjergsted	4.8%	5
Gosenmyrå	6.7%	7
Gulaksveien	6.7%	7
Jernalderveien	6.7%	7
Madlamarkveien	9.6%	10
Misjonsmarka	1.9%	2
Mosvangen 7	3.8%	4
Norvald Frafjordsgate	1.0%	1
Novvegen	0.0%	0
Red Boxes	3.8%	4
Rennebergstien	3.8%	4
Sandnes	0.0%	0
Stareveien	3.8%	4
Sørmarka	29.8%	31
Ugleveien	17.3%	18
Total	100.0%	104

Your postcode:

- 4,018.00
- 4,021.00
- 4,330.00
- 4,046.00
- 4,306.00
- 4,150.00

- 4,323.00
- 4,316.00
- 4,024.00
- 4,150.00
- 4,015.00
- 4,012.00
- 4,350.00
- 4,008.00
- 4,018.00
- 4,085.00
- 4,010.00
- 4,070.00
- 4,321.00
- 4,322.00
- 4,019.00
- 4,021.00
- 4,324.00
- 4,032.00
- 4,014.00
- 4,028.00
- 4,008.00
- 7,000.00
- 4,016.00
- 4,044.00
- 4,008.00
- 4,014.00
- 4,019.00
- 4,021.00
- 4,056.00
- 4,044.00
- 4,058.00
- 4,018.00
- 4,044.00
- 4,373.00
- 4,010.00
- 4,317.00
- 4,047.00
- 4,034.00
- 4,041.00
- 4,012.00
- 4,046.00
- 4,044.00
- 4,041.00
- 4,027.00
- 4,012.00
- 4,032.00
- 4,019.00
- 4,325.00
- 4,041.00
- 4,010.00
- 4,034.00
- 4,020.00
- 4,314.00
- 4,044.00
- 4,006.00
- 4,307.00
- 4,046.00
- 4,017.00
- 4,041.00
- 4,321.00
- 4,073.00
- 4,324.00
- 4,280.00
- 4,314.00
- 4,371.00
- 4,307.00
- 4,021.00
- 4,055.00
- 4,345.00
- 4,019.00
- 4,032.00
- 4,010.00
- 4,010.00
- 4,013.00
- 4,321.00
- 4,322.00
- 4,020.00
- 4,011.00
- 4,018.00
- 4,015.00
- 4,052.00
- 4,050.00
- 4,360.00
- 4,270.00
- 4,121.00
- 4,019.00
- 4,009.00
- 4,014.00
- 4,008.00
- 4,350.00
- 4,048.00
- 4,025.00
- 4,389.00
- 4,345.00
- 4,019.00
- 4,344.00
- 4,021.00
- 6,841.00
- 4,350.00
- 4,019.00
- 4,006.00
- 4,016.00
- 4,306.00
- 4,008.00
- 4,365.00
- 4,341.00
- 4,311.00
- 4,014.00
- 4,024.00
- 4,316.00
- 4,360.00
- 4,041.00
- 1,786.00
- 4,046.00
- 4,007.00
- 4,014.00
- 4,007.00
- 4,009.00
- 4,077.00
- 4,019.00
- 4,352.00
- 4,013.00
- 4,028.00
- 4,041.00
- 4,021.00
- 4,055.00
- 4,013.00
- 4,321.00
- 4,330.00
- 4,326.00
- 4,076.00
- 4,360.00
- 4,042.00
- 4,362.00
- 4,011.00
- 4,019.00
- 4,007.00
- 4,307.00
- 4,318.00
- 4,024.00
- 4,006.00
- 4,058.00
- 4,016.00
- 4,019.00
- 4,012.00
- 4,007.00
- 4,011.00
- 4,012.00
- 4,009.00
- 4,365.00
- 4,440.00
- 4,350.00
- 4,019.00
- 4,073.00
- 4,041.00
- 4,324.00
- 6,899.00
- 4,310.00
- 4,044.00
- 4,010.00
- 4,350.00
- 4,016.00
- 4,332.00
- 4,052.00
- 4,353.00
- 4,021.00
- 4,317.00
- 4,324.00
- 4,019.00
- 4,016.00
- 4,041.00
- 4,044.00
- 4,010.00
- 4,022.00
- 4,008.00
- 4,041.00
- 4,011.00
- 4,342.00
- 4,045.00
- 4,331.00
- 4,056.00
- 4,306.00
- 4,014.00
- 4,315.00
- 4,021.00
- 4,049.00
- 4,006.00
- 4,015.00
- 4,014.00
- 4,012.00
- 4,009.00
- 4,085.00
- 4,307.00
- 4,051.00
- 4,032.00
- 4,057.00
- 4,104.00
- 4,327.00
- 4,048.00
- 4,014.00
- 4,032.00
- 4,010.00
- 4,014.00
- 4,010.00
- 4,013.00
- 4,017.00
- 4,044.00
- 4,011.00
- 4,025.00
- 4,307.00
- 4,306.00
- 4,028.00
- 4,020.00
- 4,048.00
- 4,016.00
- 4,020.00
- 4,310.00
- 4,044.00
- 4,021.00
- 4,120.00
- 4,049.00
- 4,325.00
- 4,316.00

On average, how many times do you meet physically at the university during a week? (spring 2022)

	Percent	Respondents
never/seldom	10.5%	35
less than 1 day a week	12.0%	40
1 day a week	6.9%	23
2 days a week	13.5%	45
3 days a week	21.3%	71
4 days a week	17.1%	57
5 days a week	15.9%	53
more often (please specify)	1.5%	5
do not know	1.2%	4
Total	100.0%	333

On average, how many times do you meet physically at the university during a week? (spring 2022) - more often (please specify)

- 6-7 dager i uka
- 20 minutes
- 6
- 5-6 ganger i uka
- Hver dag
- Right now i travel to SUS because of placement
- Hver dag

	Observed minimum	Observed maximum	Average	Respondents
On average, how long (in minutes) does it take for you to travel to/from campus? (one way)	0.00	480.00	22.79	333

	Observed minimum	Observed maximum	Average	Respondents
How many kilometres/metres do you travel to/from campus everyday (one way)?	0.00	4,000.00	66.82	333

Which transport mode do you use most often to travel to and from campus? (if you use several transport modes, mark the one you travel longest by)

	Percent	Respondents
Walking	25.5%	85
Bike	4.5%	15
E-bike	1.2%	4
Bus	39.0%	130
Train	1.8%	6
Car	19.2%	64
Electric car (EV)	6.0%	20
Passenger in a car	1.5%	5
Motorcycle or moped	0.6%	2
Other (please specify)	0.6%	2
Total	100.0%	333

Which transport mode do you use most often to travel to and from campus? (if you use several transport modes, mark the one you travel longest by) - Other (please specify)

- Bus and car
- Elektrisk bysykkel
- Båt

If you use several transport modes to travel to and from the university, what is the second transport mode that you use?

	Percent	Respondents
Walking	15.9%	53
Bike	7.2%	24
E-bike	6.6%	22
Bus	19.5%	65
Train	2.1%	7
Car	7.5%	25
Electric car (EV)	1.5%	5
Passenger in a car	4.2%	14
Other (please specify)	0.9%	3
None	34.5%	115
Total	100.0%	333

If you use several transport modes to travel to and from the university, what is the second transport mode that you use? - Other (please specify)

- Ferje
- El sparkesykkel
- Ryde
- Fly
- Båt

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0: do not know) - flexibility

	Percent	Respondents
0	5.4%	18
1	3.9%	13
2	6.0%	20
3	15.3%	51
4	23.7%	79
5	45.6%	152
Total	100.0%	333

Total	100.0%	333

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0: do not know) - comfort

	Percent	Respondents
0	6.0%	20
1	9.3%	31
2	15.6%	52
3	27.3%	91
4	19.2%	64
5	22.5%	75
Total	100.0%	333

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0: do not know) - travel time

	Percent	Respondents
0	2.1%	7
1	4.5%	15
2	6.3%	21
3	14.4%	48
4	22.5%	75
5	50.2%	167
Total	100.0%	333

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0: do not know) - price

	Percent	Respondents
0	2.7%	9
1	8.7%	29
2	13.5%	45
3	20.4%	68
4	16.5%	55
5	38.1%	127
Total	100.0%	333

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0: do not know) - environmental impact

	Percent	Respondents
0	15.0%	50
1	14.1%	47
2	18.9%	63
3	25.2%	84
4	15.0%	50
5	11.7%	39
Total	100.0%	333

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0: do not know) - health

	Percent	Respondents
0	15.6%	52
1	11.7%	39
2	15.6%	52
3	22.8%	76
4	17.1%	57
5	17.1%	57
Total	100.0%	333

What other factors are important for you when choosing transport mode to and from the university?

- Om jeg skal noe videre samme dag (jobb, lengre reise)
- Time
- Can go many places on the way
- Parkerings mulighet
- Weather
- Praktisk
- Tid
- Convenience
- Bor så nære at det ikke er vits å gjøre noe annet enn å gå
- Tid og vær
- Har ikke bil, men blir nok mer kjøring om jeg skaffer
- Har ikke tilgang på bil
- Weather conditions
- Tar bilen uansett
- fleksibilitet
- Availability
- Hvor nærme bussen stopper der jeg skal
- Ingen
- cost of tickets are cheaper than filling up the gas.
- Timing (for example, buses do not always come at the right time)
- Distance of bus stop from housing
- Været, tidspunkt
- Proximity

- Availability
- At det er plass på bussen og at den er punktelig
- Trening, luft
- Safe
- Fastest and easiest way to reach university
- weather
- security
- AVAILABILITY OF INFORMATION ABOUT THE TRANSPORT MODE
- Komfort
- Temperature
- Lettvint
- Avstand fra hus til bussholdeplass. Jeg bor langt fra all kollektiv transport.
- Slipper å vente lenge på å skifte buss
- Tid
- Det er ingen andre alternativer
- Weather
- Pålitelig
- availability
- Ingenting
- safety
- Mulighet for å kunne reise hjem om nødvendig
- Price
- Tid til å sove lengst mulig om morgenen
- I have chronic pains that I must factor in when choosing how to get to campus. As well as a long distance to consider.
- Vet ikke
- Hadde jeg hatt bil hadde jeg kjørt
- Very bad infrastructure from klepp to campus
- Må ta buss
- Komme raskt frem uten venting
- Om det er ledig parkeringsplass på campus
- Is\frost\glatt
- vet ikke
- frequency of traveling
- availability
- Effektivitet
- Ingen andre
- at buss og båttider passer sammen
- Tilgjengelighet
- må hente/levere i barnehage
- availability and schedule
- tilgjengelighet
- Hvor lett det er å parkere/låse sykkel
- Vær
- Presis
- Whether
- Tilgjengelighet
- Dagsform
- Punktlighet
- Weather, if it’s a good weather, I’d rather bike
- Ingen
- Ingen
- Accessibility and ease
- Penger og miljø - buss, fleksibiliteten og tid- bil
- Flere nære butikker på veien
- Ingen
- Sykkel

- tid
- Less time travel
- raskt og enkelt
- Pålitelig
- Stressfulness
- At det er enklest mulig.
- Jobb
- weather
- Availability
- Om det er tungvint eller ikke
- været, dårlig vær blir buss hele veien, fint vær sykler jeg deler av veien.
- Jeg har en sykdom som gir fatigue, derfor må jeg ikke bruke for mye krefter på reisen til campus for da har jeg ikke krefter til å følge med på undervisningen. I koronatiden har det også handlet om å ikke ha mange nærkontakter (jeg er i risikogruppen)
- Trygghet
- tilgjengelihet
- Høy
- Komme frem
- Time

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is convenient

	Percent	Respondents
1	4.2%	14
2	3.9%	13
3	12.6%	42
4	22.5%	75
5	56.8%	189
Total	100.0%	333

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is time efficient

	Percent	Respondents
1	3.0%	10
2	1.8%	6
3	10.8%	36
4	27.0%	90
5	57.4%	191
Total	100.0%	333

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is affordable

	Percent	Respondents
1	21.6%	72
2	32.4%	108
3	30.3%	101
4	7.5%	25
5	8.1%	27
Total	100.0%	333

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is the safest travel mode

	Percent	Respondents
1	13.8%	46
2	20.7%	69
3	43.8%	146
4	12.9%	43
5	8.7%	29
Total	100.0%	333

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is convenient

	Percent	Respondents
1	16.8%	56
2	10.2%	34
3	21.3%	71
4	21.6%	72
5	30.0%	100
Total	100.0%	333

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is time efficient

	Percent	Respondents
1	39.0%	130
2	27.3%	91
3	21.6%	72
4	6.3%	21
5	5.7%	19
Total	100.0%	333

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is affordable

	Percent	Respondents
1	4.5%	15
2	0.9%	3
3	7.2%	24
4	10.8%	36
5	76.6%	255
Total	100.0%	333

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is the safest travel mode

	Percent	Respondents
1	6.6%	22
2	8.4%	28
3	32.7%	109
4	22.5%	75
5	29.7%	99
Total	100.0%	333

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is convenient

	Percent	Respondents
1	8.1%	27
2	7.8%	26
3	23.1%	77
4	32.4%	108
5	28.5%	95
Total	100.0%	333

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is time efficient

	Percent	Respondents
1	6.6%	22
2	9.6%	32
3	31.5%	105
4	32.1%	107
5	20.1%	67
Total	100.0%	333

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is affordable

	Percent	Respondents
1	1.8%	6
2	1.5%	5
3	15.6%	52
4	33.9%	113
5	47.1%	157
Total	100.0%	333

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is the safest travel mode

	Percent	Respondents
1	7.8%	26
2	25.8%	86
3	45.9%	153
4	16.5%	55
5	3.9%	13
Total	100.0%	333

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is convenient

	Percent	Respondents
1	9.9%	33
2	11.4%	38
3	24.3%	81
4	32.7%	109
5	21.6%	72
Total	100.0%	333

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is time efficient

	Percent	Respondents
1	14.1%	47
2	21.9%	73
3	28.2%	94
4	24.9%	83
5	10.8%	36
Total	100.0%	333

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is affordable

	Percent	Respondents
1	6.6%	22
2	8.7%	29
3	29.4%	98
4	31.8%	106
5	23.4%	78
Total	100.0%	333

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is the safest travel mode

	Percent	Respondents
1	3.6%	12
2	14.4%	48
3	43.5%	145
4	24.3%	81
5	14.1%	47
Total	100.0%	333

What is the main reason for why you choose to drive a car to/from the university?

- Tidsbruk og komfort
- Avstand
- Sparer tid
- Time efficiency
- Enkelt, fleksibelt
- Flexibility
- Dårlig med kollektiv transport
- Tid og avstand
- Tid
- Convenience
- Effektivt
- Får tid til å gjøre andre ting først, kommer mer presist
- Tidsperspektiv
- Kaldt ute, tar 3 ganger så lang tid m buss hver vei
- tidseffektivt
- Det er raskest.
- spare tid
- Tidseffektivt, fleksibelt, må rekke jobb etter forelesningene (buss tar for lang tid)
- Kan komme og gå når jeg vil
- Tid, kostnad, fleksibilitet
- Billig
- Fleksibilitet og tar mindre tid enn buss
- Det går sjelden buss utenfor der jeg bor. Må gå minst 15 minutter for å komme til nærmeste busstopp hvor det går oftere buss.

- det er tidseffektivt. henter også venner/medstudenter på vei til campus
- Praktisk
- Tidseffektiv
- Effektivt
- Fordi jeg har bil og da har jeg mer tid på å gjøre meg klar.
- Buss kan fort ta 40 min, å kjøre tar 5.
- Grunnet sykdom er ikke kollektiv transport/å gå en mulighet
- Vil ikke bruke penger på bil samtidig som buss
- Lang vei
- Avstand fra hjemmet, og tidsbruk
- Beste muligheten
- Kort reisetid, fleksibilitet på hjemtur til å handle middag eller andre trender på vei hjem, sparer tid
- Det er fleksibelt og praktisk for meg.
- Manglende kollektivtilbud i aktuelt tidsrom
- Dårlig kollektivtransport fra der jeg bor
- Tid
- Bor langt unna, å bil er lettest og lurest mtp min helse
- Praktisk og effektivt
- Lat
- Praktisk med hensyn til to små barn i barnehagealder og barneskole
- Praktisk
- Distance + health conditions
- Lettere da det er dårlig kollektiv tilbud. Koster mye også. Og at det alltid er fullt.
- Raskest og lettest
- Praktiskheit med tanke på tid og avstand
- Få mer tid i Stavanger mtp tidspunkt på fly
- Jeg Har bil
- Tilgjengelighet, tidsbesparende og fleksibilitet
- time, there arent' really any buses from here
- Kan sove lengre
- Time efficient
- Går raskest
- Dårlig tilbud på kollektivtransport
- Familiekabal. Levering i barnehage. Kan sitte på med andre.
- sparer tid
- Avstand
- Kollektivtilbudet fra Klepp til Stavanger (tid)
- Pga helse, i tillegg er det tidseffektivt og fleksibelt når en allerede har bil.
- TID
- Dårlig kollektivforbindelse mellom bopel og UIS
- Spare tid, rekke over flest mulig i løpet av en dag,
- dårlig kollektiv transport
- Comfort
- Reisevei, dåli kollektiv muligheter
- enkelt
- helse
- Pris og tid på buss
- Jeg slipper å regne tid med å gå ned til bussterminalen. Og det er det enkleste og raskeste alternativet når bilen står utenfor til enhver tid.
- Tid
- Tar minst tid
- Lang vei
- Må hente barna etterpå
- Det er praktisk
- Levering og henting av barn fra og til barnehage/skoleplass
- Billig, komfort
- Jeg har en sykdom som gir fatigue og trenger derfor kortest mulig reisetid og avstander å gå. Har HC-parkering slik at jeg kan parkere rett utenfor inngangene til bygg
- Det raskeste

- Sparer tid, slipper å bytte buss, slipper å bli svett før forelesning av å gå eller sykle, samboer kjører vanligvis samtidig som jeg skal ut av huset
- Tid og komfort
- For å rekke jobb
- Lett og behagelig
- Tid
- Fleksibilitet
- Tid
- convenient, not time consuming
- Praktisk

What is the main reason for why you choose to cycle to/from the university?

- Flexibility
- Flexibility
- Det er mer praktisk og raskere med å sykle
- Pris
- Mest tidseffektivt og best for miljøet
- It takes same time to get to uni as if I use bus
- miljø og det er rimelig, og det er lite med parkeringsplasser på Uis
- Lite parkeringsplasser
- Raskeste vei
- Hovedgrunnen var pandemien i fjor og siden jeg ikke har førerkort ble buss eneste andre valg og jeg ville ikke ta det pga smitte. Så det ble elsykkel på meg. Nå i dag sykkler jeg frem og tilbake på grunn av vane og at det er komfortabelt + at jeg slipper å betale bussbilletter og styret det inebærer
- Fysisk aktivitet + pris
- Går fortere enn å ta buss
- Fleksibelt
- Sykkel er mitt valgte transportmiddel til alt. Jeg velger å ikke eie bil
- Vane
- Reisetid
- Det går raskere
- Jeg bor nærme
- I live close

What is the main reason for why you choose to walk to/from the university?

- Mest praktisk. Dårlig buss.
- Campus
- Bår så nære
- Bus is expensive and doesn't have suitable routes for me to get uni without travelling around whole city first.
- Jeg bor ikke så langt vekke (der med rema 1000 Grannes)
- Kort vei, miljøvennlig
- Bor nærme
- Student housing in the campus
- By
- Nærme
- Home is close to campus
- Bor rett ved
- Home is close to campus
- Bor på campus
- Bor nærme uis
- Kort vei
- Bor på universitetet
- University is close
- Environmental and economic reasons
- Closeness
- Jeg bor rett ved siden av
- Kort vei
- Bor veldig nærme og det er unødvendig å ta buss et stopp
- Easiest way to get there
- Bor nærme, rimelig
- Close to the university

- Live close to university
- Short distance
- Close by
- Det er kort vei
- Bor like ved
- Kort avstand
- Kort vei
- Because I live so near to the University
- Det er egentlig det eneste alternativet, jeg bor bare sånn 50m fra campus
- helse, og kos
- I live right by the campus
- Fordi det er 100 meter unna
- För det ligger så närma
- I live really closeby
- Jeg bor veldig nærme og har ikke bil
- My home is close to the school
- Being very close to university
- Det er det eneste alternativet
- Save money
- Avstand
- Enkelt, praktisk
- Housing on campus
- Bor rett ved
- It's close to my home
- I live nearer to university
- There is no any bus route from dormitory to campus, so it's a must
- Logiske valget, og var ikkje klar over buss.
- Kort distanse
- distance
- Bor rett ved
- Det ligger nærme og det er bra for miljøet
- I live close by so I can just walk there
- Distance and beauty of my path (nature)
- I live close enough to the university that I don't need to use any other means of transport
- Proximity
- Fordi jeg bor rett ved
- Because I live very close by the school
- Health
- distance
- Bosted og avstand
- bor relativt nærme, har ikke bil, det går ikke direkte buss, liker å gå
- Det er så kort
- Bor nærme
- Billig
- Bor nærme skolen
- For helse og kort vei
- Jeg bor rett ved
- Ikke så langt
- Kort avstand
- Bor nærme
- Kort avstand
- Fordi jeg bor så nærme
- Fordi veien er så kort. Gir ikke meningen å gjøre noe annet.
- Trim
- distance
- Helse
- har godt av gåturen
- Byen
- Det er kort avstand

What is the main reason for why you choose to take the bus to/from the university?

- Billigere enn bil
- Har ikke ansvar for bil og slipper å tenke på parkering
- Går ofte
- Det er det eneste transportsmidle jeg har tilgang til nå. Liker heler ikke og parkere på universitetet.
- Lett
- Har ikke lappen
- I don't have a car
- Har ikke bil, for langt å gå, gidder ikke sykle
- Only opportunity
- Effektivt og ikke alt for dyrt
- Tid
- Har ikke lappen
- billig, raskt
- Fordi jeg ikke har lappen
- Distanse og tid
- Tidsbruk
- Billig
- Økonomiske årsaker
- ikke andre valg
- Mest tidseffektivt og rimeligst
- Orker ikke gå
- Eneste mulighet
- Time efficient
- price and safety
- Fordi har ikke bil
- Har ikke bil.
- I do not have other means of transportation and I dislike walking
- It's more cheaper for the student like me. It is the most flexible transport for me aside from riding a private car.
- Safe
- Lettvint, slipper å tenke på parkering, glatte veger
- Comfort
- Time efficiency, convenience
- Tid, slipper å bli svett
- It is the best possible option in terms of time and availability
- Lettest alternativ, og mer tidseffektivt enn å spasere.
- We only have one car, and it is not available when I need to go to campus.
- It is mostly convenient
- affordable
- I can relax before going to a lecture.
- Safe time
- It's convinient
- money
- It's the fastest way to get to uni without a car.
- IT IS AFFORDABLE
- billig
- Lettest
- Convenient
- Har ikke bil og er for langt å gå
- Student Price
- Convenient
- get to destination faster. Bus is convenient and you dont need to worry about the safety. As compared to a bicycle, you have constant fears of your bicycle being stolen when you pack and lock it
- Har ikke bil, billig, miljøvennlig
- Lettest
- safety at any time of the day, especially at nights
- Effektivt
- perfect timing

- Passer godt for min behov
- Cheaper and good for the environment
- I have a bus stop nearby, and there is good bus frequency. Also, it's comfortable.
- Convenience
- I dont have a car
- Det er dyrt å kjøre bil gjennom Ryfasttunnelen.
- Affordability
- Billigste alternativet, utenom å gå som blir for langt
- Due to my location the buses go frequently
- less time because idont have car
- most convenient
- Fordi det er enklest og raskest.
- Billigt
- The only travel mode
- only way to go there
- Har ikke førerkort
- Cost
- Effektivitet
- Det er tidseffektivt og ikke for dyrt
- Nærme busstopp
- billig og tidseffektivt
- Har ikke parkeringsplass der jeg bor nå
- For langt å gå, har ikke bil
- Miljø
- slipper a betale bom
- convenience and comfort
- Vil ikke stå i kø med bil
- Studentrabatt, lettere
- Convenience
- siden det er oftesst den kjappeste måten for meg
- long distance
- Tilgjengelighet, flere busser
- Miljø
- Avstand og tid
- For langt å gå, gidder ikke sykle, har ikke bil
- Jeg har ikke bil, og det er det som går nest fortest etter
- Avstand fra hjem til skolen
- no choice
- sykkel ble stjålet
- Raskeste måte å komme meg til universitetet
- Det er langt å gå
- Spare bensin og bom
- You get on and off, effortless
- øyesykdom gjør det vanskelig å kjøre når det er mørkt, har derfor ikke bil
- That’s the only way
- Tidsbesparende
- Lett, har ikkje alltid bil
- eneste muligheten
- Beste alternativ
- Ingen annet valg
- Is quicker
- Affordability
- Har ikke bil, og for langt å gå/sykle
- Affordable
- Fordi jeg må
- Har ikke bil
- Sparer penger, sparer tid ved å finne parkering
- Har ikke lappen
- It is available and easy.
- Low coast

- Raskest og ly fra vær og vind.
- Availability and price
- Bor nærme et busstopp, og er mer praktisk
- Beste måten ift. Reisevei
- tilgengelihet, og kan ikke kjøre bil
- Cheaper and faster compared to bicycle or walking. Also somewhat cheaper compared to the car.
- Its easy to acess and fast
- Only way i know
- Ryfast
- It only choice
- Rimelig og billig
- Affordability
- Letteste transportmetode + pris
- Time

What is the main reason for why you don't walk/cycle to/from university?

- Har ikke sykkel, tar for lang tid å gå
- For langt
- Bor langt unna
- Too far, not possible
- For langt.
- I live to far
- Veldig langt
- Tid og avstand
- Avstand
- Time
- For langt
- Tar lang tid, stygt vær hele tiden
- Tidsperspektiv
- For langt å gå/sykle
- upraktisk
- Jeg sykler som regel når det er fint vær.
- bor for langt vekke, tar 3 timer å gå, 50 min med sykkel
- Ikke tidseffektivt, for lang avstand til hjem
- Langt
- Avstand, tid, helse
- Langt, tungt, blir svett
- For langt
- Det er for langt og jeg ønsker ikke å dusje på universitetet.
- det er for langt å sykle eller gå 14km en vei. må ha energi til å gå på jobb etterpå også
- 100km
- Lang vei
- Liker ikke å sykle, langt å gå.
- Fordi jeg har bil.
- Oppoverbakke hele veien, vil ikke være svett hele dagen.
- har ikke sykkel, og har er for langt å gå
- Lang vei, har ikke ordentlig sykkel
- Hadde tatt meg heile dagen
- Avstanden til hjemmet
- Har ikke sykkel, raskere å kjøre
- Tar for lang tid, blir svett
- Jeg er ikke vant med å sykle. I tillegg er det altfor lang avstand for meg å sykle.
- Lang vei, logistikk mtp barn i bhg og skole
- For lang reisevei og tid
- Tid
- For langt
- Upraktisk og tidkrevende
- Lat
- Barn som skal leveres i barnehage samt strekning
- For langt, for bratt, ønsker ikke komme svett på UiS
- Distance and health
- For langt
- For langt
- For kostbart med tanke på tid og krefter
- Altfor langt

- Veldig lang vei
- Tid, vær (dusj/skift muligheter)
- distance
- Tar for lang tid
- Too far away
- Bor for langt unna.
- For langt
- gå tar for lang tid når jeg må innom barnehage. Sykling: kommer svett fram. Kjenner ikke garderobemuligheter.
- har ikke nok tid
- Avstand
- Bor altfor langt fra UiS
- Bor for langt i fra
- TID
- Avstand
- Jeg bor for langt unna
- for langt
- I have a choise to drive car
- Lang vei
- bor for langt unna
- helse
- Været
- Det er litt for langt å gå syntes jeg. Sykkel har jeg ikke, og har heller ikke planer om å investere i det når jeg allerede har bil
- Tid, vær
- Har bil tilgjengelig
- Lang vei
- Lang avstand + vær
- Det tar lang tid
- Bor langt borte fra Uis
- Langt
- Sykdommen min
- For langt
- Går eller sykler hvis jeg har god tid, har som regel ikke god tid siden forelesningen begynner tidlig og jeg trenger å sove nok før en lang dag på uis
- Tid
- Langt unna
- Ukomfortabel
- Mye tid
- Ingenting
- Tid
- too long
- Mindre praktisk

What is the main reason for why you don't take the bus to/from university?

- Stressende å måtte bytte buss. Tar gjerne mer enn dobbelt så lang tid som å kjøre
- Villighet
- Må bytte buss, tar lang tid
- There is no direct bus, need to change busses, unconvinced
- Tar for lang tid
- Takes to long time
- Tar lang tid, må ta fleire busser
- Må bytte buss og tar mye tid
- Tid
- Hassle
- Tar for lang tid
- Må først gå til bussen, så vente på bussen (kaldt), bussen er alltid forsinket, bussen er ofte full, bussen tar lang tid, er heller ikke spesielt billig
- Tidsperspektiv
- Kaldt, bytte buss, lang tid, veldig fullt
- lite tidseffektivt
- Jeg må ta 2 busser på en kort reise og har ingen busstopp i nærheten.
- for mye venting, tar 1 time med buss.
- Ikke tidseffektivt, må bytte buss i Sandnes sentrum (ventetid)
- Jeg har bil
- Ufleksibilitet, tid, helse, kostnad
- Tar tid
- Det tar dobbelt av tiden det tar å kjøre
- Det går sjelden buss utenfor der jeg bor. Må gå minst 15 minutter for å komme til nærmeste busstopp hvor det går oftere buss.

- tar for lang tid i rushtrafikken på morgenen
- Tid
- Kortere reisetid med bil
- Lang tid
- Fordi jeg har bil.
- Tilbudet er så latterlig dårlig, når bussen er forsinket eller ikke treffer på neste buss, så ville det tatt meg mindre tid å gå (30 min) enn å ta buss (40 min)
- kan ikke stille i kollektiv transport
- Samme som første
- Bil er raskere og jeg må ikke vente på buss så tog
- Finnes ikke fornuftig tilbud pga avstand
- Raskere å kjøre, koronavennlig
- Reiser av og til med buss, men blir begrenset hva jeg kan gjøre. 2 billetter til og fra de dagene jeg tar buss, 42kr, og om jeg må på jobb er det 21kr til for ny billett. Når jeg har bil, så bruker jeg heller pengene på den enn månedskort på buss
- Det koster det samme som å kjøre min egen bil derfor velger jeg bil.
- Manglende tilbud
- Lang tid å bytte å bytte fra tog til buss og omvendt
- Tid
- Tidkrevende
- Tar 5 ganger lenger å ta buss enn å kjøre bil
- Tar lang tid
- Bussforbindelsen er ikke like bra i Sandnes som feks madla. I tillegg til små barn
- Lite praktisk
- Availability and health
- Er så dårlig tilbud. Hadde den gått hele tiden og vært lettere tilgjengelig kunne det vært et alternativ.
- Må bytte to ganger
- Har lenge vore av omsyn til koronasmitte, men mest pga tid
- Tid
- Tar tid
- Tid/tungvindt ifht bil
- not possible
- Dyrt og bruker bil istedet
- Takes too much time
- Bruker for lang tid, kommer sjelden på tiden
- Går ikke buss fra varhaug
- Vanskelig å tilpasse levering i barnehage
- har ikke nok tid
- Ingen bussavganger
- Dårlig kollektivtilbud
- Tar for lang tid, mange stopp og innom Ruten for å skifte
- TID
- Tidsbruk
- Reiser med bil og buss ca 60/50
- dårlig kollektiv transport, lang tid
- I have a choise to drive car
- Få avganger, er vanskelig, og tar mye tid
- må bytte flere busser
- helse
- Pris og tid
- Jeg gjorde det i starten, jeg gjør det fortsatt noen ganger hvis jeg er redd for å ikke få parkeringsplass. Jeg tar som oftes bilen med tankte på at det har vært ganske lite oppmøte på skolen hitill. Hadde jeg vært på universitetet oftere hadde jeg nok tatt buss, siden bensinprisene er så dyre.
- Tid
- Dyrt og tar lengst tid. Tar lenger tid enn el-sykkelen
- Spare på tid
- Lang reisetid med behov å skifte rute
- Det er mer tungvint enn å kjøre bil selv
- Spare tid.
- Har bil
- Sykdommen min, tar for lang tid og gir for mye stress.

- Upraktisk
- Selv om det er en ganske kort strekning må jeg bytte buss og det er vanskelig å «time» det riktig hvis det er forsinkelser, tar buss ofte når jeg ikke blir kjørt og kommer ofte for sent
- Buss er for fattige
- Tidskrevende
- Ubehagelig
- Mye tid
- Ingenting
- Tid
- have to switch buses and it takes to long
- Mindre fleksibelt

What would be the most preferable/viable alternative travel mode for you to use to travel to/from campus?

	Percent	Respondents
Walking/jogging	5.6%	5
Cycling	19.1%	17
Taking a bus	37.1%	33
None of these	18.0%	16
Other (please specify)	20.2%	18
Total	100.0%	89

What would be the most preferable/viable alternative travel mode for you to use to travel to/from campus? - Other (please specify)

- Kjøre
- Electric scooter
- bil
- Bil
- Sitte på med noen
- Buss dersom tilbudet hadde vært brukbart
- Elbil
- Bil eller tog
- Train, but availability and health makes it hard.
- El-bil eller buss og tog
- Fly, bil
- Bil
- Bil
- Bil (helsemessig)
- bil
- Car
- Bil
- El-bil
- Ryde/kolumbus el sykkel
- Bil

Do you have the possibility to park at the university area?

	Percent	Respondents
Yes	96.6%	86
No	0.0%	0
Do not know	3.4%	3
Total	100.0%	89

How do you park your car at the university (campus Ullandhaug)?

	Percent	Respondents
I park for free in the parking lot	93.3%	83
I park for free in the parking lot with special permission	5.6%	5
I pay for the parking	1.1%	1
I park on the road/street free of charge	0.0%	0
I park on the road/street with a fee	0.0%	0
Other (please specify)	0.0%	0
Total	100.0%	89

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest parking lot from the university?	0.00	500.00	94.25	89

Do you have the possibility to park your bike at the university area?

	Percent	Respondents
Yes	100.0%	19
No	0.0%	0
Do not know	0.0%	0
Total	100.0%	19

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest bike parking from the university?	0.00	200.00	48.89	19

Do you have access to wardrobe facilities at the university?

	Percent	Respondents
Yes	36.8%	7
No	15.8%	3
Do not know	47.4%	9
Total	100.0%	19

Do you have access to bike maintenance stations at the university or in close surroundings?

	Percent	Respondents
Yes	15.8%	3
No	36.8%	7
Do not know	47.4%	9
Total	100.0%	19

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest bus stop from the place you live?	1.00	538,300.00	2,152.28	333

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest bus stop from the university?	-300.00	10,000.00	159.80	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of car parking lots at the university

	Percent	Respondents
1	17.7%	59
2	21.0%	70
3	35.4%	118
4	17.4%	58
5	8.4%	28
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Car parking lots are located within a short distance to the university buildings

	Percent	Respondents
1	1.5%	5
2	8.7%	29
3	21.9%	73
4	38.7%	129
5	29.1%	97
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of outdoor bike parking at the university

	Percent	Respondents
1	1.5%	5
2	6.0%	20
3	40.8%	136
4	30.6%	102
5	21.0%	70
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of indoor bike parking at the university

	Percent	Respondents
1	23.1%	77
2	21.3%	71
3	45.3%	151
4	8.4%	28
5	1.8%	6
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Bike parkings are located in a short distance to the university buildings

	Percent	Respondents
1	1.2%	4
2	5.1%	17
3	41.1%	137
4	30.9%	103
5	21.6%	72
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of shared bikes at the university

	Percent	Respondents
1	9.3%	31
2	21.0%	70
3	53.2%	177
4	13.8%	46
5	2.7%	9
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Shared bike stations are located within a short distance to the university buildings

	Percent	Respondents
1	6.6%	22
2	15.6%	52
3	50.2%	167
4	17.7%	59
5	9.9%	33
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of wardrobe facilities at the university

	Percent	Respondents
1	11.7%	39
2	22.5%	75
3	45.9%	153
4	12.6%	42
5	7.2%	24
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of bike maintenance stations at the university

	Percent	Respondents
1	17.7%	59
2	22.8%	76
3	50.2%	167
4	6.9%	23
5	2.4%	8
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good number of bus stops located within a short distance/close to/at the university area

	Percent	Respondents
1	0.3%	1
2	2.7%	9
3	12.3%	41
4	38.4%	128
5	46.2%	154
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - I live in a short distance to the bus stop

	Percent	Respondents
1	9.6%	32
2	8.1%	27
3	11.4%	38
4	24.6%	82
5	46.2%	154
Total	100.0%	333

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - I have a relatively short distance to the university

	Percent	Respondents
1	13.2%	44
2	14.7%	49
3	17.4%	58
4	23.1%	77
5	31.5%	105
Total	100.0%	333

Language

	Percent	Respondents
Norwegian	70.4%	233
English	29.6%	98
Total	100.0%	331

Overall Status

	Percent	Respondents
New	0.3%	1
Distributed	0.0%	0
Partially Complete	0.0%	0
Complete	99.7%	333
Rejected	0.0%	0
Total	100.0%	334

appendix C - student travel survey (LiU)

Gender:

	Percent	Respondents
Female	56.1%	46
Male	43.9%	36
Other	0.0%	0
Total	100.0%	82

	Observed minimum	Observed maximum	Average	Respondents
Age:	18.00	35.00	23.49	82

Which municipality do you live in?

	Percent	Respondents
Linköping	92.7%	76
Mjölby	0.0%	0
Norrköping	2.4%	2
Söderköping	0.0%	0
Other (please specify)	4.9%	4
Total	100.0%	82

Which municipality do you live in? - Other (please specify)

- Lund
- Mölndal
- I am admitted to LiU and signed a contract with heimstaden but have to fly there and collect the keys
- In the UK

Do you live in student housing?

	Percent	Respondents
Yes	78.0%	64
No	22.0%	18
Total	100.0%	82

Which student housing do you live in?

	Percent	Respondents
Fjärilen	0.0%	0
Flamman	3.1%	2
Gnistan	0.0%	0
Irrblosset	3.1%	2
Lambohov	1.6%	1
Ryd	92.2%	59

T1	0.0%	0
Vallastaden	0.0%	0
Total	100.0%	64

Your postcode:

- 58,735.00
- 58,248.00
- 60,247.00
- 22,734.00
- 58,255.00
- 58,334.00
- 58,232.00
- 58,246.00
- 43,169.00
- 58,212.00
- 58,439.00
- 58,750.00
- 582.00
- 34,820.00
- 60,377.00
- 58,644.00
- 58,334.00
- 58,243.00

On average, how many times do you meet physically at the university during a week? (spring 2022)

	Percent	Respondents
never/seldom	4.9%	4
less than 1 day a week	8.5%	7
1 day a week	6.1%	5
2 days a week	18.3%	15
3 days a week	24.4%	20
4 days a week	23.2%	19
5 days a week	12.2%	10
more often (please specify)	1.2%	1
do not know	1.2%	1
Total	100.0%	82

On average, how many times do you meet physically at the university during a week? (spring 2022) - more often (please specify)

6

	Observed minimum	Observed maximum	Average	Respondents
On average, how long (in minutes) does it take for you to travel to/from campus (one way)?	0.00	200.00	14.44	82

	Observed minimum	Observed maximum	Average	Respondents
How many kilometres/metres do you travel to/from campus everyday (one way)?	0.00	2,500.00	34.64	82

Which transport mode do you use most often to travel to and from campus? (if you use several transport modes, mark the one you travel longest by)

	Percent	Respondents
Walking	12.2%	10
Bike	76.8%	63
E-bike	0.0%	0
Bus	3.7%	3
Train	1.2%	1
Car	1.2%	1
Electric car (EV)	0.0%	0
Passenger in a car	0.0%	0
Motorcycle or moped	0.0%	0
Other (please specify)	4.9%	4
Total	100.0%	82

Which transport mode do you use most often to travel to and from campus? (if you use several transport modes, mark the one you travel longest by) - Other (please specify)

- Scooter (electric)
- E-scooter
- El scooter
- Waitin to see, but i guess walking or cycling, maybe skating

If you use several transport modes to travel to and from the university, what is the second transport mode that you use?

	Percent	Respondents
Walking	39.0%	32
Bike	6.1%	5
E-bike	1.2%	1
Bus	9.8%	8
Train	0.0%	0
Car	3.7%	3
Electric car (EV)	0.0%	0
Passenger in a car	1.2%	1
Other (please specify)	1.2%	1
None	37.8%	31
Total	100.0%	82

If you use several transport modes to travel to and from the university, what is the second transport mode that you use? - Other (please specify)

- Escooter

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0:do not know) - flexibility

	Percent	Respondents
0	2.4%	2
1	2.4%	2
2	1.2%	1
3	15.9%	13
4	23.2%	19
5	54.9%	45
Total	100.0%	82

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0:do not know) - comfort

	Percent	Respondents
0	2.4%	2
1	8.5%	7
2	19.5%	16
3	31.7%	26
4	23.2%	19
5	14.6%	12
Total	100.0%	82

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0:do not know) - travel time

	Percent	Respondents
0	1.2%	1
1	4.9%	4
2	9.8%	8
3	19.5%	16
4	22.0%	18
5	42.7%	35
Total	100.0%	82

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0:do not know) - price

	Percent	Respondents
0	3.7%	3
1	6.1%	5
2	6.1%	5
3	12.2%	10
4	20.7%	17
5	51.2%	42
Total	100.0%	82

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0:do not know) - environmental impact

	Percent	Respondents
0	8.5%	7
1	7.3%	6
2	17.1%	14
3	23.2%	19
4	19.5%	16
5	24.4%	20
Total	100.0%	82

On the scale 1-5, how much do the following factors influence your choice of the transport mode? (1: very little, 5: very much, 0:do not know) - health

	Percent	Respondents
0	6.1%	5
1	8.5%	7
2	19.5%	16
3	26.8%	22
4	24.4%	20
5	14.6%	12
Total	100.0%	82

What other factors are important for you when choosing transport mode to and from the university?

- Transport methods used by my friends
- Väder
- Snabbt och smidigt
- None
- Facility
- How my friends I want to go with travel to campus.
- The social aspect, all my friends travel by bike too

- Time
- It has to be practical in use
- Distance
- Weather
- availability
- Weather
- Weather
- time
- My level of exhaustion
- Weather
- Biking together with friends is fun
- om vägen är cykelanpassat
- How others are commuting
- The accessibility/simplicity: for example from ryd, there is only 1 bus/hour going directly to campus Valla so it's easier to go by bike
- When in rush, the one that is immediately available
- Weather
- Availability
- Schedule (e.g. bus timetable)
- People
- depends
- None
- Distance
- Weather
- Smidighet
- Bil
- Cycling

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is convenient

	Percent	Respondents
1	7.3%	6
2	14.6%	12
3	20.7%	17
4	25.6%	21
5	31.7%	26
Total	100.0%	82

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is time efficient

	Percent	Respondents
1	6.1%	5
2	15.9%	13
3	19.5%	16
4	30.5%	25
5	28.0%	23
Total	100.0%	82

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is affordable

	Percent	Respondents
1	32.9%	27
2	36.6%	30
3	26.8%	22
4	2.4%	2
5	1.2%	1
Total	100.0%	82

This question is about attitudes to driving car, please rate your agreement to each statement even if you do not currently drive car to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Driving car is the safest travel mode

	Percent	Respondents
1	30.5%	25
2	34.1%	28
3	24.4%	20
4	8.5%	7
5	2.4%	2
Total	100.0%	82

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is convenient

	Percent	Respondents
1	1.2%	1
2	13.4%	11
3	35.4%	29
4	28.0%	23
5	22.0%	18
Total	100.0%	82

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is time efficient

	Percent	Respondents
1	42.7%	35
2	39.0%	32
3	8.5%	7
4	7.3%	6
5	2.4%	2
Total	100.0%	82

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is affordable

	Percent	Respondents
1	1.2%	1
2	3.7%	3
3	1.2%	1
4	7.3%	6
5	86.6%	71
Total	100.0%	82

This question is about attitudes to walking, please rate your agreement to each statement even if you do not currently walk to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Walking is the safest travel mode

	Percent	Respondents
1	2.4%	2
2	8.5%	7
3	29.3%	24
4	32.9%	27
5	26.8%	22
Total	100.0%	82

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is convenient

	Percent	Respondents
1	4.9%	4
2	1.2%	1
3	14.6%	12
4	31.7%	26
5	47.6%	39
Total	100.0%	82

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is time efficient

	Percent	Respondents
1	1.2%	1
2	1.2%	1
3	11.0%	9
4	35.4%	29
5	51.2%	42
Total	100.0%	82

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is affordable

	Percent	Respondents
1	1.2%	1
2	2.4%	2
3	7.3%	6
4	25.6%	21
5	63.4%	52
Total	100.0%	82

This question is about attitudes to cycling, please rate your agreement to each statement even if you do not currently cycle to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Cycling is the safest travel mode

	Percent	Respondents
1	6.1%	5
2	23.2%	19
3	45.1%	37
4	19.5%	16
5	6.1%	5
Total	100.0%	82

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is convenient

	Percent	Respondents
1	9.8%	8
2	14.6%	12
3	24.4%	20
4	30.5%	25
5	20.7%	17
Total	100.0%	82

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is time efficient

	Percent	Respondents
1	12.2%	10
2	24.4%	20
3	26.8%	22
4	30.5%	25
5	6.1%	5
Total	100.0%	82

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is affordable

	Percent	Respondents
1	14.6%	12
2	20.7%	17
3	37.8%	31
4	20.7%	17
5	6.1%	5
Total	100.0%	82

This question is about attitudes to public transport (bus), please rate your agreement to each statement even if you do not currently take a bus to/from campus.
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Travelling by bus is the safest travel mode

	Percent	Respondents
1	4.9%	4
2	8.5%	7
3	40.2%	33
4	29.3%	24
5	17.1%	14
Total	100.0%	82

What is the main reason for why you choose to drive a car to/from the university?

- För att jag blir mer motiverad att studera i skolan än hemma

What is the main reason for why you choose to cycle to/from the university?

- Flexibility
- Hälsa
- most convenient, flexible and fast
- Most efficient travel option
- För att röra på mig
- Quickest
- I like it, fast, cheap, flexible
- It is free
- Faster than the other possibilities
- Most simple/fast way from ryd
- Time convenience. Exercise.
- Convenience
- Time efficiency
- Price
- I'm used to it as a Dutchy. And it's practical.
- Price, time
- Time
- Fast and cheap
- Save money
- Fastest route

- It is only good option.
- Time
- Fast and cheap
- Easy
- time
- Cheap and quick
- affordable
- Healthy activity
- It's convenient
- It's a good exercise and it's affordable.
- Flexibility
- It's a good start of the day
- Easy
- Flexibility and speed
- Jag har skolarbete
- Quick transport
- I love cycling
- Cheapest
- Time efficiency and health
- Billigt
- För att man får en promenad i frisk luft.
- flexibility
- price of the buses, and because te uni is near
- It’s faster than by bus
- Linköping has good distances and infrastructure for bikes
- Convenience and availability
- It is the fastest (door to door)
- Commodity
- Time consumption
- Fast
- Convenient
- easiness and flexibility, then health
- Flexibility
- Environmental impact
- Free
- Is the fastest way to get to campus
- Its fast
- Nära till campus
- Efficient way of transportation
- Convenience
- Lätt
- Jag cyklar för att det går snabbt, är flexibelt och billigt
- Free

What is the main reason for why you choose to walk to/from the university?

- Har ingen cykel
- take a short exercise
- To admire the landscape or my bike is broken
- I don't own a bike
- I’m not good at biking
- Cannot cycle
- Prices
- Health, cost, I like it
- Snabbare
- Tid

What is the main reason for why you choose to take the bus to/from the university?

- It's the only alternative, besides waking and riding a bike, and it's faster and more convenient
- Gratis
- billigt

What is the main reason for why you don't walk/cycle to/from university?

- Vädret kan påverka och att det tar längre tid

What is the main reason for why you don't take the bus to/from university?

- Det tar mycket längre tid

What would be the most preferable/viable alternative travel mode for you to use to travel to/from campus?

	Percent	Respondents
Walking/jogging	0.0%	0
Cycling	100.0%	1
Taking a bus	0.0%	0
None of these	0.0%	0
Other (please specify)	0.0%	0
Total	100.0%	1

What would be the most preferable/viable alternative travel mode for you to use to travel to/from campus? - Other (please specify)

Do you have the possibility to park at the university area?

	Percent	Respondents
Yes	100.0%	1
No	0.0%	0
Do not know	0.0%	0
Total	100.0%	1

How do you park your car at the university (campus Valla)?

	Percent	Respondents
I park for free in the parking lot	0.0%	0
I park for free in the parking lot with special permission	0.0%	0
I pay for the parking	100.0%	1
I park on the road/street free of charge	0.0%	0
I park on the road/street with a fee	0.0%	0
Other (please specify)	0.0%	0
Total	100.0%	1

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest parking lot from the university?	50.00	50.00	50.00	1

Do you have the possibility to park your bike at the university area?

	Percent	Respondents
Yes	100.0%	63
No	0.0%	0
Do not know	0.0%	0
Total	100.0%	63

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest bike parking from the university?	0.00	500.00	22.61	63

Do you have access to wardrobe facilities at the university?

	Percent	Respondents
Yes	11.1%	7
No	36.5%	23
Do not know	52.4%	33
Total	100.0%	63

Do you have access to bike maintenance stations at the university or in close surroundings?

	Percent	Respondents
Yes	61.9%	39
No	9.5%	6
Do not know	28.6%	18
Total	100.0%	63

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest bus stop from the place you live?	0.50	1,300.00	304.15	82

	Observed minimum	Observed maximum	Average	Respondents
How far (in metres) do you have to walk to the closest bus stop from the university?	0.00	2,000.00	457.57	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of car parking lots at the university

	Percent	Respondents
1	3.7%	3
2	2.4%	2
3	41.5%	34
4	29.3%	24
5	23.2%	19
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Car parking lots are located within a short distance to the university buildings

	Percent	Respondents
1	1.2%	1
2	12.2%	10
3	24.4%	20
4	34.1%	28
5	28.0%	23
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of outdoor bike parking at the university

	Percent	Respondents
1	0.0%	0
2	3.7%	3
3	7.3%	6
4	25.6%	21
5	63.4%	52
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of indoor bike parking at the university

	Percent	Respondents
1	31.7%	26
2	26.8%	22
3	20.7%	17
4	11.0%	9
5	9.8%	8
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Bike parkings are located in a short distance to the university buildings

	Percent	Respondents
1	0.0%	0
2	2.4%	2
3	7.3%	6
4	14.6%	12
5	75.6%	62
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of shared bikes at the university

	Percent	Respondents
1	15.9%	13
2	22.0%	18
3	46.3%	38
4	11.0%	9
5	4.9%	4
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - Shared bike stations are located within a short distance to the university buildings

	Percent	Respondents
1	11.0%	9
2	18.3%	15
3	47.6%	39
4	15.9%	13
5	7.3%	6
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of wardrobe facilities at the university

	Percent	Respondents
1	23.2%	19
2	25.6%	21
3	40.2%	33
4	7.3%	6
5	3.7%	3
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good availability of bike maintenance stations at the university

	Percent	Respondents
1	9.8%	8
2	20.7%	17
3	45.1%	37
4	19.5%	16
5	4.9%	4
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - There is good number of bus stops located within a short distance/close to/at the university area

	Percent	Respondents
1	7.3%	6
2	25.6%	21
3	34.1%	28
4	23.2%	19
5	9.8%	8
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - I live in a short distance to the bus stop

	Percent	Respondents
1	1.2%	1
2	7.3%	6
3	11.0%	9
4	37.8%	31
5	42.7%	35
Total	100.0%	82

How much do you agree with the following statements?
(1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree) - I have a relatively short distance to the university

	Percent	Respondents
1	1.2%	1
2	6.1%	5
3	23.2%	19
4	34.1%	28
5	35.4%	29
Total	100.0%	82

Language

	Percent	Respondents
English	81.7%	67
Swedish	18.3%	15
Total	100.0%	82

Overall Status

	Percent	Respondents
New	0.0%	0
Distributed	0.0%	0
Partially Complete	0.0%	0
Complete	100.0%	82
Rejected	0.0%	0
Total	100.0%	82