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Abstract

In line with aims of making the transport sector more sustainable, accessible bus service is essential. Nord-Jæren is an exciting geographical area concerning this because of heavy investments made here on bus rapid transit (BRT) infrastructure in recent and coming years. This thesis examines how accessible bus transport is in urban Nord-Jæren before the completion of this BRT project, named the Bus Road ("Bussveien"). Additionally, it assesses whether areas with higher address densities have better bus accessibility and vice versa.

Bus accessibility throughout urban Nord-Jæren is found from a system perspective by measuring six factors identified to influence bus transport accessibility. These are access distance, service coverage, travel time, bus route options, frequency, and service span. Each factor affects spatial or temporal and local or network accessibility. This thesis contains measures of how well each basic statistical unit ("grunnkrets") and statistical tract ("delområde") in the research area perform in the abovementioned accessibility factors, categories, and overall.

The results indicate that bus transport is generally most accessible in and between Stavanger and Sandnes city centres, where the first part of the Bus Road will come. In addition, some areas west and north of Stavanger city centre are also among the most accessible by bus transport. South and east of Sandnes city centre, less accessible areas exist, while Randaberg and Sola municipalities have the least accessible areas. Generally, the least accessible areas have among the lowest address densities, notably less than 500 addresses/km^2. However, many low-density areas are also among the most accessible.

The findings in this thesis may be used to identify areas in Nord-Jæren with poor bus transport accessibility. In addition, they can explain why some areas have poorer accessibility than others and how it can be improved.

Contents

Foreword

This thesis was written as the final piece of my master's degree in City and Regional Planning at the University of Stavanger. The subject of the thesis is related to bus transportation in Nord-Jæren. I think this is an exciting topic because of the big ongoing bus infrastructure projects here.

Although the thesis required much work, it was mostly fun to conduct. I am certain the experiences, skills, and knowledge I have acquired while writing it will be useful for me in the future. I hope the outcome is satisfactory for the reader and can contribute to better bus transport in Nord-Jæren.

I must thank my supervisor Daniela Müller-Eie and co-supervisor Ioannis Kosmidis for giving me this interesting thesis and for the invaluable help while writing it. Furthermore, I should thank everyone I have worked with and learned from at the University of Stavanger for five fun and educational years. I must also thank my family for their support and for giving me the best possible conditions for writing this thesis.

Karl Magnus Torgrimsen

Stavanger, 15th June 2022

Terms and abbreviations

Term/abbreviation	Definition	Source
Accessibility	"The quality of being accessible"	(OED, n.d.-a)
Accessible	Able to be used, reached, obtained, approached, entered, spoken with, understood, seen, dealt with, got hold of, etc.	(Cambridge Dictionary, n.d.-a; Dictionary.com, n.d.; Merriam-Webster, n.d.-b; OED, n.d.-b)
ArcMap	A GIS software developed by Esri.	
Area coverage	The geographical area that public transport serves. In this thesis, each bus stop is assumed to serve a radius of 500 m.	(Kittelson & Associates, Inc. et al., 2013, p. 720)
AWD	Acceptable walking distance to public transport. I.e., how far people are willing to walk to use public transport.	(van Soest et al., 2020)
Basic statistical unit ("grunnkrets")	The smallest geographical area used for statistics in Norway. They can be used to present regional statistics because they are small and stable over time.	(SSB, 2021a)
BRT	Bus rapid transit	
BSU	Basic statistical unit	
BTA	Bus transport accessibility	
Bus Rapid Transit	A transport system that delivers fast, comfortable, and cost-effective services through dedicated bus lanes (typically placed in the centre of the road), off-board fare collection, and fast and frequent operations.	(ITDP, n.d.)
The Bus Road "Bussveien"	A large ongoing BRT project in urban Nord-Jæren.	
Bus transport	a system of buses that: (1) operate at regular times, (2) operate on fixed routes, and (3) are used by the public for transport of people.	(Cambridge Dictionary, n.d.-c; Merriam-Webster, n.d.-d)
GIS	Geographic information system	
Headway	The time interval between arrivals of buses driving the same route in the same direction. E.g., a bus stop visited by route X twice an hour has a 30-minute headway.	(Kittelson & Associates, Inc. et al., 2013, p. 738)
IV	In-vehicle	
Kolumbus	The operator of public bus transport in the research area. This thesis only assesses bus service from Kolumbus.	
Local accessibility	Accessibility of a place or location to bus transport.	(Hillman & Pool, 1997)
LRT	Light rail transit	
Monocentric	"Having a single centre"	(Oxford, n.d.)
Network accessibility	Accessibility of locations to destinations using bus transport.	(Hillman & Pool, 1997)
Network connectivity	"Whether there is a route, or a combination of routes, that connects the boarding and the egress stops"	(Bhat et al., 2006)
NTP	National Transportation Plan, a plan created by the Norwegian parliament and other transportation actors. The plan presents the transportation policy and its goals and principles.	(Solvoll, 2021)
OD matrix	Origin-destination matrix	
Polycentric	"Having more than one centre"	(Merriam-Webster, n.d.-c)
PT	Public transport	

PTA	Public transport accessibility	
PTAL	Public Transport Accessibility Level, a method for measuring the connectivity to the public transport network.	(TfL, 2015)
PTW	Public transport-related walking	(van Soest et al., 2020)
Public transport-supportive area	An area that has sufficient population or address density to support hourly or more frequent fixed-route public transport.	(Kittelson & Associates, Inc. et al., 2013, p. 720)
Public transport	a system of vehicles (e.g., buses or trains) that: (1) operate at regular times, (2) operate on fixed routes, and (3) are used by the public for transport of people.	(Cambridge Dictionary, n.d.-c; Merriam-Webster, n.d.-d)
RVU	Reisevaneundersøkelsen (the Travel Habit Survey), a survey on Norwegians' transportation habits.	(Opinion, 2021)
Service coverage	The area located within walking distance of bus service. Areas and addresses located within 500 m of a bus stop are considered covered by service in this thesis.	(Kittelson & Associates, Inc. et al., 2013, p. 203)
Spatial accessibility	Where public transport service is and how to get to it.	(Bhat et al., 2006, p. 8)
ST	Statistical tract	
Statistical tract ("delområde")	A fixed division of municipalities into smaller geographical units.	(Noack, 2022)
TCQSM	Transit Capacity and Quality of Service Manual	(Kittelson & Associates, Inc. et al., 2013)
Temporal accessibility	When, how often, and how long public transport service can be used during a day.	(Bhat et al., 2006, p. 8)
Urban Growth Agreement	An agreement between the State, Rogaland County, and the municipalities in Nord-Jæren aiming to reach the Zero-growth target, improve traffic accessibility and safety, and contribute to high area utilisation.	(Bymiljøpakken, 2020)
Vision Zero	A vision of having no one killed or seriously wounded in road traffic.	(Statens Vegvesen, n.d.)
Zero-growth target	A goal of having the growth in passenger transport in the urban areas taken by public transport, bicycle, and walking.	(Miljødirektoratet, n.d.)

1. Introduction

This thesis aims to determine how accessible the bus transport in urban Nord-Jæren, southwest in Norway, is by examining where it is most and least accessible. Accessible bus transport is necessary because laws and objectives require the transport sector to be more sustainable. To achieve sustainability goals in urban Nord-Jæren, it is essential to know how and where accessible public transport is and how it can be improved.

Nord-Jæren is an exciting geographical area because of the heavy investments in public transport infrastructure made here in recent and coming years. These, and the research area in general, are discussed further in chapter 2. Figure 1.1 shows the chosen research area.

The research question is:

How accessible is bus transport in urban Nord-Jæren?

How accessible the bus transport is can be found by measuring its accessibility. “Accessibility” is a broad and important term in transport. It can be defined as “people’s ability to reach desired services and activities” (Litman, 2021). Chapter 3 discusses accessibility theory in more detail, while chapter 4 describes how accessibility was estimated in this thesis.

A hypothesis is that the areas with the highest address densities have the most accessible bus transport. By answering the research question, it will be possible to conclude if this is the case or not for Nord-Jæren. Address densities are used instead of regular population densities because addresses represent potential travel points in the research area. They may also be more permanent over time. In addition, address densities are assumed to be more easily compared between areas because some places, e.g., workplace areas, have very few inhabitants but many addresses. The findings and interpretation of these are discussed in chapter 5 and 6.

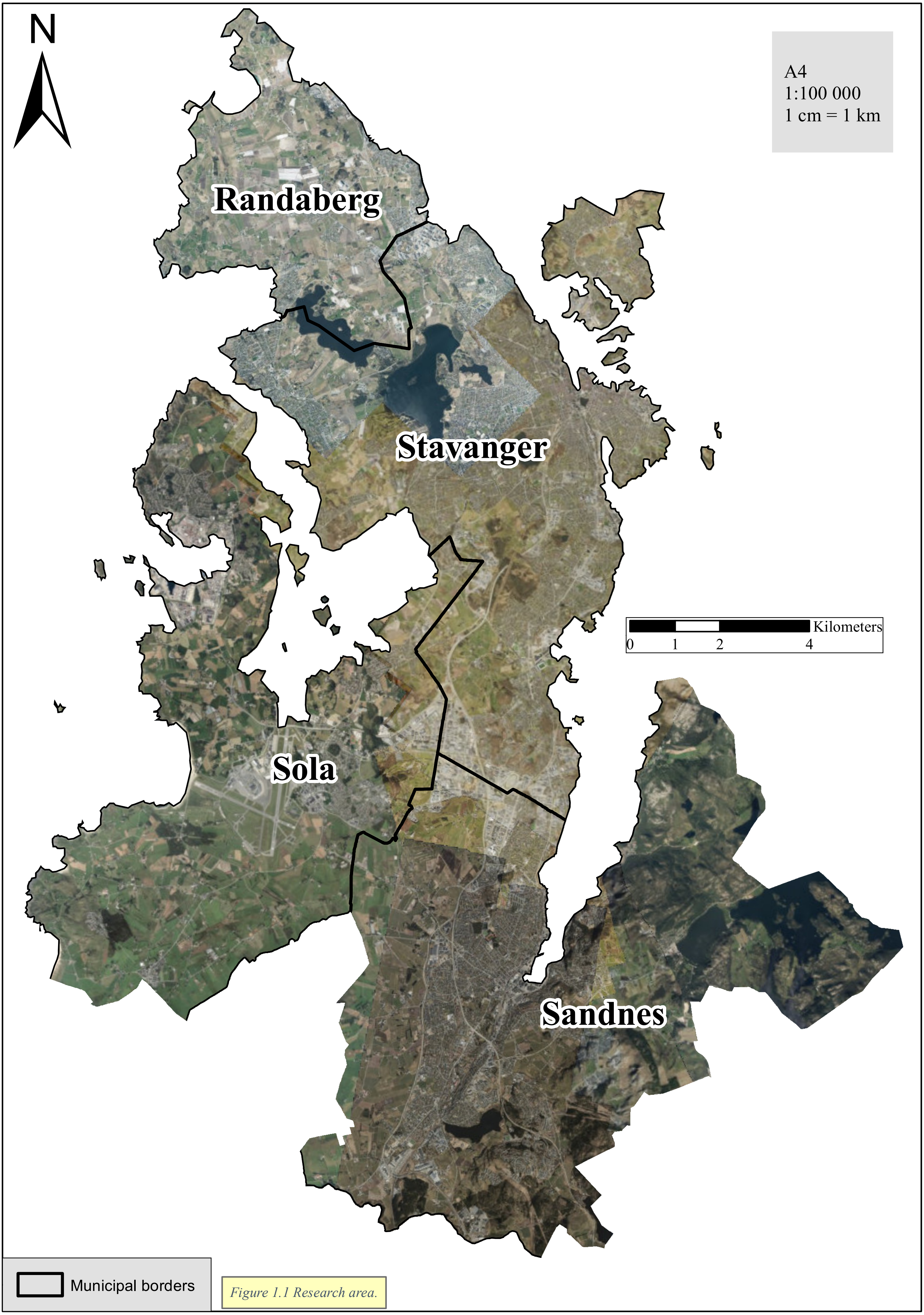

Figure 1.1 Research area.

2. Context

2.1. Global, national, and regional plans and objectives

This subchapter examines global, national, and regional plans and goals for bus transport. By assessing these, it is possible to determine if the bus transport in the research area aligns with the desired development. This also gives a context to the recent developments in the research area and globally.

2.1.1. Global plans and objectives for sustainable development

The Paris Agreement obliges its member states to contribute to limiting global warming to no more than 2 °C and preferably no more than 1.5 °C. They must also plan for how this can be achieved (UN, 2020). The agreement and its goals have led to much focus on public transport, as the transport sector constitutes around 16 % of global greenhouse gas (GHG) emissions. Passenger road transport is accountable for approximately 7 % of the total (Ritchie et al., 2020). In Nord-Jæren, road transport is responsible for around 28 % of CO_2e emissions (Stavanger kommune, 2021). More accessible bus transport is one of many ways to reduce emissions locally and globally.

The United Nations (UN) has 17 worldwide goals with appurtenant targets for sustainable development. The member states adopted these goals in 2015 to protect the planet and improve life quality and prospects for everyone (UN, n.d.-e). Goals 3, 9, 11, and 13 with belonging targets are especially relevant for bus transport in the analysis area.

Figure 2.1 Sustainability goals relevant for public transport (UN, n.d.-a, n.d.-b, n.d.-c, n.d.-d).

2.1.2. National transportation plan (NTP)

The Norwegian Government presented the latest National Transport Plan (NTP 2022–2033) in March 2021. The plan decides how much funding each transport project gets. Its slogan is "An effective, eco-friendly and safe transport system in 2050". The plan has five equal goals for the transport sector. These goals are related to cost control, use of new technology, reaching Norway's environmental goals, Vision Zero, and easier everyday travel and increased competition for trade (Samferdselsdepartementet, 2021).

NTP will positively influence Norway's chances of reaching many of the sustainability goals presented in 2.1.1. Through this plan, the state, Rogaland County, and the four Nord-Jæren municipalities have agreed on an urban growth plan for 2019-2029. In this agreement, the state contributes with around 13.4 billion NOK to amongst other finance half of the Bus Road in Nord-Jæren, improve the public transport, and reduce its fares (Samferdselsdepartementet, 2021).

2.1.3. Regional plan for Jæren and South Ryfylke ("Regionalplan for Jæren og Søre Ryfylke")

The regional plan for Jæren and South Ryfylke was approved in October 2020 and last changed in September 2021. It is a long-term plan toward 2050 for sustainable and coordinated planning of dwellings, areas, and transport. The geographic extent of the plan includes Nord-Jæren and six neighbouring municipalities. There are six goals in the plan, of which the goals of easier everyday, increased competitiveness, vigorous neighbourhoods, and durable natural resources are especially relevant for this thesis (Rogaland fylkeskommune, 2021d).

The regional plan has guidelines for how close bus stops should be to different areas. The goal is to have heavily visited areas within 100 m, work-intensive areas within 250 m (the distance should be shorter along the public transport lines and in centre areas), and dwellings within 500 m (Rogaland fylkeskommune, 2021d, p. 60).

2.1.4. The Urban Growth Agreement 2019-2029 (“Byvekstavtalen”)

The Urban Growth Agreement is an agreement between the State, Rogaland County, and the municipalities in Nord-Jæren. It was last renewed in 2019, but Nord-Jæren has since increased in size and population due to the municipal reform in 2020, where Finnøy and Rennesøy merged with Stavanger, and Forsand merged with Sandnes. Consequentially, the Urban Growth Agreement does, like this thesis, not consider all of what can now be considered Nord-Jæren.

The latest agreement is based on the guidelines presented in NTP 2018-2029. Its goals are to reach the Zero-growth target and Vision Zero, have good accessibility for all transport groups, achieve 20 % of transport through cycling in the largest cities, contribute to high area utilisation and densification, and transformation with high urban and living quality (Bymiljøpakken, 2020). To reach the Urban Growth Agreement goals, the stakeholders created the City Environment Package (“Bymiljøpakken”), a collection of projects financed by the state, county, Nord-Jæren municipalities and road toll collection. Its total cost is estimated to be around 30 billion NOK by 2033. The City Environment Package includes various infrastructure projects, shown in Figure 2.2, including the Bus Road (“Bussveien”), which is discussed further in section 2.2.4.

Figure 2.2 The projects in the City Environment Package (Bymiljøpakken, 2020).

2.2. Research area

This subchapter presents relevant information about the research area, including area explanation, population statistics, traffic, and infrastructure projects. When discussing area, only land area is considered unless stated otherwise. The information provided below gives a basis for the methodology and findings presented later. In addition, it makes it possible to compare this region with other places.

2.2.1. Area explanation

As mentioned in the introduction, the analysis area is delimited to the area shown in Figure 1.1, which lies southwest in Norway. The research area has a total area of 222.31 km^2 (SSB, 2022) and includes the most urban parts of Sandnes, Sola, and Stavanger, in addition to all of Randaberg. Appendices 1-3 contain more detailed information about the research area.

Initially, it was intended to include the whole of Nord-Jæren. However, this proved inconvenient in several ways. Firstly, it would have meant that several remote rural areas with low density and low population would have been included. These areas are challenging to compare to more urban and populous places because denser areas are expected to have better accessibility. Furthermore, it was necessary to limit the spatial extent of the research area. Reduced area was preferred over reduced population because accessibility affects individuals, not locations. The chosen research area, in this thesis sometimes referred to as urban Nord-Jæren, contains 90.7 % of the initial population but only 17.2 % of the initial area. These reductions were possible by omitting remote low-density places, notably Forsand, which contained over half of the initial area while having less than 0.4 % of the total population. Lastly, the current research area better resembles Nord-Jæren before the municipal reform in 2020. This is important because the Urban Growth Agreement was last renewed in 2019, as described in section 2.1.4. Finnøy, Rennesøy, and Forsand were merged with the Nord-Jæren municipalities in 2020, but none of these are included in the research area. Areas omitted from the research area were omitted either because of large distances to urban Nord-Jæren, lack of road connection, or low population density.

Figure 2.3 shows the research area and the four municipalities in Nord-Jæren. Appendix 1 contains a complete overview of the included areas in the research area.

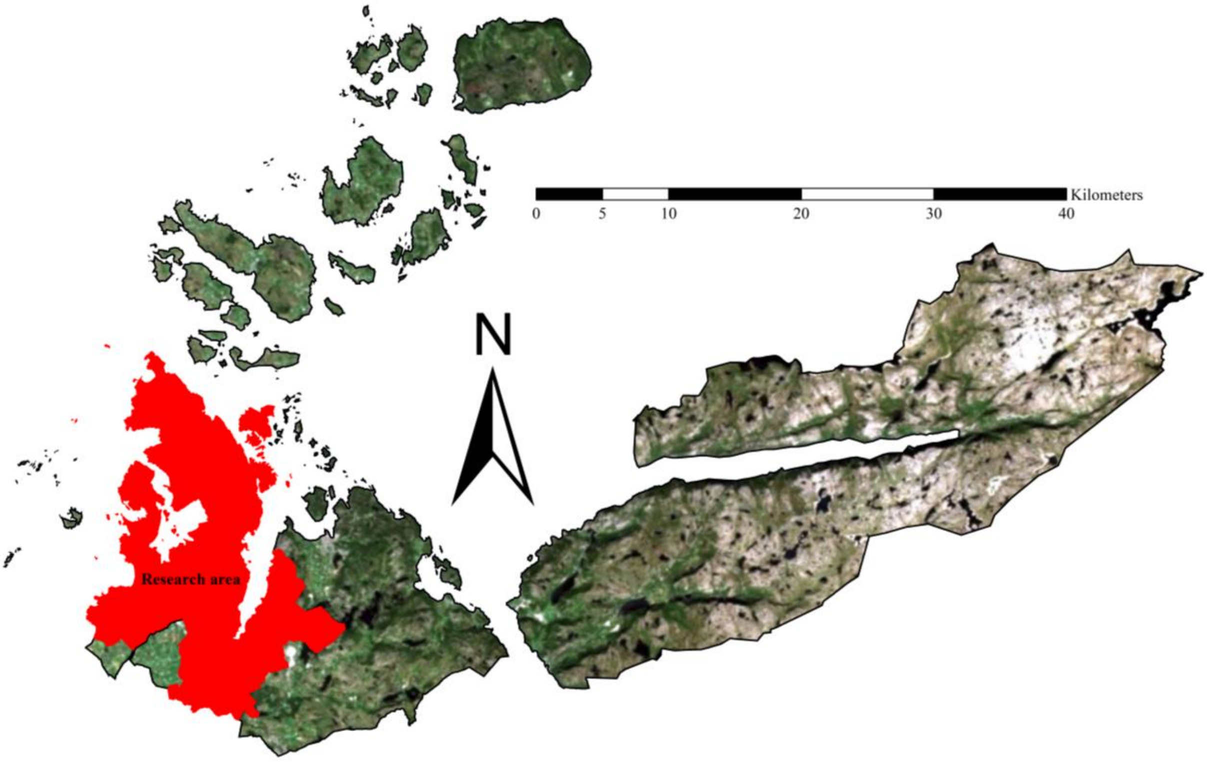

Figure 2.3 Nord-Jæren and the research area (Esri, n.d.; Geonorge, n.d.).

Included in the research area are 38 statistical tracts. A statistical tract ("delområde"), henceforth abbreviated "ST", is a fixed division of municipalities into smaller geographical areas. The purpose of this division is to have small geographical areas for municipal and regional analysis (Noack, 2022). The statistical tracts included in this thesis are listed in appendix 2.

When omitting areas from the initial research area of Nord-Jæren, it was attempted to omit or keep whole STs. This was emphasised to make the research area more coherent and simplify the comparison between STs. The STs that were omitted from the initial research area are Finnøy, Rennesøy, Bru - Sokn – Mosterøy, Øyene, Figgjo – Bråstein, Riska, Bersagel – Høle, and Forsand.

STs contain one or more areas called basic statistical units. A basic statistical unit ("grunnkrets"), here abbreviated "BSU", is the smallest geographical area used for statistics in Norway. They can be used to present regional statistics because they are small and stable over time (SSB, 2021a). The research area contains 327 BSUs, which are listed in appendix 1.

BSUs Rott, Malmheim, and Dysjaland, respectively from STs Tananger, Malmheim – Åse, and Dysjaland, were omitted because they have no road connection, or the GIS data lacks bus routes and stops here. Although these omissions are not ideal, as STs are split up, the rural characteristics and low population densities justify omitting them from the research area.

Nord-Jæren have a polycentric spatial structure, as the region has many centres, e.g., Stavanger, Sandnes and Forus, as opposed to one main centre (monocentric). In general, polycentric structures weaken the competitiveness of public transport compared to monocentric layouts (TØI, 2021, p. 69).

Figure 2.4 shows the location of each BSU in the research area, in addition to ST and municipality borders.

Figure 2.4 BSUs and STs included in the research area.

2.2.2. Population

The research area has a population of approximately 238336 inhabitants and a population density of 1072.1 inhabitants/km^2 (SSB, 2021b, 2022). As illustrated in Figure 2.5, the population is unevenly distributed across the research area. The densest populated zones seem to be along the railway between Stavanger and Sandnes. In general, it also seems like there are more bus routes where people live. The Bus Road also looks like it will connect populous areas upon completion, although some dense areas are not connected to it.

In the last 35 years, Nord-Jæren, which the research area lies in, had a population growth of around 60 %. As a comparison, the population growth for Norway in the same period was approximately 30 % (SSB, 2021c).

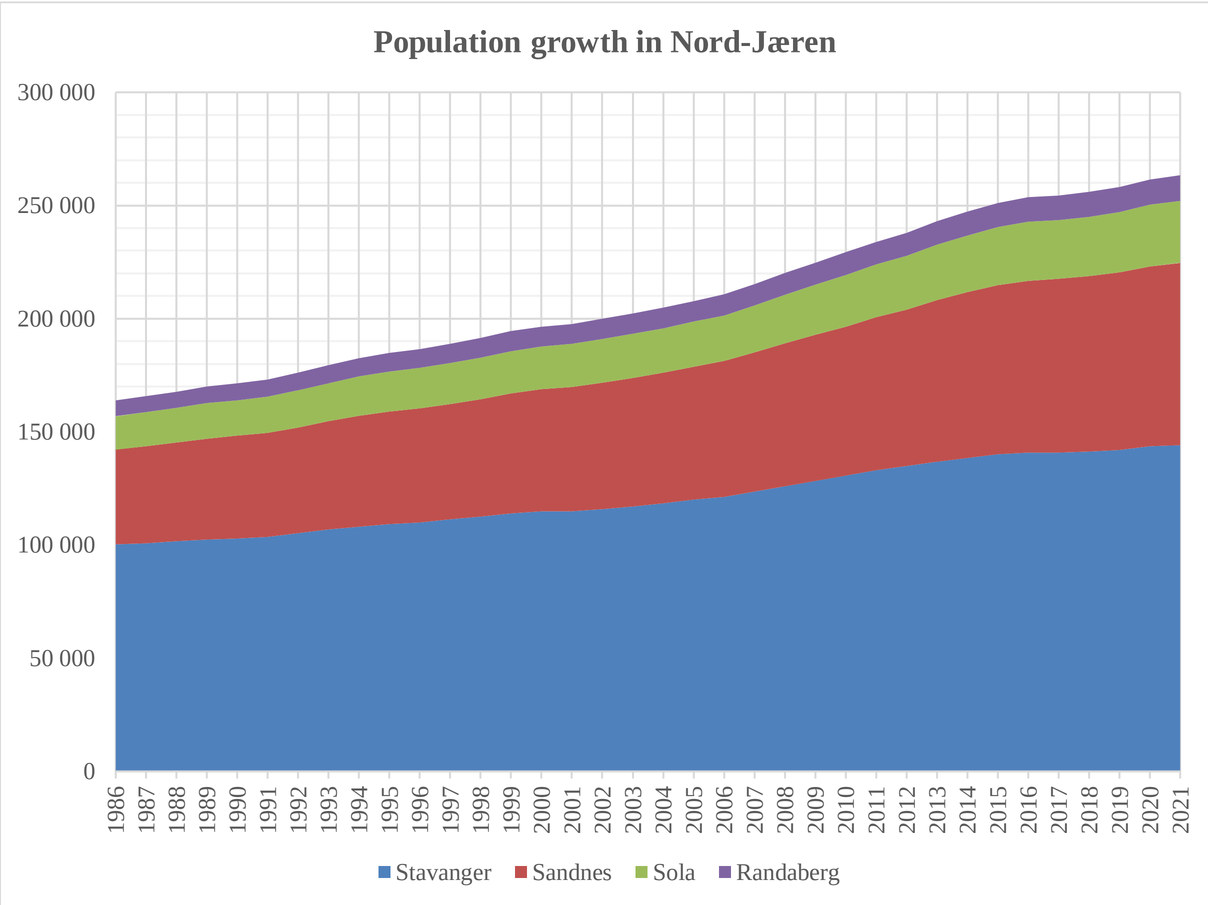

Chart 2.1 Population growth in the Nord-Jæren municipalities 1986-2021. The graph includes inhabitants in the areas belonging to each municipality after the municipality reform in 2020. Numbers from (SSB, 2021c).

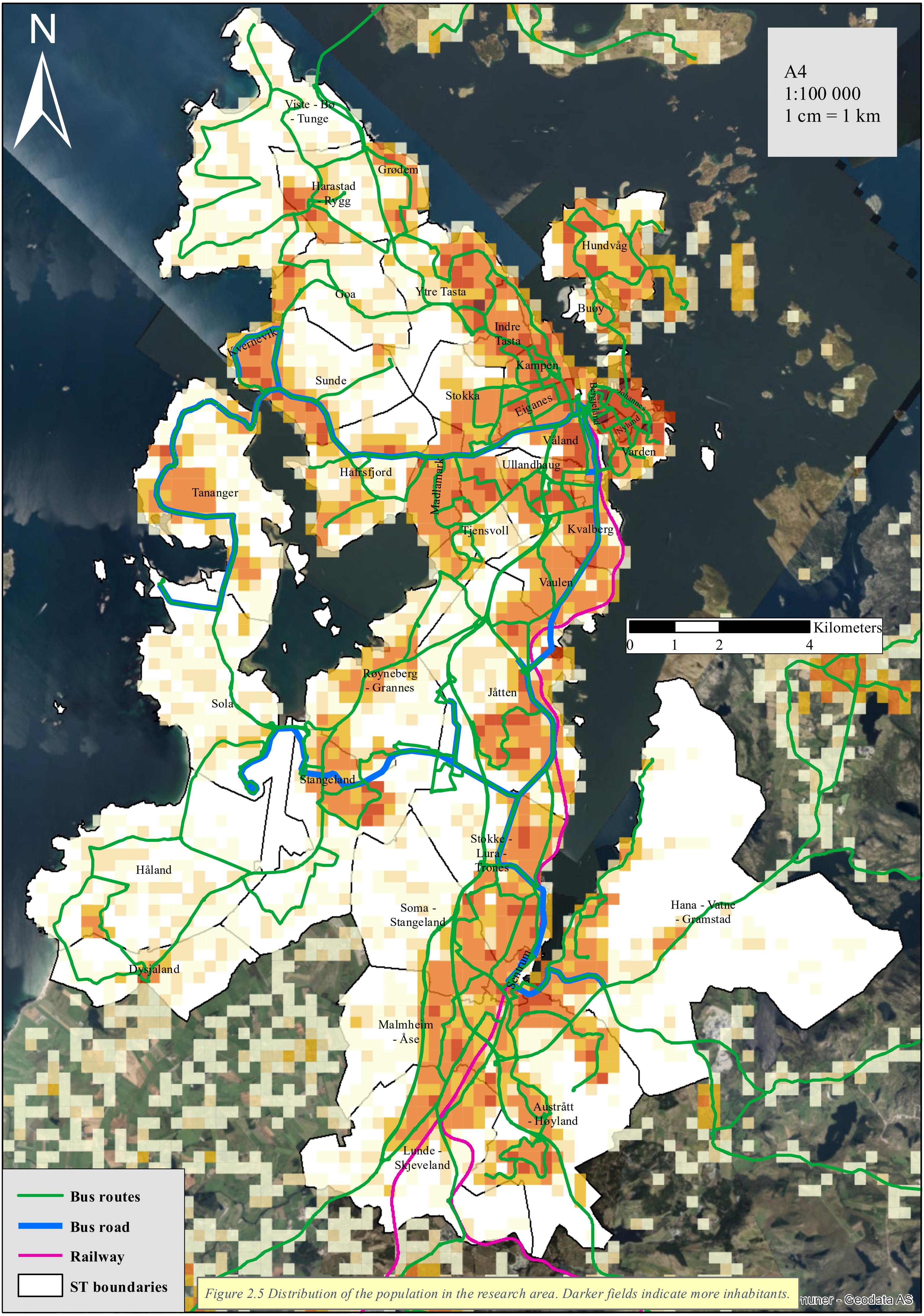

Figure 2.5 Distribution of the population in the research area. Darker fields indicate more inhabitants.

By 2050, the population in Nord-Jæren is expected to grow from 262908 to somewhere between 301294 and 337461 (14.6-28.4 % increase) (SSB, 2020b). The trend for the municipalities in Rogaland is that the population centralizes and increases in urban municipalities, while rural municipalities stagnate or lose population. Within the municipalities, densely populated areas also gain inhabitants while surrounding areas are depopulated (Rogaland fylkeskommune, 2021a). Table 2.1 shows the expected growth in each municipality in Nord-Jæren and Norway from 2021 to 2050.

Table 2.1 Expected growth in Nord-Jæren and Norway towards 2050 (SSB, 2020a, 2020b).

Place	2021 population	2050 expected population			
		Low	Change [%]	High	Change [%]
Stavanger	143896	156617	8.84	176689	22.79
Sandnes	80318	98092	22.13	109022	35.74
Sola	27398	33338	21.68	37103	35.42
Randaberg	11296	13247	17.27	14647	29.67
Nord-Jæren	262908	301294	14.60	337461	28.36
Norway	5425270	5366121	-1.09	6653729	22.64

With predicted growth, accessible bus service is mandatory to reach the Zero-growth target in the research area. Consequentially, major traffic infrastructure projects like the Bus Road and a bicycle trunk road are being built in the research area.

2.2.3. Traffic

The public transport sectors in Norway survey the population's transport habits through the Travel Habit Survey (Reisevaneundersøkelsen, RVU). The results are used for planning the future transport system. The latest version was published in December 2021 and contains statistics for 2020. Note that this survey version was influenced by the COVID-19 pandemic, which reduced the use of public transport.

The survey contains statistics for Stavanger municipality and "Stavanger surrounding country", consisting of Sandnes, Hå, Klepp, Time, Gjesdal, Sola, Randaberg, and Strand. These nine municipalities are labelled under the collective term "Nord-Jæren" in RVU 2020. Although this definition of Nord-Jæren is different from the one used in this thesis, it is assumed to be representative because higher populated municipalities, particularly Stavanger and Sandnes, are weighted accordingly.

In the tables below, the survey results from RVU 2020 for Nord-Jæren are assumed to be the weighted average from Stavanger and Stavanger surrounding country, considering the distribution of questionnaires. The same is done for Oslo, Bergen, Trondheim, and their surrounding countries. Below is a summary of findings from RVU2020 that are relevant to the topic of this assignment. All numbers are percentages.

2.2.3.1. Access to public transport

Table 2.2 shows how the survey participants view accessibility to public transport. It is worth noting that Nord-Jæren has similar perceived accessibility as the Bergen area and is better than the national average. The urban centres generally have significantly better perceived accessibility to public transport than their surrounding areas (Opinion, 2021, p. 59).

Table 2.2 Users' access to public transport (Opinion, 2021, p. 59).

Perceived accessibility to public transport	**Very good**	**Good**	**Medium**	**Poor**	**None or poor**
Nord-Jæren	44	26	10	4	17
Oslo area	61	20	6	2	11
Bergen area	37	30	13	8	13
Trondheim area	54	17	7	5	16
National average	35	21	13	10	22

2.2.3.2. Modal split

Table 2.3 shows the modal split distribution. Nord-Jæren inhabitants walk and public transport the least and drive the car the most. This may partly be attributed to the polycentric layout here, as the three other areas have more traditional monocentric structures. It is also noteworthy how few cycle, considering the Government's long-term goal of having 8 % of all trips and 20 % of trips in urban areas (Samferdselsdepartementet, 2021, p. 115) by this transport form.

Table 2.3 Daily trips, means of transport (Opinion, 2021, p. 62).

Means of transport	Walking	Public transport	Car, driver	Car, passenger	Cycle	MC/ moped	Other
Nord-Jæren	20	5	57	9	6	1	1
Oslo area	28	13	44	8	5	0	1
Bergen area	23	9	57	8	2	1	1
Trondheim area	26	8	50	9	5	1	1
National average	23	8	54	10	4	1	1

2.2.3.3. Driver's licence

Nord-Jæren has the highest share of people with a driver's license and car access, which may be one reason for the low percentage of people using public transport in the region.

Table 2.4 Share of people with driver's licence, car access, and driver's licence and car access the whole day (Opinion, 2021, pp. 56, 58).

	Driver's license (18 or older)		Car access		Driver's licence & car access	
	Yes	No	Yes	No	Yes	No
Nord-Jæren	93	7	90	10	74	26
Oslo area	87	13	77	23	62	38
Bergen area	89	11	83	17	70	30
Trondheim area	89	11	82	18	69	31
National average	90	10	85	15	70	30

2.2.3.4. Car parking, cycle access, number of trips and purpose of trips

All the surveyed areas have similar share of car parking near dwelling, cycle access, number of daily trips, and purpose of trips (Opinion, 2021, pp. 61, 63, 57, 60). It is therefore assumed that these factors cannot explain the differences in public transport use between these areas.

2.2.3.5. Trend

Between 2014-2019, i.e., before the pandemic, walking, cycling, and public transport in Nord-Jæren slightly increased (0-3 %), while car driving decreased by around 5 % (UA, 2019). The estimated national trend is that means of transport for short trips (less than 70 km) will stay relatively unchanged. For longer trips (over 70 km), cars are assumed to be used more while flights are expected to decrease. Public transport use is thought to stay unchanged or decrease (Samferdselsdepartementet, 2021, p. 24).

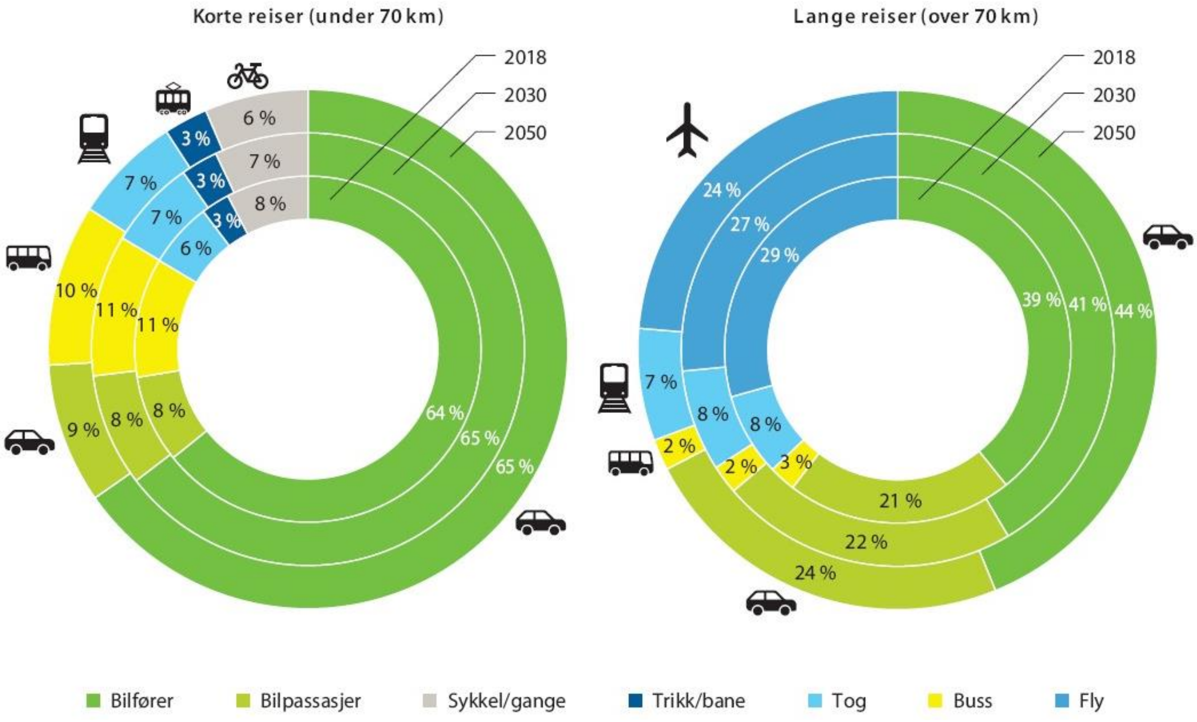

Figure 2.6 Distribution for means of transport in Norway, 2018, 2030 and 2050. The diagrams show projections for respectively short trips (less than 70 km) and long trips (more than 70 km) (Samferdselsdepartementet, 2021, p. 24).

2.2.4. The Bus Road ("Bussveien")

The Bus Road aims to better connect urban parts of Nord-Jæren by creating around 50 km of bus lanes. Over 75 % of the stretch will be dedicated lanes reserved for buses. Upon completion, this will be Norway's first full-fledged bus road system (Rogaland fylkeskommune, 2020b). The Bus Road is Nord-Jæren's most important contribution toward the Zero-growth target and a reversal of former development policies based on car usage. This new system is designed to handle twice as many passengers as the current public transport system and aims to improve accessibility for everyone (Rogaland fylkeskommune, 2019).

Users are expected to perceive the Bus Road more like an urban railway than a regular bus lane (Rogaland fylkeskommune, 2021b). It consists of mostly straight roads without unnecessary turns and roundabouts. This gives the buses a higher standard and more visibility (Rogaland fylkeskommune, 2020b). Such systems are often called Bus Rapid Transit (BRT). Subchapter 3.4 further describes BRT.

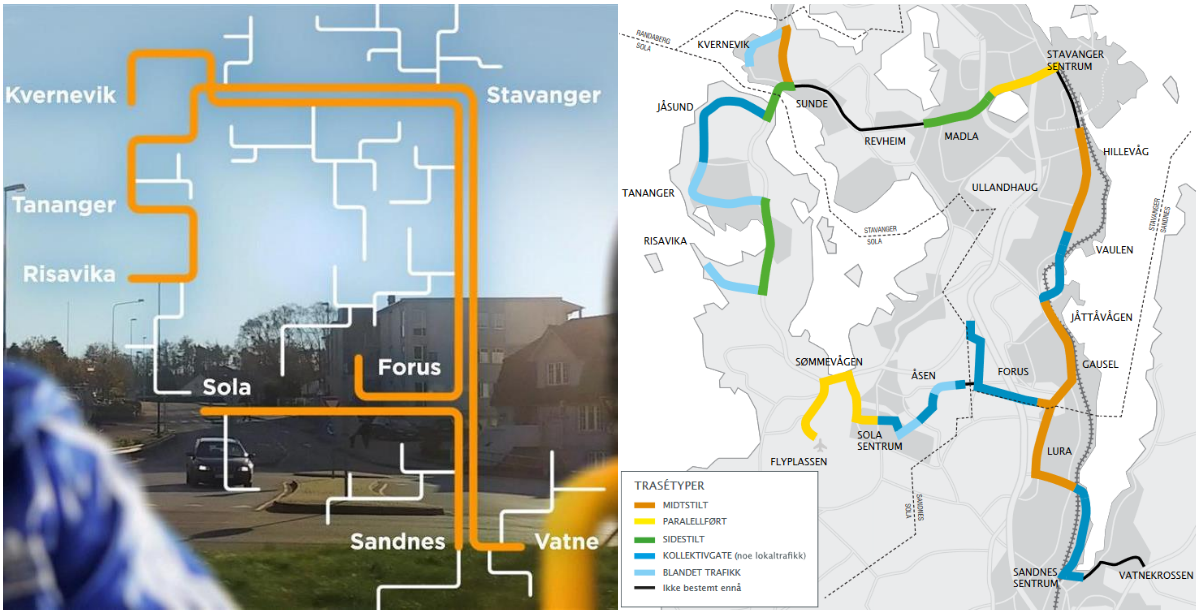

Figure 2.7 The left figure shows where the Bus Road will go (orange) and conventional routes (white). The right figure indicates which solutions are used on the Bus Road. Orange is centred, yellow is parallel, green is side by side, dark blue is transit mall (some local traffic), light blue is mixed traffic, and black is undecided (Rogaland fylkeskommune, 2020b; Stavanger kommune, 2020a).

The Bus Road will have higher frequency than conventional routes. Bus lines A and B, shown in Figure 2.9, have eight departures each hour. On the stretch Sunde-Stavanger-Forussletta, these are parallel, meaning there are 16 departures here each hour. Line A will also be open 24 hours a day (Rogaland fylkeskommune, 2020b).

Figure 2.8 The buses have dedicated lanes and drive straight through right-of-way roundabouts (Rogaland fylkeskommune, 2020a)

The Bus Road connects municipal centres in Stavanger, Sandnes, and Sola with residential and business areas on Forus, Tananger, and Jåttåvågen. On average, there will be stops every 500 m along the lane. Stops will also contain cycle parking to further enhance connectivity. 58 % of the population in Nord-Jæren live or work along the Bus Road, and the number is expected to grow by 2040, as the Urban Growth Agreement aims to develop areas along the Bus Road (Bymiljøpakken, 2020; Rogaland fylkeskommune, 2019).

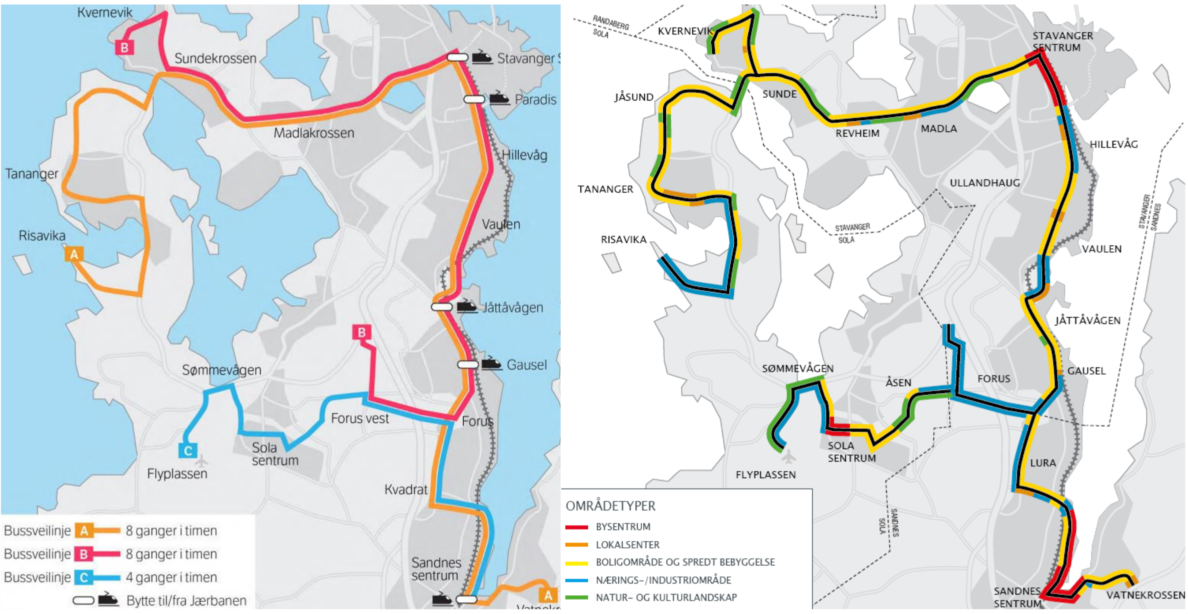

Figure 2.9 Routes on the Bus Road upon completion. Line A and B will have 8 departures each hour, while C will have 4. Right figure: area types along the Bus Road. Red = city centre, orange = local centre, yellow = residential areas and scattered buildings, blue = business/industry & green = greenery and culture (Stavanger kommune, 2020a).

The Bus Road will cover areas with different characteristics. Places along the lanes have mostly residential and business purposes, but there are also city and local centres and greenery along the road (Stavanger kommune, 2020a). Figure 2.9 shows which area types will exist along the Bus Road.

At the time of writing, six of 25 subsections of the Bus Road are completed. The first part, in Hillevåg, was finished in 2011. There is no completion date for the whole project, but in 2026, a continuous lane between Stavanger and Sandnes is expected to be completed. This will be the first opportunity to properly evaluate whether the Bus Road is a success or not (Kjetil S. Grønnestad, 2021; Rogaland fylkeskommune, 2022).

One major part of the project, the most complicated and the last to be completed between Stavanger and Sandnes, is the stretch between Vaulen and Gausel. Amongst other, current car roads and roundabout will be laid under cover. In addition, a new road dedicated to buses will cross the railroad and go from Hinnasvingene through Jåttåvågen. This supports the development of Jåttåvågen as a new district and an important hub between the Bus Road, the railroad, the University of Stavanger, and the new hospital (Stavanger kommune, 2020c). Figure 2.10 shows what the new district in Jåttåvågen may look like and the planning area of this project.

Figure 2.10 Bay area on Jåttå. White buildings are not built. Right figure: the planning area for the final part of the Bus Road between Stavanger and Sandnes, Stasjonsveien – Gauselvågen (Stavanger kommune, 2020a, 2020b).

Initially, half of the costs of the Bus Road should be paid by the State, while the rest should be covered by road toll collection. The state contribution has since been increased to 66 % due to a reduction in road toll income. The total cost is now estimated to be around 10.55 billion NOK. This does not include the bus road through Stavanger city centre and the other stretches built after 2026 (Bymiljøpakken, 2020; Kjetil S. Grønnestad, 2021).

The costs of the Bus Road have been a topic of discussion. Many feel that it is too expensive and that road tolls should not be used to fund it. There are also complaints regarding the expropriation of properties due to costs and because many lose all or parts of their homes. Some also point out that the Bus Road decreases the attractiveness of the built environment and that it may work as a barrier between neighbourhoods (Christiansen et al., 2021). Potential adverse effects of Bus Road systems are discussed further in subchapter 3.4.

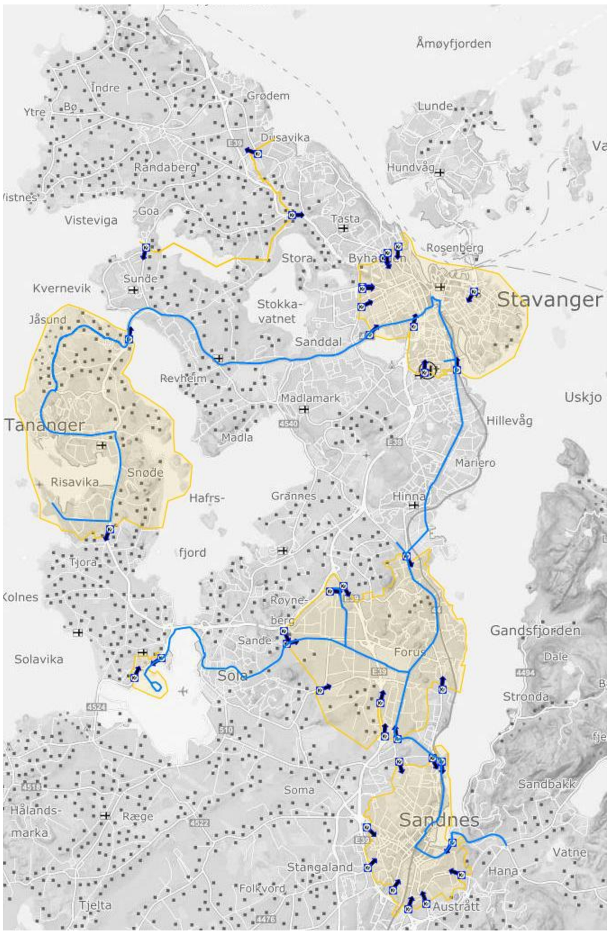

Figure 2.11 Road toll zones and the Bus Road in Nord-Jæren (Statsforvalteren i Rogaland et al., n.d.).

The decision to have the Bus Road go through the new Jåttåvågen area has also generated complaints from some residents on Hinna. This is because many would prefer the buses to go where they do today (through Hinna along county road 44) instead of the approved route further east. Consequently, many feel they get worse public transport service despite funding it through nearby road tolls. There are also concerns regarding the neighbourhoods being demolished due to building the Bus Road here (Håland, 2021).

3. Theory

3.1. Accessibility

“Accessibility” can be difficult to define. Geographer Peter Gould (1969) once noted: “accessibility is a slippery notion, one of those common terms which everyone uses until faced with the problem of defining and measuring it”. Several general definitions exist for “accessibility”, but for this thesis, it is defined as: “The quality or condition of being accessible” (OED, n.d.-a).

“Accessible” is understood as “able to be used, reached, obtained, approached, entered, understood, seen, dealt with, got hold of, bought etc.”, depending on context (Cambridge Dictionary, n.d.-a; Dictionary.com, n.d.; Merriam-Webster, n.d.-b; OED, n.d.-b) Many definitions of “accessible” include the word “easily” instead of “able to be” in the definition above, implying that if something is accessible, it is easily used, reached, understood, and so on. In this thesis, “accessible” is used in conjunction with more, less, not, very, or other adverbs to describe how accessible something is.

From the above, accessibility is measured in terms of how accessible something is. I.e., more accessible means better accessibility. Methods for measuring accessibility, i.e., how accessible something is, are discussed later in this chapter.

“Accessibility”/“accessible” can be mixed and used interchangeably with several synonyms, including perhaps most notably “availability”/“available” (Merriam-Webster, n.d.-a, n.d.-e). The Transit Capacity and Quality of Service Manual (TCQSM) uses “availability”/“available” when discussing the quality of the public transport service and “accessibility”/“accessible” when referring to universal design. Most of the other researched papers about this use “accessibility”/“accessible”, it is therefore also used here, with the definitions given above.

In general, good accessibility to economic, recreational, service, and social opportunities is an important component of quality of life (Wachs & Kumagai, 1973). Accessibility in terms of transport is an essential indicator of transportation service (Polzin et al., 2002). It can be defined as “people’s ability to reach desired services and activities” (Litman, 2021). Public transport accessibility (PTA) impacts life satisfaction, environment, daily life, job opportunities, and public participation in social activities (Saif et al., 2018).

3.2. Bus transport

3.2.1. Definition

In the literature, there seem to be few definitions of "bus transport", but several exist for "public transport", "public transportation", "public transit", or similar terms. "Public transport" is in this thesis defined as (Cambridge Dictionary, n.d.-c):

> *a system of vehicles (e.g., buses or trains) that:*
>
> *1. operate at regular times*
>
> *2. operate on fixed routes*
>
> *3. are used by the public for transport of people*

"System" is here understood as "a set of connected things or devices that operate together" (Cambridge Dictionary, n.d.-d). Hence, a "public transport system" includes everything necessary to operate a public transport service.

The difference between "public transport" and "bus transport" is, in other words, only that the former includes many forms of vehicles, e.g., trains and light rail, while bus transport only includes buses. Both definitions exclude chartered transport, i.e., transport rented for a particular purpose (Cambridge Dictionary, n.d.-b). All bus transport mentioned in this thesis refers to bus transport operated by Kolumbus, the public bus provider in the research area.

3.2.2. Bus operation

This subchapter describes various aspects of bus operation and how it operates in the research area.

Bus operation can be carried through by numerous different bus types. Standard and articulated buses are the most common bus types in the research area. Double-deck buses were used before but got replaced due to long boarding times (Oseberg, 2019).

There are four common environments for buses to operate in (Kittelson & Associates, Inc. et al., 2013, pp. 73–77):

- **Mixed traffic:** buses share lanes with general traffic.
- **Semi-exclusive:** buses have partially reserved lanes, but these are also available for other use, e.g., motorcycles and electric cars.
- **Exclusive:** a lane, portion of a roadway, or right-of-way is always reserved for buses but still subject to some external traffic interference, e.g., from intersections or crossings.
- **Grade separated:** dedicated roads exclusively for buses, e.g., Bus Rapid Transit corridors, discussed in subchapter 3.4.

Buses in the research area currently operate in all the environments mentioned above. On some of the busiest roads, fully or partially reserved roads and grade separation ensure the bus has increased mobility. The building of the Bus Road also ensures more grade-separated corridors for buses.

Bus operation can be done on fixed routes or demand responsive. Demand responsive buses operate in response to passenger trip requests. This concept is not discussed further because it is irrelevant to the research topic and not widespread in the research area. Fixed-route services run along designated routes and operate at set times or headways. They can have various stopping patterns and network designs. There are three common stopping patterns for public transport (Kittelson & Associates, Inc. et al., 2013, pp. 78–84):

- **Local:** serves all stops along a route. Emphasises more passengers over speed.
- **Limited:** buses serve only stops with higher volumes, e.g., transfer points or activity nodes, giving a faster operation and fewer buses needed.
- **Express:** often used for longer trips by rail services that operate almost non-stop over the route.

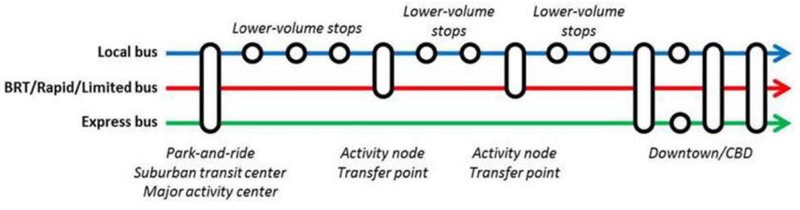

Figure 3.1 Comparison between different stopping patterns (Kittelson & Associates, Inc. et al., 2013, p. 78).

In the research area, local buses serve the most urban areas, while express buses, which drive parts of their routes on motorways, generally connect more rural areas. Fixed routes operate on one of two facility-based designs (Kittelson & Associates, Inc. et al., 2013, pp. 79–82):

- **Trunk-and-branch:** bus service operates several lines along a trunk road, which might have more population or higher density nearby. Some of these lines branch off to serve local areas, which may have lower population or density or be more rural. Many bus services may converge on a trunk road, e.g., a BRT corridor, providing a better service due to higher frequency. The Bus Road in Nord-Jæren will be based on trunk-and-branch as local branch routes converge into a trunk road.
- **Feeder:** local lines bring passengers to higher frequency bus lines, and a transfer is needed to continue the trip. Local routes in Nord-Jæren bringing people from rural areas to the Bus Road may be considered feeder routes.

Bus network design, i.e., how the bus network is laid out in a city, can influence accessibility factors such as service coverage and frequency and the trade-offs between them. Service to all important destinations within an area usually requires transfers during travels. The way these transfers are facilitated via the public transport system design influences quality of service. Four common system designs are described below (Kittelson & Associates, Inc. et al., 2013, pp. 82–83):

- **Radial networks:** all routes focus on a downtown area due to its popularity as a travel destination or central location. Trips with origin and destination other than the downtown area usually require transfer or detours through the central area.
- **Hybrid networks:** overlay radial networks and provide connection opportunities to radial routes. For trips involving non-downtown locations, faster and more direct trips are possible.
- **Hub-and-spoke networks:** local buses meet at transport centres on timed transfer (pulse) basis to transfer passengers. From here, routes connect the transfer centres with the downtown. This network gives relatively direct connections to various locations but requires good reliability, so passengers do not miss their connection.
- **Grid networks:** major streets have frequent service, and buses cover much of the region. Many trips require a transfer, but transfer times are minimized due to the frequent service.

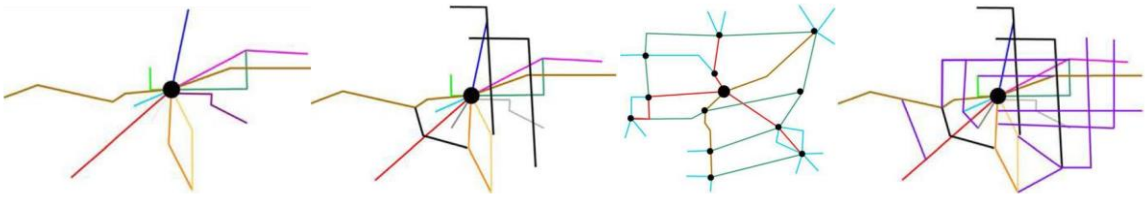

Figure 3.2 Examples of respectively radial, hybrid, hub-and-spoke, and grid network types (Kittelson & Associates, Inc. et al., 2013, p. 83).

The bus network in the research area is best described as radial or hybrid. However, instead of one main downtown area, i.e., a monocentric layout, there are several smaller centres with varying sizes and attractions (polycentric). Routes in the research area goes through at least one of the municipal centres.

3.3. Public transport accessibility

Public transport accessibility (PTA), i.e., how accessible public transport is, depends on numerous factors. This subchapter presents the most critical factors affecting PTA and how to measure them. Knowing what influences overall PTA is essential for understanding how public transport can be made more accessible and what may limit it.

In this thesis, inspired by Bhat et al. (2006), overall PTA is defined as the sum of local and network accessibility, consisting of spatial, temporal, and other accessibility. It can be formulated as below.

$$\begin{aligned} Overall\ PTA\ &= \ local\ accessibility + network\ accessibility \\ &= spatial\ accessibility + temporal\ accessibility + \ other\ accessibility \end{aligned}$$

This division of total PTA indicates that spatial and temporal accessibility are the most important elements affecting the overall PTA. "Other" factors include everything else that may influence PTA, e.g., cost, safety, and comfort. Earlier research has also identified spatial and temporal dimensions as the most important measures of PTA (Kittelson & Associates, Inc. et al., 2013; Polzin et al., 2002).

Breaking down total PTA into smaller pieces like this is helpful because it more easily shows which elements of PTA are good or bad and at what level. In addition, it makes it easier to compare different methods for measuring PTA, as various methods include different PTA categories. The division between local and network accessibility is helpful because it can say something about PTA on both local and regional levels. Emphasis on spatial and temporal PTA measures is assumed to be suitable due to the research area's large size and the available data and calculation methods. The sections below explain these five categories of accessibility, what influences them, and calculation methods.

Local accessibility, or access, is primarily determined by nearby activity and can be defined as the accessibility of a place or location to public transport (Handy, 1992; Hillman & Pool, 1997) or simply the ease of reaching public transport stops. The main topic of local accessibility is the placement of access stops. Local accessibility is influenced by spatial, temporal, and other accessibility measures (Bhat et al., 2006, p. 36). Murray et al. (1998) distinguish between access, i.e., "the opportunity for system use based upon proximity to the service and its cost", and accessibility, "the suitability of the public transport network to get individuals from their system entry point to their system exit location in a reasonable amount of time". In this thesis and other research papers, e.g. (Bhat et al., 2006), what Murray et al. define as "access" is regarded as a local accessibility measure.

Network accessibility describes the accessibility of locations to destinations using public transport (Hillman & Pool, 1997) or "the ease of travel between boarding and egress points". Network accessibility considers operation of public transport, including service span, frequency, and reliability. Like local accessibility, spatial, temporal, and other factors influence network accessibility (Bhat et al., 2006, p. 38).

Spatial accessibility considers access distance and service coverage, which affect local accessibility, and network connectivity, which affects network accessibility. It is defined as "where public transport service is found and how to get to it". (Bhat et al., 2006, pp. 8, 36–38).

Temporal accessibility depends on service span, frequency, reliability, in-vehicle travel time, and possible transfers, which influence network accessibility, in addition to access time, which affects local accessibility. It describes "when, how often, and for how long public transport service can be used" (Bhat et al., 2006, pp. 37–38).

Other accessibility measures are not categorized as spatial or temporal, e.g., safety, cost, and comfort. The main factors affecting public transport accessibility are discussed in the sections below.

3.3.1. Access distance

Access distance, or spatial proximity, i.e., whether public transport is provided near people's origins and destinations, is an important local spatial accessibility measure. If public transport is unavailable near potential passengers' origins and destinations, it is not a viable travel option (Bhat et al., 2006, p. 36; Ryus et al., 2000).

Access distance is, in this thesis, defined as the distance one needs to travel to board public transport. Access modes include amongst other walking, cycling, and car. This thesis only discusses walking because it is the most common access mode in the research area and more accessible than cycling and driving.

Several studies have been conducted on how far people are willing to walk to access public transport. Often 400-800 m (0.25-0.5 mi) thresholds are used (Currie, 2004; Kittelson & Associates, Inc. et al., 2013; Murray et al., 1998; van Soest et al., 2020). This equates to around 5-10 minutes of walking (assuming a walking speed of 4.8 km/h or 1.33 m/s). Shorter access distances correspond with better accessibility. How far people are willing to or must walk to enter public transport service depends on numerous factors. Table 3.1 highlights some of these.

Access distance can be expressed in metres as the air distance or the actual distance using the street network from origin (e.g., home) or destination (e.g., work) to the nearest access point. Depending on the layout of the street network, available paths, and inclines, the actual walking distance can be significantly longer than the air distance (Kittelson & Associates, Inc. et al., 2013, pp. 206–207).

Table 3.1 Categories and factors influencing public transport-related walking (PTW) and acceptable walking distance (AWD) to and from public transport (van Soest et al., 2020).

Category	**Factor**	**Correlation**
Personal	Age	Younger adults tend to have the highest AWD.
Personal	Personal vehicle availability	People with more private vehicles generally walk less, but the distances to PT are often longer.
Personal	Household size and type	Smaller households and dwellings tend to be in areas with better PT accessibility, leading to shorter walking distance, but the effect relies on the characteristics of the built environment.
Personal	Income	Depends on the study and cultural context. European studies found a negative correlation between higher income and PTW distance.
Personal	Employment and education	The effect on PTW appears to be weak, it is expected to be related to income and household type.
Personal	Ethnicity	Likely related to income and depends on the culture and status of PT services. European studies found that white people have higher AWD.
PT characteristics	Type	People tend to have longer AWD to trains followed by metro or LRT and the shortest to buses. I.e., longer-range modes seem to have higher AWD. In standard guidelines, AWD to rail transport and BRT is often set to 800 m, while the equivalent for conventional bus transport is 400 m.
PT characteristics	Frequency	PT riders are willing to walk more if the offered service has higher frequency.
PT characteristics	Station function and route spacing	More stops on a route seem to influence AWD negatively.
Environment	Density	Higher density, e.g., in central business districts, can lead to shorter PTW.
Environment	Walkability	Increased walkability can shorten the distances people need to walk and lengthen the distances people choose to walk.
Environment	Safety	Crime levels negatively impact the probability of walking to or using PT. Traffic safety can influence route choice to PT.
Environment	Weather	Unclear, little research.
Journey	Purpose	Walking for work trips tends to be longer.
Journey	Time of day	No strong correlation. Effect presumably strongly related to other factors, e.g., peak hours.
Journey	Trip length	Longer PT journeys tend to cause longer AWD.
Journey	Transfers	More transfers tend to lead to lower AWD. The effect is lower for metro.
Journey	Frequency of use	Regular users walk shorter than people who rarely travel with PT.
Journey	Type of walking stage	Little knowledge if AWD from home to PT is different from AWD from destination to PT on return trip.

3.3.2. Service coverage

Service coverage is, like access distance, concerned with where bus transport is provided locally. In addition, service coverage considers whether bus transport is available at or near the locations one wants to travel to. Service coverage can be measured in one of the following ways (Kittelson & Associates, Inc. et al., 2013, p. 203):

- **Route density**, which has the unit [route km/km^2]. It does not address how bus service is distributed in an area or if the potentially most productive portions of the area are served.
- **Geographic or population coverage** expresses the percentage of area or population served.
- **Potential fixed-route transit market coverage** is a method for estimating how much of a public transport-supportive area is served.

Service coverage is closely linked to access distance because if the service coverage increases, the access distance decreases, or more people have access within a set threshold. However, one difference is that service coverage can be measured in percentage while access distance is measured in metres. Service coverage can also consider which areas are public transport-supportive, i.e., have high enough density to support at least hourly bus service (Kittelson & Associates, Inc. et al., 2013, p. 203).

3.3.3. Network connectivity

Network connectivity describes whether there are routes connecting origins and destinations. The connectivity between places is regarded as worse if travels between them require transfers and if transfers require long walking distances (Bhat et al., 2006, p. 38). In this thesis, connectivity is weaker if the travelling distance between origin and destination is long and if few bus routes are available nearby. Network connectivity influences travel time because longer trips and more transfers correspond to increased travel time.

3.3.4. Travel time

Travel time is the sum of the access time, in-vehicle time and wait time, as well as transfer time and service frequencies for intermediate routes if the trip requires transfers. Access time is the time spent walking between origin or destination and PT stops. It is assumed to be proportional to the access distance. Wait time is determined by frequency and reliability (Bhat et al., 2006, pp. 37–38).

Travel time alone does not say much about the accessibility of an area unless it is compared to other locations or other modes of transport. TCQSM (2013) contains a context-based measure comparing public transport and car travel times. This is calculated using a ratio found by dividing the PT travel time for a trip by the equivalent travel time using a car. Table 3.2 shows bus-car travel time ratios from the perspective of bus passengers and bus operators. Considering the high car usage in the research area, the time competitiveness of bus service compared to car driving is essential.

Table 3.2 PT-car travel time ratios from the perspective of bus passengers and operators (Kittelson & Associates, Inc. et al., 2013, p. 229).

PT-car travel time ratio	Passenger perspective	Operator perspective
≤1	Faster trip by bus than by car.	Feasible when transit operates in a separate right-of-way, and the roadway network is congested.
>1-1.25	Comparable in-vehicle travel times by bus and car. For a 40-min commute, bus takes up to 10 min longer.	Feasible with express service. Feasible with limited-stop service in an exclusive lane or right-of-way.
>1.25-1.5	Tolerable for choice riders. For a 40-min commute, bus takes up to 20 min longer.	
>1.5-1.75	Round trip up to 1 h longer by bus for a 40 min one-way trip.	
>1.75-2	A trip takes up to twice as long by bus than by car.	May be best possible result for mixed traffic operations in congested downtown areas.
>2	Tedious for all riders.	May be best possible result for small city service that emphasizes coverage over direct connections.

Bus speed naturally impacts the travel time of routes and is hence vital to passengers. Lower travel times and increased competitiveness against other travel modes increase the attractiveness of bus transport. There are three main components of bus speed (Kittelson & Associates, Inc. et al., 2013, pp. 104–105, 117):

Table 3.3 The three main components of bus speed and factors constraining them (Kittelson & Associates, Inc. et al., 2013, pp. 104–105).

Component	Description	Constrained by
Running time	Time spent at constant speed following acceleration (max. allowed bus speed).	Guideway design (e.g., speed limit), vehicle characteristics, stopping frequency.
Passenger service time	Time spent boarding and alighting.	Number of stops and dwell time (depends on boarding and alighting volumes, fare payment, vehicle) on stops.
Delay	External factors that impede transit vehicles.	Guideway type (e.g., mixed, or preferential treatment), acceleration, traffic signal.

3.3.5. Frequency

How often service is provided is a temporal dimension affecting both local and network accessibility, and it is perhaps the main factor influencing overall trip satisfaction. Low frequency is less convenient for customers as they need to plan their trip to a greater extent and face more unproductive waiting time. Higher frequency provides more opportunities for immediate travel and allows public transport to resemble other modes, e.g., cycle or car. Higher frequency increases operation costs as more buses and drivers must be in service. Frequency is measured as the number of vehicles on a route that passes a point (e.g., a bus stop) within a given time (usually 1 hour) or headway, i.e., the time interval between vehicles operating the same route. E.g., a bus stop that is visited every 30 minutes by route X has a frequency of 2 buses per hour and a headway of 30 minutes (Kittelson & Associates, Inc. et al., 2013, pp. 170, 197–199, 738, 760). Table 3.4 describes different fixed-route headways from passengers’ and operators’ perspectives.

Table 3.4 Fixed-route PT frequency (Kittelson & Associates, Inc. et al., 2013, pp. 198–199).

Average headway	**Passenger perspective**	**Operator perspective**
≤ 5 min	Very frequent service, no need for passengers to consult schedules. Bus bunching is more likely, resulting in longer-than-planned waits for a bus and more variable passenger loads.	Feasible for bus service in very high-density corridors and where routes converge to serve a major activity centre. Exclusive right-of-way is highly desirable to reduce external impacts on buses and keep operating speeds high. Adding more frequency may not be feasible or effective due to unused capacity due to bus bunching. Using larger or longer vehicles, or replacing seats with standing areas, may be options for adding capacity short of upgrading transit modes.
>5-10 min	Frequent service, no need for passengers to consult schedules. Bus bunching is possible, resulting in longer-than-planned waits for a bus and more variable loads.	Feasible on high-density corridors with bus service, and where routes converge to serve a major activity centre. Short headways are needed for circulator routes to be able to compete with walking and bicycling (Walker, 2011). Exclusive right-of-way is desirable to reduce external impacts on buses and keep operating speeds high. Traffic congestion, dwell time variability, and differences in bus operator driving styles may result in bus bunching.
11-15 min	Relatively frequent service, but passengers will usually check scheduled arrival times to minimize their waiting time at the stop or station. Maximum desirable wait time for the next service if a bus is missed.	Often branded as "frequent service" in conjunction with long service hours, including weekends. Feasible in higher-density corridors (e.g., around 3700 dwellings/km^2 for bus service (Pushkarev et al., 1977)), routes with strong anchors on both ends, and park-and-ride-based peak period commuter bus service. Typically, the longest feasible off-peak headway that can justify BRT service.
16-30 min	Passengers will check scheduled arrival times to minimize their waiting time. Passengers must adapt their travel to the transport schedule, often resulting in suboptimal arrival or departure times.	Typically provided as 20- or 30-min headways. Feasible in moderate-density corridors (e.g., around 1850 dwellings/km^2 for bus service (Pushkarev et al., 1977)). Typically, the longest commuter bus headway.
31-59 min	Non-clockface headways require passengers to check scheduled arrival times. Passengers must adapt their travel to the transit schedule, usually resulting in suboptimal arrival or departure times.	Typically provided as 40- or 45-min headways. Feasible in low-to-moderate density corridors (e.g., 1200-1500 dwellings/km^2 (Pushkarev et al., 1977)).
60 min	Provides a minimum service level to meet basic travel needs. Passengers must adapt their travel to the transit schedule, usually resulting in suboptimal arrival and departure times.	Typical maximum headway for fixed-route bus service. Potentially feasible at densities as low as approximately 1000 dwellings/km^2, depending on the ability to subsidize service (Pushkarev et al., 1977). May be provided to meet a service coverage standard.
>60 min	Undesirable for urban transit service due to typical long waits for return trips and when a bus is missed.	May wish to consider some form of demand-responsive transit to provide service that better meets passengers' travel needs.

3.3.6. Service span

Service span describes the number of hours of a day when bus service is provided. It is essential because if bus service is not provided when a potential passenger wants to travel, other accessibility factors do not matter. Service stretching across more of the day can serve more people and variable trip purposes, giving increased flexibility for customers. The drawback of a large service span is that it increases operating costs for bus agencies. Service span is measured in hours of service (Kittelson & Associates, Inc. et al., 2013, pp. 200–202). The table below describes various hours of service options from passengers' and operators' perspectives.

Table 3.5 Hours of service from passengers' and operators' perspective (Kittelson & Associates, Inc. et al., 2013, p. 201)).

Hours of service	Passenger perspective	Operator perspective
>18 h	Serves a full range of trip purposes. Allows bus travel to replace potentially riskier travel modes late at night.	Often branded as "night" service. May require added driver pay for late-night work. May only be offered on certain days (e.g., weekends). May operate on different routes than the rest of the day (e.g., emphasizing coverage over travel time).
15-18 h	Provides service late into the evening or earlier in the morning, allowing a broad range of trip purposes to be served.	May require more than two full-time drivers per vehicle or overtime pay. Evening service may be operated on different routes than the rest of the day (e.g., emphasizing coverage over travel time).
12-14 h	Provides a long enough service span to serve traditional work hours, with some arrival and departure time flexibility.	Can be covered by two full-time drivers per vehicle.
7-11 h	Allows trips to be made during the middle of the day. At the upper end of the range, still not enough service for someone working traditional office hours who needs the flexibility to run errands after work.	Provides sufficient work for full-time drivers but may require a midday gap in service for lunch break in a system with few routes. Two part-time drivers per bus could also provide service on a route without a lunch-break service gap. Common weekday service hours for small cities. Good weekend service for small cities.
4-6 h	Peak-period service (e.g., commuter bus) provides some choice of departure times. Hourly service allows opportunities to make trips during a defined period, with less wasted time waiting for the return trip.	Typical service hours for commuter bus service that operates peak periods only. Provides sufficient work for part-time drivers. Minimum service hours for hourly service (e.g., small city weekend service).
<4 h	Basic lifeline service that allows a round trip in one day or a half-day. Passengers' days must be planned around the transit schedule, with little or no flexibility.	Might be provided on rural routes with only a few daily departures (e.g., morning, midday, afternoon). Buses and drivers may need to alternate between routes for resources to be used effectively.

3.3.7. Other accessibility measures

Safety and security can be a vital accessibility measure of PT because if it feels unsafe to access or use, it is less accessible. Safety and security can be measured in several ways, including vehicle or person accident rate, number of crimes in relation to PT, or number of traffic fines issued to PT drivers (Kittelson & Associates, Inc. et al., 2013, pp. 229–230).

Travel cost concerns whether the fare is just compared to the provided service (Kittelson & Associates, Inc. et al., 2013, p. 177). For public transport to be accessible, people must be able to pay the fare required to use it. Lower costs for better service correspond to better accessibility. This is naturally a vital accessibility measure, especially in poorer countries where large portions of one's wages may go into affording public transport (Montgomery, 2015).

Information is another factor influencing accessibility because for people to use bus service, they need to know how to use it. Necessary relevant information includes how to pay the fare, when buses will arrive, and where to get off. Information can be provided at stops, in vehicles, or digitally (Kittelson & Associates, Inc. et al., 2013, pp. 172–173). More and easily available information corresponds to better accessibility.

Comfort and convenience of public transport can be measured in terms of passenger load, reliability, travel time, ride comfort, customer relations, appearance, and stop facilities (Bhat et al., 2006, p. 38; Kittelson & Associates, Inc. et al., 2013, pp. 177, 217–218, 229–230; Zhao et al., 2002).

The accessibility factors in the "other" category have rarely been included in PTA measures because they are often difficult to quantify, and data may be unavailable (Bhat et al., 2006, p. 16).

Studies have found bus transport and the word "bus" to have a poor public image compared to other public transport modes, perhaps especially rail-based modes (Hensher & Mulley, 2015). E.g., Barlach et al. (2007) found that bus service in an intercity corridor in Israel had a poorer image than rail, despite the travel times being similar. Customer-dependent feedback may therefore perceive bus transport as less accessible than other public transport modes, despite having similar performance.

3.3.8. Summary accessibility factors

Table 3.6 summarizes the factors identified to affect PTA, which categories they belong to, and at what scale they affect accessibility.

Table 3.6 Summary of factors affecting accessibility.

Factor	Type of accessibility	Scale of accessibility	Correlation
Access distance	Spatial	Local	Shorter access distance corresponds to better accessibility.
Service coverage	Spatial	Local	Higher service coverage corresponds to better accessibility.
Network connectivity	Spatial	Network	Better accessibility if connectivity by PT is higher, and trips are shorter and require fewer transfers.
Access time	Temporal	Local	Shorter access time corresponds to better accessibility.
Travel time	Temporal	Network	Shorter travel time corresponds to better accessibility.
Frequency	Temporal	Network	Higher frequency corresponds to better accessibility.
Service span	Temporal	Network	More hours of service correspond to better accessibility.
Safety and security	Other	Local and network	Better safety and security correspond to better accessibility.
Travel cost	Other	Network	Better accessibility if the fare is lower compared to the service being provided.
Information	Other	Local and network	More and easily available information corresponds to better accessibility.
Comfort and convenience	Other	Local and network	Higher comfort and convenience correspond to better accessibility.

3.3.9. Methods for measuring public transport accessibility

Mamun & Lownes (2011) summarized nine measures for PTA, which incorporated 15 accessibility factors, as shown in Table 3.7.

Table 3.7 Summary of PT accessibility measures. Collected from (Mamun & Lownes, 2011), with some updates.

Study/paper	**Type of measure**	**Reflecting local accessibility**		**Reflecting network accessibility**	**Incorporated PTA factors**
		Spatial coverage	**Temporal coverage**		
Transit Capacity and Quality of Service Manual (TCQSM) (2013)	Level of service (LOS)	Yes	Yes	No	Service frequency, hours of service, service coverage, demographic data, vehicle capacity,
(Polzin et al., 2002)	Time-of-Day tool (Index)	Yes	Yes	No	Service coverage, time-of-day, waiting time, service frequency, demographic data
(Ryus et al., 2000)	Transit level-of-service (TLOS)	Yes	Yes	No	Service frequency, hours of service, service coverage, walking route, demographic data
(Schoon et al., 1999)	Accessibility index (AI)	No	No	Yes	Travel time, travel cost
(Fu & Xin, 2007)	Transit Service Indicator (TSI)	Yes	Yes	Yes	Service frequency, hours of service, route coverage, travel time components
(Hillman & Pool, 1997; TfL, 2010, 2015)	Public transport accessibility level (PTAL)	Yes	Yes	Yes	Service frequency, service coverage
(Rood, 1998)	The Local Index of Transit Availability (LITA)	Yes	Yes	Yes	Service frequency, vehicle capacity, route coverage
(Bhat et al., 2006)	Transit accessibility index (TAI) & Transit Dependence Index (TDI)	Yes	Yes	Yes	Access distance, travel time, comfort & parking, network connectivity, service frequency, hours of service, vehicle capacity
(Currie, 2004)	Supply & Need Index	Yes	Yes	Yes	Service frequency, service coverage, travel time, car ownership, demographic data

3.4. Bus rapid transit

The Bus Road in Nord-Jæren will be Norway’s first Bus Rapid Transit (BRT) system when line A between Stavanger and Sandnes is completed in 2026 (BRT+ Centre of Excellence & EMBARQ, 2022). BRT is sometimes referred to as buses with a high level of service (BHLS) (Hidalgo & Muñoz, 2014), but for this thesis, only “BRT” is used.

BRT is a bus-based transport system aiming to deliver fast, comfortable, and cost-effective services at metro-level capacities through dedicated bus lanes, off-board fare collection, and fast and frequent operations. A well-designed BRT system can keep buses out of traffic and operate a faster, more reliable, and more convenient service than regular bus systems (ITDP, n.d.).

Figure 3.3 BRT system with dedicated busway (Raleigh, 2022).

Since the first BRT systems appeared in the 1970s (Development Asia, 2016; Dhaka BRT, 2019; Lesley, 1983), almost 200 cities have implemented BRT systems. The implementation of new systems has been especially significant since the early 2000s. BRT is most widespread in Latin America and Asia (BRT+ Centre of Excellence & EMBARQ, 2022). BRT's popularity in Latin America is primarily due to lower construction costs than light rail transit (LRT) (Ingvardson & Nielsen, 2017).

The research on BRT systems' performance and impact and how they compare to other public transport modes is quite conflicting because it depends heavily on how extensive the design is. E.g., BRT lines segregated from other traffic and with high frequency have seen the most significant travel time reductions and increases in ridership, while simpler implementations tend to have a smaller effect. External factors such as the attractiveness of existing public transport systems, car traffic conditions, and local contexts can also influence the impact and performance of BRT systems and how they are perceived (Ingvardson & Nielsen, 2017). For example, Istanbul reduced travel time by 65 % and increased ridership by 150 % by implementing BRT (Yazıcı et al., 2013), while Seoul experienced only a 10 % ridership increase despite a 50 % travel time reduction (Cervero & Kang, 2011).

Comparing metro, LRT, and BRT, metro systems usually reduce travel times the most because they have fully segregated right of way, as opposed to the other two, which might have crossings. However, LRT and BRT can obtain high speeds with sufficient measures. All these modes can lead to significant modal shifts, and it seems like a system's quality is more important than the choice of system. However, because metro and LRT systems usually have higher capacity, they tend to have larger impacts on road congestion (Ingvardson & Nielsen, 2017).

Regarding end-user experience, transport analysts sometimes talk about “rail bias” or “coolness factor” of trains, meaning that people prefer trains over buses and that buses have a poor public image (Berg, 2011; US GAO, 2001). This could give BRT a disadvantage compared to LRT and may be why the buses in Nord-Jæren will be rebranded when BRT comes here (Rogaland fylkeskommune, 2021c).

Although BRT can perform similarly to LRT, which system to implement in an urban area will depend on various factors. In sprawling areas, e.g., Nord-Jæren, BRT’s flexibility can be a valuable feature for many communities because public transport needs can be more complex and challenging to address here than focusing on a single central business district. Other advantages of BRT are that it can be implemented in stages and that it is not as vulnerable to disruption during incidents as rails (Ingvardson & Nielsen, 2017; Steer, 2015; US GAO, 2001).

Arguments against BRT are that they have lower capacity than LRT and metros and may take up large street-level areas. In addition, BRT corridors may have poor noise and barrier effects, as opposed to underground metro systems. Therefore, these designs can make it hard to make attractive urban spaces near BRT stations. Buses’ poor public image may also challenge BRT in certain areas (Berg, 2011; Ingvardson & Nielsen, 2017; US GAO, 2001).

A critical factor for choosing BRT over LRT and especially metro, is that the economic cost can be much lower for non-rail systems (Currie & Delbosc, 2013). However, there is debate regarding how big the difference is. BRT's capital cost can be lower, but the difference depends on how much it tries to emulate LRT (Berg, 2011; Ingvardson & Nielsen, 2017; US GAO, 2001). E.g. one experiment showed that investment costs for LRT and BRT systems with the same length, frequency, speed, and route circulations, where both run on right-of-way tracks, was over 60 % more expensive for LRT (Steer, 2015). Due to differences among transit agencies, transit systems, local contexts, and how they account for costs, precise operating cost comparisons for BRT and LRT are also difficult to quantify, but some research indicates that BRT operating costs are lower or equal to LRT (Ingvardson & Nielsen, 2017; Steer, 2015; US GAO, 2001).

Another cost aspect of BRT is that they may cause increasing or decreasing real-estate prices in their proximity. Several analyses have shown decreasing real-estate prices near BRT stations because the negative issues (e.g., noise and barrier effects) were more significant than the benefits. However, the effect of public transport improvements on real-estate prices can be hard to measure because other factors than the choice of system can influence. Just the expectation of improved accessibility may also be enough to increase property value. In a survey of 41 public transport systems, the effects of BRT systems on property values varied from 0-30 %, while the effects from LRT and metro systems were respectively 0-32 % and - 7.1-20 %. The study concluded that the effects of all systems on property values are significantly positive but not significantly different from each other (Ingvardson & Nielsen, 2017).

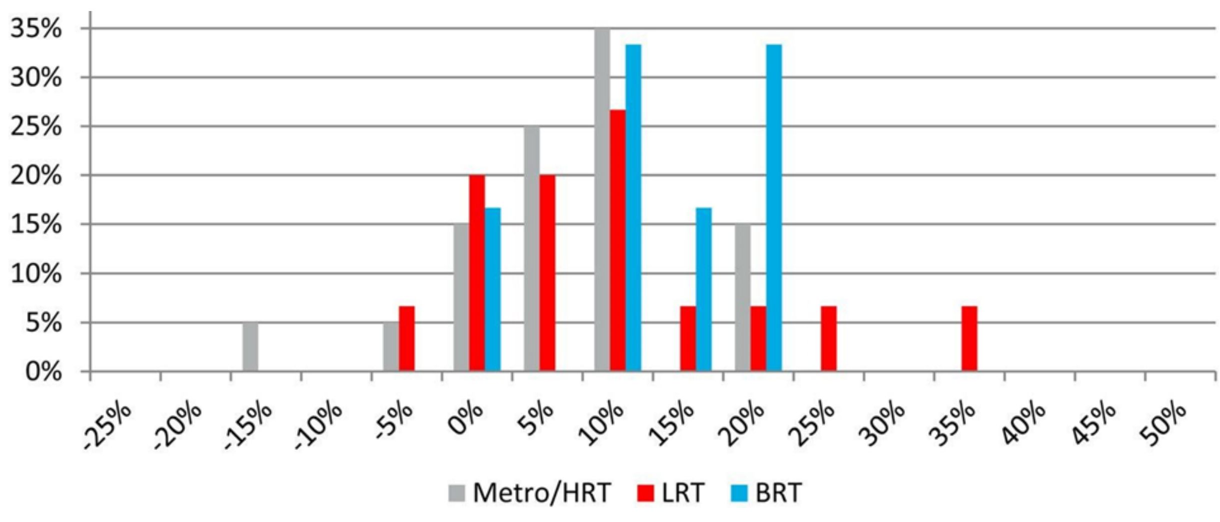

Chart 3.1 Change in property values near implementation of public transport systems for 41 reviewed systems. The y-axis shows the share of each mode, while the x-axis shows the effect on property values (Ingvardson & Nielsen, 2017).

Long term, one argument for rails over BRT is that the former is more permanent. This can demonstrate a more substantial commitment to providing high-quality public transport services, act as a catalyst for wider urban development over time, and help justify the higher capital cost of rail-based systems (Steer, 2015; US GAO, 2001).

Institute for Transportation & Development Policy (ITDP) has created a commonly used standard for classifying BRT systems. For a road to be classified as a BRT corridor, it must be at least 3 km of dedicated bus lanes and fulfil the following requirements (ITDP, 2016):

- **Right-of-way:** dedicated bus lanes ensure buses avoid delays due to mixed traffic congestion.
- **Busway alignment:** bus-only corridors keep buses away from cars to avoid delays due to turning conflicts and bus stop access.
- **Off-board fare collection:** fare payment on station or digitally reduces delays caused by on-board payment.
- **Intersection treatments:** turning across the bus lane is forbidden, or buses have traffic signal priority.
- **Platform-level boarding:** the vertical gap between the station and a waiting bus is no more than 4 cm, or the station has measures for reducing the horizontal gap.

In addition, BRT systems can be assessed on another 25 elements in the categories of service planning, infrastructure, stations, communications, and access and integration. Points are awarded based on each element's performance, forming a scorecard. The maximum score for a BRT system is 100. Points can also be deducted for negative aspects such as overcrowding, slow speeds and low frequency (ITDP, 2016). Below is the expected scorecard for the Bus Road in Nord-Jæren between Stavanger and Sandnes upon completion according to the latest standard for BRT systems created by ITDP.

3.4.1. The Bus Road in Nord-Jæren BRT scorecard

When the first part of the Bus Road between Stavanger and Sandnes opens in 2026, it will satisfy all the requirements. Table 3.8 is a scorecard for this corridor, using ITDP’s standard (ITDP, 2016), assuming it is built according to plan. The corridor gets 88 out of 100. The main drawbacks from a higher score are the placement and design of stations. No point deductions were identified. More than 85 points is regarded as gold classification, the highest achievable classification according to ITDP (ITDP, 2016). In other words, upon completion, the research area will have a comprehensive BRT system. This is assumed to improve accessibility in areas near the Bus Road drastically and enhance development here.

Table 3.8 Bus Road Stavanger-Sandnes scorecard, according to (ITDP, 2016).

Category	**Element**	**Maximum points**	**The Bus Road points**
BRT Basics	Dedicated Right-of- Way	8	8
BRT Basics	Busway Alignment	8	8
BRT Basics	Off-board Fare Collection	8	7
BRT Basics	Intersection Treatments	7	7
BRT Basics	Platform-level Boarding	7	7
Total BRT Basics		38	37
Service planning	Multiple Routes	4	4 (after 2026)
Service planning	Express, Limited, and Local Services	3	0
Service planning	Control Centre	3	3
Service planning	Located in Top Ten Corridors	2	2
Service planning	Demand Profile	3	3
Service planning	Hours of Operations	2	2
Service planning	Multi-corridor Network	2	2
Total service planning		19	16
Infrastructure	Passing Lanes at Stations	3	2
Infrastructure	Minimizing Bus Emissions	3	2
Infrastructure	Stations Set Back from Intersections	3	2
Infrastructure	Centre Stations	2	0
Infrastructure	Pavement Quality	2	2
Total infrastructure		13	8
Stations	Distances Between Stations	2	2
Stations	Safe and Comfortable Stations	3	3
Stations	Number of Doors on Bus	3	3
Stations	Docking Bays and Sub-stops	1	0
Stations	Sliding Doors in BRT Stations	1	0
Total stations		10	8
Communications	Branding	3	3
Communications	Passenger Information	2	2
Total communications		5	5
Access and integration	Universal Access	3	3
Access and integration	Integration with Other Public Transport	3	3
Access and integration	Pedestrian Access and Safety	4	3
Access and integration	Secure Bicycle Parking	2	2
Access and integration	Bicycle Lanes	2	2
Access and integration	Bicycle-Sharing Integration	1	1
Total access and integration		15	14
Total		100	88

4. Methodology

4.1. Literature research

The literature researched while writing this thesis can be divided into two parts. Part one was collection of information relating to the Context chapter. This was found using Statistics Norway (SSB) and official documents and plans available online. Some of the information was later processed using GIS software.

Part two of the literature research consisted of collecting information about topics discussed in the Theory chapter and methods presented later in this chapter. University of Stavanger's library database Oria was used online to find research papers about public transport accessibility and methods for measuring this. The library also assisted in getting hold of a paper that was not available in the database. In addition, books and regular online searches were used to obtain information.

4.2. Constraints

Available information, size of the research area, time, and software were constraints for which methods could be used. Information about the placement of bus stops, bus routes, number of bus travels, passenger registration, and travel times was obtained. However, not all bus stops and routes were included in the GIS dataset, leading to some omissions, as discussed in 2.2.1. BSUs Folkvord and Skjæveland, included in the research area, may have gotten a lower accessibility score than they should because the dataset lacked a few nearby stops and routes.

The software used, ArcMap 10.7.1, allowed for processing of the acquired data. Constraints related to software were that necessary expansions used in earlier PTA measures were unavailable. For this reason, none of the earlier PTA measures presented in Table 3.7 could be applied directly to this case. Therefore, new PTA measures incorporating parts of earlier measures were created.

4.3. Accessibility analysis

This subchapter presents the method used for answering the research question: “How accessible is bus transport in urban Nord-Jæren?”. The method was based on and created according to the research area, the identified constraints, and previously used methods for measuring public transport accessibility (PTA). GIS software was required to do the methods presented below.

Note that the method developed measured only bus transport accessibility (BTA), while the previously used methods measured public transport accessibility (PTA). While the distinction is small, one can assume that an area has better accessibility if more public transport modes are available instead of only buses. Therefore, the method developed only considered the quality of the bus service in the research area.

Ideally, all factors affecting accessibility should be considered, but there is no single method for evaluating all accessibility factors (Litman, 2021). Only some accessibility factors are measured when estimating PTA, and various methods are used. Hence, calculated PTA for an area will depend on the method and which accessibility measures it considers.

There are many ways of dividing accessibility. Yang et al. (2019) divided PTA into access to stations, accessibility of networks, and access to activities, while Geurs & van Wee (2004) identified four basic perspectives on measuring accessibility based on infrastructure, location, person, and utility. According to Halden et al. (2000), all accessibility measures relate to a specific location, opportunities, and a separation element between the location and opportunities. The Transit Capacity and Quality of Service Manual (TCQSM) (2013) classified based on availability, not accessibility. According to the manual, four availability measures must be fulfilled for public transport to be an option. These are spatial, temporal, information, and capacity availabilities. If all these are fulfilled, potential passengers will consider the comfort and convenience of public transport before choosing. Mamun & Lownes’ (2011) classification considered trip, spatial, and temporal coverage.

The method developed here considered spatial and temporal aspects of BTA as these were identified as the most critical measures of accessibility (Kittelson & Associates, Inc. et al., 2013, p. 197). These measures were also considered on local and network levels, like Bhat et al.’s (2006) approach. Accessibility factors were identified in subchapter 3.3. The factors estimated in this thesis are access distance, service coverage, travel time, bus route options, frequency, and service span.

The methods for measuring the six included factors followed the same pattern. First, each factor was measured for every BSU and ST to have a basis for comparison. While BSUs highlighted small variations in areas, STs illustrated the broader picture. Next, the measured factors for each BSU/ST were plotted against the address densities of the respective areas to see if there was any coherence between better accessibility and higher address density. Lastly, the results were illustrated on maps.

The sections below explain how access distance, service coverage, travel time, bus route options, frequency, service span, and overall accessibility were calculated and the strengths and weaknesses of the chosen methods.

4.3.1. Access distance

Access distance is a measure of spatial and local accessibility. As described in 3.3.1 and emphasised by amongst other Bhat et al. (2006), Murray (2001), and Ryus et al. (2000), access is a vital accessibility factor, it was therefore estimated in this thesis.

Murray (2001) distinguished between origin-based access, i.e., distance from residence to nearest public transport service stop, and destination-based access, i.e., distance from desired trip target to nearest public transport service stop. In this thesis, the access measure did not distinguish between origin and destination. Access distance was here the distance between an address and the nearest bus stop, regardless of whether one was walking to or from that bus stop.

4.3.1.1. Method

1. **Find access distance for each address**

First, access distance was found at address level. There were 113523 registered addresses in the data set. From each address point, the distance to the nearest bus stop was found using the GIS software ArcMap. All addresses were assumed to be potential origins and destinations of travel. Buildings containing several addresses, e.g., residential blocks or office buildings, had the equivalent number of address points.

The resulting output from this step was a table showing the access distance for each address in the research area and to which BSU, ST, and municipality they belonged.

2. **Find access distance for each basic statistical unit, statistical tract, and municipality**

The average and median access distance and the standard deviation for each BSU, ST, and municipality were found using Excel. Both average and median access distances were considered because they gave very different answers, especially for BSUs with few addresses or extreme values. In addition, the standard deviation was calculated to describe the spread.

Note that the average/median access distances and deviations calculated for STs and municipalities were based on the addresses they contained, not the BSUs. This was an important detail because it would have given a skewed answer if they were calculated based on the BSU access distances.

The resulting output of this step was a table containing average and median access distances for each BSU, ST, and municipality.

4.3.1.2. Strengths and weaknesses

One strength of this method was that both average and median access distances were calculated for each area. This gave a way of comparison and described the difference when considering only the middle or all values.

The accuracy of measured distances was also very accurate. ArcMap returned distances in metres with seven decimals, but each distance was rounded to the nearest whole metre. More accuracy was unnecessary as people would not notice if the access distance was a metre longer or shorter.

A weakness was that this method did not consider round trips because only the closest access distance was found and not the average of the two closest. In many cases, people use the bus to and from their destinations. Hence, the access distance may vary depending on which direction, i.e., on which side of the road one enters or leaves the bus. It was attempted to consider the two closest bus stops, but this proved problematic for every end stop, as these service both directions but was only counted once by the software. In addition, some routes only travelled in one direction, meaning that only one stop was used. Upon further inspection, it was revealed that the difference in distance between the average of the two nearest bus stops and only the nearest was negligible. Only around 15 % of addresses, including those where end stops were not counted twice, had a difference of 10 m or more.

The biggest weakness of this method was that air distance was used instead of actual walking distance. This caused access distances calculated in this thesis to be shorter than they are. As identified in section 3.3.1, there may be significant differences between air and actual walking distances. Due to the size of the research area and lack of street network data, air distance was appropriate. However, actual walking distance should be used for a more detailed and zoomed-in approach.

Lastly, it was not ideal that address points were used to measure distances when it was unknown how many people lived or worked at each address. It was also not separated between business addresses and residential addresses.

4.3.2. Service coverage

The geographic extent of the bus service in the research area was measured using service coverage. As discussed in section 3.3.2, service coverage considers spatial and local accessibility. A prerequisite for bus transport being accessible is that it covers the areas where people want to travel to and from, i.e., both ends of a trip. Service coverage was calculated to identify which areas were not covered by bus transport.

4.3.2.1. Method

1. **Find the service coverage area**

There were a total of 2949 active bus stops in the research area. Using ArcMap, a circle with a radius of 500 m was drawn around each bus stop point. Radiuses of 500 m were used because it was the largest recommended threshold for bus stop proximity in the regional plan (Rogaland fylkeskommune, 2021d, p. 60). Several studies have also shown that bus use decreases significantly when the access distance exceeds 500 m (AKT, 2015).

Coastlines intersected the buffer circles, so service coverage in the sea was not counted. In addition, circles intersected each other to avoid overlapping, ensuring service coverage was not counted twice for bus stops lying 1000 m or closer. Freshwater areas did not intersect circles, but this was not a significant issue as it accounted for less than 4 % of the research area plus freshwater area.

Figure 4.1 Service area (red) was found by drawing 500 m radiuses around bus stops (black) (Esri, n.d.; Geonorge, n.d.).

2. **Figure out how much of the research area is covered by service**

Using the service coverage area found in step 1, the area and addresses covered by service in each BSU, ST, and municipality were estimated. Anything outside the service coverage area was considered not served by bus transport.

4.3.2.2. Strengths and weaknesses

The main strength of the method was that it highlighted which areas lacked a bare minimum in terms of service coverage. Another strength was that it measured both how many addresses and how much area was covered by service.

A weakness with service coverage measures is that even though service coverage looks very high, the use of public transport can be small or negligible. Polzin et al. (2002) suggested that service coverage measures may exaggerate public transport's potential to serve populations. Therefore, the 500 m-threshold in the regional plan may have been exaggerated, especially when air distance was considered.

4.3.3. Travel time

Travel time influences temporal and network accessibility, as described in section 3.3.4. This thesis defined travel time as the sum of access and in-vehicle time. In addition to finding (total) travel time, only the in-vehicle (IV) travel time was found.

Total and IV travel distances were also found when estimating travel time. However, this thesis did not include travel distance as a measure of accessibility because the results were too similar to the travel time estimations.

4.3.3.1. Method

1. **Find the median geometric point from addresses in each area**

Using ArcMap, a geometric median point from addresses in each BSU and ST was found. This returned 327 and 38 points, representing the median address point in respectively each BSU and ST.

Figure 4.2 Within each BSU (red), a median point (black) from address points (green) in that BSU was found (Esri, n.d.).

2. **Find the closest bus stop to each median geometric point**

Initially, the points assembled in step 1 were intended to be used as origins and destinations when creating the OD matrix. However, when running the OD Cost Matrix tool in ArcMap, several trips were not calculated because some points were too far away from the bus route network. To solve this, the closest bus stop to each median address had to be found. This operation returned 327 and 38 new points, representing the median origin and destination in each BSU and ST.

3. **Find the access time**

Access time was assumed to be linear to the access distance. Each area's access time was estimated by dividing the median access distances found in 4.3.1 by an average walking speed. In the literature, assumed walking speeds ranging from 4.32 to 5 km/h have been used (Currie, 2004; Kittelson & Associates, Inc. et al., 2013; Schoon et al., 1999; TfL, 2015). In this thesis, like in the PTAL method, the average walking speed across the population was set to 4.8 km/h. This value was used because it had been used before and correlated to exactly 4/3 m/s or 80 m/min, simplifying calculation and interpretation. Access time was calculated in the following way:

$$Access\ time\ [min] = \frac{Access\ distance\ [m]}{Walking\ speed\ [\frac{m}{min}]} = \frac{Access\ distance\ [m]}{80\frac{m}{min}}$$

Access time was considered at both ends of the trip. I.e., on a trip from address A to address B, the total access time was the access time to the bus stop nearest address A plus the access time from the bus stop nearest address B.

4. Find the average speed of each bus route

The received GIS file contained spatial data on bus routes and their distances between each bus stop, but no information on how long the buses usually spent from one stop to another or the average speed. This was estimated using an Excel sheet containing the total travel distance and time for each route in the research area. Using this, each route's average speed across the whole route was calculated. Note that this was a simplification, as naturally the speed limit and road characteristics will influence where the bus drives faster or slower on a route. However, the average speeds found here gave an impression and a rough estimate that could be used to calculate travel time between bus stops.

5. Find the in-vehicle time between bus stops

The in-vehicle travel time between each bus stop was calculated by dividing the corresponding distances between pairs of stops by the route's average speed. The GIS file now contained estimates for each route's distance, speed, and time between bus stops.

6. Find in-vehicle travel times between origins and destinations

Using ArcMap's OD Cost Matrix tool, the IV travel times using the bus network from each BSU/ST to all BSU/ST in the research area were found. This returned $327^2 = 106929$ and $38^2 = 1444$ trip times. These times were put into OD matrixes for respectively BSUs and STs and showed the time spent inside the bus when travelling between the various areas.

7. **Find total travel times between origins and destinations**

Access times found for each BSU/ST were added to the IV travel times found in step 6, giving the total travel time between BSUs/STs.

8. **Interpret and summarize the results**

The median travel times were found from the 327/38 travel distances found for each BSU/ST in the OD matrixes (of which one was a zero-distance travel within the BSU/ST). The median represented the typical travel time needed to visit a BSU/ST inside the research area.

4.3.3.2. Strengths and weaknesses

The main weakness of this method was that centrally located areas and smaller BSUs or STs with many neighbouring BSUs or STs close by were mathematically favoured, as opposed to larger areas located along the edges of the research area. However, the delimitation of the research area aimed to only include the most urban statistical tracts. Additionally, BSUs and STs with more addresses tended to be smaller. Although places outside the research area may have been attractive travel destinations, it is assumed that the research area contained the most likely travel origins and destinations in Nord-Jæren.

A related weakness to that above was that attractiveness and opportunities present in each area were not considered. E.g., one can assume that the city centres are more popular travel destinations than typical residential areas. Closeness to city centres could therefore count more than closeness to other areas. However, a flat quantitative consideration as described above was sufficient for this thesis due to the large size of the research area. The large quantities of BSUs and STs also meant that assigning different importance to them would be challenging.

A minor issue with the GIS files and software was that it was not considered which side of the road one entered the bus and in what direction the buses went. Consequentially, the time between a pair of areas was equal in both directions. However, as almost every route went in both directions, and the difference in travel time in each direction was assumed to be negligible, this was not considered a problem. The same weaknesses identified when estimating access distance also counted for access time.

Another weakness was that the average walking speed did not reflect who was walking, whether they carried luggage, accompanied children or similar. Consequentially, the perceived accessibility may be better or worse than the calculated accessibility depending on who the individual was. However, the difference in walking speed was assumed to be low, and the average should represent most of the population. In addition, changing the walking speed from 4.8 to 4 or 6 km/h would only represent respectively 20 % decrease or 25 % increase in walking time.

Using average bus driving speed across the whole route was not representative everywhere, and this meant that two different routes overlapping on some parts of the network could have different speeds on the same road. Generally using this method, rural parts of bus routes were assumed to receive a lower speed than they should, while congested urban parts may have gotten an excessive speed.

Because the estimations did not consider waiting and transfer time, the results presented are expected to be shorter than in reality. However, as this counted for the whole research area, the relative differences between subareas are expected to be acceptable.

The biggest strength of this method was the quantity of the survey, as the OD matrixes contain estimated trip time between all BSUs/STs. Another strength was that travel time can be considered both with and without access time.

4.3.4. Number of bus routes

This measure estimated the number of bus routes found in each BSU and ST. As discussed in 3.3.3, accessibility is better if more routes are accessible nearby. An increase in available routes near origin or destination also decreases the likelihood of needing to transfer between buses on a trip.

4.3.4.1. Method

The number of routes available in each BSU or ST was found using ArcMap's intersect tool with layers containing BSU/ST borders and the bus network. The output from this operation was a table showing which bus routes intersect which BSUs/STs. The number of different routes in each BSU/ST was counted and compared throughout the research area.

Some BSUs had no bus routes inside their borders because they were very small or lay just outside the bus network. These got the same score as the neighbouring BSU with the lowest number of bus routes.

4.3.4.2. Strengths and weaknesses

The main strength and reason for including this factor were that it showed which areas lacked options when it came to bus route variations. Instead of focusing on which areas had abundant bus options, e.g., bus terminal areas, the scope was on areas with few routes.

It was also a strength that it considered bus routes at both BSU and ST level. This was beneficial because some BSUs had few options in the immediate proximity, but the STs indicated more options a bit further away.

The biggest weakness was that the BSU/ST borders were very strict. I.e., only routes that intersected borders were counted as a viable bus route in that area, but nearby routes that did not intersect could be even closer and a better option for some addresses. The number of available routes in or near an area can therefore be higher than indicated, especially for small BSUs.

Another weakness was that larger areas were more likely to include more routes. This may have been inaccurate as people living here may not be willing to use all routes found in their BSU/ST if the distance to that route is long. This method did also not consider the location of bus stops, only whether parts of a route intersected an area or not. A way to partially counteract these issues is to assess the route density found in each BSU/ST listed in appendices 1 and 2.

Lastly, it was not assessed how many routes were necessary for each area. Locations along the coast may for example require fewer bus options because they have fewer possible travel directions.

4.3.5. Frequency

Overall frequency was expressed as the average number of buses that visited the BSU/ST per hour per direction, regardless of which route they operated. In addition, the average headway of the most frequent bus route in any two hours during the day was found.

4.3.5.1. Method

Overall frequency:

1. **Find the total number of trips made by each route**

From an Excel dataset containing all trips made between 8^{th} and 14^{th} November 2021, the number of trips made by each route during a week was found. This included trips in both directions. By dividing by 2, the number of trips in each direction made by each route per week was estimated. The dataset was assumed to represent the normal condition, as no special events or holidays occurred in this period.

Some routes also varied where they started, ended, or visited. Typically, these routes alternated between starting or ending in rural areas or from a city centre. In such examples, the city centre had twice the number of trips made by that route as the rural area. This was accommodated for in the GIS file by manually inserting the number of trips for each route segment, based on the schedules available online. I.e., for every location a bus had on a route, the dataset contained the number of times a bus drove here during the week.

2. **Find the overall frequency**

Knowing the number of trips made by each route in each direction per week, the overall frequency of buses per hour per direction was found by dividing by 7 days/week and 24 hours/day. The output numbers were estimations of the average frequency of each bus route.

3. **Spatial join BSU borders with bus routes**

ArcMap was used to find which routes intersected which BSUs/STs. BSUs with no routes intersecting them were assigned the frequency of the neighbouring BSU with the lowest frequency. Where many different routes intersected an area, the area received a frequency which was the sum of frequencies.

Average headway during the two most frequent hours:

1. **Identify the most frequent two-hour period for each route**

The two hours with the most bus trips were assumed to correspond with when travel demand was highest. This period was found by examining each route's travel schedule, and the number of trips made in this period was noted for each route.

Two-hour periods were used because this time span could represent typical peak periods, e.g., 07-09 and 15-17. In addition, it is long enough to ensure that frequent service stretches over more than just one hour and that, e.g., overtime work is more flexible.

2. **Find the frequency and headway**

Bus headway on each segment of every route was found by first dividing the number of bus trips made in the most frequent period by 2 hours. E.g., if a bus route had eight trips between 07-09, the frequency was given by:

$$Frequency = \frac{Trips\ made\ in\ most\ frequent\ period}{2\ h} = \frac{8\ trips}{2\ h} = 4\frac{trips}{h}$$

The headway, i.e., the time interval between arrivals of buses driving the same route in the same direction (Kittelson & Associates, Inc. et al., 2013, p. 738), was subsequently found for each segment by dividing 60 minutes/hour by the frequency. E.g.:

$$Headway = \frac{60\frac{min}{h}}{frequency} = \frac{60\frac{min}{h}}{4\frac{trips}{h}} = 15\frac{min}{trip}$$

3. Find the best headway for each BSU and ST

Using GIS software, the route segment with the best, i.e., shortest, headway intersecting each BSU/ST was identified. Only the best headway represented the headway of the whole BSU or ST. This was done so that areas with many routes, i.e., higher frequency when considering all routes, did not get an inflated headway. This also simplified the comparison between areas, as typical headways were 7.5, 15, 30, or 60 minutes.

4.3.5.2. Strengths and weaknesses

The frequency measure said something about how often any bus route was in or near one's origin but nothing about where that bus was heading. I.e., areas with several routes may have gotten an inflated frequency because many buses operated there, but all routes may not have been viable for reaching the desired destination. This was also an issue for the headway measure, as the route with the best headway may not have been the one people use the most.

The main strength was that both overall frequency and headway in peak periods were considered. While the overall frequency described the general frequency and prioritization of an area, the headway measure explained how accessible the various areas were during peak periods. E.g., for school and work commuters, frequent service between 7-9 and 15 and 17 may be sufficient.

4.3.6. Service span

Service span, i.e., how much time of the day service is available, was measured in hours of service for each BSU and ST using “hourly-or-worse service” from TCQSM (2013, p. 202) and GIS software.

4.3.6.1. Method

1. **Find the hours of service of every route in the research area**

For all routes and variants of routes inside the research area, hours with at least one departure were counted. E.g., a route that started trips at 00:15, 00:45, 06:15, 06:30, 06:45 and 07:00 would have three hours of service. The frequency or number of trips each hour was not considered.

2. **Find the largest service span in each BSU/ST**

Using ArcMap, the route with the largest service span intersecting each BSU/ST was found. The service span of this route represented the service span for the BSU/ST.

4.3.6.2. Strengths and weaknesses

The main strength of the method was that it showed how many hours of the day people need to wait less than one hour for bus service, and where. E.g., for a BSU/ST with 18 hours service span, one can in 18 of the 24 hours of that day, expect to wait no more than an hour for bus service.

A weakness of this method was that only the route with largest service span was considered. In some cases, the service span could have been longer if the service spans of all routes in an area had been aggregated, especially when including weekend night routes. It may also be that the longest-serving route was not always viable for the requested travel. However, in most cases, the route with the longest service span represented the overall picture well because it also typically had the highest frequency and most likely destinations.

Another weakness that counted for the number of bus routes and frequency measures was that only routes that intersected BSU/ST borders counted as viable bus routes in that area, but nearby undetected routes that did not intersect could have better service spans. For BSUs that did not have any routes intersecting them, the service span of the adjacent BSU with the shortest service span was used to represent this so that all BSUs had a measure of service span.

4.3.7. Overall accessibility

The overall accessibility was estimated as the average score from the six factors described above. This composite measure, ranging from 0 (worst) to 100 (best), was assumed to describe how accessible the bus service was in every BSU/ST compared to all other BSUs/STs. I.e., overall accessibility was a measure of relative accessibility within the research area, not an absolute measure. Relative accessibility was used because it simplified the comparison between areas and better illustrated the differences between them.

4.3.7.1. Method

1. **Find how well each area performs on each factor compared to other areas**

For each factor included in the overall accessibility measure, the worst value received a score of 0, while the best got a 1. The remaining values correlated to somewhere between 0 and 1, depending on how close they were to the best or worst. Note that for some factors, the maximum or minimum score was set for values other than the highest and lowest scores to represent the distribution better. E.g., for bus route options, the highest value was 28, but BSUs/STs with five or more options received the maximum score because more than this was not expected to improve accessibility.

If accessibility was better when the value was smaller, e.g., travel time or access distance, the following formula was used:

$$Accessibility\ factor\ score_{area\ i} = \frac{Highest\ value - Accessibility\ value_{area\ i}}{Difference\ between\ highest\ and\ lowest\ value}$$

If a higher estimated value corresponded with better accessibility, e.g., for hours of service or service coverage, the formula below was used:

$$Accessibility\ factor\ score_{area\ i} = 1 - \frac{Highest\ value - Accessibility\ value_{area\ i}}{Difference\ between\ highest\ and\ lowest\ value}$$

If one of the formulas above returned a value above 1.00 because the value required to get the top score was set lower than the maximum value, it was rounded down to 1.00.

2. Combine the scores from each factor into a composite score

The overall accessibility was found using the formula below:

$$Total\ accessibility = \frac{100}{6} * (Access\ distance + Service\ coverage + Travel\ time + Bus\ route\ options + \frac{Overall\ frequency}{2} + \frac{Headway}{2} + Service\ span)$$

Overall frequency and headway both described the frequency factor. Therefore, the frequency score was assumed to be the average of these two measures. If these scores were not divided by two, the frequency would effectively count twice towards the overall accessibility.

Everything was divided by six to get the average score. The reason for multiplying by 100 was to have the overall accessibility score between 0 and 100 instead of 0 and 1.

4.3.7.2. Strengths and weaknesses

The main strength and reason for including this measure were that it provided a composite overview of the relative bus transport accessibility in the research area. The measure also considered what was assumed to be the most critical factors of bus transport accessibility.

A potential weakness was that the weighing of each factor towards the overall accessibility could be different. I.e., the various factors could be multiplied by a coefficient to represent more or less of the overall accessibility, depending on their importance. However, in this case, it was decided that each of the six factors should count equal to the final score. This was done because how people weigh each factor will vary significantly between individuals. E.g., the elderly might favour short access distances over short travel times, while young people may think that frequency is twice as important as access distance.

4.3.8. Accessibility factors not considered

The accessibility factors not considered in this thesis were safety and security, travel cost, comfort and appearance, reliability, capacity, and information.

5. Results

This chapter summarizes the results for each of the six accessibility factors measured. The main findings are presented here, but the complete overview, additional maps and charts are given in the appendices. The results will answer which areas in Nord-Jæren have the best bus transport accessibility and whether denser areas in terms of addresses have better service. The implications of the findings are discussed in the Discussion chapter.

5.1. Access distance

Overall, the access distances throughout the research area are very good. Of the 113523 address points included, 28.2 % (n = 31993) of the addresses have an access distance of 100 m or less. This indicates very good accessibility and is suitable for heavily visited areas according to the regional plan. Many of these addresses are located near the city centre in Stavanger or Sandnes. 48.1 % (n = 54628) have access distance in the (100, 250] m interval, i.e., suitable for workplace intensive areas, while 19.9 % (n = 22565) lie in the (250, 500] m interval, which is the upper recommendation for dwellings. 2.3 % (n = 3517) of the addresses have access distance between 500 and 800 m, and only 0.7 % longer than 800 m. According to the regional plan, access distances over 500 m are not recommended for bus transport (Rogaland fylkeskommune, 2021d, p. 60). Figure 5.1 reveals that many of the poorest access distances are found in rural areas in Sola and Sandnes.

The median access distance for the research area is 154 m, while the average is 191 m. The standard deviation is 162 m. The relatively large difference between median and average indicates some extreme values.

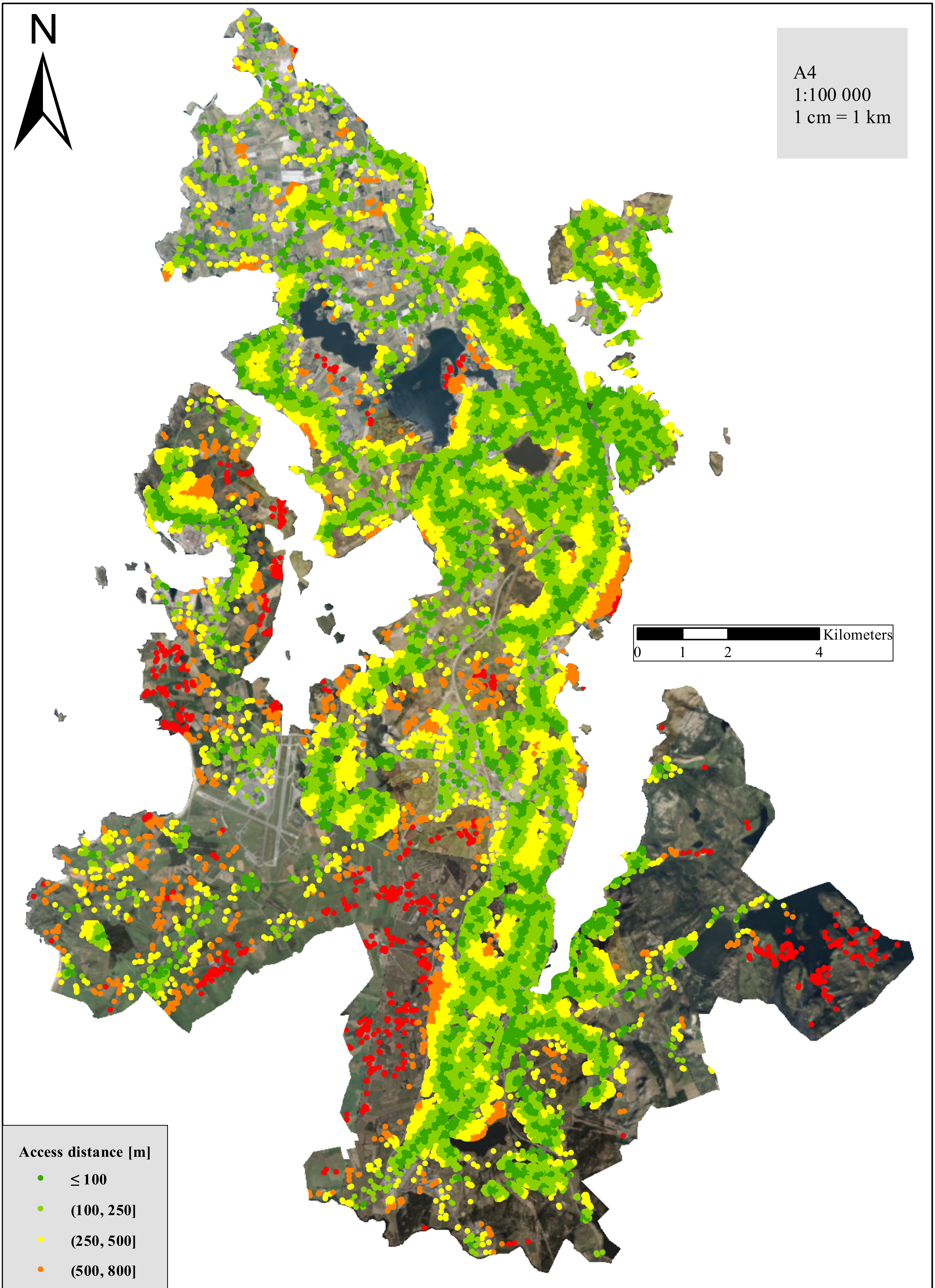

Figure 5.1 Access distance for each address in the research area.

When looking at median access distance in the 327 BSUs, the main finding is that the access distances are very good. Only 2.1 % (n = 7) of the BSUs included in the dataset have access distance above 500 m, meaning that almost every BSU has median access distance suitable for at least dwellings. 82.3 % (n = 269) of the BSUs also fulfil the recommendations for workplace-intensive areas (250 m), and 15.3 % (n = 50) have access distance suitable for the most visited places (Rogaland fylkeskommune, 2021d, p. 60).

Typical for many BSUs with the shortest access distances is that they are in or near Stavanger or Sandnes city centres. Large and relatively rural Haga, Folkvord, Kolnes, and Soma have the longest access distances. Figure 5.2 shows the median access distance in each BSU. As discussed above and evident in the map, most BSUs in the research area have good bus stop accessibility.

Chart 5.1 shows the relationship between BSU median access distances and address densities. Notable from this scatter plot is that all BSUs with density above 1000 addresses/km^2 have access distances of 500 m or less and that the six BSUs with access distance longer than 600 m all have near-zero address density. In addition, access is particularly good for BSUs with densities of at least 4000 addresses/km^2 as these have access distances below 250 m, which is the regional plan's recommendation for workplace-intensive areas (Rogaland fylkeskommune, 2021d, p. 60).

BSUs that stand out include residential areas Gauselnuten and Vaulen. Although they are within the threshold recommended for dwelling areas, these have relatively high address densities of respectively 1970 and 1000 addresses/km^2 but medium to long access distances of 463 and 485 m. Sentrum vest 1, which lies along the bay area in Stavanger city centre, also has a relatively long access distance of 326 m considering its attractiveness and high density of 4038 addresses/km^2.

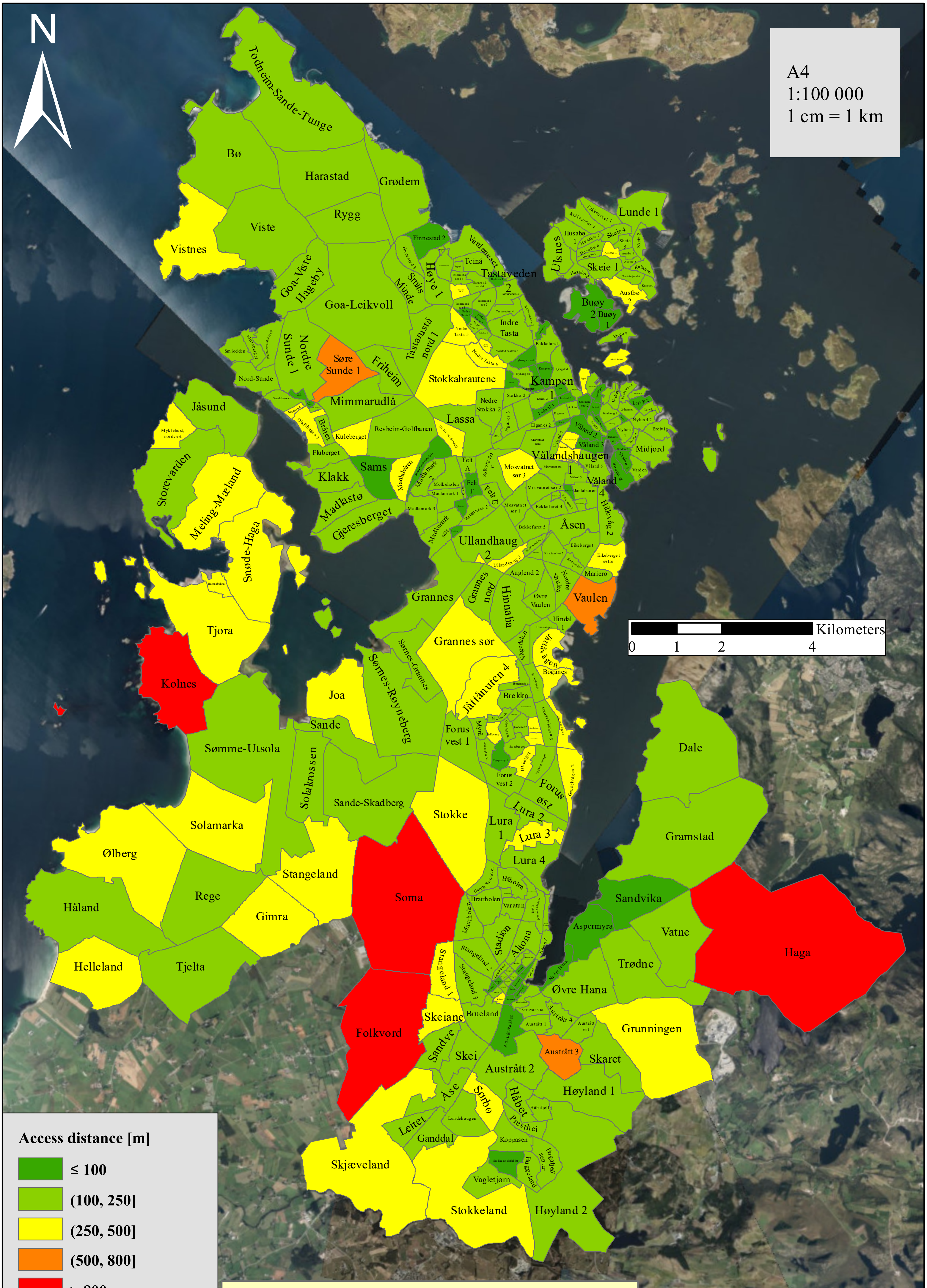

Figure 5.2 Median access distance for each BSU in the research area.

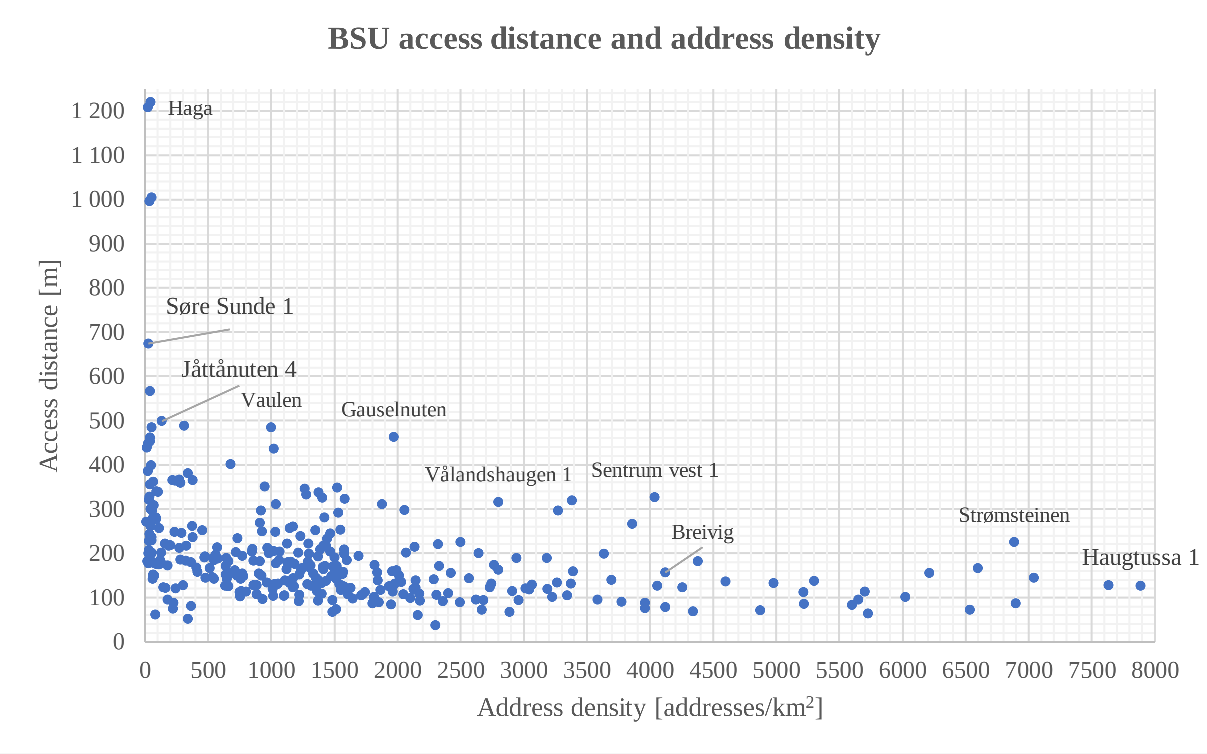

Chart 5.1 Scatter plot showing each BSUs address density and access distance. Correlation = -0.33.

5.2. Service coverage

The total land and freshwater area in the research area is 231.34 km^2. The service area covers 64.5 % (149.24 km^2) of this. Because much of the research area is uninhabited, this says little about the quality of the service coverage, but one can assume there is around 64.5 % chance of being within 500 m of a bus stop from a random point within the research area. Only around 3.8 % (n = 4337) of addresses in the research area lie outside a service area. I.e., almost every address in the research area has a bus stop within 500 m, indicating that the service coverage is almost perfect. Considering that only 64.5 % of the research area is covered by service, but 96.2 % of addresses are, the placement of bus stops also seems coherent with where addresses are located, or vice versa.

There are 237 BSUs with 100 % of addresses served by bus transport and 199 BSUs where all land area is covered by bus service. Around 28.4 % (n = 93) of BSUs have more than 10 % of their area unserved, but only 13.1 % (n = 43) have more than 10 % of their addresses unserved. I.e., there is also a coherence between the location of addresses and bus stops in BSUs.

Vaulen, Austrått 3, Haga, Søre Sunde 1, Soma, Kolnes, and Folkvord have the poorest service coverages as they have more than half of both area and addresses unserved by bus service. Figure 5.3 highlights where service coverage is high in terms of addresses. In addition, it shows where the service coverage area is.

Figure 5.4 shows the difference in percentage points between the share of addresses served and the share of area served, in addition to the service coverage area. As evident in the figure, most BSUs have around the same or higher percentage of addresses served than percentage of land served. Noteworthy is BSUs where the share of area served is much higher than the share of addresses served (orange and red fields), i.e., Austbø 3, Grannes Sør, and Austrått 3. In these places, there could be potential and space for development near bus stops. Alternatively, more bus stops could be added to increase the service coverage of existing addresses.

In BSUs with a much higher share of addresses served than area served (green), e.g., Dale, Gramstad, Gimra, and Håland, the placement of buildings and bus stops has been coordinated coherently. As evident in Figure 5.4, these have a low percentage of land covered by bus transport compared to the percentage of addresses covered.

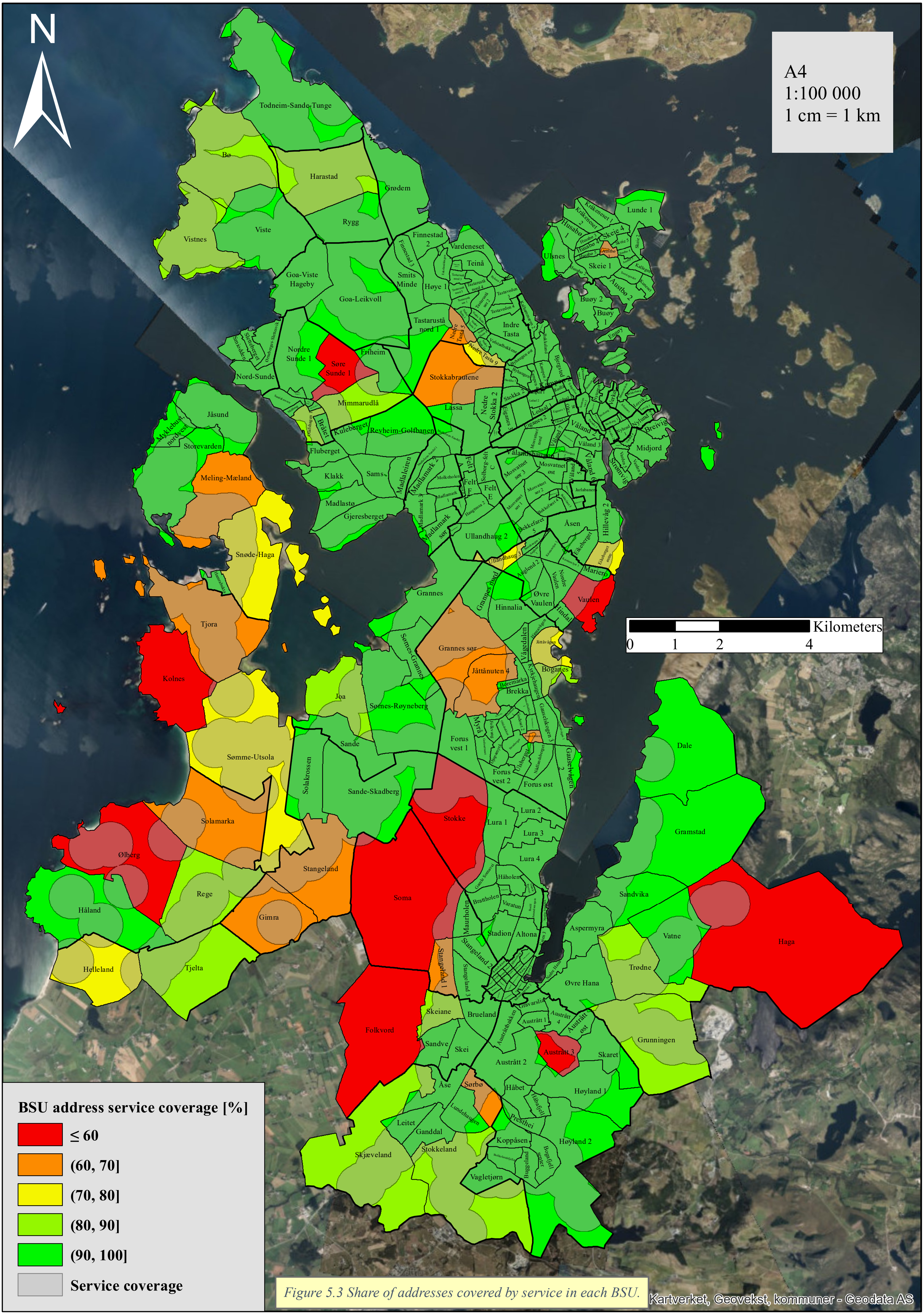

Figure 5.3 Share of addresses covered by service in each BSU.

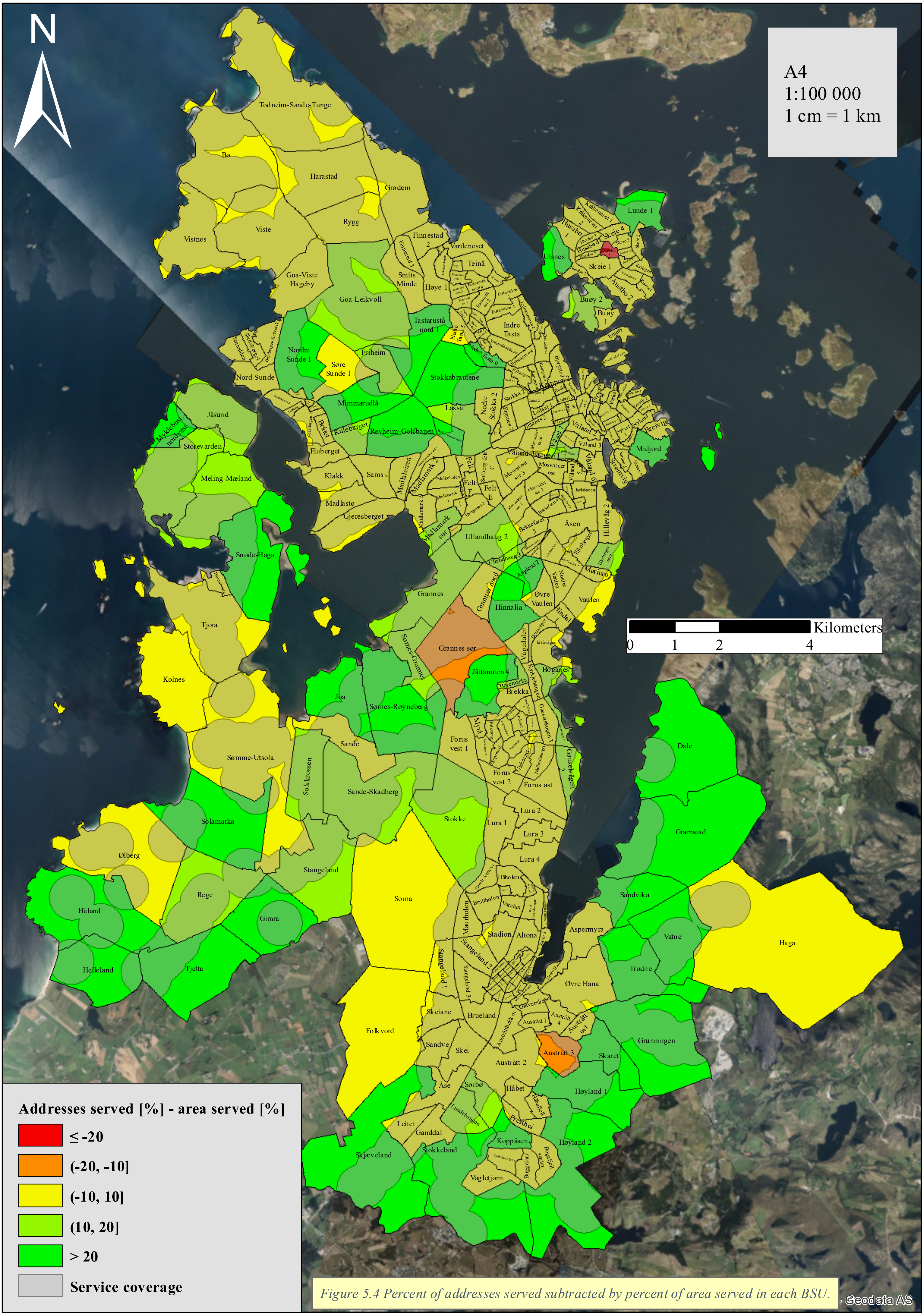

Figure 5.4 Percent of addresses served subtracted by percent of area served in each BSU.

Chart 5.2 shows each BSU's address density plotted against area and address coverage. As shown in the plot, there is a tendency for denser BSUs to have higher service coverage. E.g., all 60 BSUs with address density of more than 2000 addresses/km^2 have over 95 % of both area and addresses covered by service. Most BSUs near Stavanger and Sandnes city centre have high service coverage. These areas and those with near 100 % area coverage should therefore be targets of possible development if it is a goal to have bus service available within a maximum of 500 m. Any development here, regardless of placement, would be covered by bus service.

Gauselnuten, Sørbø, and Vaulen have relatively poor service coverage despite having address densities over 1000 addresses/km^2. These have respectively 31.5 % (n = 62), 30.6 % (n = 213), and 56.1 % (n = 494) of addresses outside service coverage. The densest parts of these could benefit from having more bus stops with corresponding routes if the target is to improve service coverage. However, this should be weighed against the drawbacks of potentially changing existing routes' efficiency and travel speed.

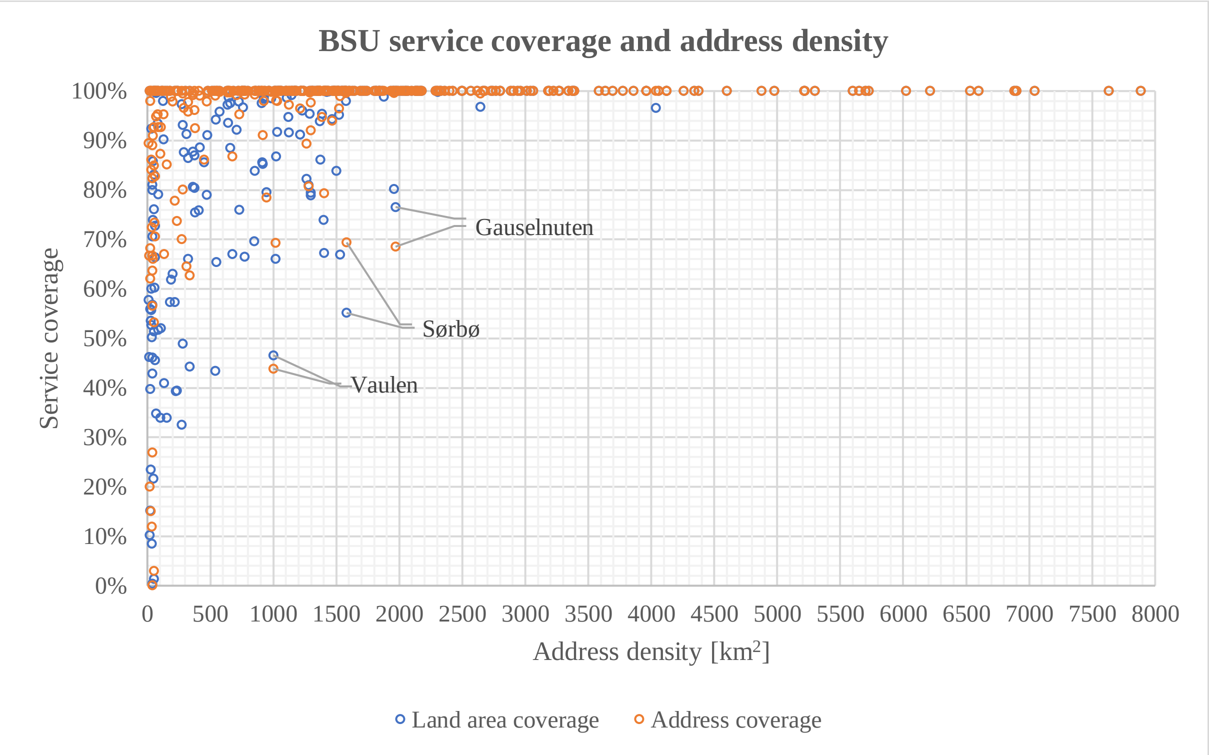

Chart 5.2 Land area and address service coverage plotted against address density in BSUs. Correlation address density and land area coverage = 0.42. Correlation address density and address coverage = 0.29.

5.3. Travel time

Total travel time and in-vehicle travel time correspond very strong with total travel distance and in-vehicle travel distance (correlation > 0.96 for both BSU and ST). Appendices 1 and 2 contain supplementary results from travel distance and time estimations. Appendices 15-22 shows travel times and distances between all BSUs and STs in OD-matrixes, including and excluding access times and distances.

Figure 5.5 shows the median travel time for each ST when making trips to all STs in the research area. As noted in 4.3.3, this survey mathematically favoured centrally located areas, but the bus network layout and number of available routes also influenced travel times. Notable is that the half (n = 19) of the STs which have the best travel times constitute only 27.7 % (61.7 km^2) of the total research area. This highlights that small STs clustered together have a mathematical advantage over larger STs in rural areas.

Areas centrally located in the research area or close to Stavanger city centre are most accessible in this survey. STs near Stavanger generally have much better travel times than other STs. Some exceptions are Hundvåg and Buøy, which are close to Stavanger in air distance but have relatively long travel distances. Areas along the research area boundary and more rural places, particularly in Sandnes and Sola municipalities, have the longest travel times.

Increase in density and decrease in travel time corresponds more for STs (correlation = -0.55) than for BSUs (correlation = -0.33). In Chart 5.3, Sandnes city centre (Sentrum) particularly sticks out with poor travel time compared to address density. Other STs with long total travel time compared to density include Kvernevik, Hundvåg, and Buøy. Jåtten, Hafrsfjord, and Røyneberg – Grannes have short travel times combined with modest address densities. The accessible travel times here can be utilized more by further developing these areas by densification.

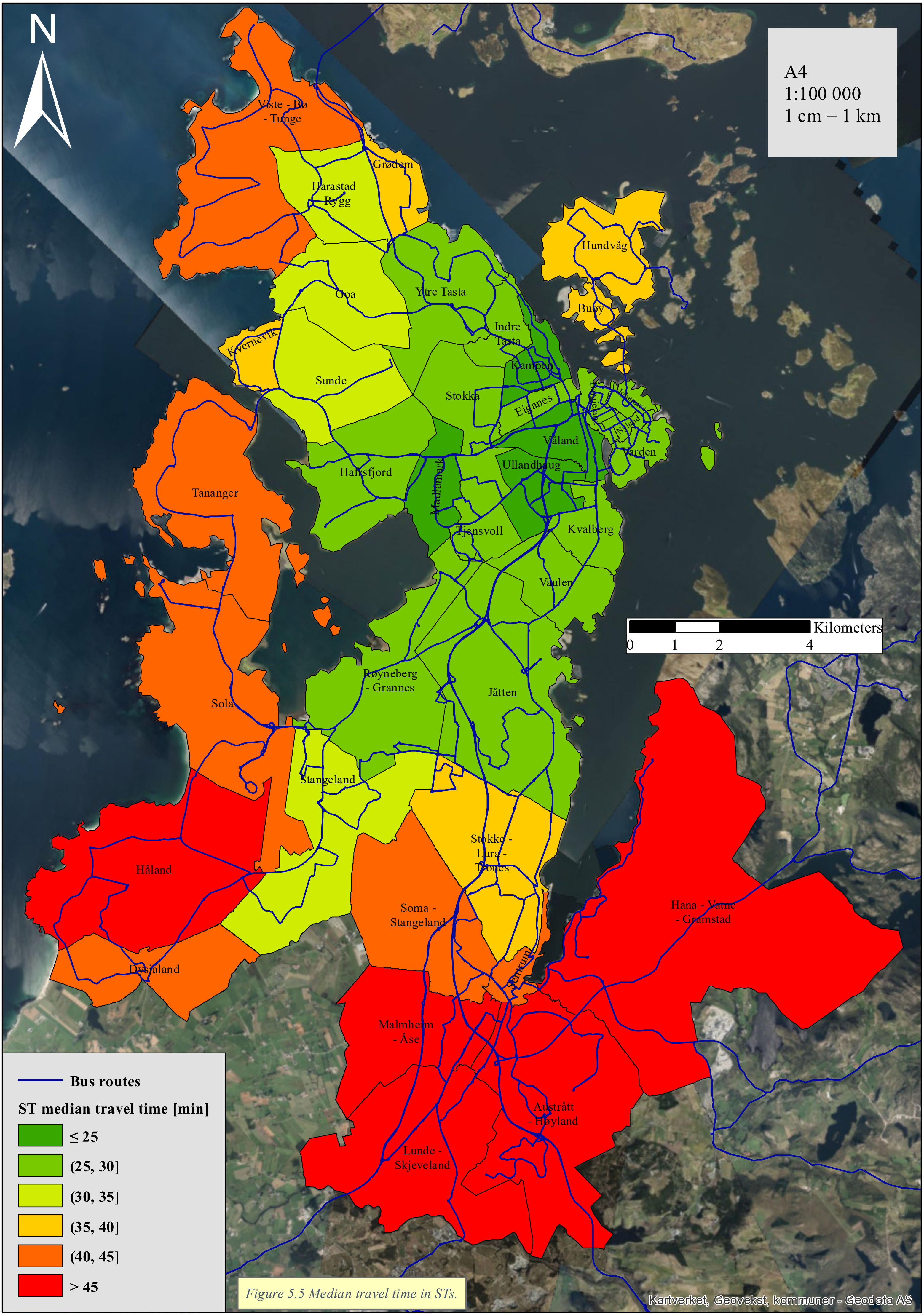

Figure 5.5 Median travel time in STs.

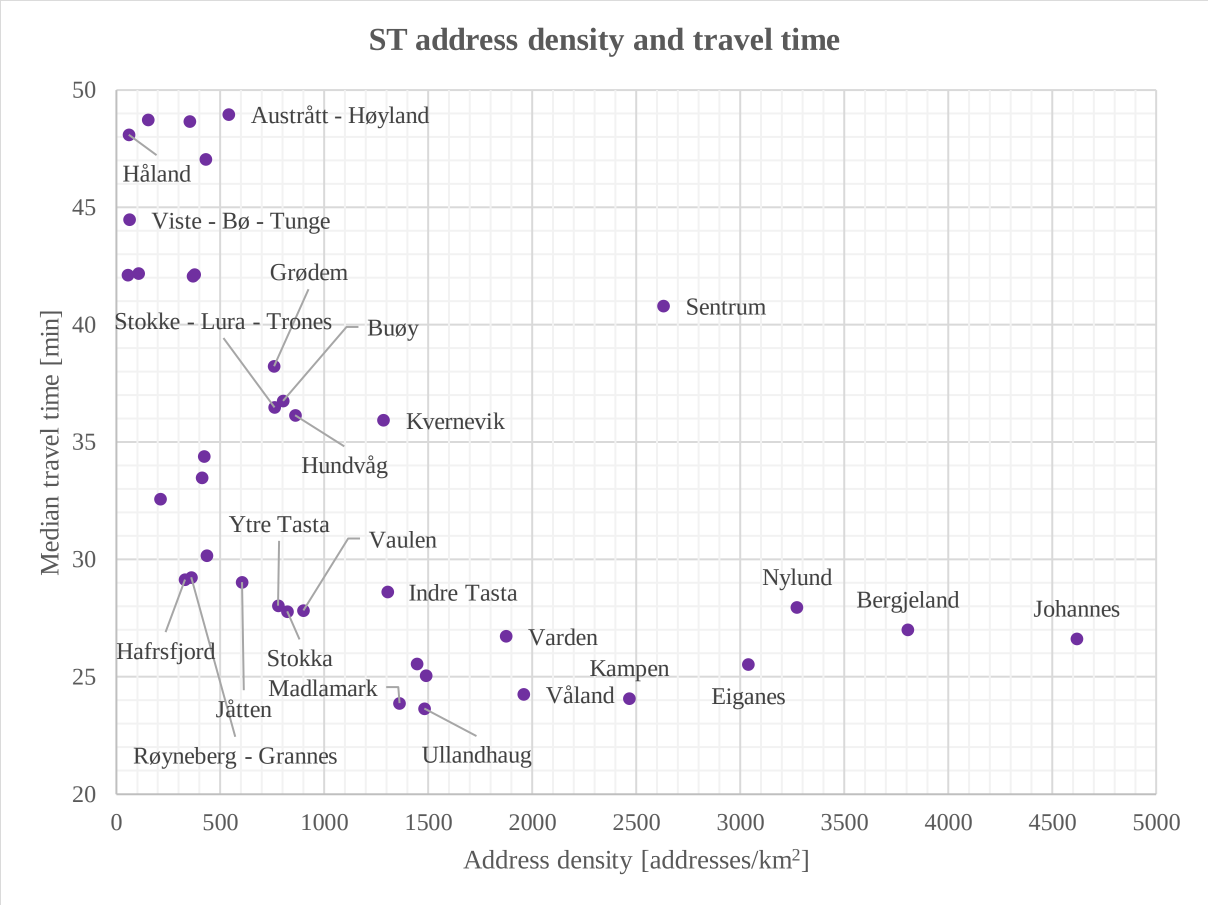

Chart 5.3 Scatter plot of the address density and travel times of STs. Correlation = -0.55.

In addition to median travel time, travel time accessibility can be assessed regarding how many STs are reachable within 10, 20, and 30 minutes. More STs available within these thresholds indicate more nearby travel opportunities. Denser STs generally tend to have more STs within 10, 20, and 30 minutes, as illustrated in Chart 5.4.

Sandnes city centre (Sentrum) has the most notable mismatch between density and STs reachable within 10, 20, and 30 minutes. Its off-centre location within the research area is unfavourable for travel time. In addition, most nearby STs here are large with low densities. Possible attractive areas that could have been included in the travel time survey to enhance the travel time here include Figgjo and Ålgård, which lies further southeast of Sandnes. However, these locations were not included because large rural areas separate them from urban Nord-Jæren.

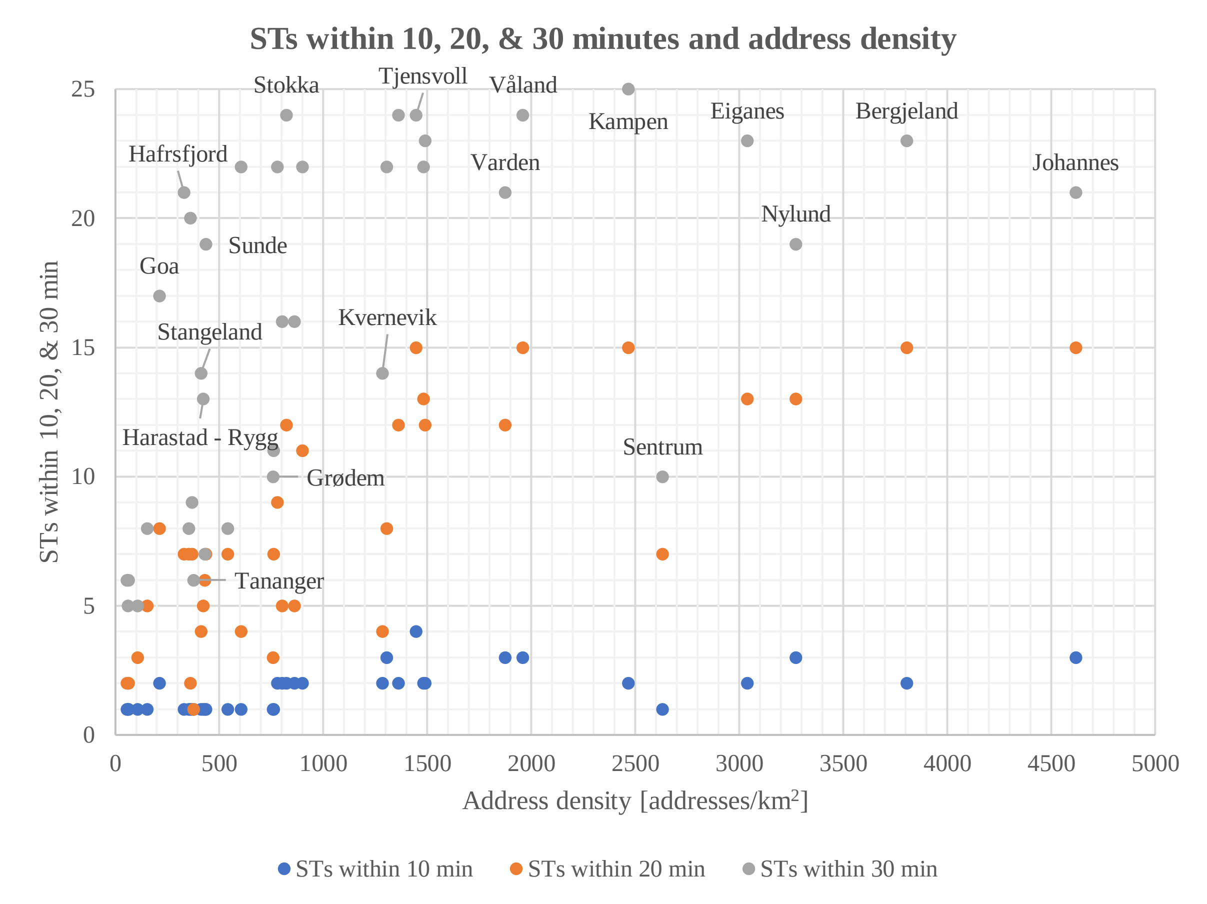

Chart 5.4 ST address densities and how many STs are reachable within 10, 20, and 30 minutes of bus travel, including access time at origin and destination. Correlation = 0.61, 0.75, and 0.53.

5.4. Bus route options

The number of bus route options is relatively good throughout the research area, with a few notable exceptions. Inhabitants in and between Stavanger and Sandnes city centres can generally choose between many options, while Sola and Randaberg have poorer accessibility in this category.

There are 25 (7.6 %) BSUs with only one bus option nearby and 34 (10.4 %) with two. Most of these are located along the coast or in rural areas. Around 21.4 % (n = 70) of BSUs have three different bus routes available nearby, indicating medium bus route option accessibility.

It is assumed that most travelling destinations can be reached by only one bus from these places. People living in one of the 46 BSUs (14.1 %) with four different bus routes have good accessibility. In addition to reaching the most likely destinations by only one bus, trips from here will in many cases have increased frequency due to some routes overlapping. The remaining 152 BSUs (46.5 %) have five or more bus routes nearby. These have excellent accessibility and can reach most other BSUs in the research area by only one bus. It is also likely that these have more varied bus route types, including regular, express, and night-time buses.

One area between Stavanger and Sandnes city centres sticks particularly out. As shown in Figure 5.6, BSUs Myrå, Mariamarka, Godeset 1 and 2, Folkvang, Ofolsbakken, Godesettunet, Djupamyrå, Storaberget, and Ulsberget from statistical tract Jåtten form an enclave-like red area. These have an address density above 1000 addresses/km^2, but contrary to surrounding BSUs on all edges, they only have one bus route option (route X31).

Other BSUs with only one bus route and medium to high address density are Paradis 2, Byhaugen, and Jåttåvågen. The latter two are surrounded by areas with more options and may therefore have better than perceived bus options accessibility. Jåttåvågen will also be one of the main development areas along the Bus Road, as discussed in 2.2.4, so improved accessibility is expected here. Paradis 2 is located among high-density BSUs with relatively poor bus options. This area, and Stavanger East in general, have medium to low number of buses to choose from, despite having very high address densities.

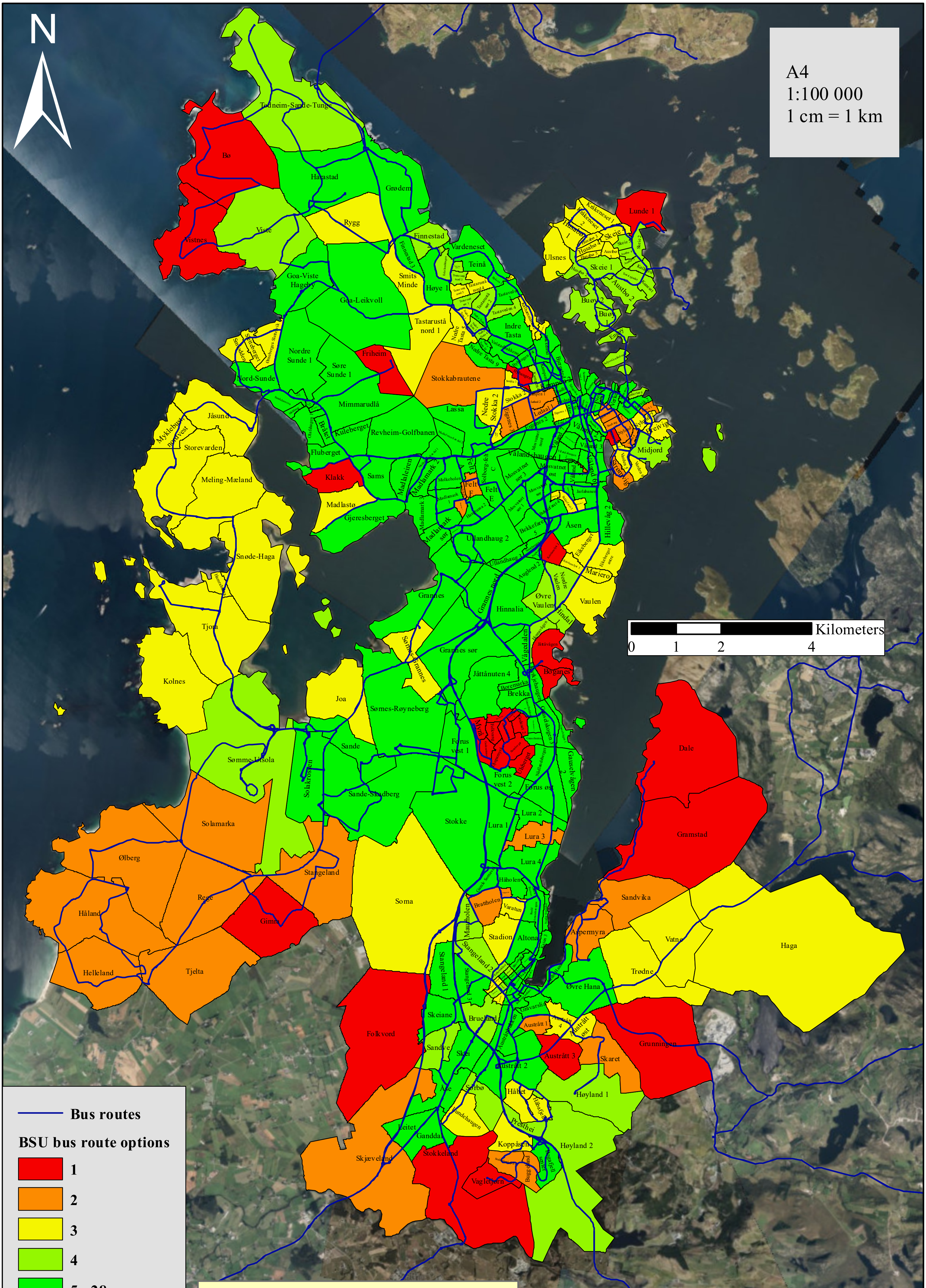

Figure 5.6 Number of bus route options in each BSU.

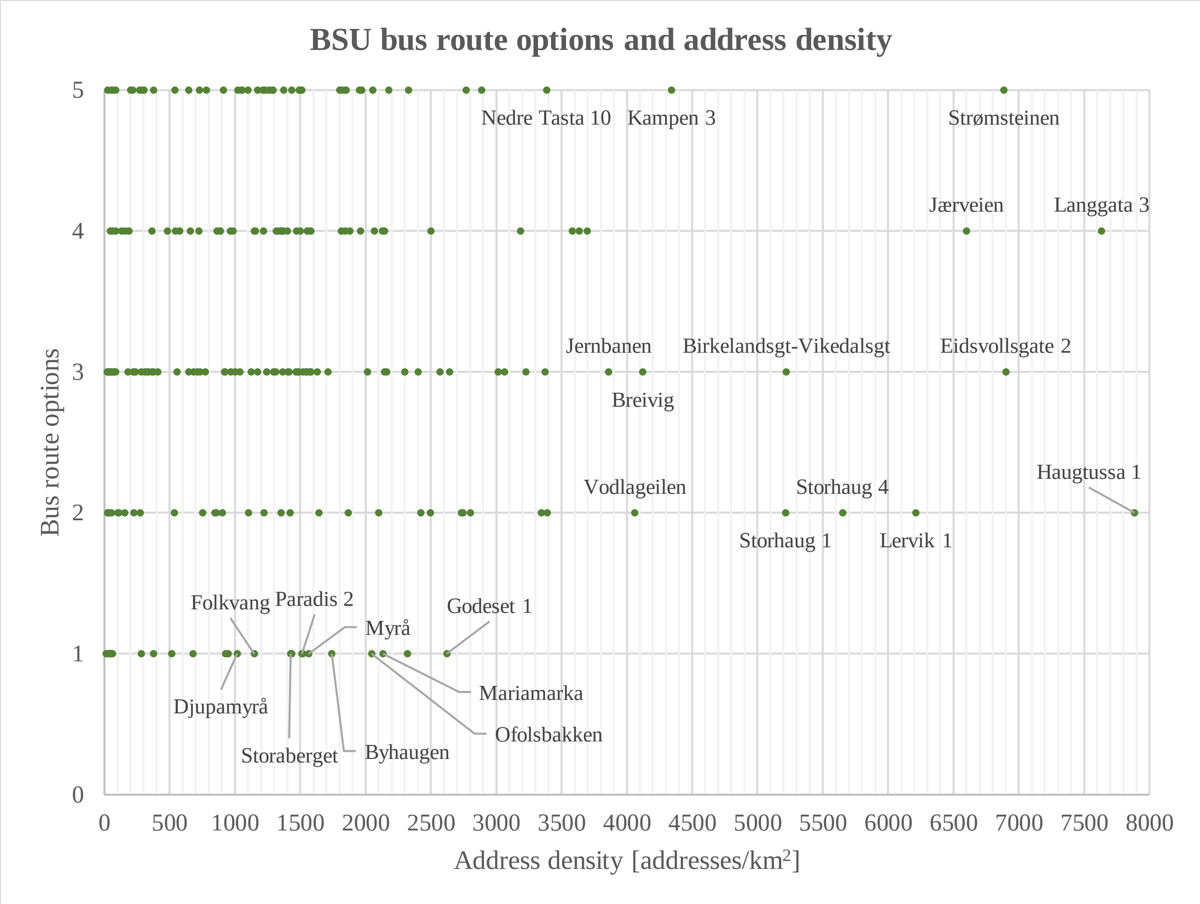

Chart 5.5 Bus route options and address density in BSUs. The y-axis is cut off at 5 because 5 or more options is regarded as very accessible.

5.5. Frequency

Frequency is measured as overall frequency, which is linear with number of buses per week, and as the best average two-hour headway in each BSU and ST. Noticeably, some areas have comparatively better minimum headways than overall frequency, indicating that bus schedules are adjusted well to the peak periods. Such adjustments are helpful for work trips but limit the flexibility regarding leisure trips. Here, frequency is displayed at BSU level, but appendix 2 contains frequency at ST level.

5.5.1. Overall frequency

The areas in and between Stavanger and Sandnes city centres have the highest overall frequency. Neighbouring BSUs with an average of less than one bus available per hour throughout the week are predominantly found in Sola municipality, coastline areas, or rural places. When many BSU neighbours all have the same frequency, it indicates that the overall frequency in that region is similar and that the result is not caused by some areas being just outside a bus route. Many addresses in small single red or orange fields surrounded by higher frequency areas, e.g., Boganes, Jåttåvågen, and Husabø 5, may therefore have better accessibility than what is indicated.

Some clusters of BSUs stick out with comparatively better frequencies all around them, including low-density BSUs like Friheim, Tastarustå nord 1, and Stokkabrautene near Stavanger city centre, as well as a few BSUs east of Stavanger city centre.

Chart 5.6, which compares overall frequency with address density, shows that several high-density BSUs have poor frequency. Notable examples include Nylund 1, Storhaug 1-4, and Paradis 2. Some of these are surrounded by higher frequency BSUs, meaning that some addresses here may have high frequencies just outside the BSU borders. The same area mentioned in Jåttå ST in last subchapter also has low overall frequency compared with address density due to only one bus operating here.

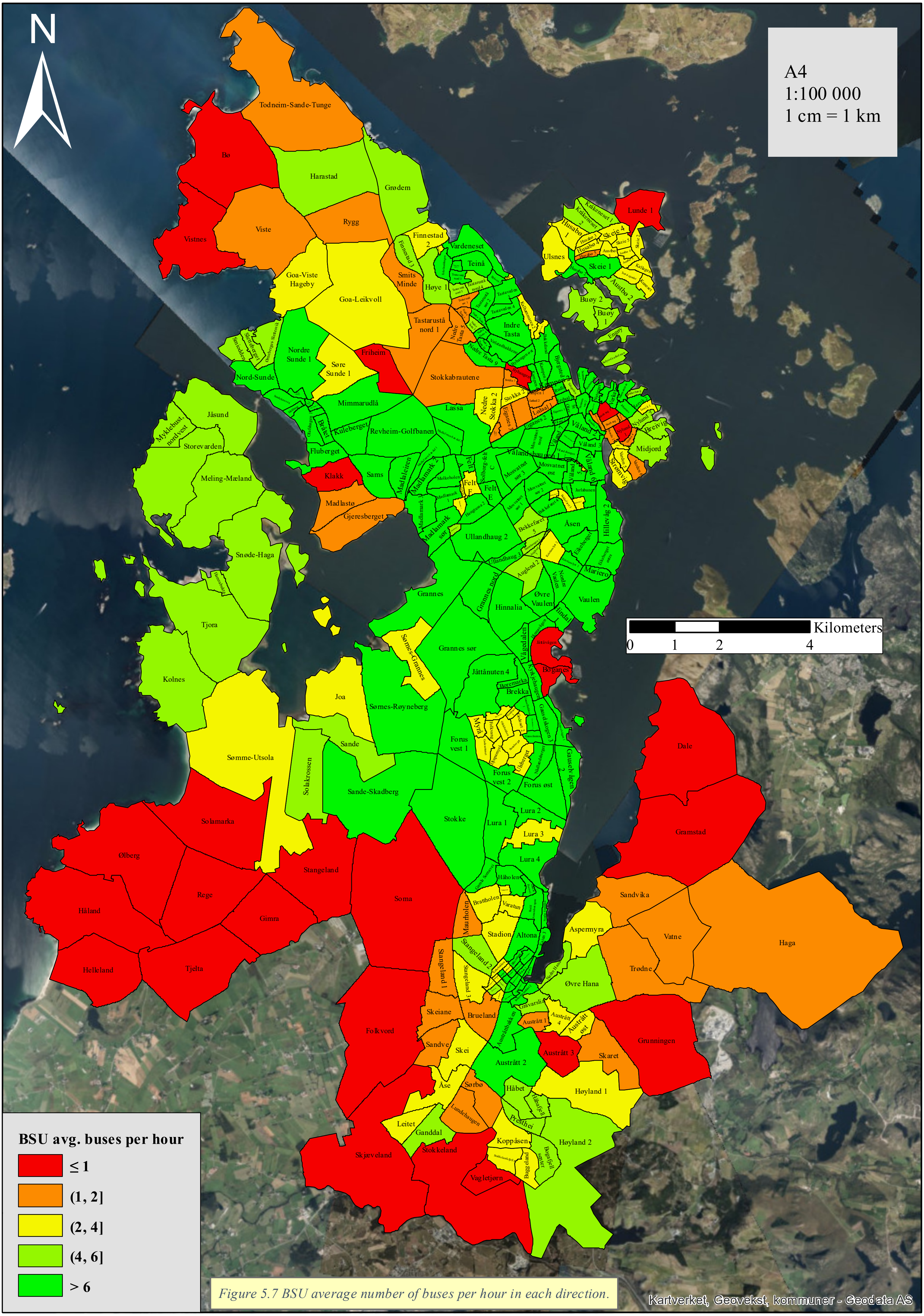

Figure 5.7 BSU average number of buses per hour in each direction.

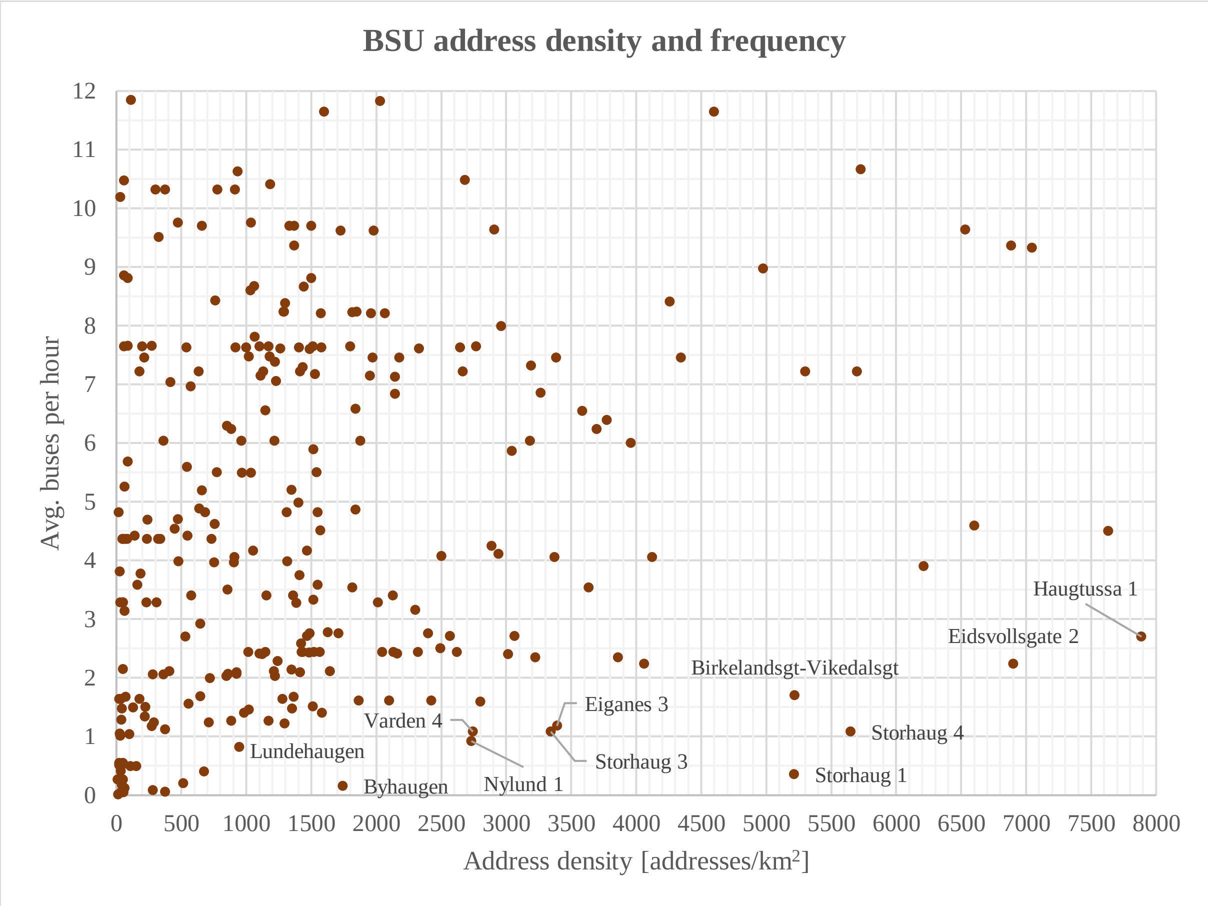

Chart 5.6 The scatter plot shows the average overall bus frequency per hour in normal weeks and address density for BSUs. Only frequencies of 6 or fewer buses per hour are included, as higher frequency than this is unnecessary. There is no correlation because there are several outliers from areas with very high frequency and very low density, e.g., bus terminal areas.

5.5.2. Headway

The area in and between Stavanger and Sandnes also has the best headways. Most places here never have more than 15 minutes between buses on the same route in peak periods (assuming that buses are on time).

Some rural and coastline areas in Sandnes, Sola and Randaberg have the worst headways. However, many of these areas have comparatively better minimum headways than overall frequency.

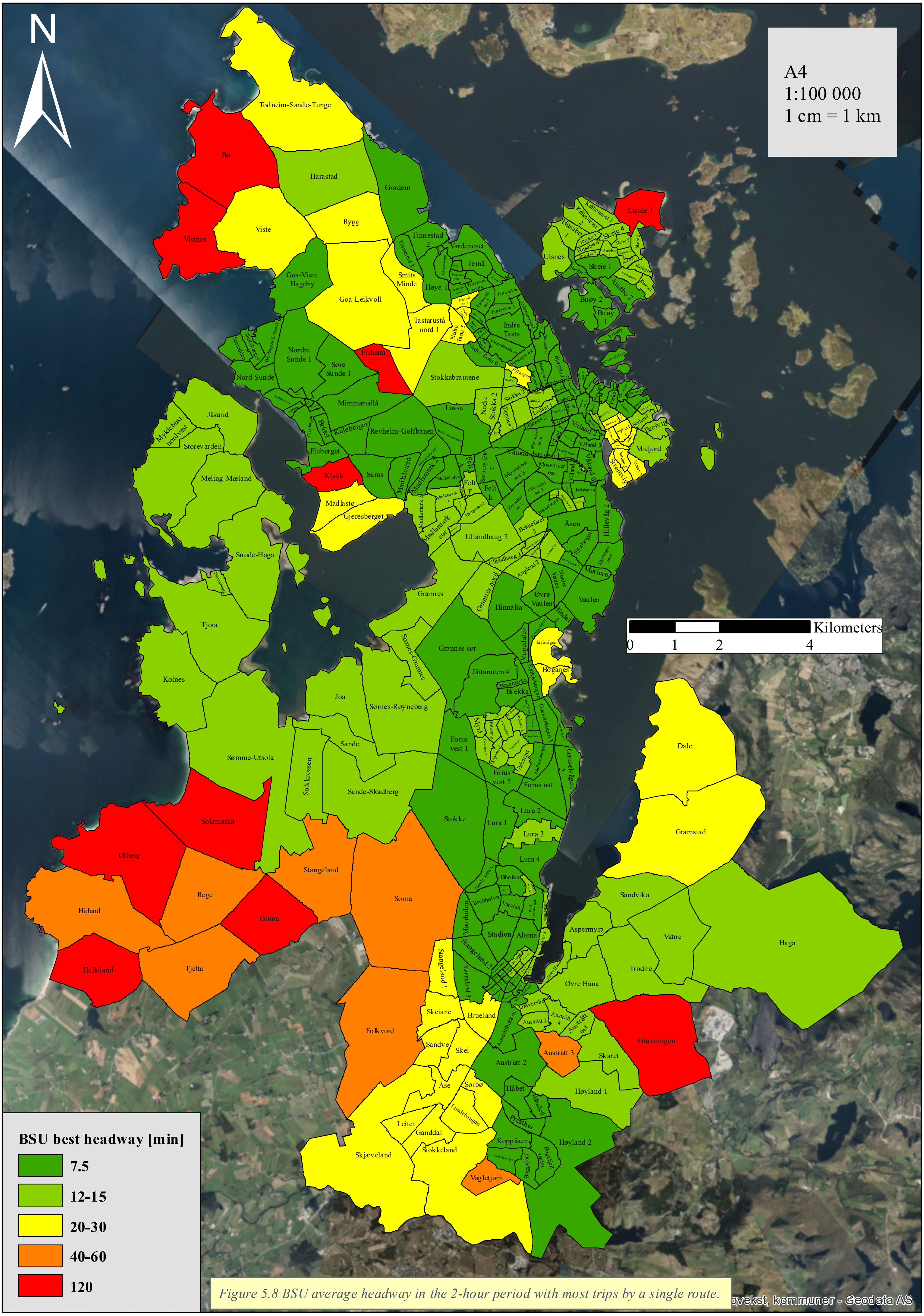

Figure 5.8 BSU average headway in the 2-hour period with most trips by a single route.

All areas with headway of one hour or more have less than 400 addresses/km^2, and no BSU with headway of 30 minutes or worse have more than 1800 addresses/km^2. Varden 3 and 4, Nylund 1, as well as Storhaug 3 and 4 have comparatively poorer headways of 20 minutes, considering their high address densities of more than 1700 addresses/km^2.

5.6. Service span

The findings in this subchapter are illustrated at BSU level, but appendix 2 shows more generalized information at ST level.

The service span in the research area is generally very good, particularly between Sandnes and Stavanger city centres. Most BSUs in the research area (n = 188) have bus service available 24 hours each weekday. Only 19.3 % (n = 63) of BSUs have a service span of 18 hours or less, of which 10.4 % (n = 34) have less than 15 hours. Some places with low service spans, e.g., Byhaugen and Storhaug 1, are also surrounded by higher service span areas, meaning that the service span accessibility here may be better than indicated in Figure 5.9.

The worst service spans over large areas are found southwest in Sola, west and east in Sandnes, and west in Randaberg. Bus travel flexibility to these areas is limited, especially if long access distances are undesired.

Low-density BSUs generally have the worst service spans, but not all BSUs with low address density have poor service spans. Twenty-five (7.6 %) BSUs have 12 hours or less service span. These have address densities below 400 addresses/km^2, except for Vagletjørn, Byhaugen, and Storhaug 1, which are all surrounded by BSUs with high address densities and large service spans.

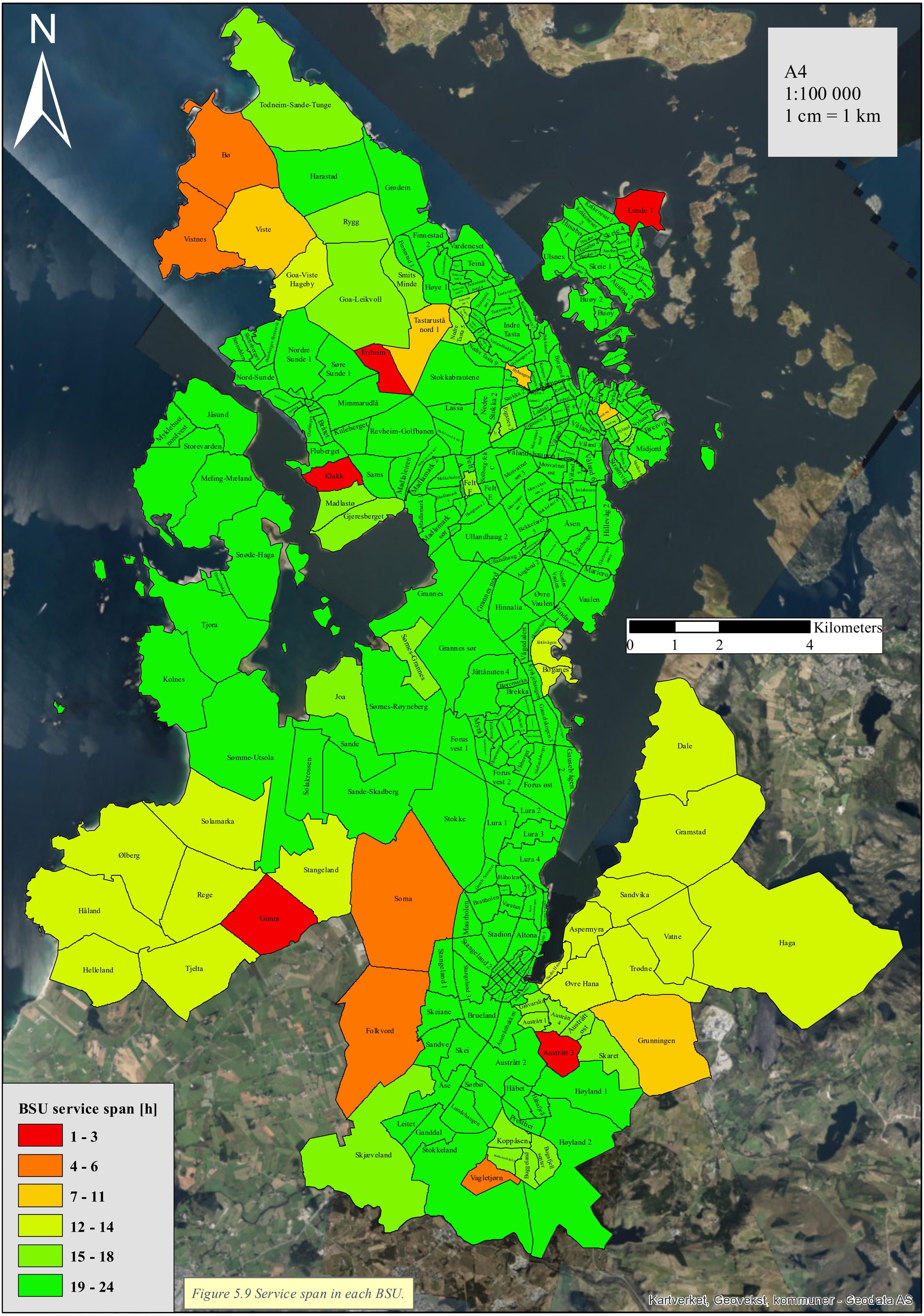

Figure 5.9 Service span in each BSU.

5.7. Overall accessibility

Overall accessibility is shown at both BSU and ST levels. The BSU level results are generally emphasized and ironed out at ST level because here only the best score is considered for some factors. E.g., an ST consisting of four BSUs with service span of 18 hours and one BSU with service span of 24 hours will have a service span of 24 hours. Although this is not always representative, the ST scope gives a broader view of the overall situation in a region.

5.7.1. Basic statistical units

Total bus transport accessibility is best in and between Sandnes and Stavanger city centres. There are some comparatively less accessible areas here, but most of them are nearby BSUs with among the best accessibilities. North and west of Stavanger city centre, the accessibility is mostly good or very good compared to other BSUs.

Rural and coastline areas in Randaberg, Sandnes, and particularly Sola have the worst bus transport accessibility. Many medium-accessible BSUs are also found in Sandnes municipality, far from the city centre.

The area mentioned earlier regarding bus route options and frequency consisting of BSUs Myrå, Mariamarka, Godeset 1 and 2, Folkvang, Ofolsbakken, Godesettunet, Djupamyrå, Storaberget, and Ulsberget again sticks out. Considering this area's density and placement between Sandnes and Stavanger, the accessibility is worse than in other comparable areas. This area scores worse because only one bus operates here, reducing bus route options and overall frequency scores.

It is also seen from Chart 5.7 that relative accessibility of 50 % or less, i.e., at least twice as poor accessibility as the best BSUs, is predominantly found in low-density BSUs, notable with less than 500 addresses/km^2. However, low address density BSUs are not necessarily less accessible than higher density areas.

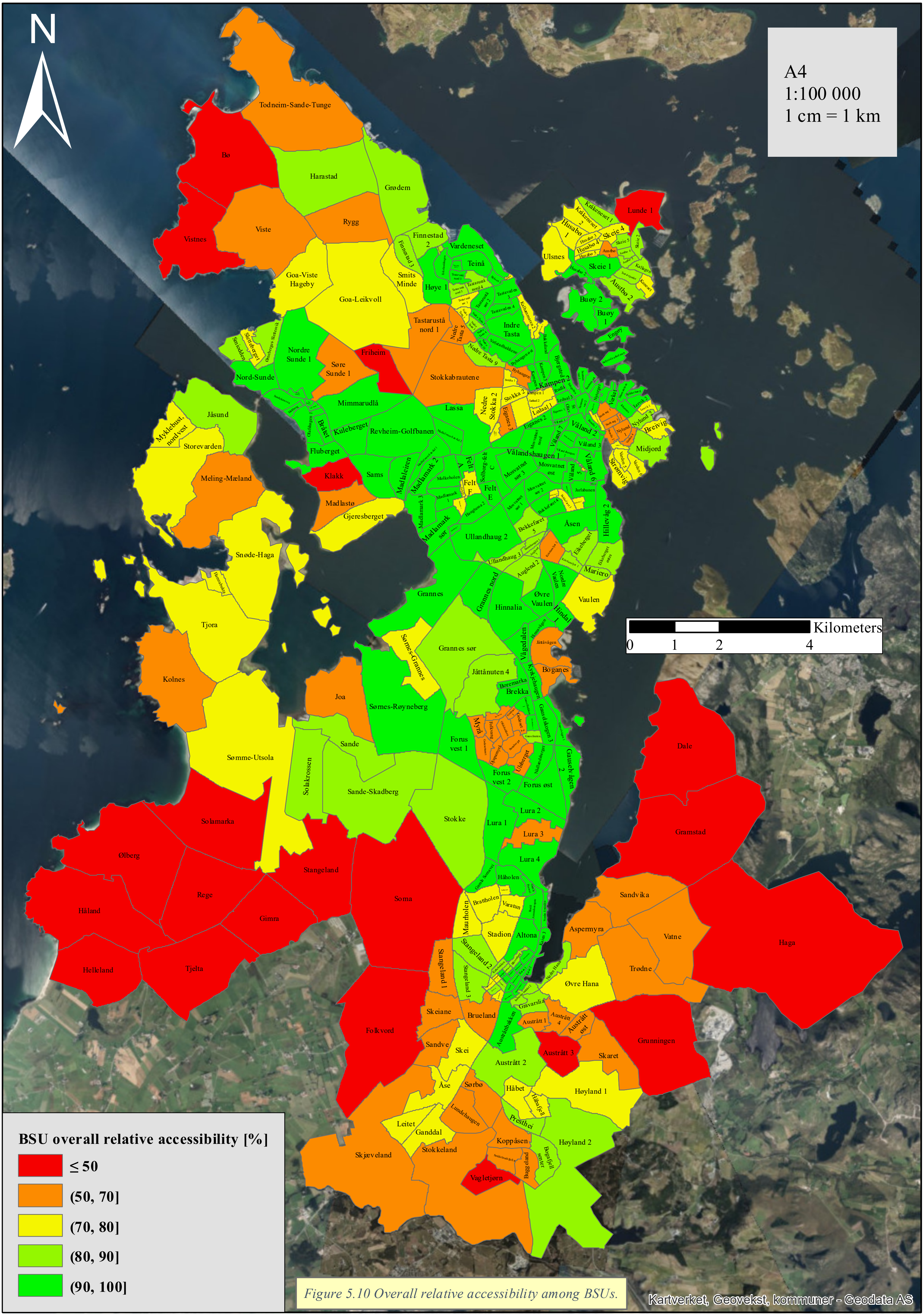

Figure 5.10 Overall relative accessibility among BSUs.

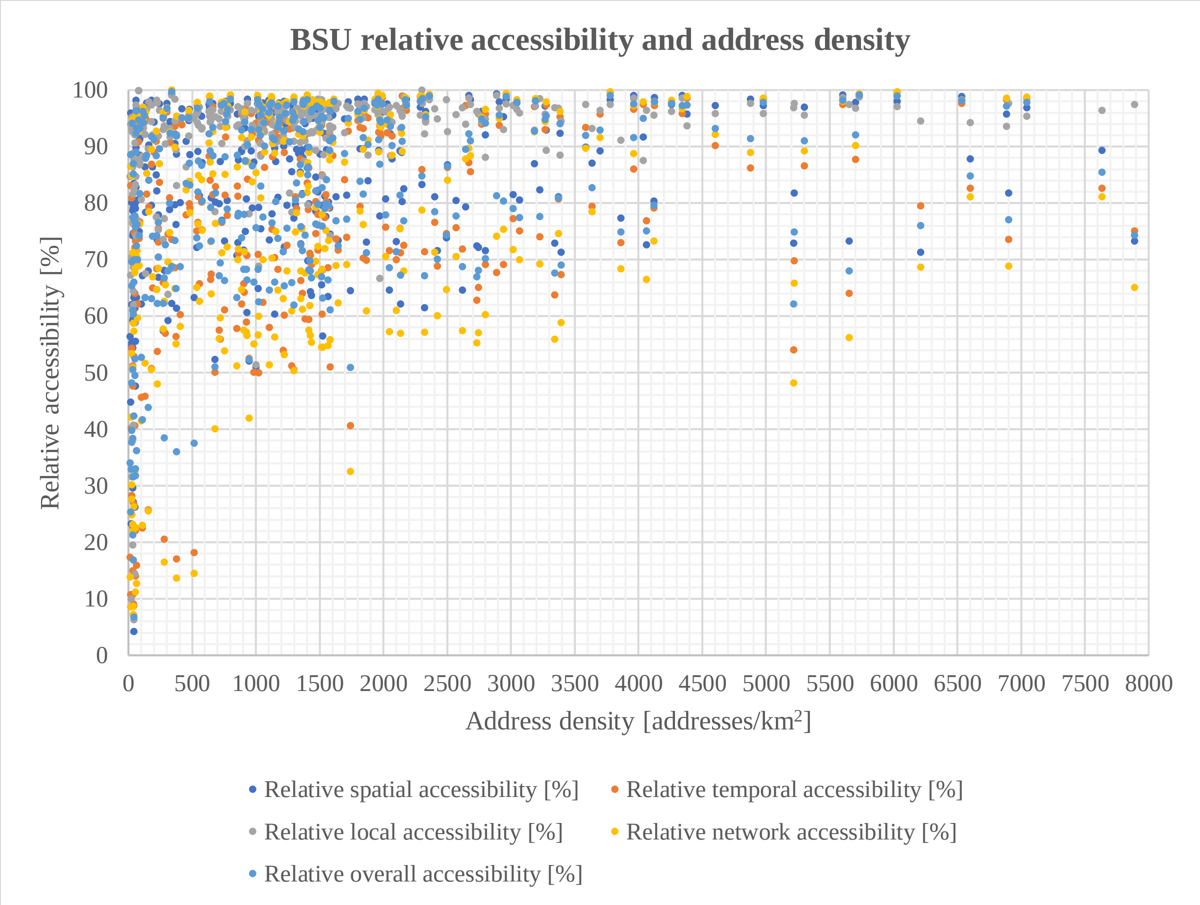

Chart 5.7 BSU relative spatial, temporal, local, network and overall accessibility plotted against address density. Correlations against address density respectively 0.25, 0.30, 0,30, 0.26, and 0.30.

5.7.2. Statistical tracts

The Stavanger and Sandnes city centres and the line between clearly have better accessibility than the other areas, as was also illustrated at BSU level. In addition, north and west of Stavanger city centre have comparatively better accessibility.

Costal and rural areas away from the two main city centres in Nord-Jæren are less accessible by bus transport. Sola municipality again has the areas with the poorest accessibility, particularly in Håland and Dysjaland, which are the least accessible STs in this thesis. Randaberg and the largest and less dense STs in Sandnes are also among the least accessible areas in urban Nord-Jæren.

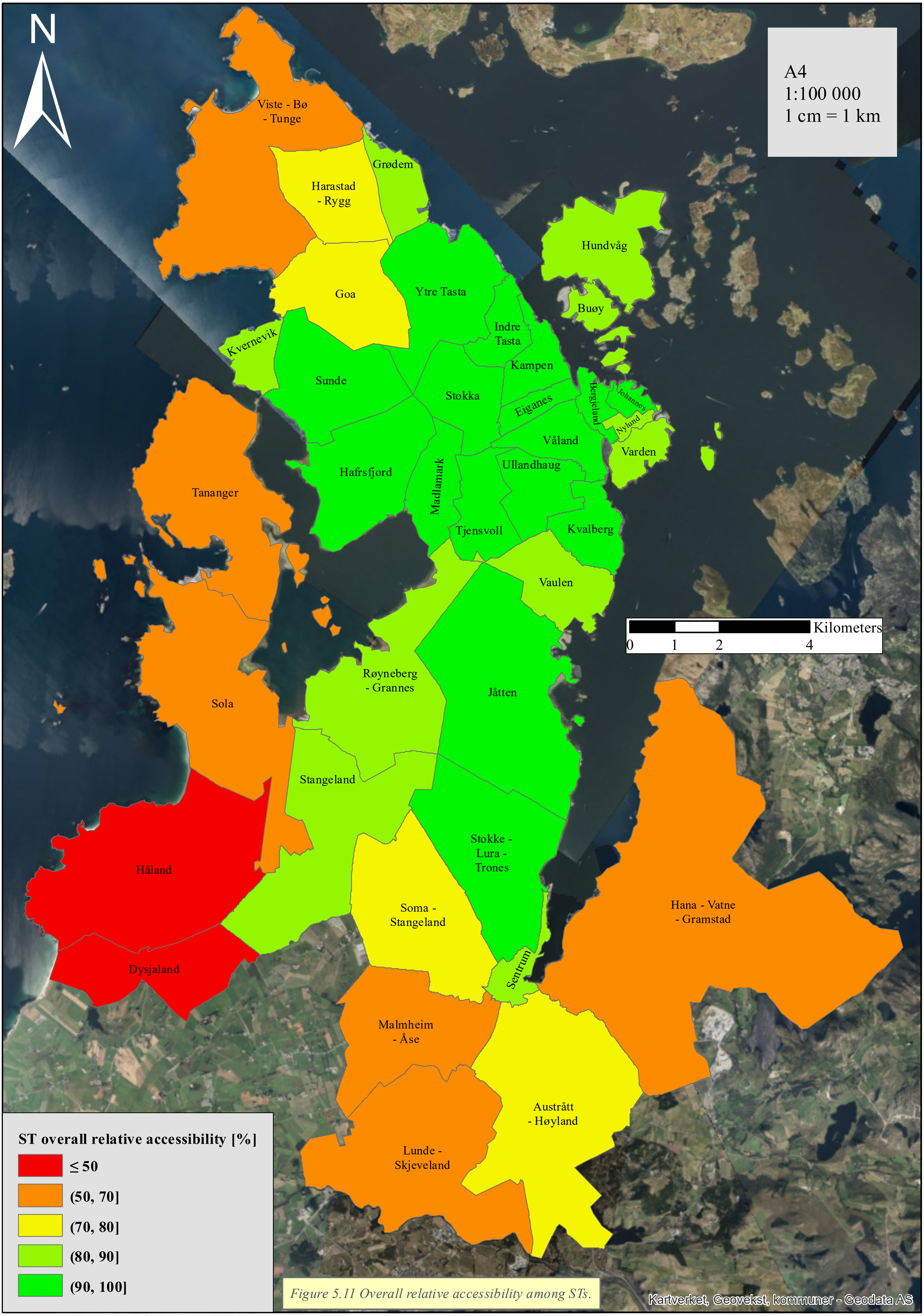

Figure 5.11 Overall relative accessibility among STs.

There is medium correlation between overall accessibility and address density in STs. As shown in Chart 5.8, all STs achieving 60 % or less in any accessibility category have address density below 450 addresses/km^2. Local accessibility is a bit low in Vaulen and Kvalberg, considering the address densities found here. Varden and Nylund stick out with their temporal and network accessibility, mainly because the service span and frequency are lower here.

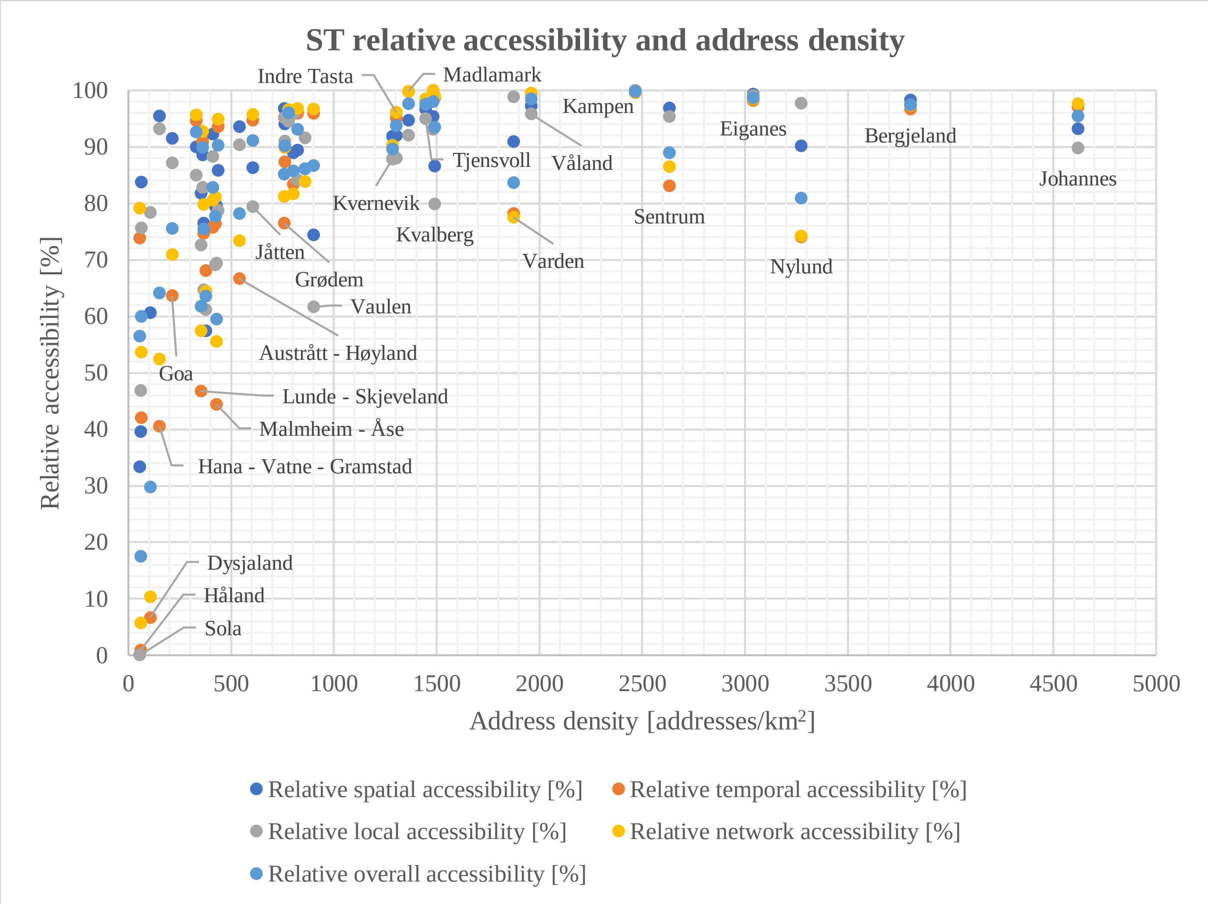

Chart 5.8 ST relative spatial, temporal, local, network and overall accessibility plotted against address density. Correlations = 0.46, 0.47, 0.47, 0.45, and 0.52.

5.7.3. Municipalities

An estimation for accessibility in the four municipalities included in this thesis is found by considering the average accessibility of the BSUs and STs in the respective municipalities. Average is used instead of median because Randaberg and Sola contain very few BSUs and STs compared to Stavanger.

Chart 5.9 shows that when considering BSUs in the research area municipalities, Stavanger has the best total accessibility. Stavanger is the densest area in this thesis with over 1000 addresses/km^2 and has the best accessibility in the four subcategories. Sandnes, the second densest area with around 400 addresses/km^{2,} is the second most accessible in all subcategories and overall. Sola and Randaberg, which both have address density of around 210 addresses/km^{2,} have similar accessibility when assessing the BSUs they consist of.

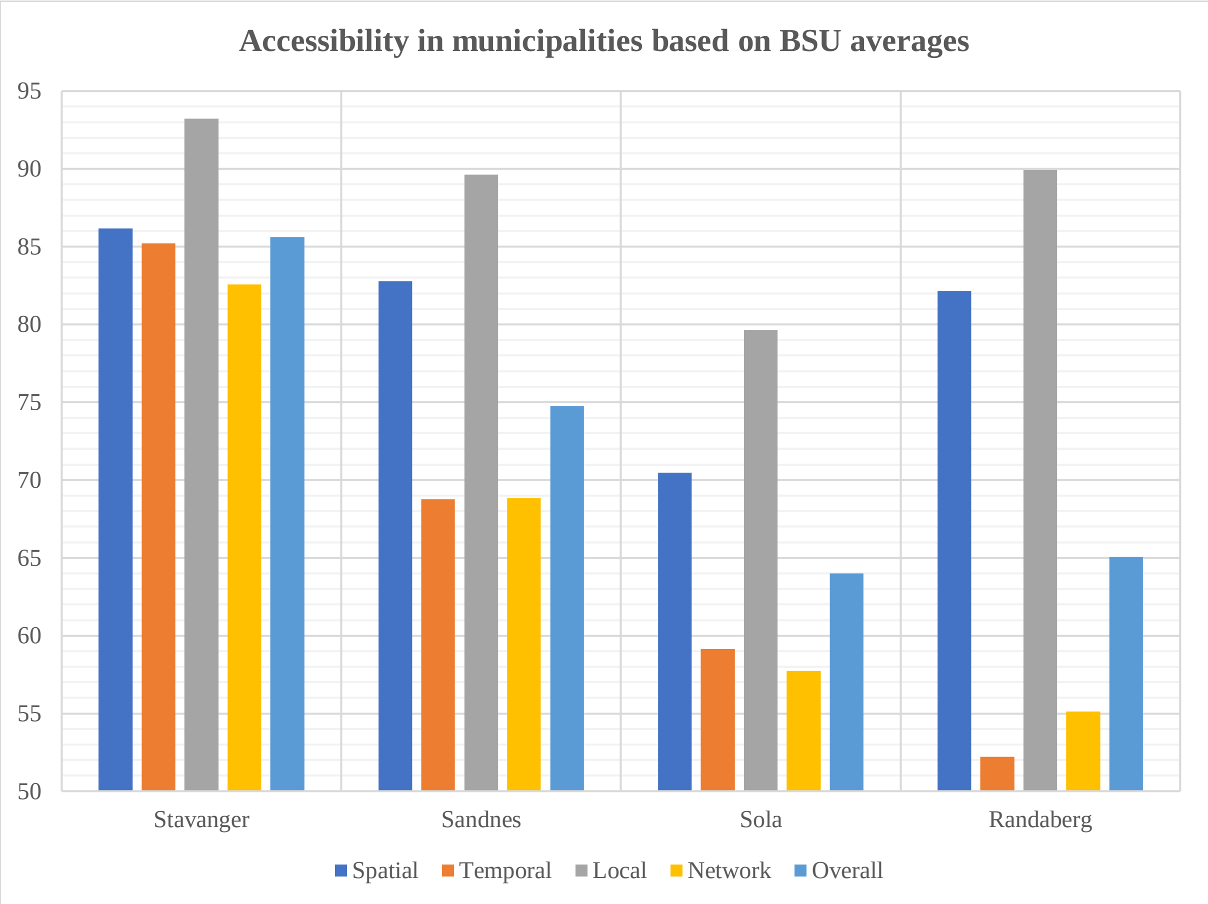

Chart 5.9 Each municipality's estimated relative spatial, temporal, local, network, and overall accessibility based on their BSUs. Note that the y-axis is shortened to improve readability.

Scaling up to STs contained in municipalities gives some alterations. Sandnes and Randaberg are almost equally accessible, while Sola is the least accessible area. This is in line with what is illustrated in Figure 5.10 and Figure 5.11.

There are smallest differences in the spatial and local aspects, mainly because bus stops are similarly accessible across the research area. Temporal and network accessibility differ more because travel times, frequency, service span, and bus route options vary more from area to area.

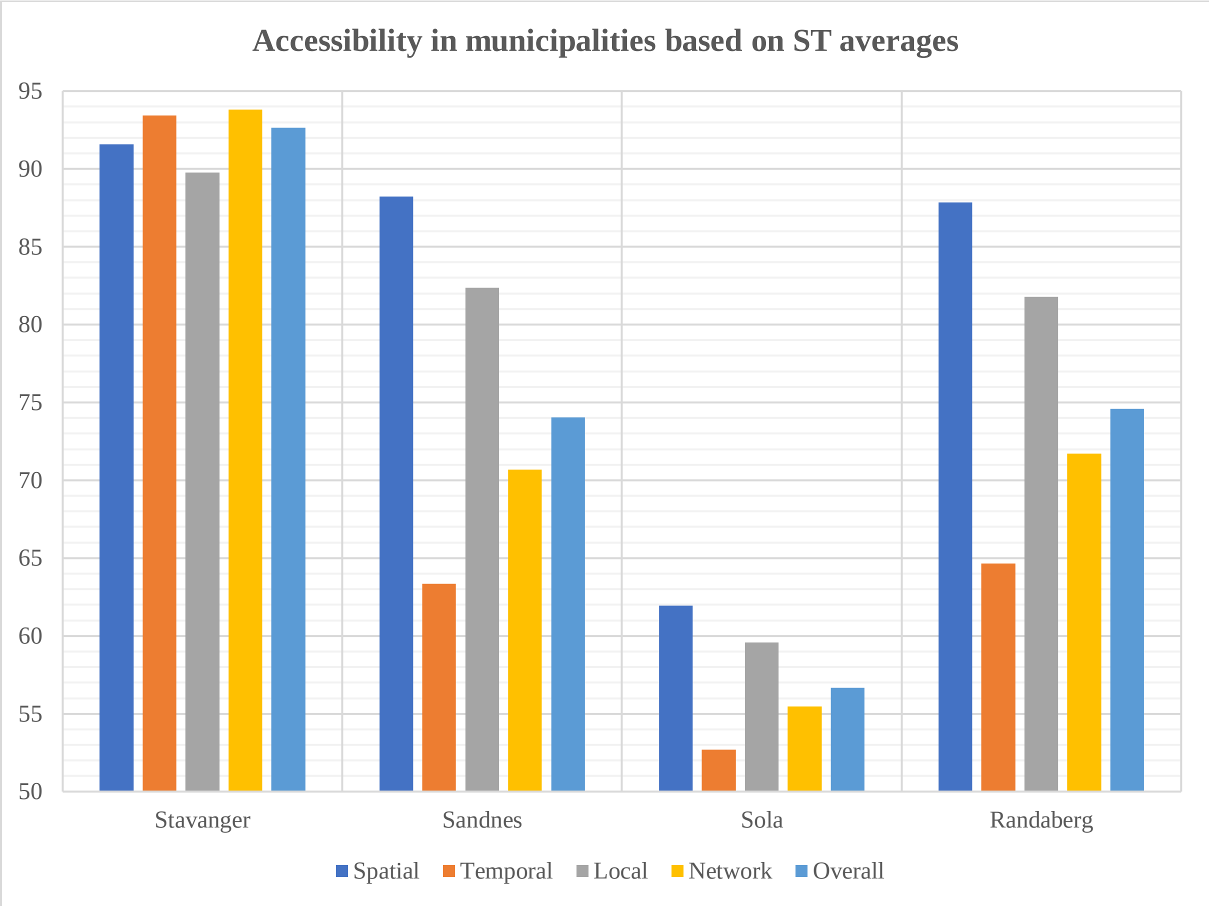

Chart 5.10 Estimated relative spatial, temporal, local, network, and total accessibility in the research area municipalities based on ST scores. Note that the y-axis is shortened to improve readability.

6. Discussion

This chapter aims to answer the research question, “How accessible is bus transport in urban Nord-Jæren?” and confirm or reject the hypothesis of whether denser areas are more accessible by bus transport. In addition, it discusses whether neighbourhoods and regions in urban Nord-Jæren seem to be developed around bus transport or if bus transport is developed around neighbourhoods. Implications of the findings are also discussed.

Six factors of bus transport accessibility in urban Nord-Jæren were assessed: access distance, service coverage, travel time, bus route options, frequency, and service span. These were combined into one composite measure describing the overall accessibility throughout the research area. In addition, estimations of spatial, temporal, local, and network accessibility in each BSU/ST were conducted.

6.1. Overall accessibility

This thesis suggests that bus transport is most accessible in and between Stavanger and Sandnes city centres, where the first part of the Bus Road will come, and some areas west and north of Stavanger city centre. Less accessible areas exist south and east of Sandnes city centre. Randaberg and Sola municipalities, particularly STs Håland and Dysjaland, are the least accessible areas. The findings are in line with the latest Travel Habit Survey (Reisevaneundersøkelsen, RVU) findings, which found that Stavanger residents perceive accessibility to public transport better than residents in “Stavanger surrounding country”, which consists of amongst other Sandnes, Sola, and Randaberg (Opinion, 2021, p. 59). Although RVU includes train transport and the analysis area differs slightly, this indicates a coherence between perceived accessibility and the accessibility factors measured in this thesis. This is also in line with the literature discussed in 3.1. Improving the accessibility factors examined in this thesis may therefore lead to improved perceived public transport accessibility in RVU. The share of people perceiving public transport accessibility as “very good” and the share of daily trips by public transport in seven researched areas was estimated in the latest RVU (Opinion, 2021, pp. 59, 62). The correlation between these values is 0.82, meaning that more accessible public transport will likely lead to more people using it.

Generally, areas with higher address densities have better accessibility, but not all low-density areas have poor accessibility. However, the least accessible areas have low address densities under 500 addresses/km^2. Correlations between address densities and accessibility are higher for STs than for BSUs because the former is more general and less influenced by extreme values. Dense areas being more accessible for public transport is in line with RVU, which shows that Oslo, Stavanger, Trondheim, and Bergen have better perceived accessibility than their lower density surrounding countries (Opinion, 2021, p. 59). Better accessibility in denser areas is also beneficial for the bus operator, as more people can be served in smaller areas, increasing efficiency, and reducing costs. Continued densification and urbanization of people and workplaces may therefore prompt further improvement of bus transport accessibility in Nord-Jæren.

Bus transport in the research area seems mostly based on needs, i.e., bus transport is developed due to existing neighbourhoods, and not the other way around. Because buses in Nord-Jæren have been using regular road networks, planning around it may have been challenging. As discussed in 3.4, rail-based transport provides the most permanent and predictable basis for development. However, considering how comprehensive the Bus Road will be, as described in 3.4.1, it marks a predictable basis for development and a shift towards inducing more use of bus transport.

Especially the axis between Sandnes and Stavanger is a priority area in the regional plan. When the first part of the Bus Road opens here, accessibility will increase due to higher frequency and shorter travel times. Construction of residential blocks aiming to exploit the coming BRT system has already started. However, considering the Bus Road between Stavanger and Sandnes is built parallel to existing rail lines, and in the already most accessible areas for bus transport, the need for it can be discussed. Whether it can force a modal shift from car, train, or cycle to bus remains to be seen. In addition, several high-density areas north and south of the Bus Road, e.g., Tasta, will not be connected to it.

6.2. Access distance and service coverage

The findings suggest that the access distances are very good in urban Nord-Jæren. Almost the entire research area fulfils the recommendations in the regional plan for access distances to bus stops. Improving access distances is assumed to have little effect on the overall perceived bus transport accessibility because only a few percent of addresses in urban Nord-Jæren have poor access distances.

Chart 5.1 shows that BSUs with at least 1000 addresses/km^2 have less than 500 m median access distance while BSUs with densities of more than 4000 addresses/km^2 have median access distance below 200 m. These may therefore be suitable for respectively dwellings and workplaces if a goal is to follow the recommendations in the regional plan.

Access distances and service coverage have been coherently developed with addresses, as only 64.5 % of the research area is covered by service, but 96.2 % of addresses are. The creation of the Bus Road will cause more addresses to be located near bus stops due to the development of areas nearby. Existing access distances will remain unchanged, but the acceptable walking distance for bus transport may increase for BRT systems, as described in Table 3.1.

Although a goal is to develop areas within service coverage and with short access distances, one issue is that these places may not be the most attractive, at least not for residential development, for example due to noise or barrier issues. In some BSUs with coastline, e.g., Vaulen, Ølberg, and Snøde-Haga, relatively much ground is covered by bus service, but many addresses are outside of this near the sea. Therefore, policymakers and contractors may want to assess whether potential development areas are attractive in other ways than just proximity to bus service. In addition, they should consider the type of development to prioritize, as, for example, office buildings would likely be less sensitive to noise than dwellings.

Limitations concerning the access distance and service coverage measurements are that air distance was used instead of actual walking distance. The results are, therefore, a bit better than in reality. This can be addressed in a more detailed survey in the future.

6.3. Travel times

Assessment of travel times using bus transport in urban Nord-Jæren suggest that statistical tracts around Stavanger city centre are the least time-consuming to reach from other statistical tracts in the research area. Further away from here correspond with increasing travel times and distances. Generally, the densest statistical tracts have the shortest travel times, except for Sandnes city centre. This survey was influenced by the spatial location of areas within the research area so that places along the research area boundaries were not favoured. However, the research area aimed only to include the most urban areas of Nord-Jæren. From a purely spatial location point of view, the results suggest that development should be targeted toward the densest areas near Stavanger if the goal is to reduce travel times and distances. However, the coming BRT system will improve travel times between Stavanger and Sandnes and later to western parts of urban Nord-Jæren. Therefore, and due to the expected population growth in the respective Nord-Jæren municipalities, these are more likely development areas for transformation and densification, as stated in the regional plan.

6.4. Bus route options

The number of bus routes to choose from when travelling in the research area varies greatly and explains much of the difference in accessibility. The most accessible areas in this category have five or more bus routes, while the least accessible only has one. There is no correlation between number of bus routes and address density.

The line between Stavanger and Sandnes has the most bus route options, except from an area in Jåttå statistical tract, which only has one bus route in their neighbourhood. This area used to have more routes, but routes 1 and 6 were discontinued here in 2016 and 2013 due to cost-prioritization (Aarre, 2013; Askildsen, 2016). Nearby BSUs a bit further away have several options, but since this area has a relatively high density and 2408 addresses, more buses can be viable here. With the routes previously operating here, it would have been among the most accessible areas in urban Nord-Jæren, but due to it only having one route, frequency and especially bus options are relatively poor. Bus Road travels to and from this area will likely require transfers, and residents living here will not be able to exploit the benefits of the new BRT system fully. To induce more use of bus transport here, routes previously operating here could be brought back.

6.5. Frequency

Frequency is perhaps the most varying factor in the research area. Again, the line between Stavanger and Sandnes, where the Bus Road is coming, is most accessible, while rural areas receive a bare minimum. This highlights the costs of operating frequent service, as the areas with the most potential passengers have the best frequency. In addition, rural areas, where routes are longer and require more fuel, are the least accessible. Notable is that even though overall frequency is low in many places, headways in peak periods mostly align well with when most travels happen.

Because frequencies can be altered quickly, development around frequent bus lines can be risky. The Bus Road marks a priority development area and a permanent infrastructure planned with higher frequency than today. However, if the client base for the coming BRT system is too low, the need for higher frequency here may be discussed. This highlights the implications of politically choosing to operate highly accessible public transport and finding the ideal balance between costs and income.

6.6. Service span

The last factor to be measured was service span. Bus service is accessible the entire the day in the densest areas. Night-time service is likely costly compared to the number of passengers utilizing it. The large service spans found in the research area highlight that bus service is a political choice rather than a business model in urban Nord-Jæren. It can also be questioned how much emissions are saved by operation of night-time bus service if the buses are near empty.

7. Conclusion

The research question of this thesis was “How accessible is bus transport in urban Nord-Jæren?”. The results indicate that bus transport is generally most accessible in and between Stavanger and Sandnes city centres, where the first part of the Rus Road will open. In addition, some areas west and north of Stavanger city centre are also among the most accessible by bus transport. Less accessible areas exist south and east of Sandnes city centre, while Randaberg and Sola municipalities have the least accessible areas.

A hypothesis was that the areas with the highest address densities have the best public transport service. The hypothesis is partially confirmed as the correlation between better accessibility and higher address density is only 0.30 for basic statistical units and 0.52 for statistical tracts. The reason for the large difference and why the correlations are not higher is because several outliers exist, especially for BSUs due to their small sizes. Generally, the least accessible areas have among the lowest address densities, notably less than 500 addresses/km^2. However, many low-density areas are also among the most accessible.

Until the Bus Road project started, it seemed like bus service was provided to existing neighbourhoods, not the opposite. How accessible the service is, seems based on need and operating costs compared to ridership. Many of the most accessible areas are where most people can be served effectively. The least accessible areas, typically rural, with small client bases and requiring long routes, only have a minimum of bus service. Bus travellers here are likely not choice riders but take the bus out of necessity.

This thesis' main contribution to the field of study is estimations of bus accessibility in urban Nord-Jæren. Findings provided in this thesis may help policymakers and Kolumbus determine which areas in urban Nord-Jæren are under- or overserviced by bus transport. By assessing address density concerning bus accessibility, one can also assess whether the distribution of bus service here is just, and in line with potential client bases.

Bus accessibility throughout urban Nord-Jæren was found by measuring six different factors identified to influence bus transport accessibility. These are access distance, service coverage, travel time, bus route options, frequency, and service span. Each factor affects spatial or temporal and local or network accessibility. This thesis contains measures of how well each

BSU and ST perform in the abovementioned factors and categories. This data can explain the lack of accessibility in the various areas and how to improve it.

As opposed to existing surveys on bus transport accessibility, which use user feedback, this thesis offers accessibility estimations from a system point of view. Results found here may supplement existing survey results and be a basis for comparing perceived and estimated accessibility.

Limitations of this thesis are that some of the measurement methods estimated higher accessibility than what is the reality. Furthermore, some accessibility factors, e.g., costs, safety, and reliability, were not considered due to the extent of this thesis or software limitations.

Further research may address the limitations described above. Research in the future on bus accessibility in Nord-Jæren can also examine the Bus Road's effects once completed and assess changes in accessibility from what is estimated in this thesis. In addition, studies can assess how the public transport accessibility changes if train service is included. Lastly, area-based questionnaires in the research area would also be very interesting, although a large sample size would be needed. By conducting these, one could compare perceived and estimated accessibility in Nord-Jæren BSUs or STs.

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Figure references

Figures are referenced in figure texts.

Maps are created using (Esri, n.d.; Geonorge, n.d.).

Appendices

Appendices 1-3 show information and all findings for each BSU, ST, and municipality in the research area.

Appendices 4-5 show how well each BSU and ST score on the various accessibility factors, categories, and overall.

Appendices 6-13 are maps omitted from the findings chapter. They illustrate various accessibility factors throughout the research area in other scales than those in the text.

Appendix 14 contains charts illustrating various accessibility factors and coherences.

Appendices 15-22 are OD matrixes showing travel distances and travel times between BSUs/STs, including and excluding access distances and access times.

Appendix 1 - Basic statistical units

BSU no.	BSU	ST no.	ST	Municipal no.	Municipality	Total area [km²] (ArcMap)	Land area [km²] (SSB)	Freshwater area [km²] (SBB)	Addresses	Address density [addresses/km²]	Population	Population density [inhabitants/km²]	Bus network length [km]	Route density [km/km²]	Access distance (avg.) [m]	Access time (avg.) [min]	Access distance std. deviation [m]	Access distance (median) [m]	Access time (median) [min]	Service coverage [km²]	Area service coverage [%]	Addresses outside service coverage	Address service coverage [%]	% addresses served minus % area served (% points)	Median in-vehicle travel distance [km]	Median in-vehicle travel time [min]	Median in-vehicle travel speed [km/h]	Median travel distance [km]	Median travel time [min]	Median travel speed [km/h]	BSUs within 10 min	BSUs within 20 min	BSUs within 30 min	Bus route options	Total buses per week (both directions)	Avg. buses per hour (each direction)	Minimum headway [min]	Service span [h]	Relative spatial accessibility [%]	Relative temporal accessibility [%]	Relative local accessibility [%]	Relative network accessibility [%]	Relative overall accessibility [%]
11030101	Buøy 2	11030100	Buøy	1103	Stavanger	0,61	0,72	0	261	362,5	564	783,3	1,71	2,37	81	1,0	60	68	0,9	0,54	87,7 %	1	99,6 %	11,9 %	11,7	28,6	24,6	11,9	31,6	22,7	18	61	150	4	2030	6,0	7,5	24	90,6	93,6	98,4	89,9	92,3
11030102	Buøy 1	11030100	Buøy	1103	Stavanger	0,20	0,22	0	268	1218,2	653	2968,2	1,65	7,49	92	1,1	40	91	1,1	0,20	100,0 %	0	100,0 %	0,0 %	10,8	25,7	25,2	11,1	29,5	22,6	13	78	169	4	2030	6,0	7,5	24	90,1	94,9	97,6	90,9	92,8
11030104	Engøy	11030100	Buøy	1103	Stavanger	0,16	0,19	0	183	963,2	421	2215,8	0,78	4,13	133	1,7	63	122	1,5	0,16	100,0 %	0	100,0 %	0,0 %	10,2	24,2	25,3	10,5	27,9	22,6	15	89	182	4	2030	6,0	7,5	24	89,3	95,9	96,4	91,7	93,1
11030105	Sølyst-Grasholmen	11030100	Buøy	1103	Stavanger	0,20	0,18	0	338	1877,8	443	2461,1	0,59	3,28	311	3,9	60	318	4,0	0,19	98,8 %	0	100,0 %	1,2 %	9,7	23,0	25,4	10,2	29,1	21,0	7	77	168	4	2030	6,0	7,5	24	84,0	95,2	88,5	91,1	90,4
11030201	Verket	11030200	Johannes	1103	Stavanger	0,10	0,09	0	448	4977,8	685	7611,1	0,66	7,37	133	1,7	47	135	1,7	0,10	100,0 %	0	100,0 %	0,0 %	8,1	19,7	24,5	8,4	24,0	21,0	19	130	209	6	3015	9,0	7,5	24	97,3	98,3	95,9	98,6	97,9
11030202	Strømsteinen	11030200	Johannes	1103	Stavanger	0,11	0,13	0	895	6884,6	1478	11369,2	0,86	6,63	225	2,8	89	191	2,4	0,11	100,0 %	0	100,0 %	0,0 %	8,0	19,4	24,7	8,3	24,0	20,9	15	115	200	5	3146	9,4	7,5	24	95,8	98,3	93,6	98,6	97,2
11030203	Spilderhaug	11030200	Johannes	1103	Stavanger	0,06	0,06	0	191	3183,3	345	5750,0	0,04	0,67	189	2,4	65	207	2,6	0,06	100,0 %	0	100,0 %	0,0 %	8,5	20,4	25,0	8,9	26,0	20,7	16	114	197	4	2030	6,0	7,5	24	87,0	97,1	93,0	92,7	92,8
11030205	Johannes	11030200	Johannes	1103	Stavanger	0,12	0,12	0	511	4258,3	935	7791,7	0,64	5,34	123	1,5	42	126	1,6	0,12	100,0 %	0	100,0 %	0,0 %	8,4	20,2	25,0	8,8	24,9	21,3	19	129	205	6	2826	8,4	7,5	24	97,5	97,8	96,2	98,2	97,6
11030206	Lervik 1	11030200	Johannes	1103	Stavanger	0,08	0,08	0	497	6212,5	645	8062,5	0,52	6,46	155	1,9	67	168	2,1	0,08	100,0 %	0	100,0 %	0,0 %	8,6	21,4	24,2	9,0	25,5	21,2	9	108	203	2	1311	3,9	15,0	19	71,4	79,6	94,6	68,7	76,1
11030207	Lervik 2	11030200	Johannes	1103	Stavanger	0,10	0,10	0	137	1370,0	221	2210,0	1,10	10,95	92	1,2	29	95	1,2	0,10	100,0 %	0	100,0 %	0,0 %	8,5	20,4	25,0	8,8	24,6	21,6	20	131	207	5	3146	9,4	7,5	24	98,3	97,9	97,5	98,4	98,1
11030302	Nylund 1	11030300	Nylund	1103	Stavanger	0,13	0,13	0	355	2730,8	823	6330,8	0,39	2,99	123	1,5	46	126	1,6	0,13	100,0 %	0	100,0 %	0,0 %	8,3	23,0	21,7	8,6	26,8	19,2	7	90	194	2	310	0,9	20,0	18	72,5	62,9	96,2	55,3	67,0
11030303	Nylund 2	11030300	Nylund	1103	Stavanger	0,17	0,18	0	607	3372,2	1100	6111,1	1,48	8,20	132	1,6	86	112	1,4	0,17	100,0 %	0	100,0 %	0,0 %	8,6	20,8	24,9	8,9	24,7	21,7	21	124	207	3	1365	4,1	15,0	19	81,2	80,7	96,8	74,6	80,9
11030304	Storhaug 3	11030300	Nylund	1103	Stavanger	0,07	0,07	0	234	3342,9	505	7214,3	0,60	8,56	105	1,3	42	110	1,4	0,07	100,0 %	0	100,0 %	0,0 %	8,4	22,1	22,6	8,6	26,5	19,5	7	89	196	2	364	1,1	20,0	18	72,9	63,7	96,9	56,0	67,7
11030305	Storhaug 4	11030300	Nylund	1103	Stavanger	0,02	0,02	0	113	5650,0	240	12000,0	0,22	11,16	95	1,2	27	96	1,2	0,02	100,0 %	0	100,0 %	0,0 %	8,1	22,2	21,9	8,3	26,0	19,2	9	95	197	2	364	1,1	20,0	18	73,3	64,0	97,4	56,2	68,0
11030401	Breivig	11030400	Varden	1103	Stavanger	0,21	0,24	0	989	4120,8	2125	8854,2	0,67	2,80	157	2,0	99	142	1,8	0,21	100,0 %	0	100,0 %	0,0 %	9,2	22,5	24,5	9,6	27,3	21,0	11	98	188	3	1365	4,1	15,0	19	80,4	79,1	95,6	73,3	79,7
11030402	Midjord	11030400	Varden	1103	Stavanger	0,63	0,65	0	910	1400,0	1611	2478,5	2,64	4,07	108	1,3	51	102	1,3	0,47	74,0 %	0	100,0 %	26,0 %	8,7	23,1	22,5	9,1	26,4	20,6	21	119	196	4	1675	5,0	15,0	19	89,8	83,6	97,2	81,9	86,3
11030405	Strømvig	11030400	Varden	1103	Stavanger	0,22	0,23	0	378	1643,5	740	3217,4	1,36	5,91	98	1,2	45	91	1,1	0,22	100,0 %	0	100,0 %	0,0 %	8,0	18,6	25,8	8,3	22,2	22,4	25	138	222	2	709	2,1	20,0	19	73,4	71,8	97,7	62,4	72,5
11030406	Varden 3	11030400	Varden	1103	Stavanger	0,05	0,05	0	108	2160,0	254	5080,0	0,69	13,77	60	0,7	24	61	0,8	0,05	100,0 %	0	100,0 %	0,0 %	7,9	19,7	24,1	8,3	22,9	21,6	32	130	215	3	811	2,4	20,0	19	82,6	72,6	98,9	68,1	76,9
11030407	Varden 4	11030400	Varden	1103	Stavanger	0,07	0,07	0	192	2742,9	470	6714,3	0,20	2,84	131	1,6	33	137	1,7	0,07	100,0 %	0	100,0 %	0,0 %	8,5	20,5	25,0	8,8	24,3	21,8	17	117	208	2	364	1,1	20,0	18	72,2	65,1	95,8	57,1	68,1
11030408	Varden 5	11030400	Varden	1103	Stavanger	0,12	0,12	0	178	1483,3	395	3291,7	0,95	7,92	94	1,2	52	81	1,0	0,12	100,0 %	0	100,0 %	0,0 %	8,3	21,0	23,7	8,6	24,4	21,0	17	120	208	3	818	2,4	20,0	19	82,0	71,7	98,0	67,4	76,1
11030409	Varden 6	11030400	Varden	1103	Stavanger	0,16	0,17	0	110	647,1	266	1564,7	0,15	0,87	142	1,8	64	119	1,5	0,16	100,0 %	0	100,0 %	0,0 %	8,2	21,0	23,5	8,5	24,5	20,9	19	119	209	3	566	1,7	20,0	18	81,0	67,5	96,5	64,0	73,3
11030501	Sentrum øst	11030500	Bergjeland	1103	Stavanger	0,09	0,09	0	394	4377,8	253	2811,1	0,39	4,30	183	2,3	75	189	2,4	0,09	100,0 %	0	100,0 %	0,0 %	7,5	18,7	24,0	7,9	23,5	20,2	16	127	208	8	4260	12,7	7,5	24	95,8	98,6	93,7	98,9	97,4
11030502	Nytorget	11030500	Bergjeland	1103	Stavanger	0,09	0,09	0	371	4122,2	408	4533,3	1,82	20,23	79	1,0	40	81	1,0	0,09	100,0 %	0	100,0 %	0,0 %	8,2	22,1	22,2	8,4	25,6	19,6	15	121	203	8	4260	12,7	7,5	24	98,7	97,3	98,0	97,8	97,9
11030503	Blåsenborg	11030500	Bergjeland	1103	Stavanger	0,07	0,07	0	493	7042,9	627	8957,1	0,60	8,58	145	1,8	57	147	1,8	0,07	100,0 %	0	100,0 %	0,0 %	7,9	19,2	24,5	8,2	23,7	20,8	19	134	209	6	3135	9,3	7,5	24	96,9	98,5	95,4	98,8	97,8
11030504	Storhaug 1	11030500	Bergjeland	1103	Stavanger	0,13	0,13	0	678	5215,4	1249	9607,7	1,18	9,07	112	1,4	54	110	1,4	0,13	100,0 %	0	100,0 %	0,0 %	8,4	22,6	22,2	8,7	27,0	19,2	6	80	191	2	119	0,4	15,0	10	72,9	54,1	96,9	48,3	62,1
11030506	Birkelandsgt-Vikedalsgt	11030500	Bergjeland	1103	Stavanger	0,05	0,05	0	261	5220,0	422	8440,0	0,91	18,10	85	1,1	35	90	1,1	0,05	100,0 %	0	100,0 %	0,0 %	8,3	23,3	21,3	8,7	26,5	19,6	10	89	190	3	572	1,7	15,0	19	81,8	69,8	97,7	65,8	74,9
11030507	Bergjeland	11030500	Bergjeland	1103	Stavanger	0,07	0,07	0	392	5600,0	559	7985,7	1,24	17,77	84	1,0	54	64	0,8	0,07	100,0 %	0	100,0 %	0,0 %	8,2	21,8	22,5	8,4	25,3	20,0	14	120	207	16	8141	24,2	7,5	24	99,2	97,5	98,7	98,0	98,2
11030509	Sentrum vest 1	11030500	Bergjeland	1103	Stavanger	0,09	0,08	0	323	4037,5	168	2100,0	0,00	0,00	326	4,1	77	341	4,3	0,09	96,5 %	0	100,0 %	3,5 %	7,5	18,7	24,0	8,1	25,4	19,0	9	104	198	28	14522	43,2	7,5	24	91,7	97,4	87,6	97,9	95,0
11030510	Sentrum vest 2	11030500	Bergjeland	1103	Stavanger	0,11	0,08	0,03	27	337,5	4	50,0	2,94	36,77	52	0,7	23	56	0,7	0,11	100,0 %	0	100,0 %	0,0 %	7,2	18,0	24,1	7,5	21,2	21,3	39	151	224	28	14522	43,2	7,5	24	99,4	100,0	99,1	100,0	99,7
11030511	Paradis 1	11030500	Bergjeland	1103	Stavanger	0,08	0,08	0	60	750,0	97	1212,5	0,31	3,93	112	1,4	52	110	1,4	0,08	100,0 %	0	100,0 %	0,0 %	8,0	21,5	22,3	8,4	25,3	19,9	12	105	205	14	6685	19,9	7,5	24	97,9	97,5	96,9	98,0	97,7
11030512	Paradis 2	11030500	Bergjeland	1103	Stavanger	0,08	0,08	0	121	1512,5	292	3650,0	0,56	7,06	74	0,9	33	75	0,9	0,08	100,0 %	0	100,0 %	0,0 %	7,9	20,8	22,7	8,1	24,0	20,3	19	118	210	1	507	1,5	20,0	19	65,5	68,1	98,3	54,5	67,0
11030601	St Olav	11030600	Våland	1103	Stavanger	0,08	0,08	0	482	6025,0	552	6900,0	1,01	12,69	101	1,3	43	104	1,3	0,08	100,0 %	0	100,0 %	0,0 %	7,3	18,1	24,3	7,6	21,7	21,1	33	149	220	19	6404	19,1	7,5	24	98,1	99,7	97,1	99,8	99,0
11030602	Eiganes 1	11030600	Våland	1103	Stavanger	0,11	0,11	0	236	2145,5	384	3490,9	0,30	2,71	138	1,7	45	146	1,8	0,11	100,0 %	0	100,0 %	0,0 %	7,3	18,6	23,6	7,8	22,8	20,6	23	141	216	3	2298	6,8	7,5	24	80,3	99,0	95,4	89,2	91,0
11030603	Eiganes 2	11030600	Våland	1103	Stavanger	0,36	0,29	0,07	293	1010,3	655	2258,6	3,24	11,19	119	1,5	46	122	1,5	0,36	100,0 %	0	100,0 %	0,0 %	7,4	18,8	23,7	7,7	23,1	19,9	21	145	212	10	4729	14,1	7,5	24	97,6	98,8	96,4	99,1	98,3
11030604	Mosvatnet nord	11030600	Våland	1103	Stavanger	0,40	0,25	0,15	280	1120,0	693	2772,0	0,96	3,84	163	2,0	74	156	1,9	0,38	94,7 %	0	100,0 %	5,3 %	7,4	18,8	23,7	7,7	23,5	19,6	18	142	212	9	4338	12,9	7,5	24	96,7	98,6	95,0	98,9	97,8
11030606	Våland 2	11030600	Våland	1103	Stavanger	0,25	0,25	0	590	2360,0	1096	4384,0	2,75	11,01	91	1,1	64	75	0,9	0,25	100,0 %	0	100,0 %	0,0 %	7,7	19,3	23,8	7,9	22,6	21,0	22	139	219	19	8782	26,1	7,5	24	98,9	99,1	98,3	99,3	99,0
11030607	Vålandsskråningen	11030600	Våland	1103	Stavanger	0,11	0,11	0	360	3272,7	820	7454,5	0,00	0,00	297	3,7	61	297	3,7	0,11	100,0 %	0	100,0 %	0,0 %	7,7	19,3	23,8	8,1	25,4	19,2	9	117	202	14	6841	20,4	7,5	24	92,9	97,4	89,4	97,9	95,5
11030608	Våland 3	11030600	Våland	1103	Stavanger	0,17	0,18	0	391	2172,2	775	4305,6	1,26	7,00	109	1,4	60	97	1,2	0,17	100,0 %	0	100,0 %	0,0 %	7,8	20,3	23,1	8,2	23,9	20,6	13	131	208	14	6841	20,4	7,5	24	98,3	98,4	97,4	98,7	98,3
11030611	Våland 1	11030600	Våland	1103	Stavanger	0,04	0,04	0	151	3775,0	225	5625,0	0,39	9,65	91	1,1	28	95	1,2	0,04	100,0 %	0	100,0 %	0,0 %	7,1	17,7	23,9	7,3	21,8	20,2	25	151	213	9	2149	6,4	7,5	24	98,3	99,6	97,5	99,7	99,1
11030612	Våland 7	11030600	Våland	1103	Stavanger	0,14	0,14	0	274	1957,1	523	3735,7	1,85	13,19	159	2,0	106	135	1,7	0,11	80,2 %	1	99,6 %	19,5 %	7,1	17,7	23,9	7,4	22,3	19,9	16	148	212	9	4348	12,9	7,5	24	97,1	99,3	95,7	99,5	98,4
11030613	Våland 4	11030600	Våland	1103	Stavanger	0,02	0,02	0	27	1350,0	75	3750,0	0,09	4,41	127	1,6	58	113	1,4	0,02	100,0 %	0	100,0 %	0,0 %	8,1	21,1	23,0	8,5	24,9	20,5	18	120	212	2	718	2,1	15,0	19	72,8	72,6	96,8	63,1	72,7
11030614	Våland 6	11030600	Våland	1103	Stavanger	0,34	0,34	0	547	1608,8	1188	3494,1	2,35	6,91	108	1,3	48	104	1,3	0,34	100,0 %	0	100,0 %	0,0 %	8,0	20,5	23,4	8,3	24,4	20,5	18	123	212	15	7036	20,9	7,5	24	98,1	98,0	97,1	98,4	98,1
Total						231,03	222,31	9,03	113523	510,7	238336	1072,1	517,84	2,33	191	2,4	162	154	1,9	149,24	64,6 %	4337	96,2 %	31,6 %	11,6	27,5	25,3	12,0	32,2	22,3				53	22656	67,4							
Average						0,71	0,68	0,03	347,2	1552,5	728,9	2973,3	1,58	4,71	199	2,5	92	189	2,4	0,46	89,4 %	13,3	95,0 %	5,6 %	12,0	28,3	25,2	12,3	32,9	22,2	12,2	71,0	147,2	5,5	2156,8	6,4	16,5	20,8	84,1	78,3	91,2	76,6	80,8
Median						0,27	0,26	0	266	1230,6	559	2811,1	1,06	3,64	166	2,1	74	154	1,9	0,24	100,0 %	0	100,0 %	0,0 %	11,1	26,1	25,1	11,4	31,1	22,1	11	70	154	4	1621	4,8	7,5	24	88,7	81,6	95,0	83,1	85,1

The appendix shows information and findings for each BSU in the research area.
References: (Esri, n.d.; SSB, 2021a, 2022)

Appendix 2 - Statistical tracts

ST no.	ST	Municipal no.	Municipality	Total area [km²] (ArcMap)	Land area [km²] (SSB)	Freshwater area [km²] (SBB)	Addresses	Address density [addresses /km²]	Population	Population density [inhabitants /km²]	Bus network length [km]	Route density [km/km²]	Access distance (avg.) [m]	Access time (avg.) [min]	Access distance std. deviation [m]	Access distance (median) [m]	Access time (median) [min]	Service coverage [km²]	Area service coverage [%]	Addresses outside service coverage	Address service coverage [%]
11030100	Buøy	1103	Stavanger	1,17	1,31	0	1050	801,5	2081	1588,5	4,73	3,61	167	2,1	116	124	1,6	1,09	93,4 %	1	99,9 %
11030200	Johannes	1103	Stavanger	0,56	0,58	0	2679	4619,0	4309	7429,3	3,82	6,58	168	2,1	81	162	2,0	0,56	100,0 %	0	100,0 %
11030300	Nylund	1103	Stavanger	0,40	0,40	0	1309	3272,5	2668	6670,0	2,69	6,72	121	1,5	68	114	1,4	0,40	100,0 %	0	100,0 %
11030400	Varden	1103	Stavanger	1,45	1,53	0	2865	1872,5	5861	3830,7	6,66	4,35	124	1,5	75	107	1,3	1,29	88,7 %	0	100,0 %
11030500	Bergjeland	1103	Stavanger	0,86	0,82	0,03	3120	3804,9	4079	4974,4	9,96	12,14	136	1,7	93	115	1,4	0,86	99,6 %	0	100,0 %
11030600	Våland	1103	Stavanger	2,19	1,98	0,22	3879	1959,1	7518	3797,0	14,20	7,17	146	1,8	97	125	1,6	2,12	96,7 %	1	100,0 %
11030700	Ullandhaug	1103	Stavanger	2,55	2,35	0,20	3480	1480,9	7394	3146,4	14,64	6,23	152	1,9	82	142	1,8	2,50	98,1 %	0	100,0 %
11030800	Eiganes	1103	Stavanger	0,95	0,95	0	2887	3038,9	4929	5188,4	4,86	5,11	119	1,5	63	106	1,3	0,95	100,0 %	0	100,0 %
11030900	Kampen	1103	Stavanger	1,75	1,76	0	4340	2465,9	7658	4351,1	12,24	6,96	107	1,3	55	100	1,3	1,75	100,0 %	0	100,0 %
11031200	Hundvåg	1103	Stavanger	4,48	4,59	0	3944	859,3	9906	2158,2	11,78	2,57	168	2,1	95	149	1,9	4,00	89,3 %	11	99,7 %
11031700	Jåtten	1103	Stavanger	12,54	12,65	0	7642	604,1	17112	1352,7	44,33	3,50	223	2,8	139	194	2,4	10,51	83,8 %	328	95,7 %
11031800	Vaulen	1103	Stavanger	3,41	3,38	0,01	3040	899,4	7312	2163,3	9,48	2,80	280	3,5	204	214	2,7	2,62	76,8 %	518	83,0 %
11031900	Kvalberg	1103	Stavanger	2,16	2,16	0,02	3218	1489,8	5927	2744,0	7,13	3,30	220	2,7	129	194	2,4	2,00	92,4 %	128	96,0 %
11032000	Tjensvoll	1103	Stavanger	2,69	2,67	0,03	3862	1446,4	6143	2300,7	12,30	4,61	150	1,9	92	128	1,6	2,44	90,5 %	12	99,7 %
11032100	Stokka	1103	Stavanger	3,16	2,29	0,87	1881	821,4	4342	1896,1	5,03	2,19	196	2,4	152	157	2,0	1,77	56,1 %	107	94,3 %
11032200	Madlamark	1103	Stavanger	2,50	2,37	0,10	3227	1361,6	7508	3167,9	8,52	3,59	172	2,1	115	143	1,8	2,30	91,9 %	22	99,3 %
11032300	Hafrsfjord	1103	Stavanger	5,98	5,55	0,39	1832	330,1	4323	778,9	12,05	2,17	197	2,5	117	181	2,3	4,77	79,8 %	25	98,6 %
11032400	Kvernevik	1103	Stavanger	1,46	1,42	0	1823	1283,8	4744	3340,8	4,93	3,47	184	2,3	92	174	2,2	1,46	100,0 %	0	100,0 %
11032500	Sunde	1103	Stavanger	5,54	4,58	0,97	1995	435,6	4896	1069,0	8,41	1,84	224	2,8	135	200	2,5	3,27	59,0 %	81	95,9 %
11032600	Indre Tasta	1103	Stavanger	1,63	1,62	0	2112	1303,7	5299	3271,0	3,85	2,38	185	2,3	105	168	2,1	1,51	92,5 %	14	99,3 %
11032700	Ytre Tasta	1103	Stavanger	5,93	5,41	0,55	4205	777,3	9601	1774,7	17,63	3,26	159	2,0	95	132	1,7	5,15	86,8 %	6	99,9 %
11080100	Sentrum	1108	Sandnes	1,16	1,15	0	3025	2630,4	3849	3347,0	7,75	6,74	140	1,8	68	128	1,6	1,16	100,0 %	0	100,0 %
11080200	Stokke - Lura - Trones	1108	Sandnes	8,39	8,39	0,01	6380	760,4	14443	1721,5	32,23	3,84	175	2,2	119	147	1,8	6,64	79,2 %	70	98,9 %
11080300	Soma - Stangeland	1108	Sandnes	8,27	8,26	0	3030	366,8	7266	879,7	14,56	1,76	298	3,7	268	216	2,7	2,45	29,6 %	430	85,8 %
11080400	Malmheim - Åse	1108	Sandnes	7,05	7,06	0	3027	428,8	6810	964,6	13,65	1,93	287	3,6	296	207	2,6	2,36	33,6 %	343	88,7 %
11080500	Lunde - Skjeveland	1108	Sandnes	12,10	11,50	0,59	4062	353,2	8829	767,7	19,53	1,70	238	3,0	164	194	2,4	6,59	54,5 %	420	89,7 %
11080600	Austrått - Høyland	1108	Sandnes	13,68	13,43	0,25	7236	538,8	16808	1251,5	41,22	3,07	170	2,1	95	156	1,9	10,12	73,9 %	25	99,7 %
11080700	Hana - Vatne - Gramstad	1108	Sandnes	31,82	27,56	4,20	4171	151,3	8361	303,4	27,89	1,01	178	2,2	258	116	1,5	10,32	32,4 %	153	96,3 %
11240100	Tananger	1124	Sola	10,45	10,46	0	3940	376,7	8036	768,3	12,65	1,21	283	3,5	199	230	2,9	6,01	57,5 %	598	84,8 %
11240200	Sola	1124	Sola	12,30	12,26	0	677	55,2	1141	93,1	18,21	1,48	498	6,2	378	401	5,0	6,69	54,4 %	297	56,1 %
11240300	Håland	1124	Sola	14,08	13,99	0	834	59,6	1734	123,9	18,46	1,32	334	4,2	218	270	3,4	7,39	52,5 %	183	78,1 %
11240400	Dysjaland	1124	Sola	5,24	5,25	0	554	105,5	1261	240,2	5,69	1,08	236	2,9	254	116	1,5	2,13	40,6 %	92	83,4 %
11240500	Stangeland	1124	Sola	9,88	9,88	0	4059	410,8	8157	825,6	18,26	1,85	195	2,4	131	161	2,0	6,78	68,6 %	58	98,6 %
11240600	Røyneberg - Grannes	1124	Sola	8,65	8,62	0	3102	359,9	6735	781,3	17,91	2,08	215	2,7	144	172	2,1	6,26	72,4 %	145	95,3 %
11270100	Goa	1127	Randaberg	5,25	4,66	0,58	989	212,2	2360	506,4	9,00	1,93	198	2,5	118	168	2,1	4,30	82,0 %	13	98,7 %
11270200	Grødem	1127	Randaberg	1,89	1,92	0	1456	758,3	3561	1854,7	7,08	3,68	142	1,8	82	129	1,6	1,82	96,7 %	0	100,0 %
11270300	Harastad - Rygg	1127	Randaberg	4,14	4,13	0,01	1747	423,0	3747	907,3	12,69	3,07	255	3,2	157	213	2,7	3,56	86,0 %	186	89,4 %
11270400	Viste - Bø - Tunge	1127	Randaberg	13,32	13,42	0	844	62,9	1628	121,3	21,82	1,63	235	2,9	158	190	2,4	11,33	85,1 %	70	91,7 %
Total/overall				231,03	222,31	9,03	113523	510,7	238336	1072,1	517,84	2,33	191	2,4	162	154	1,9	149,24	64,6 %	4337	96,2 %
Average				6,08	5,85	0,24	2987,4	1131,1	6272,0	2169,8	13,63	3,53	202	2,5	140	167	2,1	3,93	78,3 %	114	94,6 %
Median				4,31	4,36	0	3028,5	768,8	5894,0	1748,1	12,15	3,07	184	2,3	117	159	2,0	2,48	85,6 %	25	98,8 %

ST no.	% addresses served minus % area served (% points)	Median in-vehicle travel distance [km]	Median in-vehicle travel time [min]	Median in-vehicle travel speed [km/h]	Median travel distance [km]	Median travel time [min]	Median travel speed [km/h]	STs within 10 min	STs within 20 min	STs within 30 min	Bus route options	Total buses per week (both directions)	Avg. buses per hour (each direction)	Minimum headway [min]	Service span [h]	Relative spatial accessibility [%]	Relative temporal accessibility [%]	Relative local accessibility [%]	Relative network accessibility [%]	Relative overall accessibility [%]
11030100	6,5 %	13,3	32,7	24,4	13,6	36,8	22,2	2	5	16	4	2030	6,0	7,5	24	88,9	83,4	95,8	81,7	85,7
11030200	0,0 %	9,1	22,1	24,7	9,5	26,6	21,4	3	15	21	7	3210	9,6	7,5	24	93,2	97,1	89,8	97,7	95,4
11030300	0,0 %	9,5	24,3	23,3	9,8	28,0	20,9	3	13	19	4	1675	5,0	15	19	90,2	74,0	97,8	74,2	80,9
11030400	11,3 %	9,4	23,4	24,1	9,7	26,7	21,8	3	12	21	4	1934	5,8	15	19	90,9	78,2	98,8	77,5	83,6
11030500	0,4 %	8,8	23,3	22,6	9,1	27,0	20,1	2	15	23	28	14547	43,3	7,5	24	98,3	96,7	97,5	97,3	97,4
11030600	3,3 %	8,4	20,4	24,6	8,7	24,3	21,5	3	15	24	28	12679	37,7	7,5	24	97,2	99,4	95,8	99,5	98,5
11030700	1,9 %	8,4	20,2	24,9	8,7	23,7	22,1	2	13	22	14	4717	14,0	7,5	24	95,4	100,0	93,1	100,0	98,0
11030800	0,0 %	8,9	22,1	24,1	9,1	25,5	21,4	2	13	23	10	4183	12,4	7,5	24	99,3	98,1	99,0	98,5	98,6
11030900	0,0 %	8,4	20,7	24,2	8,6	24,1	21,5	2	15	25	9	4171	12,4	7,5	24	100,0	99,6	100,0	99,7	99,8
11031200	10,4 %	13,1	32,0	24,7	13,5	36,1	22,4	2	5	16	4	2213	6,6	7,5	24	86,1	86,1	91,6	83,9	86,1
11031700	11,9 %	10,8	24,5	26,3	11,2	29,0	23,0	1	4	22	23	7739	23,0	7,5	24	86,3	94,7	79,4	95,7	91,1
11031800	6,1 %	9,8	23,2	25,4	10,2	27,8	21,9	2	11	22	16	6779	20,2	7,5	24	74,4	95,9	61,6	96,7	86,7
11031900	3,7 %	9,1	20,7	26,3	9,4	25,0	22,6	2	12	23	16	7136	21,2	7,5	24	86,6	98,6	79,9	98,9	93,5
11032000	9,2 %	9,0	21,7	25,0	9,3	25,6	22,0	4	15	24	14	6789	20,2	7,5	24	96,6	98,1	94,9	98,5	97,5
11032100	38,2 %	9,5	23,6	24,1	9,8	27,8	21,1	2	12	24	9	2817	8,4	7,5	24	89,4	95,9	84,1	96,7	93,1
11032200	7,5 %	8,8	20,2	26,2	9,1	23,9	22,9	2	12	24	12	6098	18,1	7,5	24	94,7	99,8	92,1	99,8	97,6
11032300	18,9 %	10,2	24,7	24,6	10,5	29,1	21,7	1	7	21	7	2975	8,9	7,5	24	90,0	94,6	85,0	95,7	92,6
11032400	0,0 %	13,2	31,5	25,2	13,5	35,9	22,6	2	4	14	5	2554	7,6	7,5	24	91,9	87,9	87,8	90,3	89,6
11032500	36,9 %	10,6	25,5	25,0	11,0	30,2	21,9	1	7	19	5	2574	7,7	7,5	24	85,8	93,6	78,7	94,9	90,2
11032600	6,8 %	9,4	24,1	23,5	9,8	28,6	20,5	3	8	22	7	3433	10,2	7,5	24	92,0	95,1	87,9	96,1	93,8
11032700	13,0 %	9,6	24,5	23,6	9,9	28,0	21,3	2	9	22	6	3325	9,9	7,5	24	96,4	95,7	94,5	96,5	96,0
11080100	0,0 %	15,7	36,4	25,9	16,0	40,8	23,5	1	7	10	20	8854	26,4	7,5	24	96,9	83,0	95,3	86,4	89,0
11080200	19,7 %	13,6	33,2	24,7	14,0	36,5	23,1	1	7	11	20	6094	18,1	7,5	24	94,0	87,3	91,0	89,9	90,2
11080300	56,2 %	15,8	38,0	25,0	16,2	42,1	23,0	1	7	9	8	1734	5,2	7,5	24	76,4	74,7	64,6	79,8	75,5
11080400	55,1 %	17,9	43,0	25,0	18,4	47,1	23,5	1	6	7	8	1180	3,5	30	20	79,6	44,4	69,4	55,5	59,5
11080500	35,2 %	19,4	44,4	26,3	19,9	48,7	24,5	1	7	8	7	1521	4,5	30	20	81,8	46,7	72,6	57,4	61,8
11080600	25,7 %	18,7	45,1	24,8	19,0	49,0	23,3	1	7	8	18	4422	13,2	7,5	20	93,6	66,7	90,4	73,3	78,2
11080700	63,9 %	20,1	44,8	26,9	20,3	48,7	25,0	1	5	8	6	1455	4,3	15	14	95,4	40,6	93,2	52,5	64,1
11240100	27,3 %	16,0	37,6	25,5	16,3	42,1	23,3	1	1	6	3	1468	4,4	15	24	57,5	68,0	61,2	64,4	63,5
11240200	1,8 %	16,8	35,4	28,5	17,4	42,1	24,8	1	2	6	5	1974	5,9	15	24	33,3	73,9	0,0	79,1	56,5
11240300	25,6 %	22,5	42,7	31,7	22,9	48,1	28,6	1	2	5	2	171	0,5	60	12	39,6	0,9	46,8	5,7	17,5
11240400	42,8 %	20,1	38,8	31,1	20,3	42,2	28,9	1	3	5	2	166	0,5	60	12	60,6	6,7	78,4	10,4	29,8
11240500	29,9 %	13,9	29,5	28,2	14,2	33,5	25,4	1	4	14	11	2115	6,3	15	20	92,2	75,7	88,3	80,5	82,8
11240600	22,9 %	11,7	25,5	27,5	11,9	29,2	24,5	1	2	20	18	4046	12,0	15	24	88,5	90,9	82,8	92,7	89,9
11270100	16,7 %	11,8	28,4	24,9	12,1	32,6	22,4	2	8	17	7	1219	3,6	7,5	17	91,4	63,6	87,2	70,9	75,6
11270200	3,3 %	13,2	34,5	22,9	13,4	38,2	21,1	1	3	10	6	1553	4,6	7,5	24	96,8	76,5	95,2	81,2	85,2
11270300	3,3 %	12,6	30,1	25,1	13,0	34,4	22,6	1	5	13	7	1526	4,5	15	24	79,4	76,4	69,1	81,1	77,7
11270400	6,6 %	18,5	40,5	27,4	18,8	44,5	25,4	1	2	6	6	881	2,6	20	17	83,7	42,1	75,6	53,7	59,9
Total/overall	31,6 %	11,6	27,5	25,3	12,0	32,2	22,3				53	22656	67,4							
Average	16,4 %	12,8	29,8	25,5	13,1	33,9	22,9	1,7	7,9	16,1	10,2	3788	11,3	13,4	22,1	85,9	78,4	82,8	81,2	81,6
Median	9,8 %	11,7	27,0	25,0	12,0	31,4	22,5	1,5	7,0	18,0	7,0	2696	8,0	7,5	24	90,5	86,7	88,1	88,2	87,8

Total/overall = total across the whole research area

Average/median = average/median from the listed STs

References: (Esri, n.d.; SSB, 2021a, 2022)

Appendix 3 - Municipalities

Municipal no.	Municipality	Total area [km^2] (ArcMap)	Land area [km^2] (SSB)	Freshwater area [km^2] (SBB)	Addresses	Address density [addresses /km^2]	Population	Population density [inhabitants /km^2]	Bus network length [km]	Route density [km/km^2]	Access distance (avg.) [m]	Access time (avg.) [min]	Access distance std. deviation [m]	Access distance (median) [m]	Access time (median) [min]	Service coverage [km^2]	Area service coverage [%]	Addresses outside service coverage	Address service coverage [%]	% addresses served minus % area served (% points)	Avg. relative spatial accessibility [%] among BSUs	Avg. relative temporal accessibility [%] among BSUs	Avg. relative local accessibility [%] among BSUs	Avg. relative network accessibility [%] among BSUs	Avg. relative overall accessibility [%] among BSUs	Avg. relative spatial accessibility [%] among STs	Avg. relative temporal accessibility [%] among STs	Avg. relative local accessibility [%] among STs	Avg. relative network accessibility [%] among STs	Avg. relative overall accessibility [%] among STs
1103	Stavanger	63,39	60,37	3,39	64390	1066,6	133610	2213,2	219,25	3,63	172	2,2	118	145	1,8	53,32	84,1 %	1254	98,1 %	13,9 %	86,2	85,2	93,2	82,6	85,6	91,6	93,4	89,8	93,8	92,6
1108	Sandnes	82,46	77,35	5,05	30931	399,9	66366	858,0	156,83	2,03	202	2,5	190	157	2,0	39,64	48,1 %	1441	95,3 %	47,3 %	82,8	68,8	89,6	68,8	74,8	88,2	63,4	82,4	70,7	74,0
1124	Sola	60,59	60,46	0	13166	217,8	27064	447,6	91,18	1,51	252	3,2	201	192	2,4	35,26	58,2 %	1373	89,6 %	31,4 %	70,5	59,1	79,7	57,7	64,0	61,9	52,7	59,6	55,5	56,7
1127	Randaberg	24,59	24,13	0,59	5036	208,7	11296	468,1	50,59	2,10	208	2,6	140	171	2,1	21,02	85,5 %	269	94,7 %	9,2 %	82,2	52,2	89,9	55,1	65,1	87,8	64,6	81,8	71,7	74,6
Total/overall		231,03	222,31	9,03	113523	510,7	238336	1072,1	517,84	2,33	191	2,4	162	154	1,9	149,24	64,6 %	4337	96,2 %	31,6 %	84,1	78,3	91,2	76,6	80,8	85,9	78,4	82,8	81,2	81,6

Total/overall = total across the whole research area

Avg. relative accessibility [%] among BSUs/STs = average accessibility [%] from the BSUs/STs contained in the respective municipalities.

The appendix shows information and findings for the included parts of each municipality in the research area.
References: (Esri, n.d.; SSB, 2021a, 2022)

Appendix 4 - BSU accessibility

Type of accessibility		Spatial						Temporal												
Scale of accessibility		Local				Network										Spatial accessibility	Temporal accessibility	Local accessibility	Network accessibility	Overall accessibility
BSU no.	BSU	Access distance (median) [m]	Access distance score	Address service coverage [%]	Service coverage score	Bus route options	Bus route options score	Median total travel time [min]	Travel time score	Avg. buses per hour (each direction)	Overall frequency score	Minimum headway [min]	Headway score	Service span [h]	Service span score					
11030101	Buøy 2	68	0,97	99,6 %	1,00	4	0,75	31,6	0,75	6,0	1,00	7,5	1,00	24	1,00	90,6	93,6	98,4	89,9	92,3
11030102	Buøy 1	91	0,95	100,0 %	1,00	4	0,75	29,5	0,80	6,0	1,00	7,5	1,00	24	1,00	90,1	94,9	97,6	90,9	92,8
11030104	Engøy	122	0,93	100,0 %	1,00	4	0,75	27,9	0,84	6,0	1,00	7,5	1,00	24	1,00	89,3	95,9	96,4	91,7	93,1
11030105	Sølyst-Grasholmen	318	0,77	100,0 %	1,00	4	0,75	29,1	0,81	6,0	1,00	7,5	1,00	24	1,00	84,0	95,2	88,5	91,1	90,4
11030201	Verket	135	0,92	100,0 %	1,00	6	1	24,0	0,93	9,0	1,00	7,5	1,00	24	1,00	97,3	98,3	95,9	98,6	97,9
11030202	Strømsteinen	191	0,87	100,0 %	1,00	5	1	24,0	0,93	9,4	1,00	7,5	1,00	24	1,00	95,8	98,3	93,6	98,6	97,2
11030203	Spilderhaug	207	0,86	100,0 %	1,00	4	0,75	26,0	0,88	6,0	1,00	7,5	1,00	24	1,00	87,0	97,1	93,0	92,7	92,8
11030205	Johannes	126	0,92	100,0 %	1,00	6	1	24,9	0,91	8,4	1,00	7,5	1,00	24	1,00	97,5	97,8	96,2	98,2	97,6
11030206	Lervik 1	168	0,89	100,0 %	1,00	2	0,25	25,5	0,89	3,9	0,65	15,0	0,86	19	0,78	71,4	79,6	94,6	68,7	76,1
11030207	Lervik 2	95	0,95	100,0 %	1,00	5	1	24,6	0,92	9,4	1,00	7,5	1,00	24	1,00	98,3	97,9	97,5	98,4	98,1
11030302	Nylund 1	126	0,92	100,0 %	1,00	2	0,25	26,8	0,86	0,9	0,15	20,0	0,76	18	0,74	72,5	62,9	96,2	55,3	67,0
11030303	Nylund 2	112	0,94	100,0 %	1,00	3	0,5	24,7	0,91	4,1	0,68	15,0	0,86	19	0,78	81,2	80,7	96,8	74,6	80,9
11030304	Storhaug 3	110	0,94	100,0 %	1,00	2	0,25	26,5	0,87	1,1	0,18	20,0	0,76	18	0,74	72,9	63,7	96,9	56,0	67,7
11030305	Storhaug 4	96	0,95	100,0 %	1,00	2	0,25	26,0	0,88	1,1	0,18	20,0	0,76	18	0,74	73,3	64,0	97,4	56,2	68,0
11030401	Breivig	142	0,91	100,0 %	1,00	3	0,5	27,3	0,85	4,1	0,68	15,0	0,86	19	0,78	80,4	79,1	95,6	73,3	79,7
11030402	Midjord	102	0,94	100,0 %	1,00	4	0,75	26,4	0,87	5,0	0,83	15,0	0,86	19	0,78	89,8	83,6	97,2	81,9	86,3
11030405	Strømvig	91	0,95	100,0 %	1,00	2	0,25	22,2	0,98	2,1	0,35	20,0	0,76	19	0,78	73,4	71,8	97,7	62,4	72,5
11030406	Varden 3	61	0,98	100,0 %	1,00	3	0,5	22,9	0,96	2,4	0,40	20,0	0,76	19	0,78	82,6	72,6	98,9	68,1	76,9
11030407	Varden 4	137	0,92	100,0 %	1,00	2	0,25	24,3	0,92	1,1	0,18	20,0	0,76	18	0,74	72,2	65,1	95,8	57,1	68,1
11030408	Varden 5	81	0,96	100,0 %	1,00	3	0,5	24,4	0,92	2,4	0,40	20,0	0,76	19	0,78	82,0	71,7	98,0	67,4	76,1
11030409	Varden 6	119	0,93	100,0 %	1,00	3	0,5	24,5	0,92	1,7	0,28	20,0	0,76	18	0,74	81,0	67,5	96,5	64,0	73,3
11030501	Sentrum øst	189	0,87	100,0 %	1,00	8	1	23,5	0,94	12,7	1,00	7,5	1,00	24	1,00	95,8	98,6	93,7	98,9	97,4
11030502	Nytorget	81	0,96	100,0 %	1,00	8	1	25,6	0,89	12,7	1,00	7,5	1,00	24	1,00	98,7	97,3	98,0	97,8	97,9
11030503	Blåsenborg	147	0,91	100,0 %	1,00	6	1	23,7	0,94	9,3	1,00	7,5	1,00	24	1,00	96,9	98,5	95,4	98,8	97,8
11030504	Storhaug 1	110	0,94	100,0 %	1,00	2	0,25	27,0	0,86	0,4	0,06	15,0	0,86	10	0,39	72,9	54,1	96,9	48,3	62,1
11030506	Birkelandsgt-Vikedalsgt	90	0,95	100,0 %	1,00	3	0,5	26,5	0,87	1,7	0,28	15,0	0,86	19	0,78	81,8	69,8	97,7	65,8	74,9
11030507	Bergjeland	64	0,97	100,0 %	1,00	16	1	25,3	0,90	24,2	1,00	7,5	1,00	24	1,00	99,2	97,5	98,7	98,0	98,2
11030509	Sentrum vest 1	341	0,75	100,0 %	1,00	28	1	25,4	0,90	43,2	1,00	7,5	1,00	24	1,00	91,7	97,4	87,6	97,9	95,0
11030510	Sentrum vest 2	56	0,98	100,0 %	1,00	28	1	21,2	1,00	43,2	1,00	7,5	1,00	24	1,00	99,4	100,0	99,1	100,0	99,7
11030511	Paradis 1	110	0,94	100,0 %	1,00	14	1	25,3	0,90	19,9	1,00	7,5	1,00	24	1,00	97,9	97,5	96,9	98,0	97,7
11030512	Paradis 2	75	0,97	100,0 %	1,00	1	0	24,0	0,93	1,5	0,25	20,0	0,76	19	0,78	65,5	68,1	98,3	54,5	67,0
11030601	St Olav	104	0,94	100,0 %	1,00	19	1	21,7	0,99	19,1	1,00	7,5	1,00	24	1,00	98,1	99,7	97,1	99,8	99,0
11030602	Eiganes 1	146	0,91	100,0 %	1,00	3	0,5	22,8	0,96	6,8	1,00	7,5	1,00	24	1,00	80,3	99,0	95,4	89,2	91,0
11030603	Eiganes 2	122	0,93	100,0 %	1,00	10	1	23,1	0,95	14,1	1,00	7,5	1,00	24	1,00	97,6	98,8	96,4	99,1	98,3
11030604	Mosvatnet nord	156	0,90	100,0 %	1,00	9	1	23,5	0,94	12,9	1,00	7,5	1,00	24	1,00	96,7	98,6	95,0	98,9	97,8
11030606	Våland 2	75	0,97	100,0 %	1,00	19	1	22,6	0,97	26,1	1,00	7,5	1,00	24	1,00	98,9	99,1	98,3	99,3	99,0
11030607	Vålandsskråningen	297	0,79	100,0 %	1,00	14	1	25,4	0,90	20,4	1,00	7,5	1,00	24	1,00	92,9	97,4	89,4	97,9	95,5
11030608	Våland 3	97	0,95	100,0 %	1,00	14	1	23,9	0,93	20,4	1,00	7,5	1,00	24	1,00	98,3	98,4	97,4	98,7	98,3
11030611	Våland 1	95	0,95	100,0 %	1,00	9	1	21,8	0,99	6,4	1,00	7,5	1,00	24	1,00	98,3	99,6	97,5	99,7	99,1
11030612	Våland 7	135	0,92	99,6 %	1,00	9	1	22,3	0,97	12,9	1,00	7,5	1,00	24	1,00	97,1	99,3	95,7	99,5	98,4
11030613	Våland 4	113	0,94	100,0 %	1,00	2	0,25	24,9	0,91	2,1	0,35	15,0	0,86	19	0,78	72,8	72,6	96,8	63,1	72,7
11030614	Våland 6	104	0,94	100,0 %	1,00	15	1	24,4	0,92	20,9	1,00	7,5	1,00	24	1,00	98,1	98,0	97,1	98,4	98,1
11030615	Vålandshaugen 1	327	0,76	100,0 %	1,00	15	1	28,1	0,83	20,9	1,00	7,5	1,00	24	1,00	92,1	95,8	88,2	96,6	94,2
11030616	Vålandshaugen 2	345	0,75	100,0 %	1,00	15	1	26,9	0,86	20,9	1,00	7,5	1,00	24	1,00	91,6	96,5	87,4	97,2	94,4
11030701	Våland 5	147	0,91	100,0 %	1,00	11	1	25,6	0,89	12,7	1,00	7,5	1,00	24	1,00	96,9	97,3	95,4	97,8	97,1
11030702	Mosvatnet øst	135	0,92	100,0 %	1,00	12	1	25,3	0,90	13,4	1,00	7,5	1,00	24	1,00	97,3	97,5	95,9	98,0	97,4
11030704	Bekkefaret 2	139	0,91	100,0 %	1,00	3	0,5	23,8	0,94	2,7	0,45	15,0	0,86	19	0,78	80,5	75,7	95,7	70,6	77,7
11030705	Bekkefaret 3	134	0,92	100,0 %	1,00	3	0,5	24,8	0,91	2,7	0,45	15,0	0,86	19	0,78	80,6	75,1	95,9	70,1	77,4
11030706	Bekkefaret 4	122	0,93	100,0 %	1,00	11	1	24,5	0,92	11,8	1,00	7,5	1,00	19	0,78	97,6	92,5	96,4	94,0	94,7
11030707	Bekkefaret 5	172	0,89	100,0 %	1,00	9	1	24,9	0,91	4,9	0,81	15,0	0,86	19	0,78	96,3	84,1	94,4	87,3	89,3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11032609	Nedre Tasta 9	314	0,77	77,8 %	0,78	5	1	35,9	0,64	7,5	1,00	7,5	1,00	24	1,00	85,1	91,0	77,6	92,8	88,4
11032610	Nedre Tasta 10	318	0,77	100,0 %	1,00	5	1	28,9	0,81	7,5	1,00	7,5	1,00	24	1,00	92,3	95,3	88,5	96,2	94,0
11032703	Vardeneset	161	0,90	99,7 %	1,00	5	1	32,1	0,73	8,2	1,00	7,5	1,00	24	1,00	96,5	93,3	94,7	94,7	94,7
11032705	Eskelandshagen	121	0,93	100,0 %	1,00	4	0,75	33,6	0,70	8,2	1,00	7,5	1,00	24	1,00	89,3	92,4	96,4	88,9	91,1
11032708	Nedre Tasta 1	92	0,95	100,0 %	1,00	3	0,5	28,3	0,83	1,7	0,28	20,0	0,76	17	0,70	81,7	64,0	97,6	61,2	71,6
11032709	Nedre Tasta 2	84	0,96	100,0 %	1,00	5	1	27,0	0,86	7,2	1,00	7,5	1,00	24	1,00	98,6	96,5	97,9	97,2	97,4
11032710	Nedre Tasta 3	215	0,85	100,0 %	1,00	4	0,75	30,4	0,77	4,1	0,68	7,5	1,00	24	1,00	86,8	86,4	92,7	84,1	86,5
11032711	Nedre Tasta 4	132	0,92	100,0 %	1,00	4	0,75	26,5	0,87	7,1	1,00	7,5	1,00	24	1,00	89,0	96,7	96,0	92,4	93,4
11032712	Nedre Tasta 5	465	0,65	63,6 %	0,64	3	0,5	30,7	0,77	1,3	0,21	20,0	0,76	17	0,70	59,6	60,9	64,5	58,7	60,4
11032714	Teinå	155	0,90	100,0 %	1,00	5	1	32,0	0,73	8,2	1,00	7,5	1,00	24	1,00	96,7	93,4	95,1	94,7	94,8
11032715	Byåsen 1	91	0,95	100,0 %	1,00	5	1	28,4	0,82	8,2	1,00	7,5	1,00	24	1,00	98,4	95,6	97,7	96,5	96,8
11032716	Finnestad 1	115	0,93	100,0 %	1,00	4	0,75	37,0	0,61	3,6	0,60	7,5	1,00	24	1,00	89,5	80,3	96,7	79,2	84,2
11032717	Finnestad 2	83	0,96	100,0 %	1,00	4	0,75	38,4	0,58	3,6	0,60	7,5	1,00	24	1,00	90,3	79,4	98,0	78,5	84,1
11032718	Finnestad 3	122	0,93	100,0 %	1,00	6	1	38,9	0,57	4,7	0,78	7,5	1,00	24	1,00	97,6	83,7	96,4	87,0	89,7
11032719	Høye 1	146	0,91	100,0 %	1,00	6	1	31,4	0,75	5,3	0,88	7,5	1,00	24	1,00	97,0	90,7	95,4	92,5	93,4
11032720	Smits Minde	137	0,92	100,0 %	1,00	3	0,5	31,3	0,75	1,7	0,28	20,0	0,76	17	0,70	80,5	62,2	95,8	59,7	70,1
11032721	Tastarustå nord 1	151	0,90	100,0 %	1,00	3	0,5	29,2	0,80	1,1	0,17	20,0	0,76	11	0,43	80,2	54,3	95,2	53,5	65,4
11032722	Tastarustå nord 2	118	0,93	100,0 %	1,00	4	0,75	33,3	0,70	8,2	1,00	7,5	1,00	24	1,00	89,4	92,6	96,6	89,1	91,2
11032723	Tastarustå nord 3	173	0,89	100,0 %	1,00	4	0,75	34,4	0,68	8,2	1,00	7,5	1,00	24	1,00	87,9	91,9	94,3	88,5	90,2
11032724	Tastarustå nord 4	188	0,88	100,0 %	1,00	3	0,5	30,4	0,78	5,5	0,92	7,5	1,00	24	1,00	79,2	92,3	93,8	83,8	86,7
11032725	Tastarustå nord 5	324	0,77	100,0 %	1,00	3	0,5	36,3	0,63	5,5	0,92	7,5	1,00	24	1,00	75,5	88,6	88,3	80,9	83,0
11032726	Tastarustå sør 1	114	0,93	100,0 %	1,00	4	0,75	28,6	0,82	1,3	0,21	20,0	0,76	17	0,70	89,5	62,2	96,7	64,7	73,9
11032727	Tastarustå sør 2	122	0,93	100,0 %	1,00	4	0,75	28,1	0,83	6,2	1,00	7,5	1,00	24	1,00	89,3	95,8	96,4	91,6	93,0
11080101	Blåsenborg	223	0,85	100,0 %	1,00	6	1	37,8	0,59	7,2	1,00	15,0	0,86	24	1,00	94,9	86,3	92,3	89,0	90,0
11080102	Gannsområdet	112	0,94	100,0 %	1,00	6	1	35,3	0,65	7,2	1,00	15,0	0,86	24	1,00	97,9	87,8	96,8	90,2	92,1
11080103	Kaien 1	97	0,95	100,0 %	1,00	6	1	36,7	0,62	7,2	1,00	15,0	0,86	24	1,00	98,3	86,9	97,4	89,6	91,8
11080104	Kaien 2	216	0,85	100,0 %	1,00	10	1	37,7	0,60	7,8	1,00	15,0	0,86	24	1,00	95,1	86,3	92,6	89,1	90,1
11080105	Rådhusteateret	68	0,97	100,0 %	1,00	6	1	36,3	0,63	7,2	1,00	15,0	0,86	24	1,00	99,1	87,2	98,6	89,7	92,3
11080106	Kirkebakken	106	0,94	100,0 %	1,00	4	0,75	37,9	0,59	3,5	0,59	7,5	1,00	24	1,00	89,7	79,5	97,0	78,6	83,9
11080107	Gamlehjemmet	202	0,86	100,0 %	1,00	4	0,75	38,0	0,59	3,5	0,59	7,5	1,00	24	1,00	87,1	79,4	93,2	78,5	82,7
11080108	Langgata 1	143	0,91	100,0 %	1,00	6	1	37,3	0,61	7,2	1,00	15,0	0,86	24	1,00	97,0	86,6	95,5	89,3	91,1
11080109	Rutebilstasjonen	35	1,00	100,0 %	1,00	18	1	36,1	0,63	26,0	1,00	7,5	1,00	24	1,00	99,9	90,9	99,9	92,7	94,7
11080110	Industriområdet 1	66	0,97	100,0 %	1,00	13	1	36,9	0,62	14,6	1,00	7,5	1,00	20	0,83	99,1	86,0	98,6	88,8	91,6
11080111	Eidsvollsgate 1	196	0,87	100,0 %	1,00	9	1	40,1	0,54	11,7	1,00	7,5	1,00	24	1,00	95,6	88,4	93,4	90,8	91,5
11080112	Langgata 2	135	0,92	100,0 %	1,00	9	1	37,2	0,61	11,7	1,00	7,5	1,00	24	1,00	97,3	90,2	95,9	92,2	93,2
11080113	Vågsgate	92	0,95	100,0 %	1,00	14	1	36,6	0,62	14,6	1,00	7,5	1,00	20	0,83	98,4	86,2	97,6	89,0	91,4
11080114	Eidsvollsgate 2	90	0,95	100,0 %	1,00	3	0,5	38,7	0,57	2,2	0,37	7,5	1,00	24	1,00	81,8	73,6	97,7	68,9	77,1
11080115	Langgata 3	120	0,93	100,0 %	1,00	4	0,75	39,3	0,56	4,5	0,75	7,5	1,00	24	1,00	89,3	82,7	96,5	81,2	85,5
11080116	Høylandsgata	94	0,95	100,0 %	1,00	9	1	37,7	0,60	10,5	1,00	7,5	1,00	20	0,83	98,3	85,6	97,5	88,4	91,0
11080117	Eidsvollsgate 3	69	0,97	100,0 %	1,00	3	0,5	38,6	0,57	2,4	0,39	7,5	1,00	24	1,00	82,4	74,1	98,5	69,3	77,6
11080118	Jærveien	176	0,88	100,0 %	1,00	4	0,75	40,0	0,54	4,6	0,77	7,5	1,00	24	1,00	87,8	82,6	94,2	81,1	84,9
11080119	Jernbanen	254	0,82	100,0 %	1,00	3	0,5	40,4	0,53	2,4	0,39	7,5	1,00	24	1,00	77,4	73,0	91,1	68,4	74,9
11080122	Industriområdet 2	221	0,85	100,0 %	1,00	13	1	40,0	0,54	13,2	1,00	7,5	1,00	20	0,83	95,0	84,1	92,4	87,3	88,8
11080123	Kaien 3	126	0,92	100,0 %	1,00	6	1	34,4	0,68	7,2	1,00	15,0	0,86	24	1,00	97,5	88,3	96,2	90,6	92,2
11080124	Nordre Stranden	184	0,88	100,0 %	1,00	6	1	34,7	0,67	7,2	1,00	15,0	0,86	24	1,00	96,0	88,2	93,9	90,5	91,5
11080201	Stokke	437	0,68	56,6 %	0,57	17	1	32,4	0,73	12,1	1,00	7,5	1,00	24	1,00	74,7	93,1	62,0	94,5	85,2
11080202	Lura 1	142	0,91	100,0 %	1,00	18	1	30,4	0,77	15,4	1,00	7,5	1,00	24	1,00	97,1	94,4	95,6	95,5	95,5
11080203	Lura 2	193	0,87	100,0 %	1,00	20	1	29,2	0,80	18,0	1,00	7,5	1,00	24	1,00	95,7	95,1	93,5	96,1	95,3
11080204	Lura 3	294	0,79	100,0 %	1,00	2	0,25	32,1	0,73	2,6	0,43	15,0	0,86	20	0,83	68,0	71,1	89,5	61,9	69,8
11080205	Lura 4	150	0,91	100,0 %	1,00	18	1	31,1	0,76	10,4	1,00	7,5	1,00	24	1,00	96,9	94,0	95,3	95,2	95,2
11080206	Varatun	100	0,95	100,0 %	1,00	3	0,5	33,7	0,69	2,4	0,40	7,5	1,00	24	1,00	81,5	77,3	97,3	71,8	79,1
11080207	Roald Amundsensgate	109	0,94	100,0 %	1,00	9	1	33,1	0,71	9,6	1,00	7,5	1,00	24	1,00	98,0	92,7	96,9	94,2	95,0
11080208	Altona	121	0,93	100,0 %	1,00	9	1	34,4	0,68	9,6	1,00	7,5	1,00	24	1,00	97,6	91,9	96,4	93,5	94,4
11080209	Stadion	192	0,87	97,2 %	0,97	3	0,5	36,8	0,62	2,4	0,40	7,5	1,00	24	1,00	78,1	75,4	92,2	70,3	76,6
11080210	Gamle Postvei	107	0,94	100,0 %	1,00	7	1	33,3	0,70	7,4	1,00	15,0	0,86	24	1,00	98,0	89,0	97,0	91,2	92,9
11080211	Håholen	105	0,94	100,0 %	1,00	10	1	34,7	0,67	8,4	1,00	7,5	1,00	24	1,00	98,0	91,7	97,1	93,4	94,4
11080212	Vodlageilen	121	0,93	100,0 %	1,00	2	0,25	33,3	0,70	2,2	0,37	7,5	1,00	24	1,00	72,6	76,9	96,5	66,5	75,1
11080213	Gamle Somavei	183	0,88	100,0 %	1,00	10	1	32,8	0,72	8,7	1,00	7,5	1,00	24	1,00	96,0	92,9	93,9	94,3	94,2
11080214	Brattholen	105	0,94	100,0 %	1,00	2	0,25	34,7	0,67	3,5	0,58	7,5	1,00	24	1,00	73,1	81,3	97,1	70,0	77,8
11080301	Soma	941	0,27	12,0 %	0,12	3	0,5	47,4	0,36	0,4	0,07	60,0	0,00	5	0,17	29,7	15,0	19,5	22,0	21,3
11080302	Stangeland 1	424	0,69	69,3 %	0,69	5	1	45,5	0,41	1,5	0,24	30,0	0,57	19	0,78	79,3	50,0	68,9	60,0	62,6
11080303	Stangeland 2	221	0,85	93,9 %	0,94	4	0,75	40,8	0,52	4,2	0,69	7,5	1,00	24	1,00	84,6	80,3	89,4	79,3	82,2
11080304	Stangeland 3	161	0,90	100,0 %	1,00	7	1	40,4	0,53	3,8	0,62	7,5	1,00	24	1,00	96,6	78,8	94,8	83,1	86,4
11080305	Maurholen	144	0,91	100,0 %	1,00	4	0,75	36,5	0,63	1,5	0,24	7,5	1,00	19	0,78	88,7	66,3	95,5	68,1	75,9
11080402	Folkvord	1120	0,13	0,0 %	0,00	1	0	55,9	0,15	0,2	0,03	60,0	0,00	5	0,17	4,2	8,8	6,3	7,0	6,8
11080403	Skeiane	329	0,76	80,7 %	0,81	6	1	44,7	0,42	1,6	0,27	30,0	0,57	19	0,78	85,6	51,2	78,4	61,0	66,0
11080404	Sandve	195	0,87	99,8 %	1,00	4	0,75	44,9	0,42	1,4	0,23	30,0	0,57	19	0,78	87,2	50,1	93,4	55,1	66,0
11080405	Brueland	191	0,87	100,0 %	1,00	4	0,75	41,2	0,51	2,0	0,33	30,0	0,57	20	0,83	87,4	55,9	93,6	59,7	69,4
11080406	Skei	158	0,90	100,0 %	1,00	7	1	43,0	0,47	3,3	0,55	30,0	0,57	20	0,83	96,6	60,4	94,9	68,3	75,9
11080501	Skjæveland	355	0,74	87,3 %	0,87	2	0,25	46,1	0,39	1,0	0,17	30,0	0,57	17	0,70	62,1	45,7	80,7	41,5	52,7
11080502	Leitet	188	0,87	96,4 %	0,96	5	1	45,3	0,41	2,1	0,35	30,0	0,57	20	0,83	94,6	54,0	92,0	63,2	71,4
11080503	Ganddal	115	0,93	100,0 %	1,00	5	1	45,4	0,41	4,2	0,69	30,0	0,57	20	0,83	97,8	62,5	96,7	70,0	77,6
11080504	Åse	190	0,87	94,8 %	0,95	6	1	44,1	0,44	3,3	0,54	30,0	0,57	20	0,83	94,0	59,5	91,0	67,6	74,3
11080505	Lundehaugen	157	0,90	92,0 %	0,92	3	0,5	43,0	0,47	1,2	0,20	30,0	0,57	19	0,78	77,3	50,5	91,0	50,4	62,0
11080506	Stokkeland	291	0,79	84,0 %	0,84	1	0	48,1	0,34	1,0	0,17	30,0	0,57	20	0,83	54,4	47,6	81,6	38,1	50,5
11080507	Sørbø	292	0,79	69,4 %	0,69	4	0,75	43,4	0,46	1,4	0,23	30,0	0,57	19	0,78	74,5	51,0	74,3	55,8	61,1
11080601	Austråttbakken	91	0,95	100,0 %	1,00	10	1	39,8	0,54	10,6	1,00	7,5	1,00	20	0,83	98,4	84,3	97,7	87,4	90,3
11080602	Austrått 1	134	0,92	100,0 %	1,00	2	0,25	42,6	0,48	2,0	0,34	15,0	0,86	18	0,74	72,3	60,2	95,9	53,2	65,4
11080603	Austrått øst	128	0,92	100,0 %	1,00	3	0,5	45,1	0,41	2,1	0,35	15,0	0,86	18	0,74	80,8	58,9	96,2	57,2	68,3
11080604	Austrått 2	200	0,87	99,7 %	1,00	8	1	44,7	0,42	7,0	1,00	7,5	1,00	19	0,78	95,4	80,2	93,2	84,1	86,7
11080605	Håbet	139	0,91	100,0 %	1,00	3	0,5	45,1	0,41	5,5	0,92	7,5	1,00	19	0,78	80,5	77,9	95,7	72,3	79,0
11080606	Austrått 3	598	0,55	26,9 %	0,27	1	0	49,2	0,31	0,1	0,01	60,0	0,00	2	0,04	27,2	9,1	40,8	7,3	16,9
11080607	Austrått 4	161	0,90	100,0 %	1,00	3	0,5	44,2	0,44	2,1	0,35	15,0	0,86	18	0,74	79,9	59,5	94,8	57,6	68,2
11080608	Skaret	191	0,87	100,0 %	1,00	2	0,25	46,5	0,38	2,0	0,34	15,0	0,86	18	0,74	70,7	57,8	93,6	51,3	63,4
11080609	Gravarslia	207	0,86	100,0 %	1,00	7	1	42,1	0,49	4,1	0,68	15,0	0,86	18	0,74	95,3	69,2	93,0	75,4	80,4
11080611	Håbafjell	111	0,94	100,0 %	1,00	3	0,5	45,7	0,40	5,5	0,92	7,5	1,00	19	0,78	81,2	77,5	96,9	72,0	79,1
11080612	Presthei	127	0,92	100,0 %	1,00	4	0,75	47,7	0,35	5,6	0,93	7,5	1,00	19	0,78	89,1	76,6	96,2	76,3	82,0
11080613	Bogafjell senter	154	0,90	100,0 %	1,00	5	1	51,2	0,26	4,9	0,81	7,5	1,00	18	0,74	96,8	70,3	95,1	76,3	81,7
11080614	Koppåsen	153	0,90	100,0 %	1,00	3	0,5	48,9	0,32	2,1	0,35	7,5	1,00	18	0,74	80,1	60,3	95,1	58,2	68,8
11080615	Buggeland	154	0,90	100,0 %	1,00	2	0,25	52,6	0,23	4,0	0,66	7,5	1,00	18	0,74	71,7	65,7	95,1	57,6	68,3
11080616	Stokkelandsfjellet	95	0,95	100,0 %	1,00	2	0,25	60,1	0,05	4,0	0,66	7,5	1,00	18	0,74	73,3	61,1	97,5	53,9	66,4
11080617	Vagletjørn	157	0,90	100,0 %	1,00	1	0	56,3	0,14	0,2	0,03	40,0	0,38	5	0,17	63,3	18,2	95,0	14,6	37,5
11080618	Høyland 1	215	0,85	98,9 %	0,99	4	0,75	48,5	0,33	3,8	0,63	15,0	0,86	19	0,78	86,4	65,0	92,1	67,0	74,2
11080619	Høyland 2	152	0,90	100,0 %	1,00	4	0,75	48,2	0,34	5,7	0,95	7,5	1,00	19	0,78	88,5	76,7	95,2	76,3	81,7
11080701	Nedre Hana	56	0,98	100,0 %	1,00	5	1	38,3	0,58	4,3	0,71	15,0	0,86	14	0,57	99,4	67,8	99,1	74,2	81,3
11080702	Øvre Hana	169	0,89	100,0 %	1,00	6	1	40,9	0,52	4,1	0,68	15,0	0,86	13	0,52	96,3	64,3	94,5	71,4	78,0
11080703	Aspermyra	90	0,95	100,0 %	1,00	2	0,25	41,7	0,50	2,4	0,40	15,0	0,86	14	0,57	73,5	58,0	97,7	51,4	64,6
11080704	Grunningen	282	0,80	89,5 %	0,89	1	0	46,1	0,39	0,3	0,04	120,0	0,00	7	0,26	56,5	17,3	84,7	13,9	34,1
11080705	Vatne	172	0,89	100,0 %	1,00	3	0,5	44,7	0,42	1,6	0,27	15,0	0,86	12	0,48	79,6	50,8	94,4	50,6	63,1
11080706	Gramstad	138	0,92	92,6 %	0,93	1	0	45,7	0,40	0,6	0,09	30,0	0,57	14	0,57	61,4	40,7	92,1	32,5	49,5
11080707	Haga	1278	0,00	20,0 %	0,20	3	0,5	62,0	0,00	1,6	0,27	15,0	0,86	12	0,48	23,3	40,2	10,0	42,1	33,0
11080708	Dale	179	0,88	98,0 %	0,98	1	0	50,4	0,28	0,6	0,09	30,0	0,57	14	0,57	62,1	37,8	93,1	30,2	48,2
11080709	Trodne	198	0,87	86,2 %	0,86	3	0,5	44,0	0,44	1,6	0,27	15,0	0,86	12	0,48	74,3	51,2	86,4	51,0	61,1
11080710	Sandvika	87	0,96	100,0 %	1,00	2	0,25	42,4	0,48	1,5	0,25	15,0	0,86	14	0,57	73,5	53,8	97,8	48,0	62,2
11240102	Jåsund	172	0,89	97,8 %	0,98	3	0,5	35,3	0,65	4,4	0,73	15,0	0,86	24	1,00	78,8	81,0	93,3	74,8	80,1
11240103	Storevarden	209	0,86	95,3 %	0,95	3	0,5	42,4	0,48	4,4	0,73	15,0	0,86	24	1,00	77,0	76,6	90,6	71,3	76,8
11240104	Meling-Mæland	353	0,74	62,7 %	0,63	3	0,5	47,3	0,36	4,4	0,73	15,0	0,86	24	1,00	62,3	73,6	68,5	68,9	68,8
11240105	Hamrabukta	284	0,80	95,2 %	0,95	3	0,5	47,1	0,37	4,4	0,73	15,0	0,86	24	1,00	75,0	73,8	87,5	69,0	74,3
11240106	Snøde-Haga	320	0,77	73,7 %	0,74	3	0,5	48,1	0,34	4,4	0,73	15,0	0,86	24	1,00	66,9	73,1	75,3	68,5	70,4
11240107	Myklebust,nordvest	274	0,81	94,9 %	0,95	3	0,5	41,8	0,50	4,4	0,73	15,0	0,86	24	1,00	75,2	77,0	87,7	71,6	76,2
11240201	Tjora	343	0,75	66,0 %	0,66	3	0,5	45,4	0,41	4,4	0,73	15,0	0,86	24	1,00	63,7	74,8	70,6	69,8	70,0
11240202	Kolnes	956	0,26	3,0 %	0,03	3	0,5	49,6	0,30	4,4	0,73	15,0	0,86	24	1,00	26,3	72,2	14,4	67,8	52,5
11240203	Sømme-Utsola	235	0,84	70,6 %	0,71	4	0,75	38,5	0,57	3,1	0,52	15,0	0,86	20	0,83	76,5	69,5	77,2	70,6	72,5
11240301	Solamarka	308	0,78	62,0 %	0,62	2	0,25	42,7	0,47	0,3	0,04	120,0	0,00	12	0,48	55,0	24,9	69,9	24,9	37,8
11240302	Ølberg	473	0,65	53,2 %	0,53	2	0,25	47,2	0,36	0,3	0,04	120,0	0,00	12	0,48	47,6	22,1	58,9	22,7	33,0
11240303	Håland	233	0,84	92,7 %	0,93	2	0,25	48,0	0,34	0,5	0,08	60,0	0,00	12	0,48	67,2	22,5	88,3	23,0	41,7
11240304	Rege	249	0,83	82,3 %	0,82	2	0,25	41,3	0,51	0,5	0,08	60,0	0,00	12	0,48	63,3	26,7	82,5	26,4	42,4
11240401	Tjelta	106	0,94	85,1 %	0,85	2	0,25	42,8	0,47	0,5	0,08	60,0	0,00	12	0,48	68,1	25,7	89,6	25,6	43,9
11240402	Helleland	276	0,80	72,4 %	0,72	2	0,25	46,1	0,39	0,3	0,04	120,0	0,00	12	0,48	59,3	22,8	76,4	23,2	38,4
11240501	Gimra	433	0,68	66,7 %	0,67	1	0	44,4	0,43	0,0	0,00	120,0	0,00	1	0,00	44,8	10,8	67,3	8,6	25,4
11240502	Solakrossen	115	0,93	99,7 %	1,00	6	1	32,9	0,71	5,2	0,87	15,0	0,86	20	0,83	97,7	81,6	96,5	85,2	88,5
11240503	Sande-Skadberg	181	0,88	99,2 %	0,99	11	1	35,9	0,64	6,3	1,00	15,0	0,86	20	0,83	95,8	83,1	93,7	86,5	88,5
11240504	Stangeland	372	0,73	68,2 %	0,68	2	0,25	38,8	0,57	0,5	0,08	60,0	0,00	12	0,48	55,3	28,3	70,5	27,6	39,9
11240601	Sande	155	0,90	99,6 %	1,00	6	1	32,3	0,73	4,7	0,78	15,0	0,86	20	0,83	96,6	79,9	94,9	83,9	87,0
11240602	Joa	350	0,74	80,0 %	0,80	3	0,5	33,6	0,70	2,1	0,34	15,0	0,86	18	0,74	68,2	65,8	77,3	62,7	66,8
11240603	Sømes-Røyneberg	187	0,88	95,8 %	0,96	16	1	30,4	0,77	9,5	1,00	15,0	0,86	24	1,00	94,5	90,8	91,7	92,6	92,3
11240604	Sømes-Grannes	157	0,90	99,1 %	0,99	3	0,5	29,0	0,81	2,1	0,34	15,0	0,86	18	0,74	79,7	68,6	94,5	64,9	73,4
11240605	Grannes	144	0,91	99,1 %	0,99	8	1	25,3	0,90	7,0	1,00	15,0	0,86	24	1,00	96,7	93,9	95,1	95,1	95,1
11270101	Goa-Viste Hageby	168	0,89	100,0 %	1,00	5	1	35,4	0,65	2,9	0,49	7,5	1,00	13	0,52	96,4	66,5	94,5	73,2	79,3
11270102	Goa-Leikvoll	173	0,89	92,7 %	0,93	5	1	31,4	0,75	2,2	0,36	20,0	0,76	17	0,70	93,8	64,1	90,7	71,3	76,8
11270201	Grødem	129	0,92	100,0 %	1,00	6	1	42,1	0,49	4,6	0,77	7,5	1,00	24	1,00	97,4	81,4	96,1	85,1	88,3
11270301	Rygg	247	0,83	96,1 %	0,96	3	0,5	37,0	0,61	1,1	0,18	20,0	0,76	17	0,70	76,3	56,4	89,4	55,1	64,9
11270302	Harastad	198	0,87	86,1 %	0,86	7	1	41,4	0,50	4,5	0,76	15,0	0,86	24	1,00	90,9	78,0	86,4	82,4	83,5
11270401	Viste	167	0,89	95,3 %	0,95	4	0,75	38,3	0,58	1,5	0,25	30,0	0,57	11	0,43	86,5	45,9	92,2	51,7	63,3
11270402	Vistnes	260	0,82	84,9 %	0,85	1	0	44,6	0,43	0,1	0,01	120,0	0,00	4	0,13	55,5	14,1	83,3	11,3	31,8
11270403	Bø	172	0,89	89,1 %	0,89	1	0	49,9	0,30	0,1	0,01	120,0	0,00	4	0,13	59,3	10,8	88,9	8,7	31,6
11270404	Todneim-Sande-Tunge	226	0,84	91,0 %	0,91	4	0,75	45,1	0,42	1,5	0,24	20,0	0,76	17	0,70	83,5	52,9	87,7	57,3	66,0
Best		32	1,00	100,00 %	1,00	5	1,00	21,2	1,00	6,0	1,00	7,5	1,00	24	1,00	99,9	100,0	100,0	100,0	99,7
Worst		1278	0,00	0,00 %	0,00	1	0,00	62,0	0,00	0,0	0,00	60,0	0,00	1	0,00	4,2	8,8	6,3	7,0	6,8
Range		1245	1,00	100,00 %	1,00	4	1,00	40,8	1,00	6,0	1,00	52,5	1,00	23	1,00	95,7	91,2	93,7	93,0	92,9

The appendix shows how well each BSU scores relative to other BSUs on each accessibility factor, in each category, and overall.

The worst value for each of the seven parameters (access distance, service coverage, bus route options, travel time, overall frequency, headway, and service span) gets a score of 0.

The best value in five of the parameters correlates to a score of 1. For bus route options and overall frequency, a score of 1 is achieved for all BSUs with respectively 5 or more bus route options, and 7 or more buses per hour. Any excess over this is assumed not to improve accessibility.

The remaining values are linearly graded according to their proximity to the best or worst.

The frequency factor is the average of overall frequency and headway.

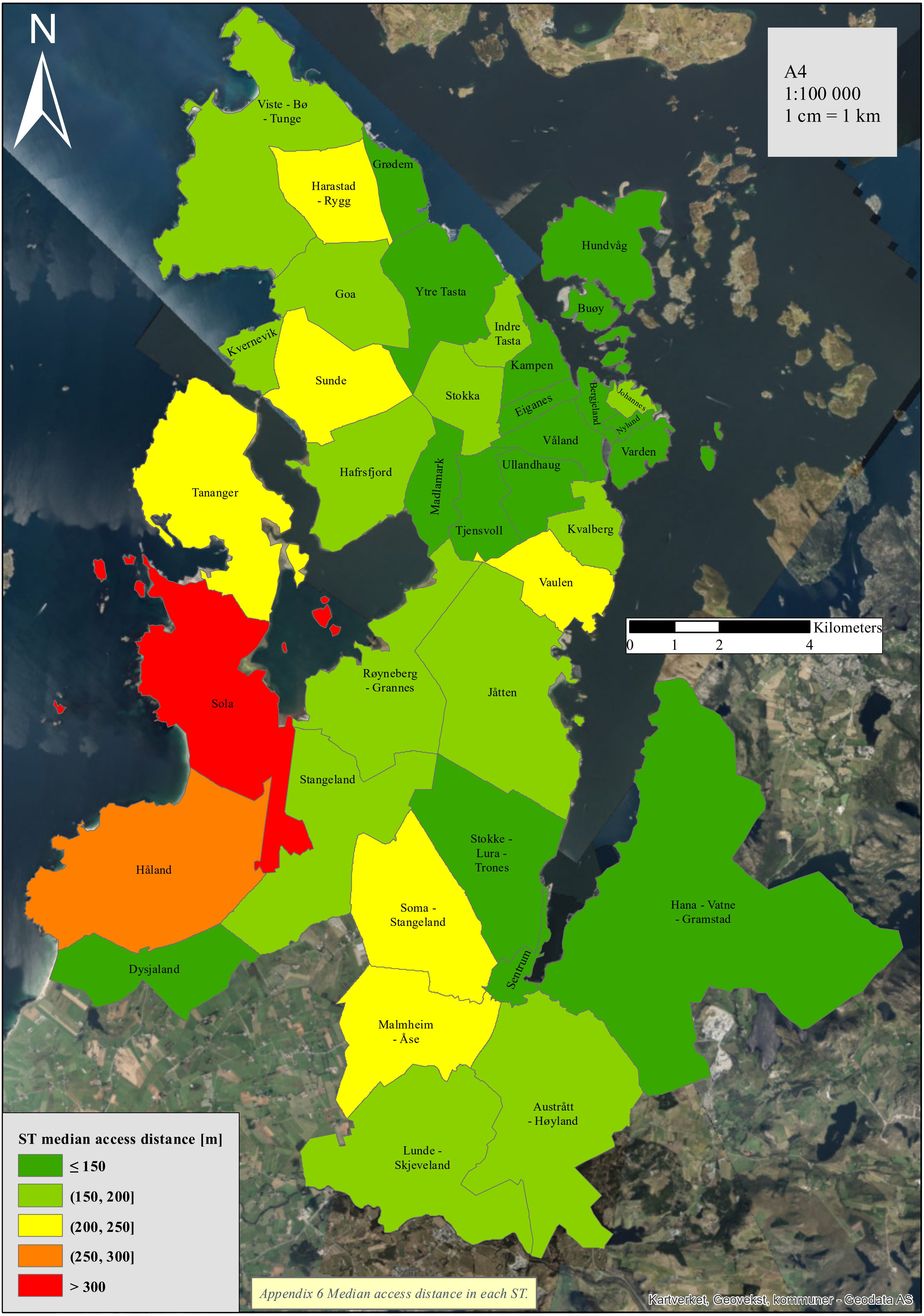
Spatial/temporal/local/network accessibility = average score from the factors influencing each accessibility category, multiplied by 100

Overall accessibility = average score from all six factors, multiplied by 100

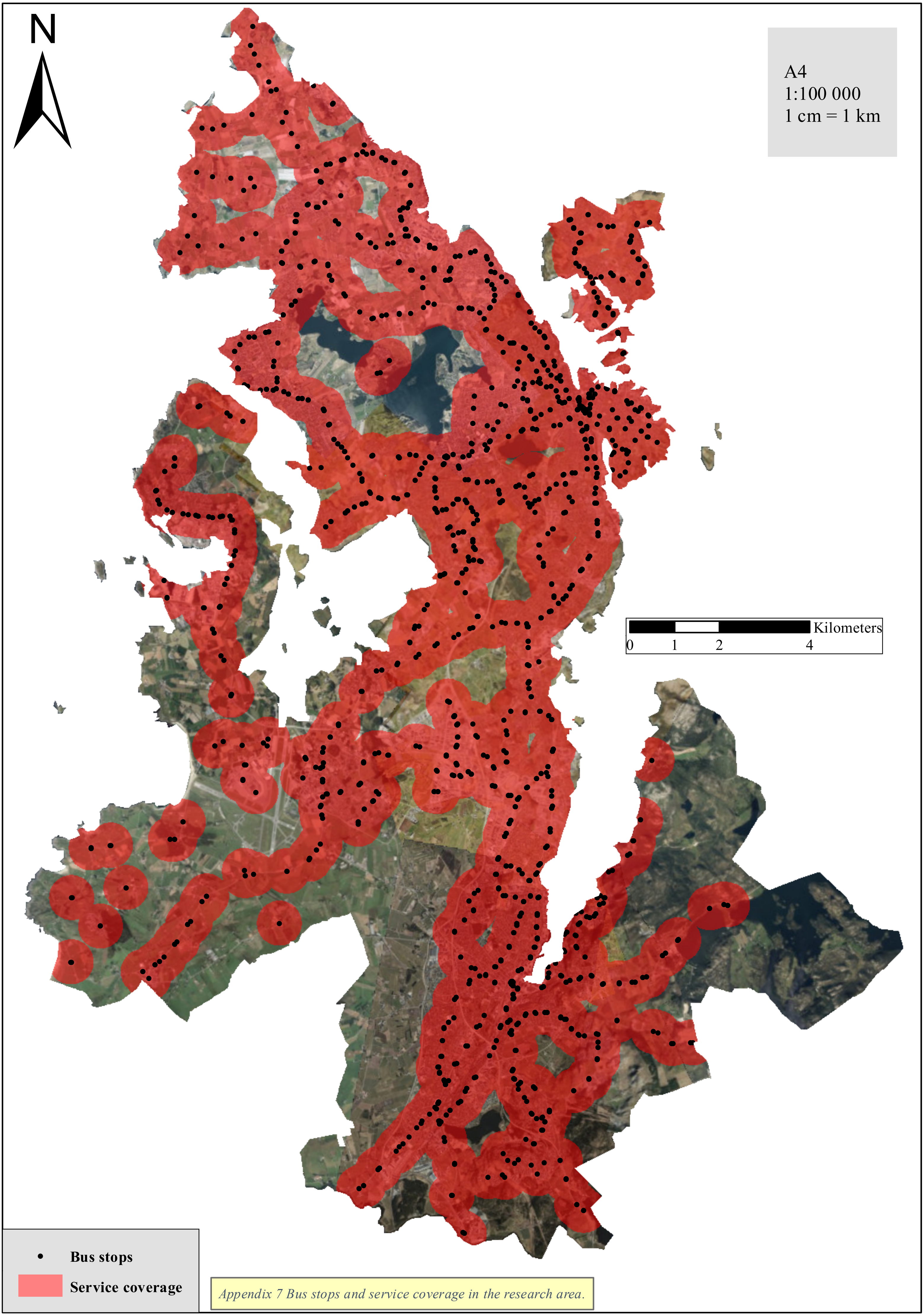
Appendix 5 - ST accessibility

Type of accessibility		Spatial						Temporal												
Scale of accessibility		Local				Network														
ST no.	ST	Access distance (median) [m]	Access distance score	Address service coverage [%]	Service coverage score	Bus route options	Bus route options score	Median total travel time [min]	Travel time score	Avg. buses per hour (each direction)	Overall frequency score	Minimum headway [min]	Headway score	Service span [h]	Service span score	Spatial accessibility	Temporal accessibility	Local accessibility	Network accessibility	Overall accessibility
11030100	Buøy	124	0,92	99,9 %	1,00	4	0,75	36,8	0,48	6,0	0,85	7,5	1,00	24	1,00	88,9	83,4	95,8	81,7	85,7
11030200	Johannes	162	0,80	100,0 %	1,00	7	1,00	26,6	0,88	9,6	1,00	7,5	1,00	24	1,00	93,2	97,1	89,8	97,7	95,4
11030300	Nylund	114	0,96	100,0 %	1,00	4	0,75	28,0	0,83	5,0	0,69	15,0	0,86	19	0,58	90,2	74,0	97,8	74,2	80,9
11030400	Varden	107	0,98	100,0 %	1,00	4	0,75	26,7	0,88	5,8	0,81	15,0	0,86	19	0,58	90,9	78,2	98,8	77,5	83,6
11030500	Bergjeland	115	0,95	100,0 %	1,00	28	1,00	27,0	0,87	43,3	1,00	7,5	1,00	24	1,00	98,3	96,7	97,5	97,3	97,4
11030600	Våland	125	0,92	100,0 %	1,00	28	1,00	24,3	0,98	37,7	1,00	7,5	1,00	24	1,00	97,2	99,4	95,8	99,5	98,5
11030700	Ullandhaug	142	0,86	100,0 %	1,00	14	1,00	23,7	1,00	14,0	1,00	7,5	1,00	24	1,00	95,4	100,0	93,1	100,0	98,0
11030800	Eiganes	106	0,98	100,0 %	1,00	10	1,00	25,5	0,93	12,4	1,00	7,5	1,00	24	1,00	99,3	98,1	99,0	98,5	98,6
11030900	Kampen	100	1,00	100,0 %	1,00	9	1,00	24,1	0,98	12,4	1,00	7,5	1,00	24	1,00	100,0	99,6	100,0	99,7	99,8
11031200	Hundvåg	149	0,84	99,7 %	0,99	4	0,75	36,1	0,51	6,6	0,94	7,5	1,00	24	1,00	86,1	86,1	91,6	83,9	86,1
11031700	Jåtten	194	0,69	95,7 %	0,90	23	1,00	29,0	0,79	23,0	1,00	7,5	1,00	24	1,00	86,3	94,7	79,4	95,7	91,1
11031800	Vaulen	214	0,62	83,0 %	0,61	16	1,00	27,8	0,83	20,2	1,00	7,5	1,00	24	1,00	74,4	95,9	61,6	96,7	86,7
11031900	Kvalberg	194	0,69	96,0 %	0,91	16	1,00	25,0	0,94	21,2	1,00	7,5	1,00	24	1,00	86,6	98,6	79,9	98,9	93,5
11032000	Tjensvoll	128	0,91	99,7 %	0,99	14	1,00	25,6	0,92	20,2	1,00	7,5	1,00	24	1,00	96,6	98,1	94,9	98,5	97,5
11032100	Stokka	157	0,81	94,3 %	0,87	9	1,00	27,8	0,84	8,4	1,00	7,5	1,00	24	1,00	89,4	95,9	84,1	96,7	93,1
11032200	Madlamark	143	0,86	99,3 %	0,98	12	1,00	23,9	0,99	18,1	1,00	7,5	1,00	24	1,00	94,7	99,8	92,1	99,8	97,6
11032300	Hafrsfjord	181	0,73	98,6 %	0,97	7	1,00	29,1	0,78	8,9	1,00	7,5	1,00	24	1,00	90,0	94,6	85,0	95,7	92,6
11032400	Kvernevik	174	0,76	100,0 %	1,00	5	1,00	35,9	0,51	7,6	1,00	7,5	1,00	24	1,00	91,9	87,9	87,8	90,3	89,6
11032500	Sunde	200	0,67	95,9 %	0,91	5	1,00	30,2	0,74	7,7	1,00	7,5	1,00	24	1,00	85,8	93,6	78,7	94,9	90,2
11032600	Indre Tasta	168	0,77	99,3 %	0,98	7	1,00	28,6	0,80	10,2	1,00	7,5	1,00	24	1,00	92,0	95,1	87,9	96,1	93,8
11032700	Ytre Tasta	132	0,89	99,9 %	1,00	6	1,00	28,0	0,83	9,9	1,00	7,5	1,00	24	1,00	96,4	95,7	94,5	96,5	96,0
11080100	Sentrum	128	0,91	100,0 %	1,00	20	1,00	40,8	0,32	26,4	1,00	7,5	1,00	24	1,00	96,9	83,0	95,3	86,4	89,0
11080200	Stokke - Lura - Trones	147	0,84	98,9 %	0,97	20	1,00	36,5	0,49	18,1	1,00	7,5	1,00	24	1,00	94,0	87,3	91,0	89,9	90,2
11080300	Soma - Stangeland	216	0,62	85,8 %	0,68	8	1,00	42,1	0,27	5,2	0,72	7,5	1,00	24	1,00	76,4	74,7	64,6	79,8	75,5
11080400	Malmheim - Åse	207	0,65	88,7 %	0,74	8	1,00	47,1	0,08	3,5	0,46	30,0	0,57	20	0,67	79,6	44,4	69,4	55,5	59,5
11080500	Lunde - Skjeveland	194	0,69	89,7 %	0,76	7	1,00	48,7	0,01	4,5	0,62	30,0	0,57	20	0,67	81,8	46,7	72,6	57,4	61,8
11080600	Austrått - Høyland	156	0,82	99,7 %	0,99	18	1,00	49,0	0,00	13,2	1,00	7,5	1,00	20	0,67	93,6	66,7	90,4	73,3	78,2
11080700	Hana - Vatne - Gramstad	116	0,95	96,3 %	0,92	6	1,00	48,7	0,01	4,3	0,59	15,0	0,86	14	0,17	95,4	40,6	93,2	52,5	64,1
11240100	Tananger	230	0,57	84,8 %	0,65	3	0,50	42,1	0,27	4,4	0,60	15,0	0,86	24	1,00	57,5	68,0	61,2	64,4	63,5
11240200	Sola	401	0,00	56,1 %	0,00	5	1,00	42,1	0,27	5,9	0,83	15,0	0,86	24	1,00	33,3	73,9	0,0	79,1	56,5
11240300	Håland	270	0,44	78,1 %	0,50	2	0,25	48,1	0,03	0,5	0,00	60,0	0,00	12	0,00	39,6	0,9	46,8	5,7	17,5
11240400	Dysjaland	116	0,95	83,4 %	0,62	2	0,25	42,2	0,27	0,5	0,00	60,0	0,00	12	0,00	60,6	6,7	78,4	10,4	29,8
11240500	Stangeland	161	0,80	98,6 %	0,97	11	1,00	33,5	0,61	6,3	0,89	15,0	0,86	20	0,67	92,2	75,7	88,3	80,5	82,8
11240600	Røyneberg - Grannes	172	0,76	95,3 %	0,89	18	1,00	29,2	0,78	12,0	1,00	15,0	0,86	24	1,00	88,5	90,9	82,8	92,7	89,9
11270100	Goa	168	0,77	98,7 %	0,97	7	1,00	32,6	0,65	3,6	0,48	7,5	1,00	17	0,42	91,4	63,6	87,2	70,9	75,6
11270200	Grødem	129	0,90	100,0 %	1,00	6	1,00	38,2	0,42	4,6	0,63	7,5	1,00	24	1,00	96,8	76,5	95,2	81,2	85,2
11270300	Harastad - Rygg	213	0,62	89,4 %	0,76	7	1,00	34,4	0,58	4,5	0,62	15,0	0,86	24	1,00	79,4	76,4	69,1	81,1	77,7
11270400	Viste - Bø - Tunge	190	0,70	91,7 %	0,81	6	1,00	44,5	0,18	2,6	0,33	20,0	0,76	17	0,42	83,7	42,1	75,6	53,7	59,9
Best		100	1,00	100,0 %	1,00	5	1,00	23,7	1,00	7,0	1,00	7,5	1,00	24	1,00	100,0	100,0	100,0	100,0	99,8
Worst		401	0,00	56,1 %	0,00	1	1,00	49,0	0,00	0,5	0,00	60,0	0,00	12	0,00	33,3	0,9	0,0	5,7	17,5
Range		301	1,00	43,9 %	1,00	4	0,00	25,3	1,00	6,5	1,00	52,5	1,00	12	1,00	66,7	99,1	100,0	94,3	82,3

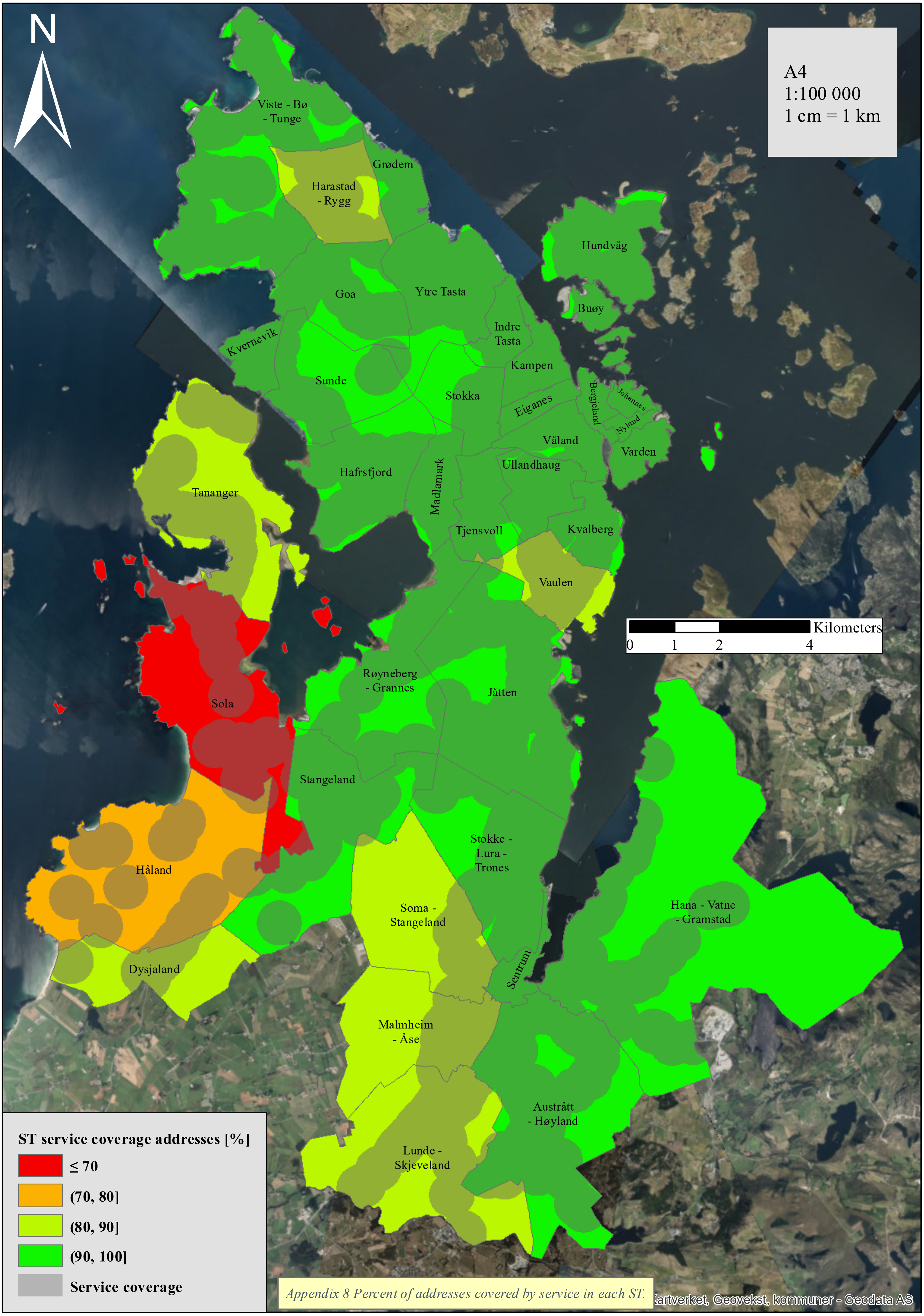
The appendix shows how well each ST scores relative to other STs on each accessibility factor, in each category, and overall.
The worst value for six of the seven parameters (access distance, service coverage, travel time, overall frequency, headway, and service span) gets a score of 0. For bus route options, the worst value is set to 1, but the lowest found among STs is 2.
The best value for five of the parameters correlates to a score of 1. For bus route options and overall frequency, a full score is achieved for all BSUs with respectively 5 or more bus route options, and 7 or more buses per hour. Any excess over this is assumed not to improve accessibility. The remaining values are linearly graded according to their proximity to the best or worst.
The frequency factor is the average of overall frequency and headway.
Spatial/temporal/local/network accessibility = average score from the factors influencing each accessibility category, multiplied by 100
Overall accessibility = average score from all seven factors, multiplied by 100



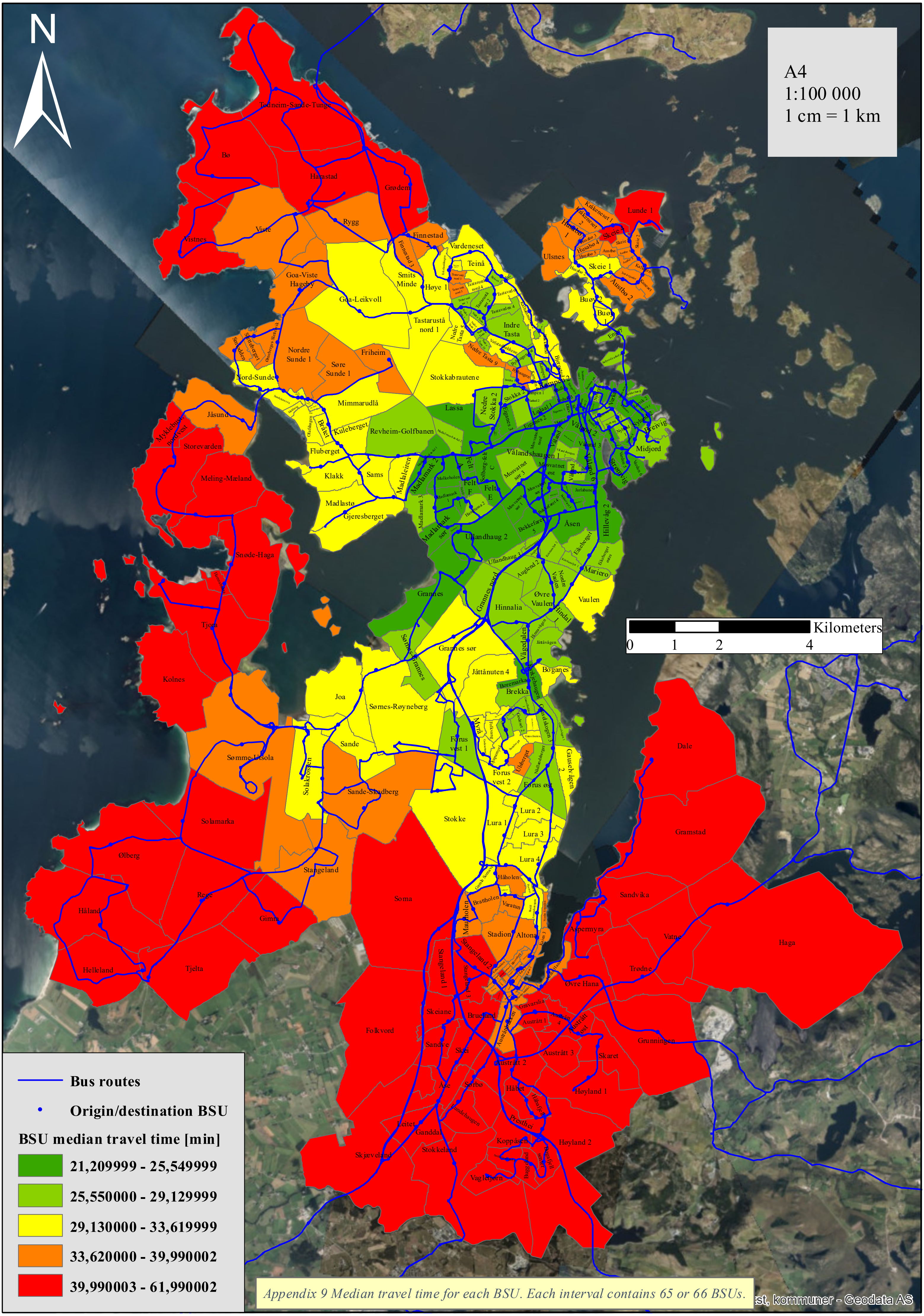
Appendix 6 Median access distance in each ST.



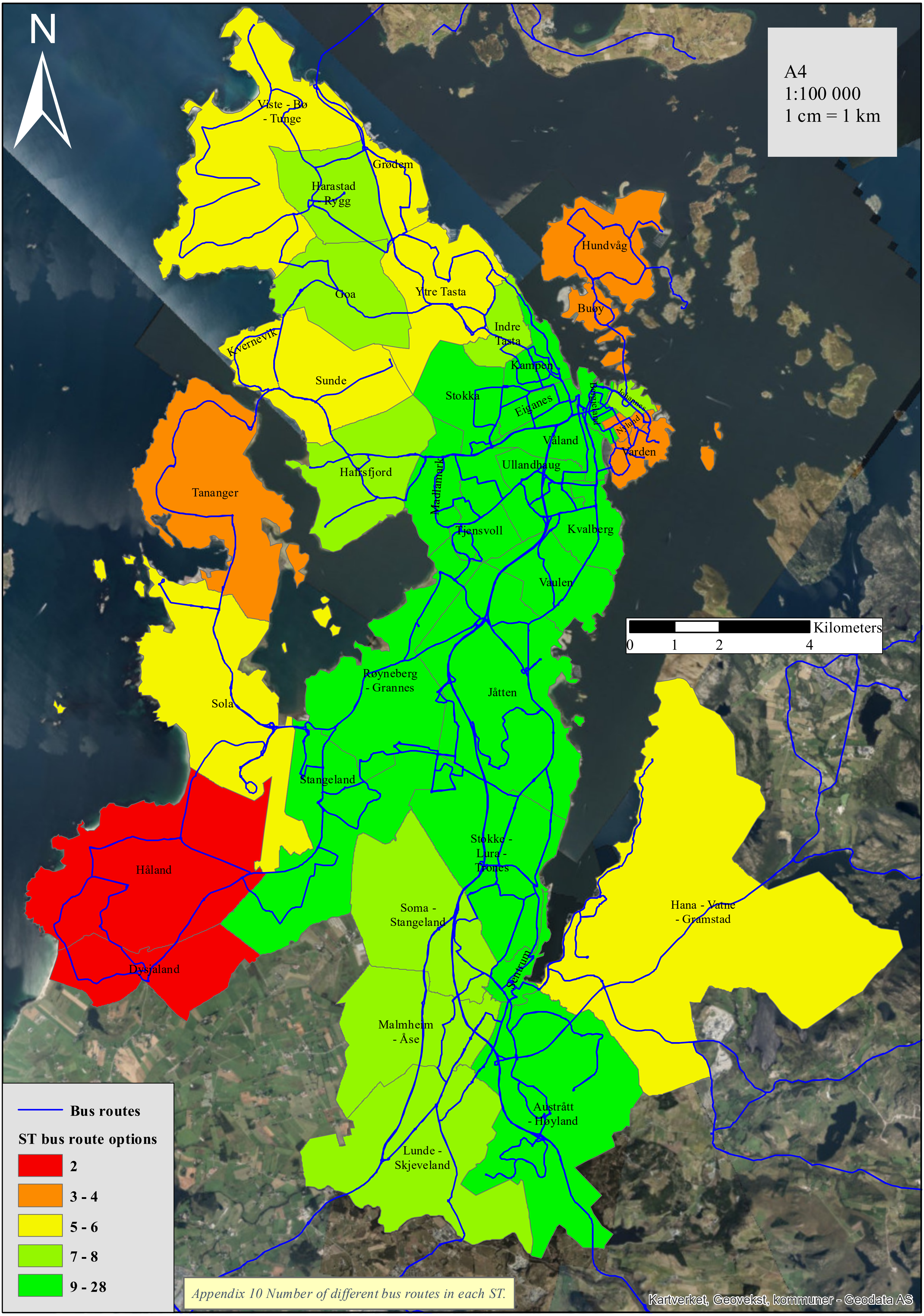
Appendix 7 Bus stops and service coverage in the research area.



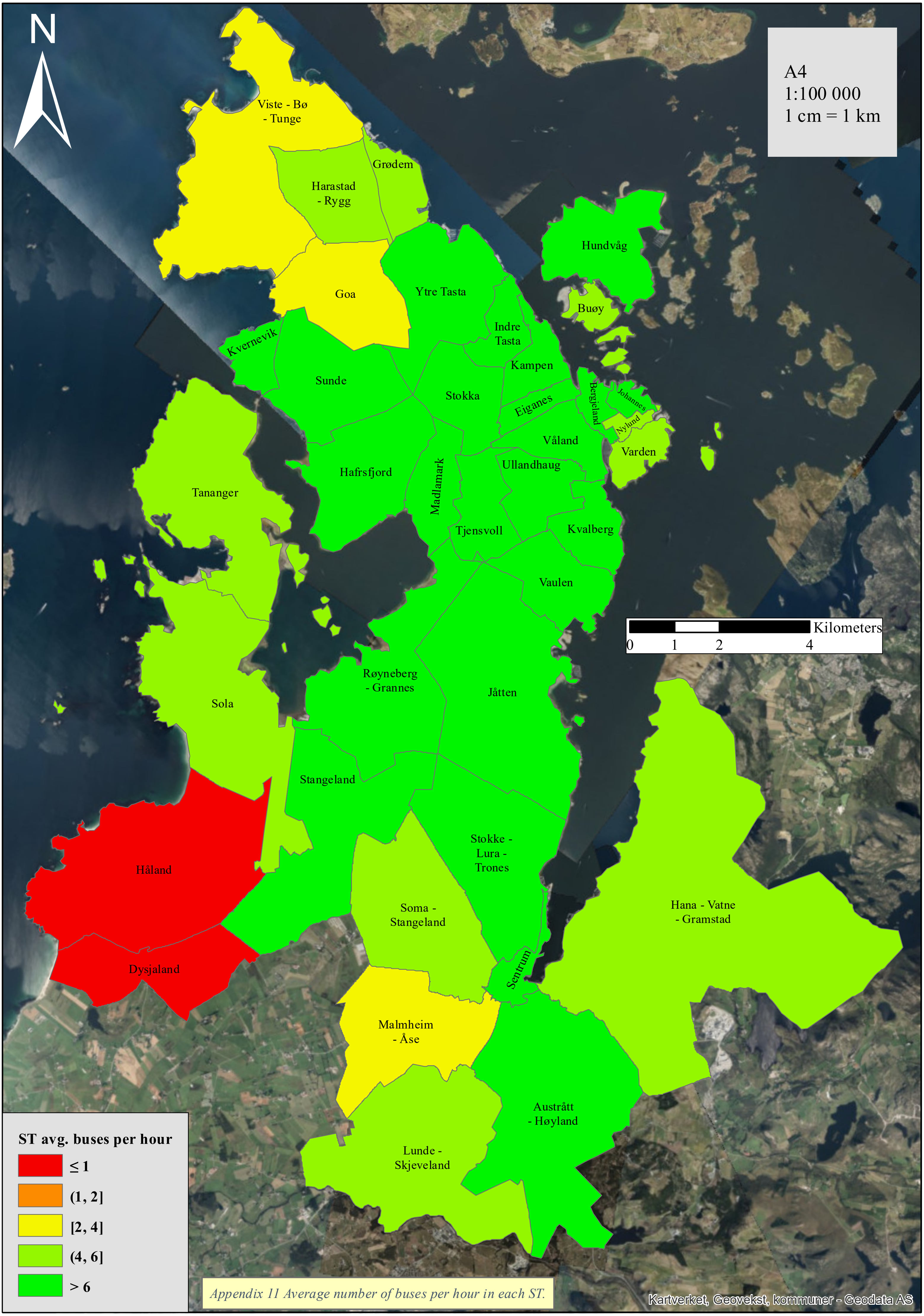
Appendix 8 Percent of addresses covered by service in each ST.



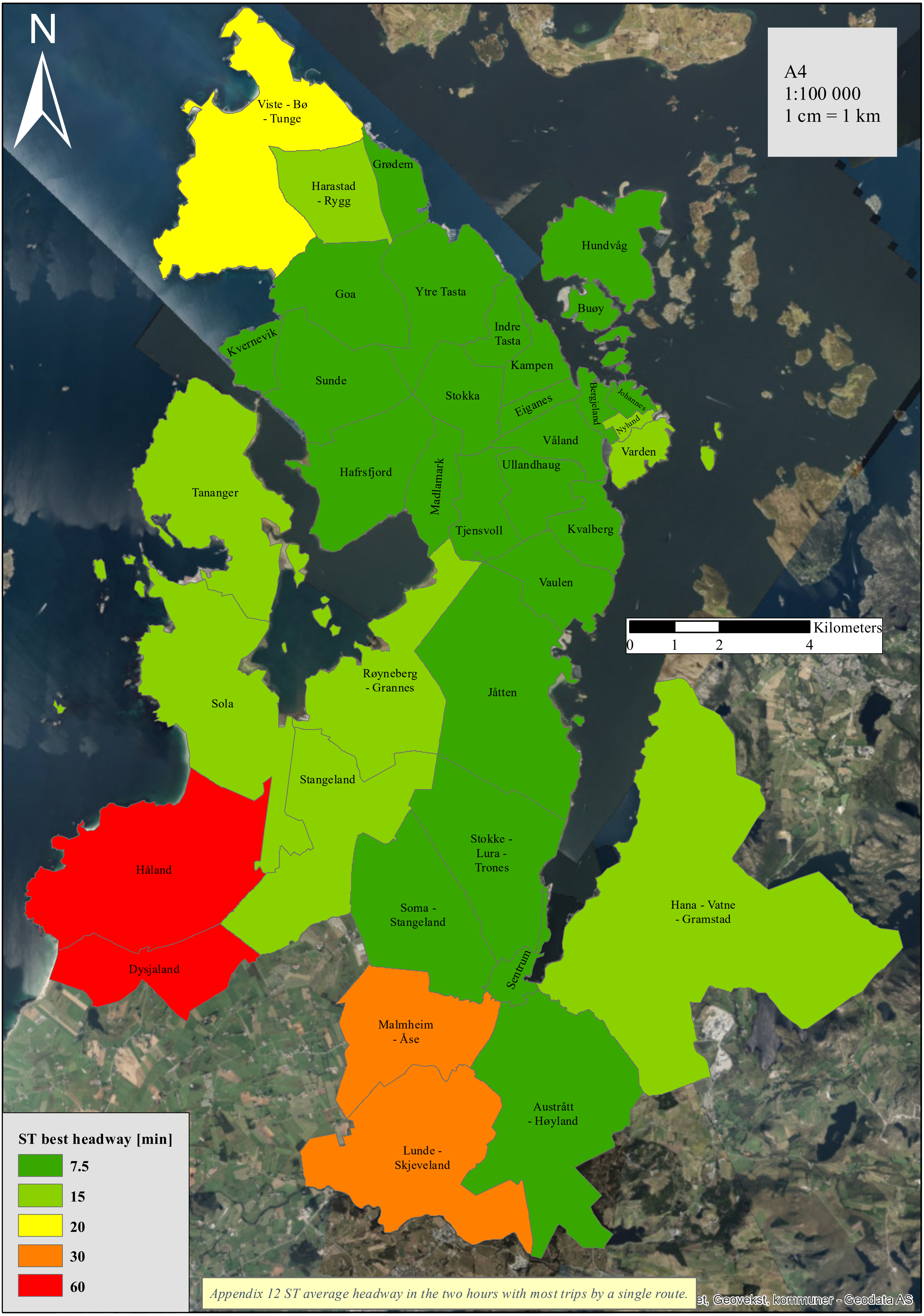
Appendix 9 Median travel time for each BSU. Each interval contains 65 or 66 BSUs.



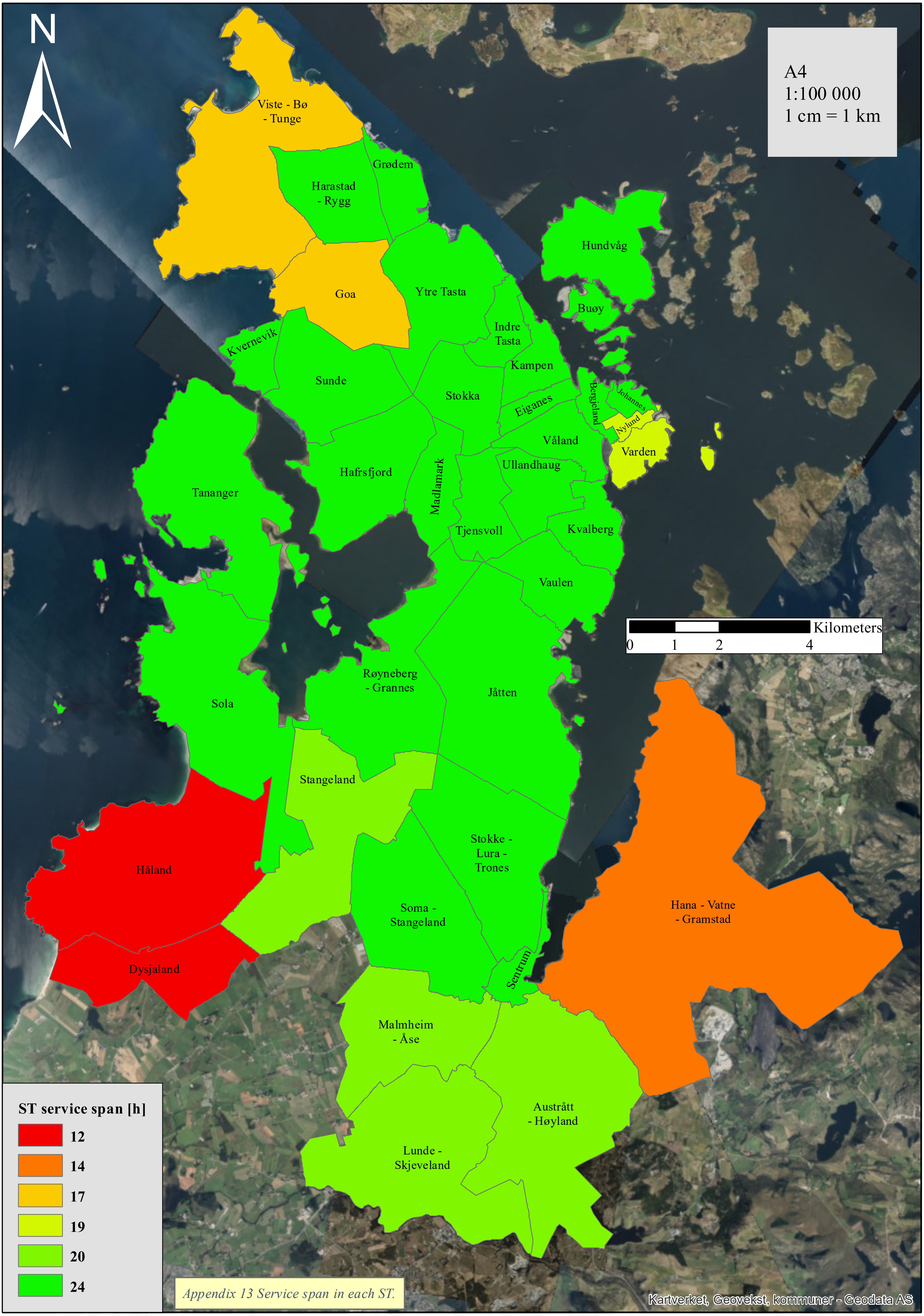
Appendix 10 Number of different bus routes in each ST.



Appendix 11 Average number of buses per hour in each ST.



Appendix 12 ST average headway in the two hours with most trips by a single route.



Appendix 13 Service span in each ST.

Appendix 14 - Charts

A14.1 Access distance

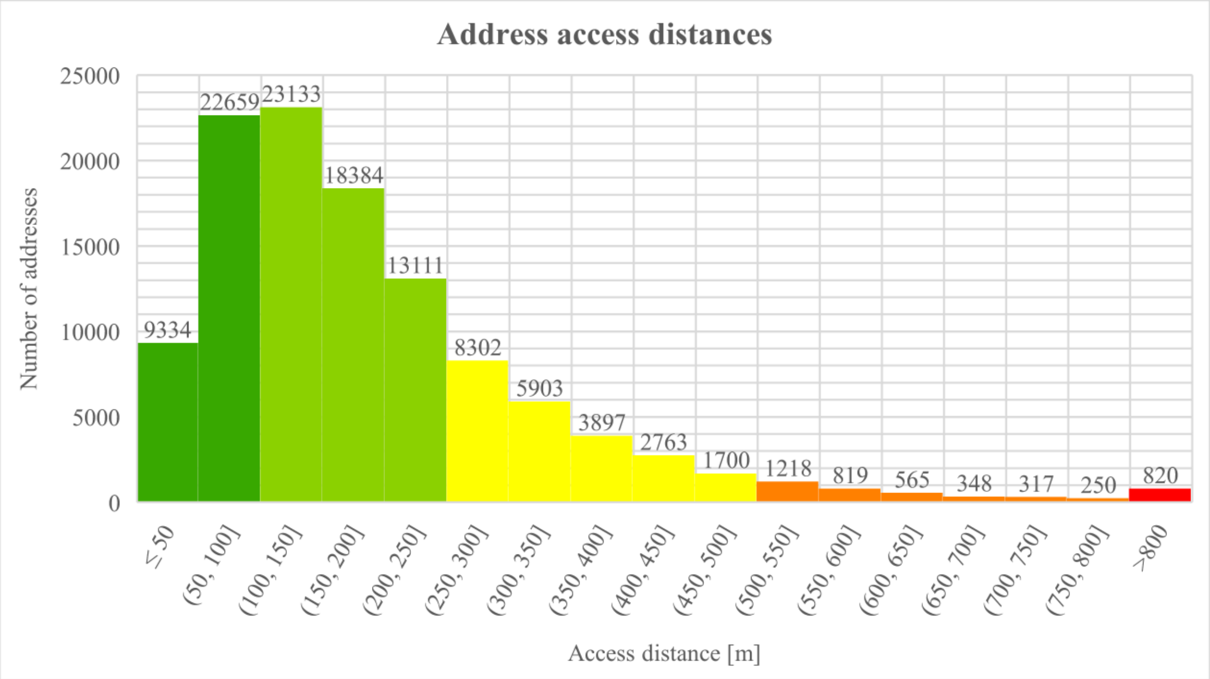


Chart 1 Histogram showing access distances in 50 m intervals and how many addresses belong to each.

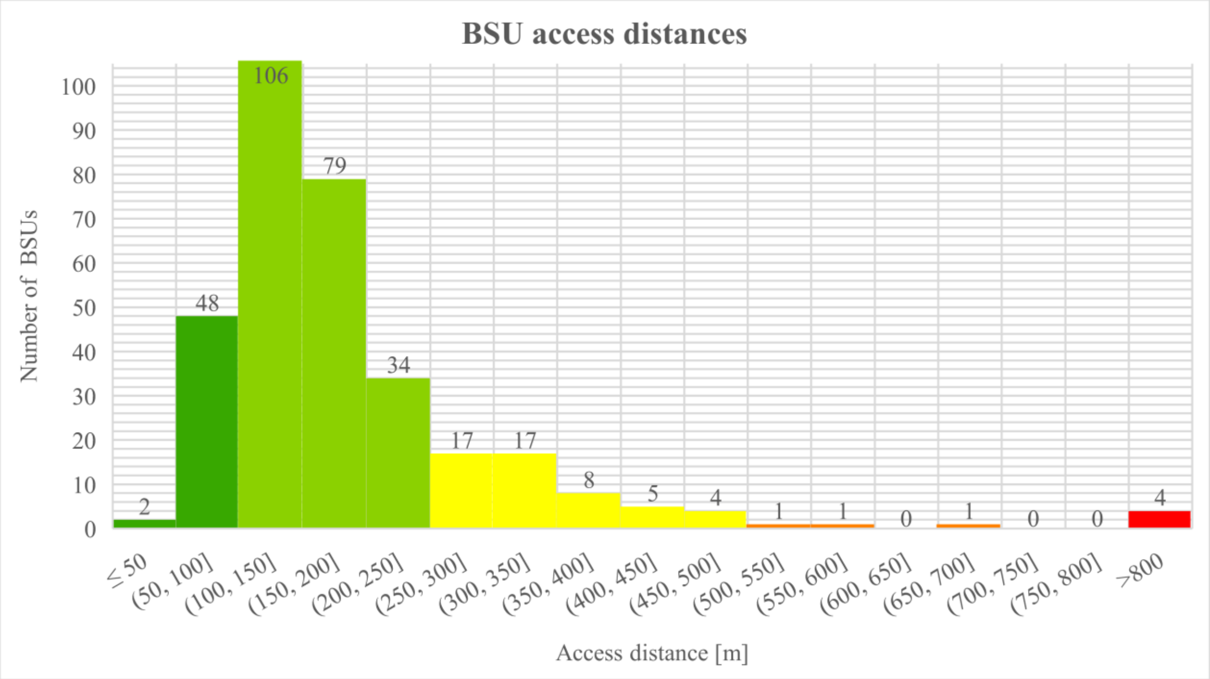


Chart 2 The histogram shows access distances in 50 m intervals and how many BSUs belong to each.

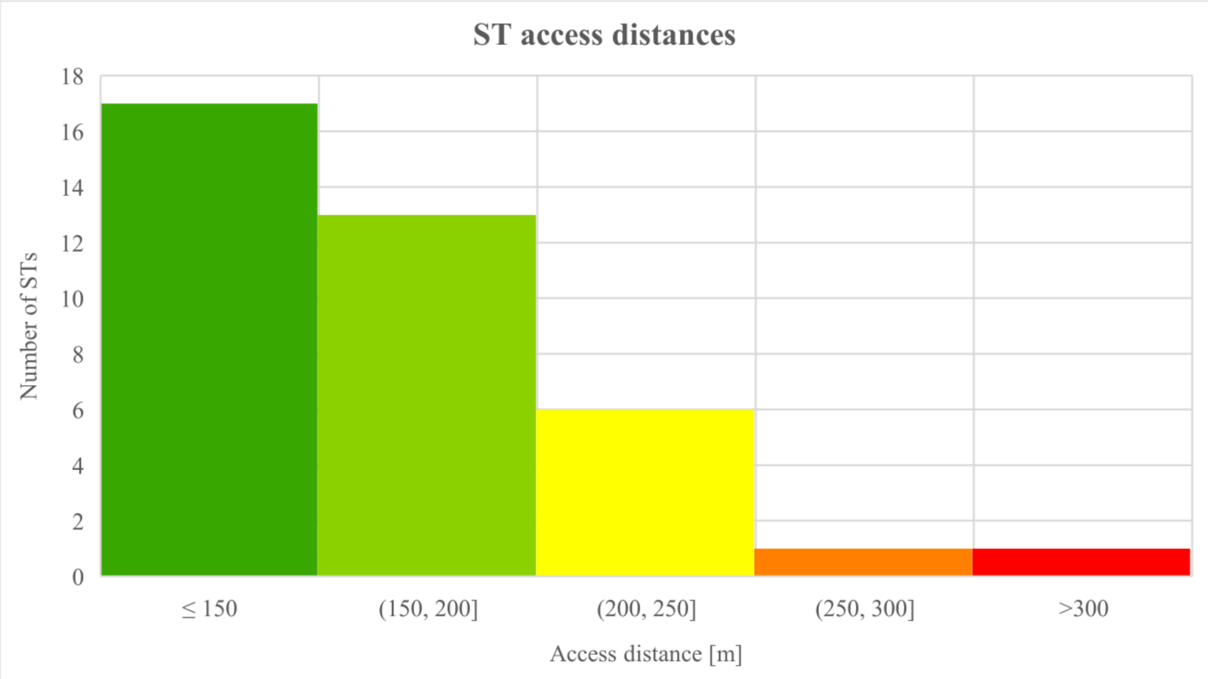


Chart 3 Histogram showing access distances in 50 m intervals and how many STs belong to each.

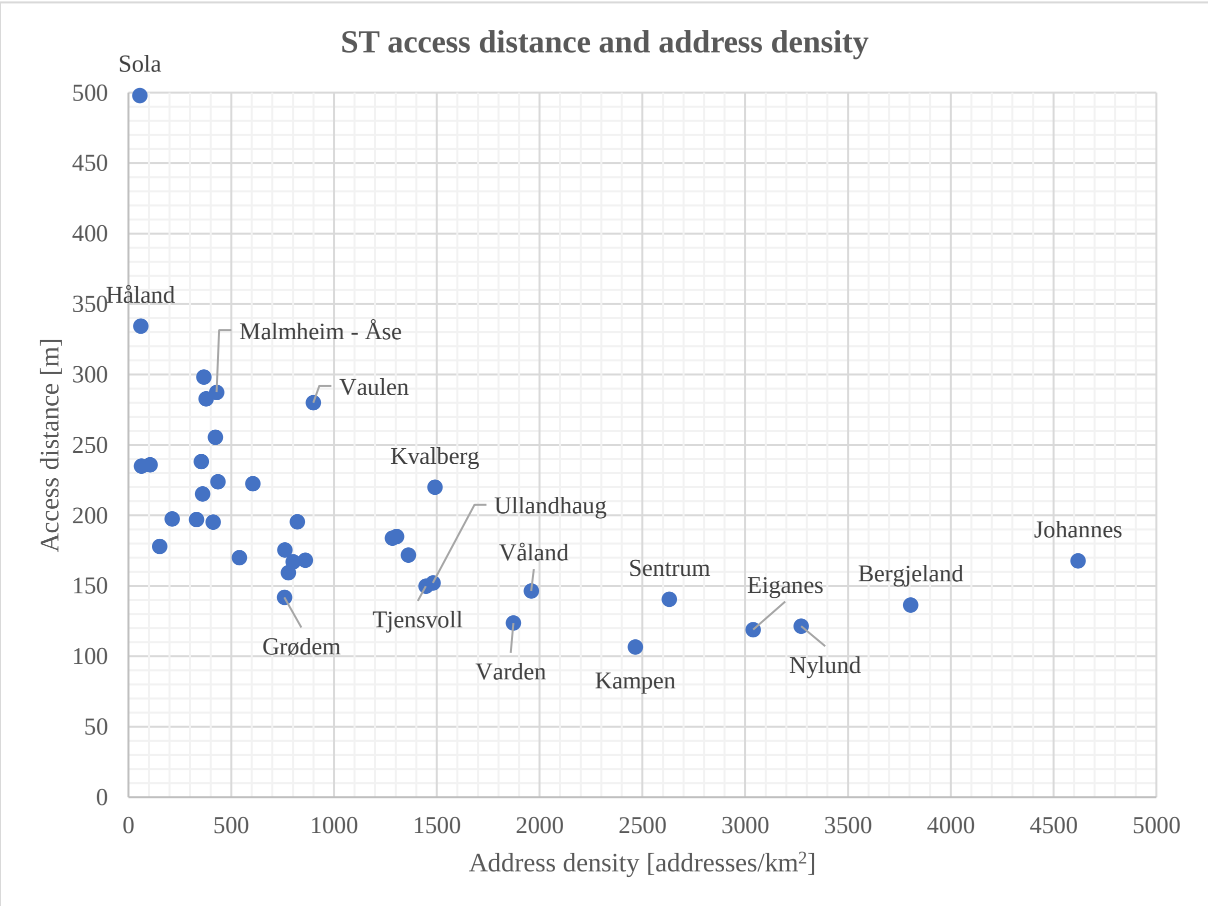


Chart 4 Scatter plot showing the coherence between access distance and address density in STs. Correlation = -0.47.

A14.2 Service coverage

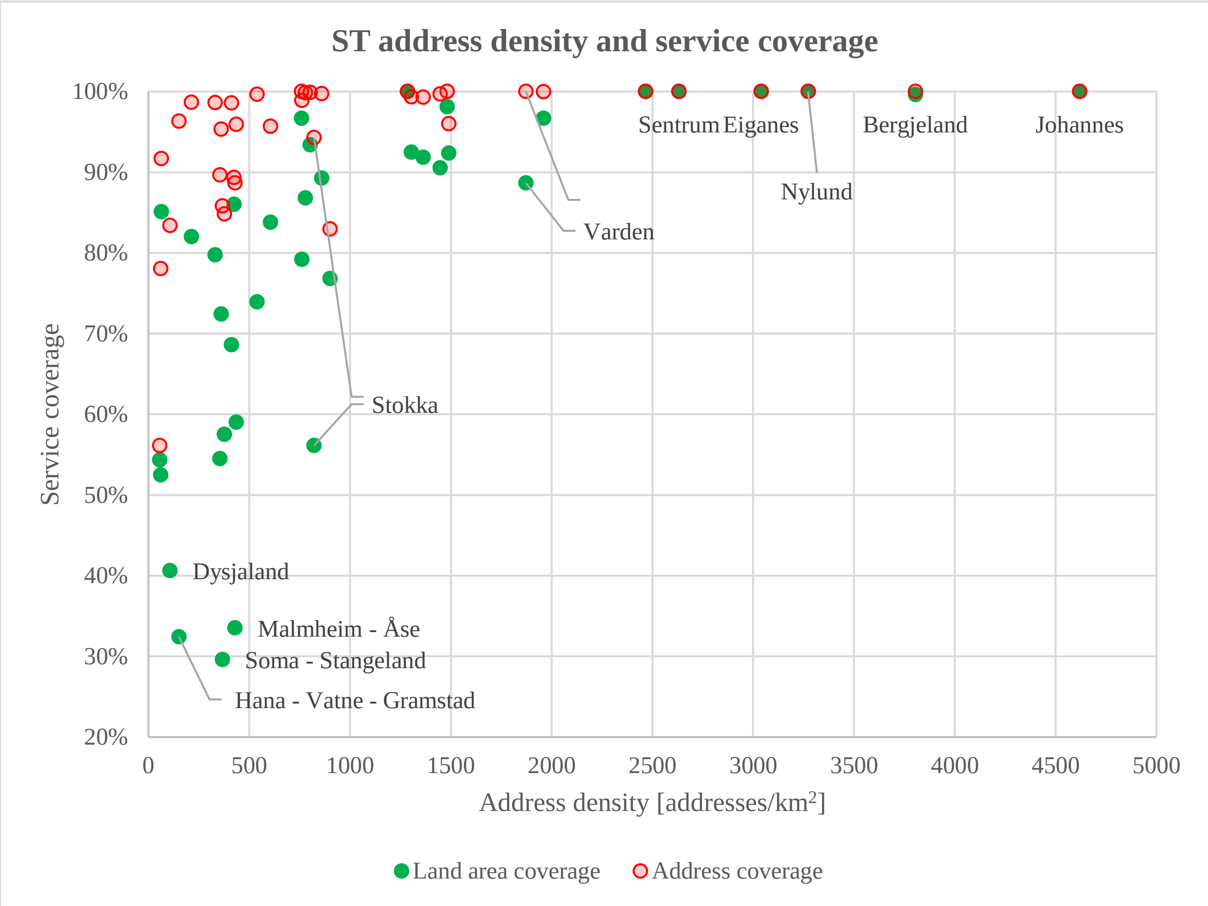


Chart 5 STs' land area and address service coverage plotted against address density. Correlation address density and land area coverage = 0.64. Correlation address density and address coverage = 0.45.

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A14.3 Travel time

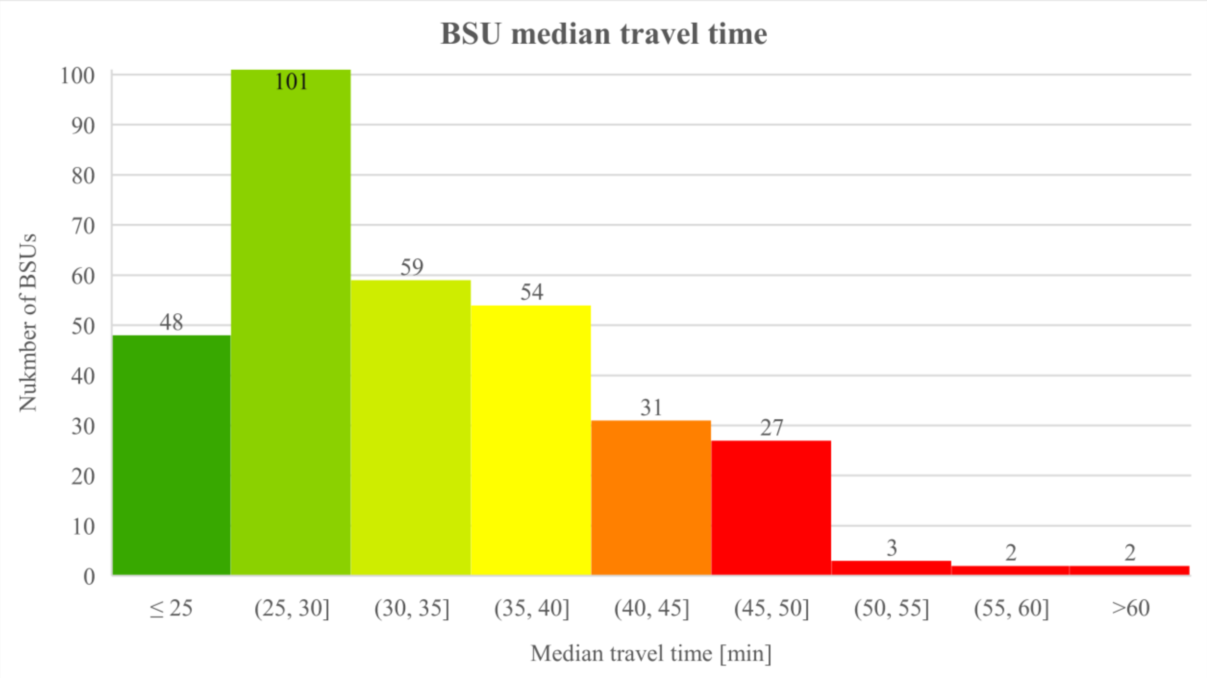

Chart 6 Number of BSUs in each interval for median travel time to all BSUs.

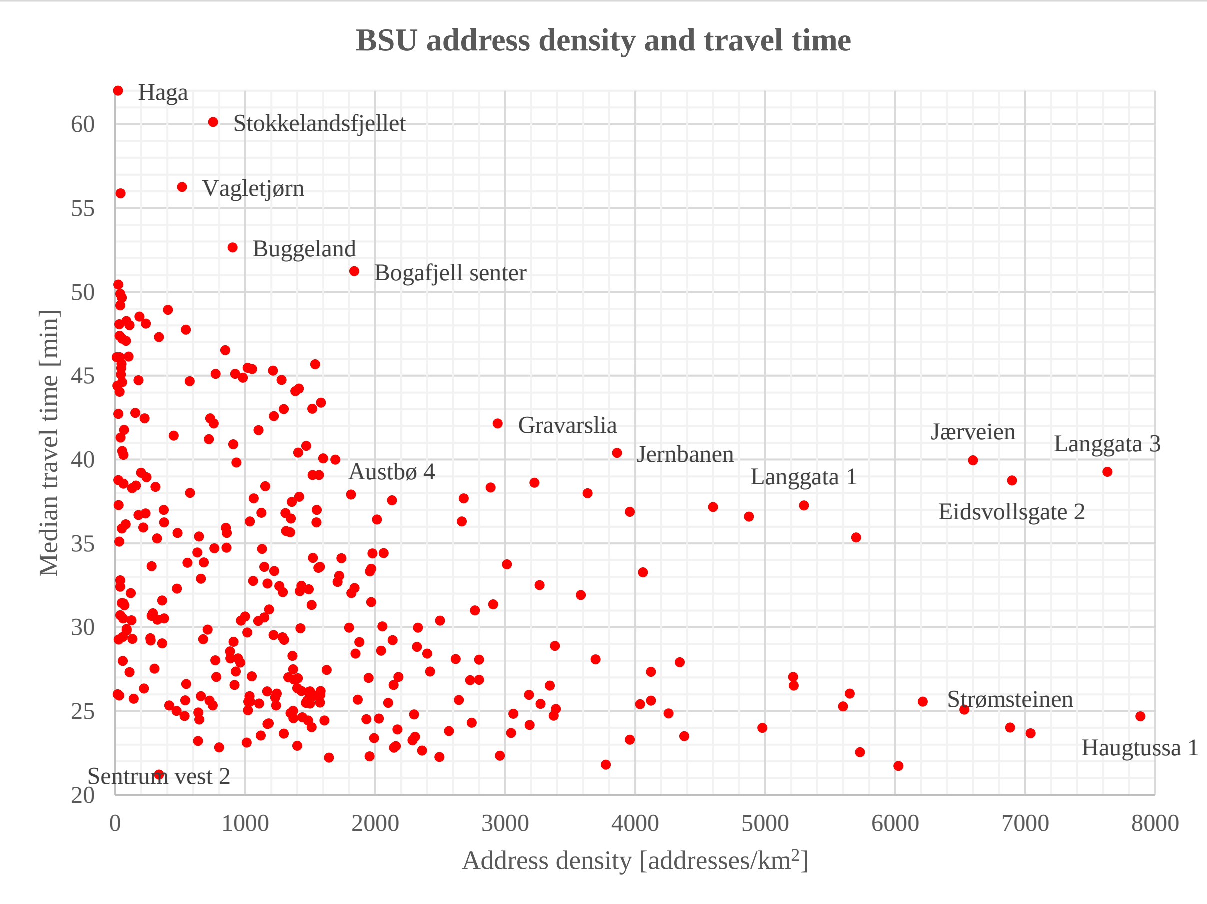

Chart 7 Address density and median travel times of BSUs. Correlation = -0.33.

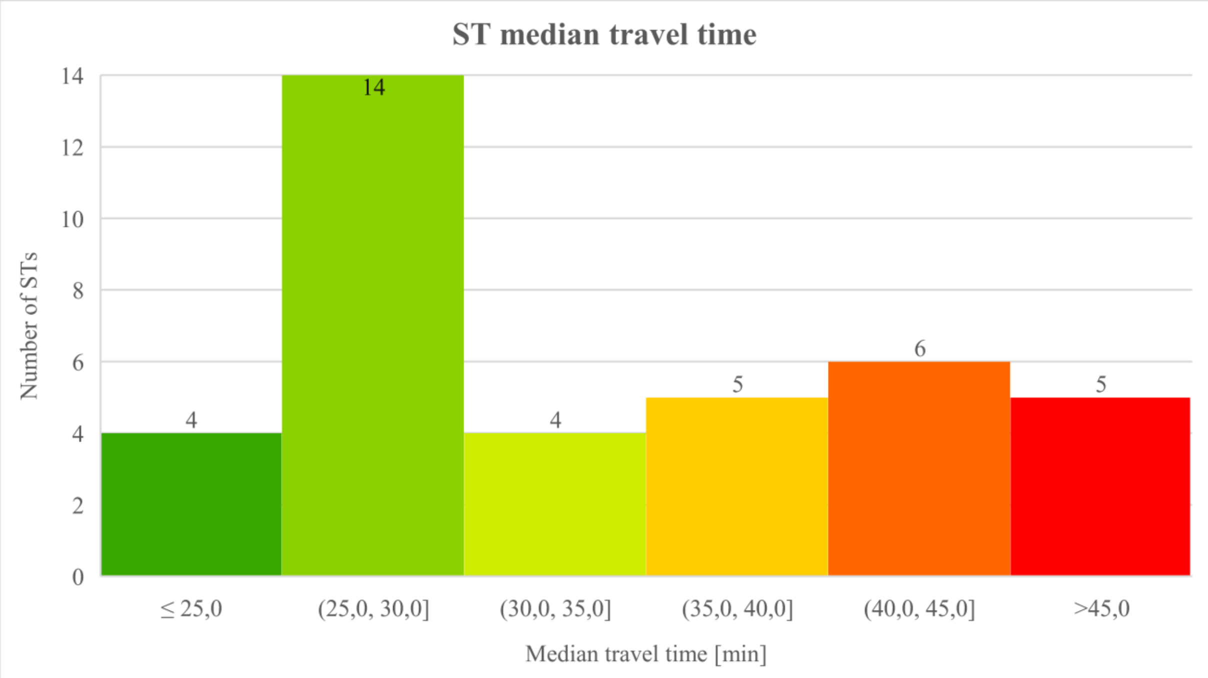

Chart 8 Number of STs in each interval for median travel time to other STs.

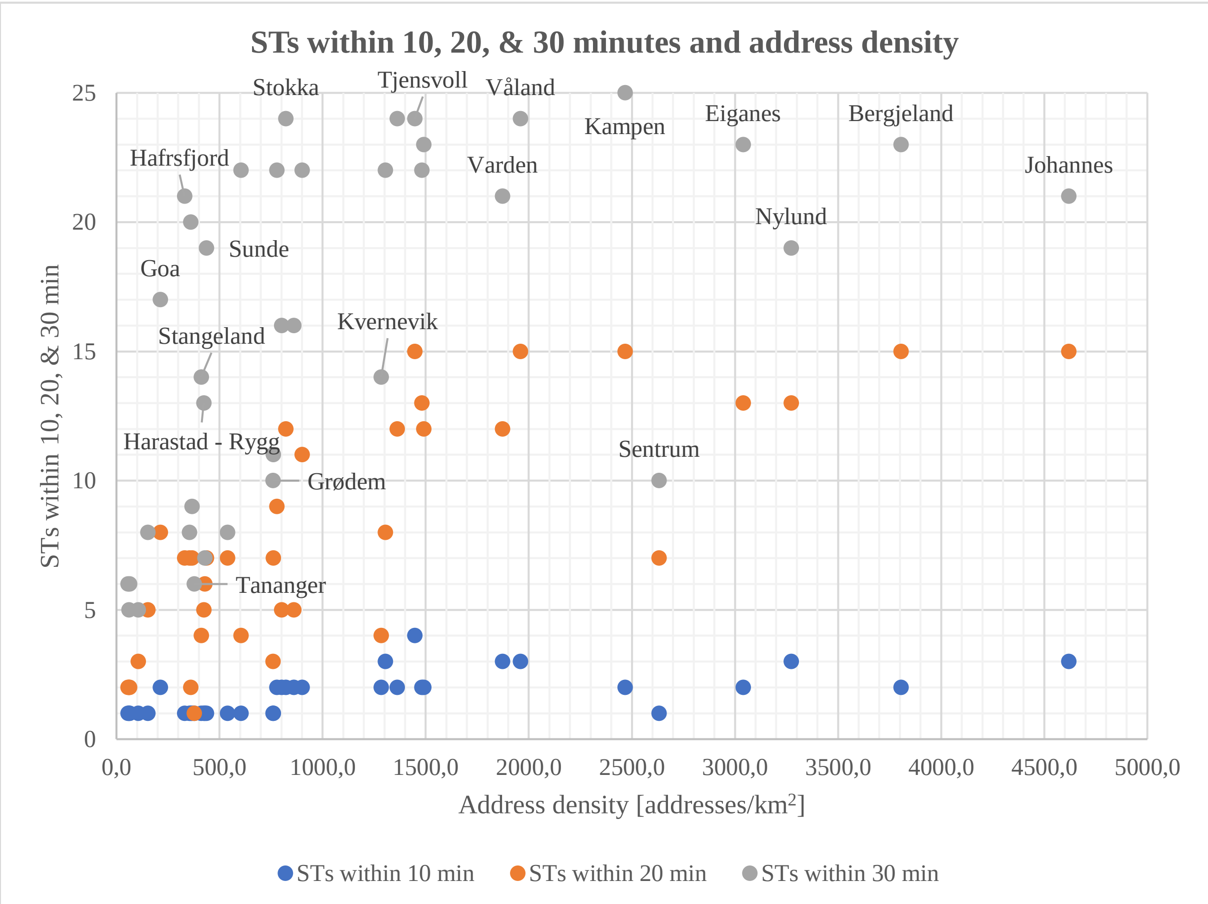

Chart 9 Number of STs that can be reached from each ST by travelling 10, 20, or 30 minutes, and the address density in each ST. Correlations = 0.61, 0,75, and 0.53 respectively.

A14.4 Frequency

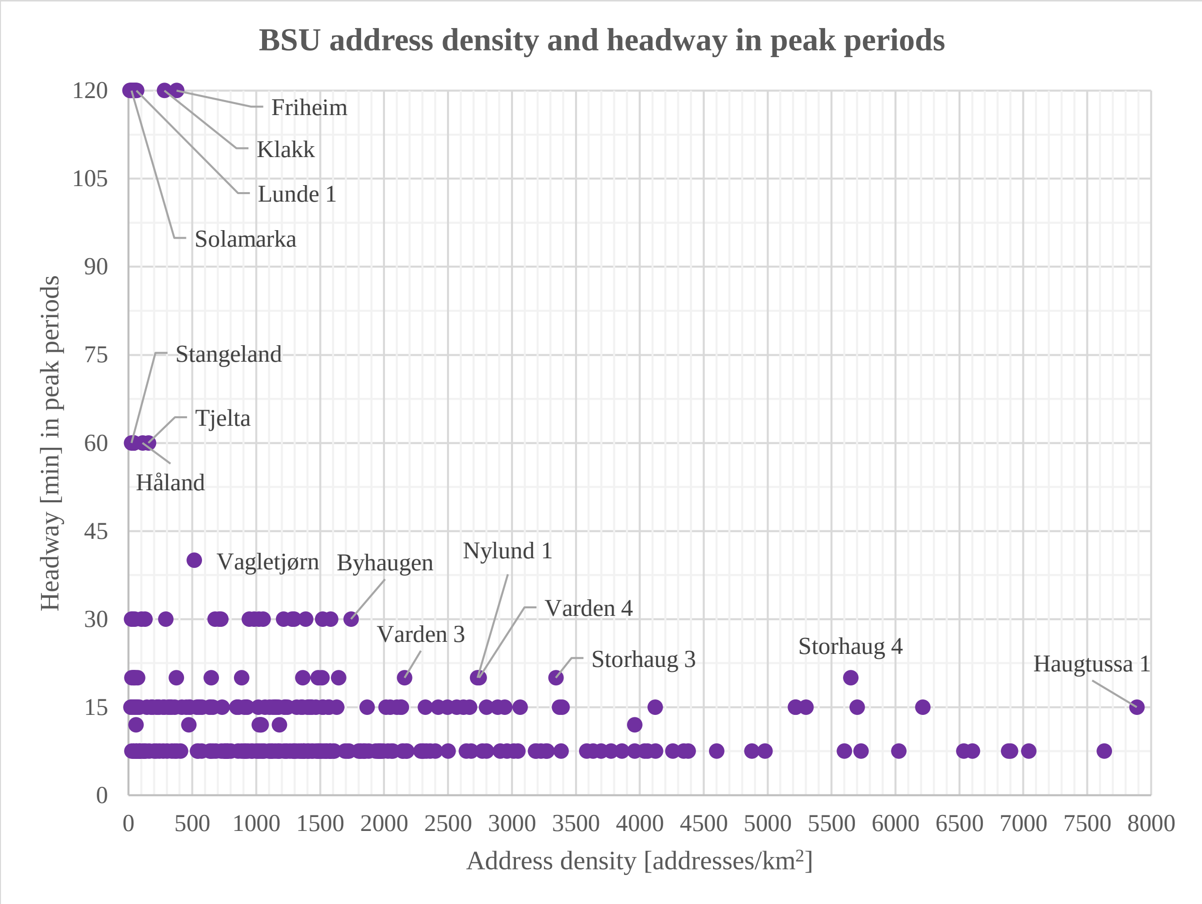

Chart 10 Peak period headway and address density in BSUs. Correlation = -0.26. The low coherence is because of few headway variables.

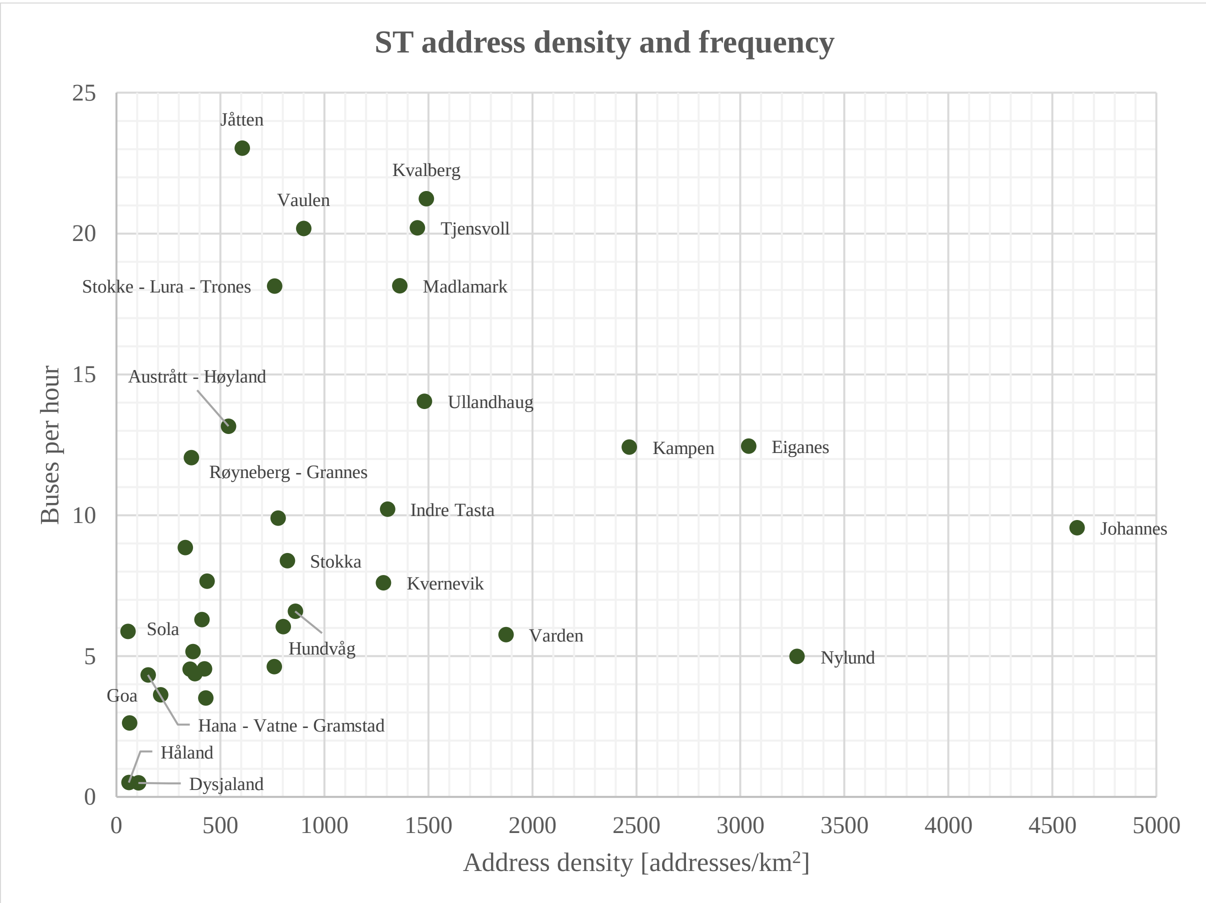

Chart 11 Average number of buses per hour and density in STs. Correlation = 0.50.

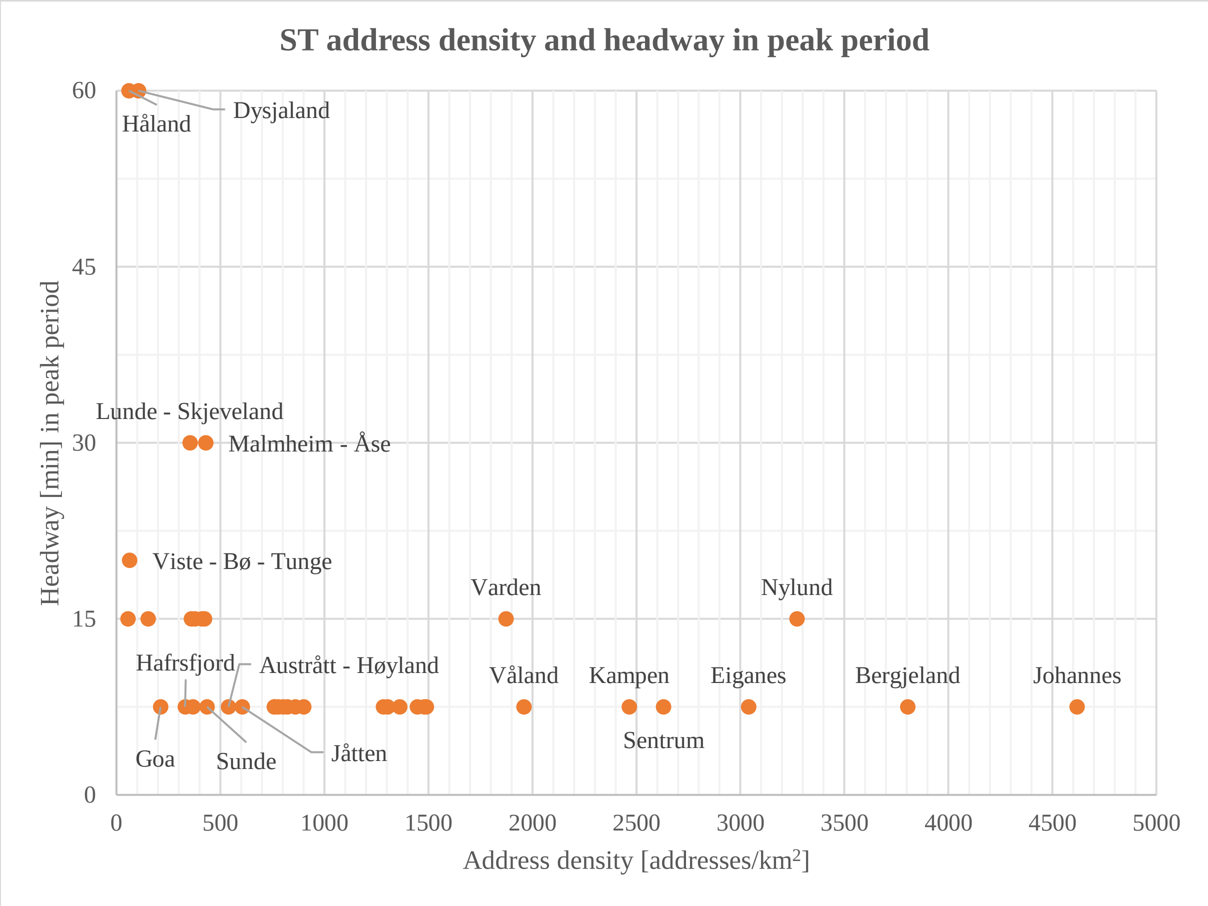

Chart 12 ST peak period headway and address density. Correlation = -0,33. The low correlation is mainly because 65.8 % (n = 25) of the STs have headways of 7.5 minutes.

A14.5 Service span

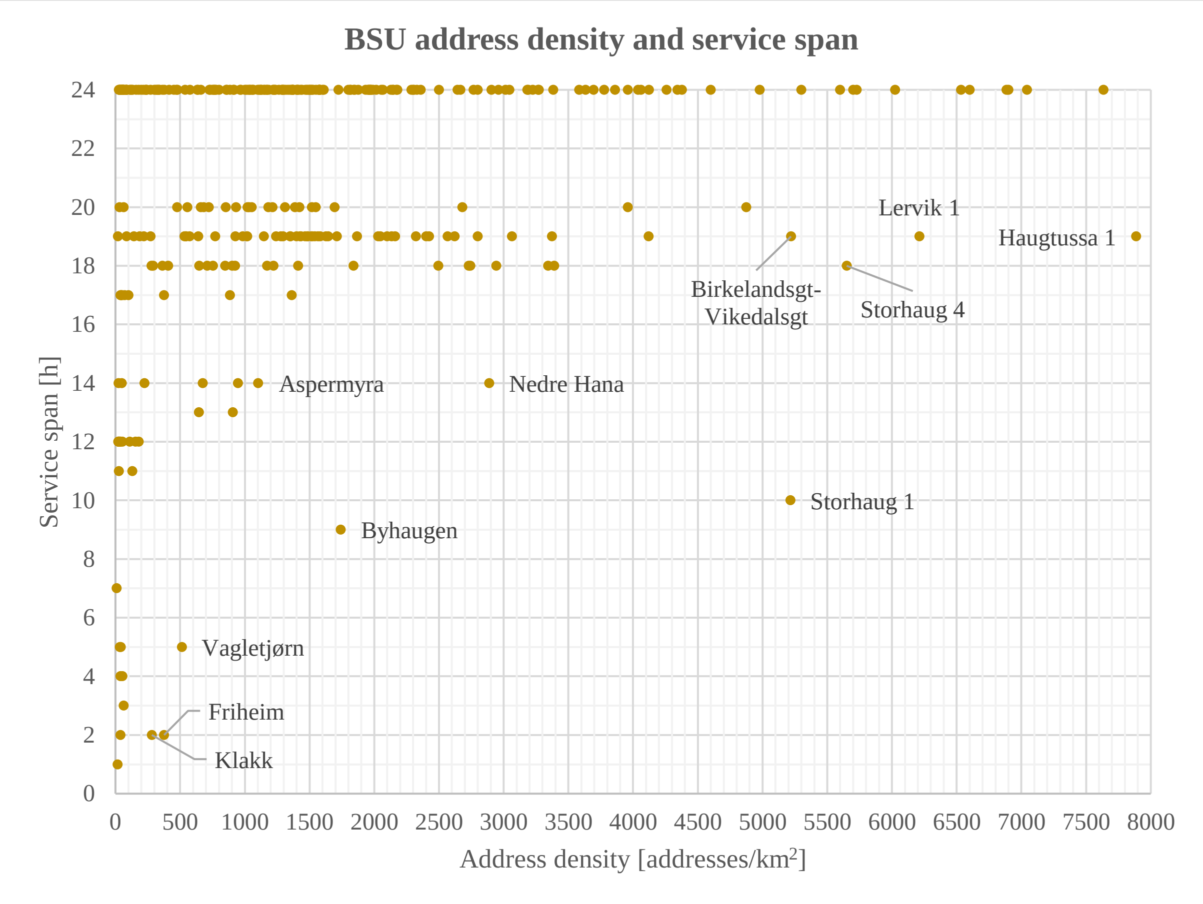

Chart 13 Density and service span in BSUs. Correlation = 0.24. The correlation is low because many BSUs achieve the maximum score of 24 hours of service.

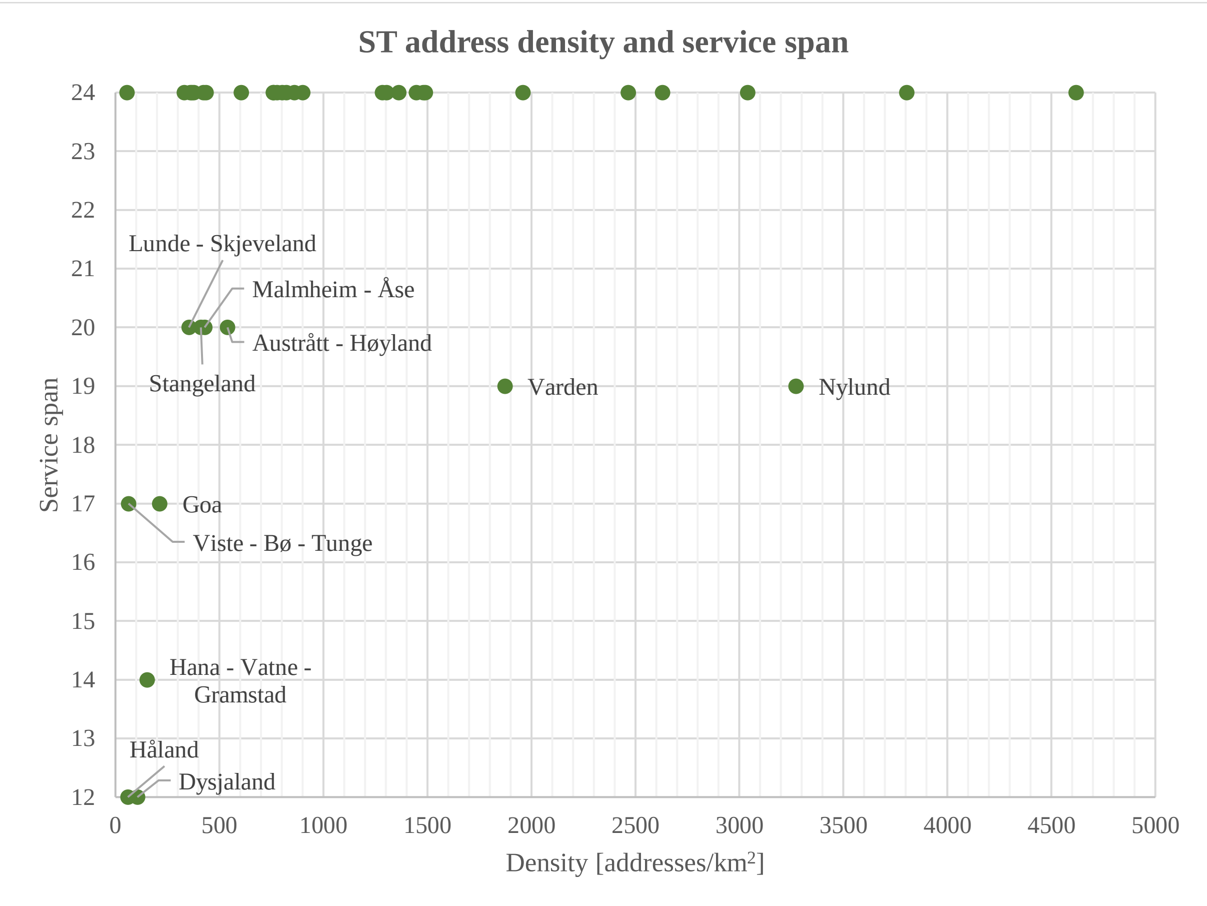

Chart 14 Address density and service spans in STs. Correlation = 0.32. Low correlation due to many max y-values.

Appendix 15 - BSU IV travel distance OD matrix

The OD matrix shows in-vehicle travel distances in km between BSUs.

Appendix 16 - BSU travel distance OD matrix

The OD matrix shows access distances plus in-vehicle travel distances in km between BSUs.

Appendix 17 - BSU IV travel time OD matrix

The OD matrix shows in-vehicle travel times in minutes between BSUs.

Appendix 18 - BSU travel time OD matrix

From/to	[illegible]

The OD matrix shows access times plus in-vehicle travel times in minutes between BSUs.

Appendix 19 - ST IV travel distance OD matrix

To/from	11030100	11030200	11030300	11030400	11030500	11030600	11030700	11030800	11030900	11031200	11031700	11031800	11031900	11032000	11032100	11032200	11032300	11032400	11032500	11032600	11032700	11080100	11080200	11080300	11080400	11080500	11080600	11080700	11240100	11240200	11240300	11240400	11240500	11240600	11270100	11270200	11270300	11270400	STs within 5 km	STs within 10 km	STs within 15 km
11030100		4,2	6,2	5,2	8,0	7,4	8,7	9,1	8,5	1,7	13,6	9,9	8,5	10,7	9,4	10,3	12,1	17,4	13,0	10,2	11,2	20,1	18,3	20,5	22,6	24,1	23,1	24,5	19,7	22,4	27,4	24,8	19,2	15,1	15,7	15,9	16,0	21,9	3	13	20
11030200	4,2		2,1	1,1	3,7	3,5	4,6	5,7	4,2	4,1	9,5	5,8	4,4	6,5	5,1	6,1	7,9	13,2	8,7	6,9	7,0	16,0	14,2	16,4	18,5	20,0	19,0	20,4	15,5	18,3	23,3	20,7	15,1	11,0	11,5	11,7	11,8	17,7	10	20	26
11030300	6,2	2,1		1,5	2,0	3,0	3,5	5,8	3,7	6,0	8,5	4,8	3,3	5,6	5,7	6,4	9,0	13,3	9,9	6,9	6,4	15,0	13,1	15,4	17,4	18,9	18,0	19,3	16,7	17,2	22,2	19,7	14,0	10,0	10,9	11,2	11,2	17,1	9	21	28
11030400	5,2	1,1	1,5		3,4	4,3	4,0	6,0	5,2	5,0	8,9	5,2	3,8	6,0	6,3	7,2	9,0	14,3	9,9	7,1	7,9	15,4	13,6	15,8	17,9	19,4	18,4	19,8	16,6	17,7	22,7	20,2	14,5	10,4	12,4	12,7	12,7	18,6	7	20	27
11030500	8,0	3,7	2,0	3,4		1,7	4,0	4,8	2,4	7,8	8,9	5,2	3,8	5,3	4,4	5,1	7,7	12,0	8,6	5,7	5,1	15,4	13,6	15,8	17,9	19,4	18,4	19,8	15,4	17,7	22,7	20,1	14,5	10,4	9,6	9,9	9,9	15,8	10	23	27
11030600	7,4	3,5	3,0	4,3	1,7		4,2	4,6	2,2	7,1	8,8	5,1	3,7	4,6	3,9	4,4	7,0	11,8	7,9	5,5	4,9	15,3	13,5	15,4	17,8	19,3	18,3	19,5	14,7	17,6	22,5	20,1	14,0	10,3	9,4	9,6	9,7	15,6	13	23	28
11030700	8,7	4,6	3,5	4,0	4,0	4,2		5,3	5,4	8,5	8,3	5,8	4,4	2,6	5,5	4,3	6,9	12,1	7,8	6,5	8,1	14,8	12,6	14,2	16,9	18,3	17,8	18,3	14,6	14,8	19,4	17,6	11,2	7,9	12,4	12,8	12,9	18,8	9	21	31
11030800	9,1	5,7	5,8	6,0	4,8	4,6	5,3		5,1	8,8	11,2	8,0	6,6	5,1	2,2	5,0	7,5	10,7	8,4	2,1	3,8	17,7	14,7	17,1	19,0	20,5	19,9	21,3	15,2	18,6	23,2	21,5	13,9	11,8	8,4	8,9	9,0	14,9	7	22	28
11030900	8,5	4,2	3,7	5,2	2,4	2,2	5,4	5,1		8,4	10,0	6,3	4,9	5,6	3,4	5,4	7,5	9,6	8,4	3,3	3,5	16,6	14,7	17,1	19,0	20,5	19,6	20,9	15,1	18,8	23,7	21,3	15,2	11,5	7,2	8,6	7,5	13,4	9	23	27
11031200	1,7	4,1	6,0	5,0	7,8	7,1	8,5	8,8	8,4		13,4	9,7	8,3	10,5	9,3	10,2	12,0	17,3	12,8	10,0	11,1	19,9	18,1	20,3	22,4	23,9	23,0	24,3	19,6	22,2	27,2	24,7	19,0	14,9	15,6	15,8	15,9	21,8	3	13	21
11031700	13,6	9,5	8,5	8,9	8,9	8,8	8,3	11,2	10,0	13,4		3,7	5,1	8,5	10,6	9,1	10,9	16,0	11,8	12,4	12,8	8,2	6,3	8,7	10,6	12,1	11,2	12,5	18,6	14,1	18,8	17,0	9,1	7,8	16,3	17,5	17,6	23,5	2	16	30
11031800	9,9	5,8	4,8	5,2	5,2	5,1	5,8	8,0	6,3	9,7	3,7		1,4	5,7	8,1	7,7	10,3	15,3	11,1	9,2	9,1	10,2	8,4	10,8	12,7	14,2	13,2	14,6	17,9	16,2	20,8	18,9	11,2	9,2	13,5	13,8	13,9	19,8	4	20	32
11031900	8,5	4,4	3,3	3,8	3,8	3,7	4,4	6,6	4,9	8,3	5,1	1,4		4,3	6,7	6,3	8,8	13,9	9,7	7,8	7,6	11,6	9,8	12,2	14,1	15,6	14,7	16,0	16,5	16,6	21,5	19,1	12,5	9,3	12,1	12,3	12,4	18,3	10	22	31
11032000	10,7	6,5	5,6	6,0	5,3	4,6	2,6	5,1	5,6	10,5	8,5	5,7	4,3		2,9	2,5	4,5	9,6	5,4	7,2	8,3	15,0	12,9	14,5	17,2	18,6	18,0	18,6	12,2	14,0	18,7	17,4	10,5	7,7	10,0	13,2	12,3	18,2	7	21	31
11032100	9,4	5,1	5,7	6,3	4,4	3,9	5,5	2,2	3,4	9,3	10,6	8,1	6,7	2,9		2,8	5,3	10,2	6,2	4,3	5,9	17,1	15,2	16,8	19,5	20,9	20,1	20,9	13,0	16,4	21,0	19,3	12,8	9,6	9,8	11,0	10,2	16,1	8	21	27
11032200	10,3	6,1	6,4	7,2	5,1	4,4	4,3	5,0	5,4	10,2	9,1	7,7	6,3	2,5	2,8		3,4	8,7	4,3	7,1	8,1	14,7	12,5	14,0	16,8	18,2	17,6	18,1	11,1	13,6	18,2	17,8	10,0	8,1	8,9	13,1	12,2	18,1	8	21	31
11032300	12,1	7,9	9,0	9,0	7,7	7,0	6,9	7,5	7,5	12,0	10,9	10,3	8,8	4,5	5,3	3,4		6,6	3,4	9,6	10,2	17,4	15,6	17,4	19,8	21,4	20,4	21,5	10,1	14,2	21,6	19,6	13,4	9,9	7,0	15,2	11,6	16,6	4	18	27
11032400	17,4	13,2	13,3	14,3	12,0	11,8	12,1	10,7	9,6	17,3	16,0	15,3	13,9	9,6	10,2	8,7	6,6		4,8	8,6	8,7	22,5	20,6	22,8	24,9	26,4	25,5	26,8	11,6	14,6	27,0	24,7	18,8	15,0	2,4	10,6	6,9	12,0	3	10	24
11032500	13,0	8,7	9,9	9,9	8,6	7,9	7,8	8,4	8,4	12,8	11,8	11,1	9,7	5,4	6,2	4,3	3,4	4,8		10,5	10,9	18,3	16,4	18,3	20,7	22,2	21,3	22,4	6,8	12,4	22,5	20,5	14,3	10,8	4,6	12,9	9,2	14,3	5	18	29
11032600	10,2	6,9	6,9	7,1	5,7	5,5	6,5	2,1	3,3	10,0	12,4	9,2	7,8	7,2	4,3	7,1	9,6	8,6	10,5		1,6	18,9	16,7	18,3	21,0	22,4	21,9	22,4	15,9	20,5	25,2	23,6	16,1	13,9	6,2	6,7	6,8	12,7	5	20	26
11032700	11,2	7,0	6,4	7,9	5,1	4,9	8,1	3,8	3,5	11,1	12,8	9,1	7,6	8,3	5,9	8,1	10,2	8,7	10,9	1,6		19,3	17,4	19,8	21,7	23,2	22,3	23,6	16,0	21,3	26,4	24,0	17,7	14,2	6,3	5,1	6,6	12,5	5	19	26
11080100	20,1	16,0	15,0	15,4	15,4	15,3	14,8	17,7	16,6	19,9	8,2	10,2	11,6	15,0	17,1	14,7	17,4	22,5	18,3	18,9	19,3		3,7	3,2	3,8	3,9	3,0	4,9	22,4	17,1	21,7	19,9	12,1	14,4	22,8	24,0	24,1	30,0	7	8	16
11080200	18,3	14,2	13,1	13,6	13,6	13,5	12,6	14,7	14,7	18,1	6,3	8,4	9,8	12,9	15,2	12,5	15,6	20,6	16,4	16,7	17,4	3,7		2,9	4,3	5,8	5,1	8,0	19,0	13,7	18,3	16,5	8,7	12,5	21,0	22,1	22,2	28,1	4	11	23
11080300	20,5	16,4	15,4	15,8	15,8	15,4	14,2	17,1	17,1	20,3	8,7	10,8	12,2	14,5	16,8	14,0	17,4	22,8	18,3	18,3	19,8	3,2	2,9		3,5	4,3	4,4	6,5	20,6	15,4	20,0	18,2	10,4	14,6	22,9	24,5	24,6	30,5	6	8	15
11080400	22,6	18,5	17,4	17,9	17,9	17,8	16,9	19,0	19,0	22,4	10,6	12,7	14,1	17,2	19,5	16,8	19,8	24,9	20,7	21,0	21,7	3,8	4,3	3,5		6,4	4,9	7,8	23,3	18,0	22,6	20,8	13,0	16,8	25,3	26,4	26,5	32,4	5	7	11
11080500	24,1	20,0	18,9	19,4	19,4	19,3	18,3	20,5	20,5	23,9	12,1	14,2	15,6	18,6	20,9	18,2	21,4	26,4	22,2	22,4	23,2	3,9	5,8	4,3	6,4		5,8	8,1	24,8	19,5	24,1	22,3	14,5	18,3	26,8	27,9	28,0	33,9	3	7	10
11080600	23,1	19,0	18,0	18,4	18,4	18,3	17,8	19,9	19,6	23,0	11,2	13,2	14,7	18,0	20,1	17,6	20,4	25,5	21,3	21,9	22,3	3,0	5,1	4,4	4,9	5,8		7,2	24,1	18,9	23,5	21,7	13,9	17,4	25,8	27,0	27,1	33,0	4	7	11
11080700	24,5	20,4	19,3	19,8	19,8	19,5	18,3	21,3	20,9	24,3	12,5	14,6	16,0	18,6	20,9	18,1	21,5	26,8	22,4	22,4	23,6	4,9	8,0	6,5	7,8	8,1	7,2		26,5	21,2	25,8	24,0	16,2	18,7	27,0	28,3	28,4	34,3	2	7	9
11240100	19,7	15,5	16,7	16,6	15,4	14,7	14,6	15,2	15,1	19,6	18,6	17,9	16,5	12,2	13,0	11,1	10,1	11,6	6,8	15,9	16,0	22,4	19,0	20,6	23,3	24,8	24,1	26,5		8,8	18,5	16,2	10,3	12,5	9,7	17,9	14,3	19,3	1	4	14
11240200	22,4	18,3	17,2	17,7	17,7	17,6	14,8	18,6	18,8	22,2	14,1	16,2	16,6	14,0	16,4	13,6	14,2	14,6	12,4	20,5	21,3	17,1	13,7	15,4	18,0	19,5	18,9	21,2	8,8		13,2	10,9	5,0	7,3	15,0	23,2	19,5	24,6	2	4	15
11240300	27,4	23,3	22,2	22,7	22,7	22,5	19,4	23,2	23,7	27,2	18,8	20,8	21,5	18,7	21,0	18,2	21,6	27,0	22,5	25,2	26,4	21,7	18,3	20,0	22,6	24,1	23,5	25,8	18,5	13,2		6,7	9,6	13,1	27,1	31,3	30,4	36,3	1	3	5
11240400	24,8	20,7	19,7	20,2	20,1	20,1	17,6	21,5	21,3	24,7	17,0	18,9	19,1	17,4	19,3	17,8	19,6	24,7	20,5	23,6	24,0	19,9	16,5	18,2	20,8	22,3	21,7	24,0	16,2	10,9	6,7		9,4	9,7	25,0	28,7	28,0	33,9	1	4	5
11240500	19,2	15,1	14,0	14,5	14,5	14,0	11,2	13,9	15,2	19,0	9,1	11,2	12,5	10,5	12,8	10,0	13,4	18,8	14,3	16,1	17,7	12,1	8,7	10,4	13,0	14,5	13,9	16,2	10,3	5,0	9,6	9,4		5,8	18,9	22,7	22,2	28,1	2	7	26
11240600	15,1	11,0	10,0	10,4	10,4	10,3	7,9	11,8	11,5	14,9	7,8	9,2	9,3	7,7	9,6	8,1	9,9	15,0	10,8	13,9	14,2	14,4	12,5	14,6	16,8	18,3	17,4	18,7	12,5	7,3	13,1	9,7	5,8		15,3	19,0	18,3	24,2	1	13	29
11270100	15,7	11,5	10,9	12,4	9,6	9,4	12,4	8,4	7,2	15,6	16,3	13,5	12,1	10,0	9,8	8,9	7,0	2,4	4,6	6,2	6,3	22,8	21,0	22,9	25,3	26,8	25,8	27,0	9,7	15,0	27,1	25,0	18,9	15,3		8,3	4,6	9,7	4	17	24
11270200	15,9	11,7	11,2	12,7	9,9	9,6	12,8	8,9	8,6	15,8	17,5	13,8	12,3	13,2	11,0	13,1	15,2	10,6	12,9	6,7	5,1	24,0	22,1	24,5	26,4	27,9	27,0	28,3	17,9	23,2	31,3	28,7	22,7	19,0	8,3		3,7	9,6	2	10	21
11270300	16,0	11,8	11,2	12,7	9,9	9,7	12,9	9,0	7,5	15,9	17,6	13,9	12,4	12,3	10,2	12,2	11,6	6,9	9,2	6,8	6,6	24,1	22,2	24,6	26,5	28,0	27,1	28,4	14,3	19,5	30,4	28,0	22,2	18,3	4,6	3,7		5,9	3	12	23
11270400	21,9	17,7	17,1	18,6	15,8	15,6	18,8	14,9	13,4	21,8	23,5	19,8	18,3	18,2	16,1	18,1	16,6	12,0	14,3	12,7	12,5	30,0	28,1	30,5	32,4	33,9	33,0	34,3	19,3	24,6	36,3	33,9	28,1	24,2	9,7	9,6	5,9		1	4	10
Total	536,3	395,4	381,1	400,3	376,1	368,3	375,8	401,5	383,7	530,7	432,2	386,6	368,0	370,3	388,0	367,6	432,4	547,2	441,6	432,1	449,8	570,5	510,4	568,6	644,4	694,0	664,5	718,6	601,0	610,3	818,1	744,7	517,7	466,7	515,6	593,2	564,3	771,9	190	538	844
Average	14,1	10,4	10,0	10,5	9,9	9,7	9,9	10,6	10,1	14,0	11,4	10,2	9,7	9,7	10,2	9,7	11,4	14,4	11,6	11,4	11,8	15,0	13,4	15,0	17,0	18,3	17,5	18,9	15,8	16,1	21,5	19,6	13,6	12,3	13,6	15,6	14,8	20,3	5,0	14,2	22,2
Median	13,3	9,1	9,5	9,4	8,8	8,4	8,4	8,9	8,4	13,1	10,8	9,8	9,1	9,0	9,5	8,8	10,2	13,2	10,6	9,4	9,6	15,7	13,6	15,8	17,9	19,4	18,7	20,1	16,0	16,8	22,5	20,1	13,9	11,7	11,8	13,2	12,6	18,5	4,0	14,5	26,0

The OD matrix shows in-vehicle travel distances in km between STs.

Appendix 20 - ST travel distance OD matrix

To/from	11030100	11030200	11030300	11030400	11030500	11030600	11030700	11030800	11030900	11031200	11031700	11031800	11031900	11032000	11032100	11032200	11032300	11032400	11032500	11032600	11032700	11080100	11080200	11080300	11080400	11080500	11080600	11080700	11240100	11240200	11240300	11240400	11240500	11240600	11270100	11270200	11270300	11270400	STs within 5 km	STs within 10 km	STs within 15 km
11030100		4,5	6,4	5,5	8,2	7,6	8,9	9,3	8,7	2,0	13,9	10,2	8,8	10,9	9,7	10,6	12,4	17,7	13,3	10,5	11,5	20,4	18,5	20,9	22,9	24,4	23,4	24,7	20,1	22,9	27,8	25,1	19,5	15,4	16,0	16,2	16,3	22,2	3	12	20
11030200	4,5		2,4	1,4	4,0	3,8	4,9	6,0	4,5	4,4	9,9	6,2	4,7	6,8	5,5	6,4	8,2	13,5	9,1	7,2	7,3	16,3	14,5	16,8	18,8	20,3	19,3	20,6	15,9	18,8	23,7	21,0	15,4	11,3	11,8	12,0	12,2	18,0	10	20	26
11030300	6,4	2,4		1,7	2,3	3,2	3,8	6,0	3,9	6,3	8,8	5,1	3,6	5,8	6,0	6,7	9,3	13,6	10,2	7,2	6,7	15,2	13,4	15,7	17,7	19,2	18,3	19,6	17,0	17,8	22,6	19,9	14,3	10,3	11,2	11,4	11,6	17,5	8	19	27
11030400	5,5	1,4	1,7		3,6	4,5	4,3	6,2	5,4	5,3	9,2	5,5	4,1	6,2	6,5	7,5	9,3	14,6	10,2	7,4	8,2	15,7	13,8	16,2	18,2	19,7	18,7	20,0	17,0	18,2	23,1	20,4	14,8	10,7	12,7	12,9	13,1	18,9	7	19	27
11030500	8,2	4,0	2,3	3,6		1,9	4,2	5,1	2,6	8,1	9,2	5,5	4,1	5,5	4,7	5,4	8,0	12,3	8,9	6,0	5,4	15,7	13,8	16,2	18,2	19,7	18,7	20,0	15,7	18,2	23,0	20,4	14,8	10,7	9,9	10,1	10,3	16,2	9	21	27
11030600	7,6	3,8	3,2	4,5	1,9		4,5	4,9	2,4	7,4	9,1	5,4	4,0	4,8	4,2	4,7	7,3	12,1	8,2	5,8	5,2	15,6	13,8	15,8	18,1	19,6	18,6	19,8	15,0	18,1	22,9	20,3	14,3	10,6	9,7	9,9	10,1	15,9	12	22	27
11030700	8,9	4,9	3,8	4,3	4,2	4,5		5,6	5,6	8,8	8,6	6,1	4,7	2,9	5,8	4,6	7,2	12,4	8,1	6,8	8,4	15,0	12,9	14,6	17,3	18,7	18,1	18,6	14,9	15,3	19,8	17,9	11,5	8,2	12,7	13,1	13,3	19,1	9	21	29
11030800	9,3	6,0	6,0	6,2	5,1	4,9	5,6		5,3	9,1	11,5	8,3	6,9	5,3	2,5	5,2	7,8	11,0	8,7	2,4	4,0	18,0	15,0	17,4	19,3	20,8	20,1	21,5	15,5	19,1	23,6	21,7	14,2	12,1	8,6	9,1	9,3	15,2	5	22	27
11030900	8,7	4,5	3,9	5,4	2,6	2,4	5,6	5,3		8,6	10,3	6,6	5,2	5,8	3,7	5,7	7,8	9,8	8,7	3,6	3,7	16,8	14,9	17,4	19,3	20,8	19,8	21,1	15,5	19,3	24,0	21,5	15,5	11,8	7,5	8,8	7,8	13,7	8	23	27
11031200	2,0	4,4	6,3	5,3	8,1	7,4	8,8	9,1	8,6		13,8	10,1	8,6	10,8	9,6	10,5	12,3	17,6	13,2	10,3	11,4	20,2	18,4	20,7	22,7	24,2	23,3	24,5	20,0	22,8	27,6	24,9	19,3	15,3	15,9	16,1	16,2	22,1	3	12	20
11031700	13,9	9,9	8,8	9,2	9,2	9,1	8,6	11,5	10,3	13,8		4,1	5,5	8,8	10,9	9,5	11,3	16,4	12,2	12,7	13,1	8,5	6,7	9,1	11,0	12,5	11,5	12,8	19,0	14,7	19,2	17,3	9,5	8,2	16,7	17,8	18,0	23,9	2	16	30
11031800	10,2	6,2	5,1	5,5	5,5	5,4	6,1	8,3	6,6	10,1	4,1		1,8	6,1	8,4	8,1	10,6	15,7	11,6	9,6	9,4	10,6	8,7	11,2	13,1	14,6	13,6	14,9	18,4	16,8	21,3	19,3	11,6	9,6	13,9	14,1	14,3	20,2	3	18	32
11031900	8,8	4,7	3,6	4,1	4,1	4,0	4,7	6,9	5,2	8,6	5,5	1,8		4,6	7,0	6,6	9,2	14,3	10,1	8,1	8,0	12,0	10,1	12,6	14,5	16,0	15,0	16,3	16,9	17,2	22,0	19,4	12,9	9,7	12,5	12,7	12,8	18,7	9	20	30
11032000	10,9	6,8	5,8	6,2	5,5	4,8	2,9	5,3	5,8	10,8	8,8	6,1	4,6		3,2	2,8	4,8	9,9	5,7	7,5	8,5	15,2	13,2	14,8	17,5	18,9	18,3	18,8	12,5	14,6	19,1	17,7	10,8	8,0	10,3	13,5	12,7	18,5	7	20	30
11032100	9,7	5,5	6,0	6,5	4,7	4,2	5,8	2,5	3,7	9,6	10,9	8,4	7,0	3,2		3,1	5,7	10,5	6,6	4,6	6,2	17,4	15,5	17,2	19,9	21,3	20,4	21,2	13,4	16,9	21,4	19,6	13,1	9,9	10,2	11,3	10,5	16,4	8	20	27
11032200	10,6	6,4	6,7	7,5	5,4	4,7	4,6	5,2	5,7	10,5	9,5	8,1	6,6	2,8	3,1		3,7	9,0	4,6	7,4	8,4	15,0	12,8	14,4	17,1	18,5	17,9	18,4	11,4	14,1	18,6	18,1	10,3	8,4	9,2	13,4	12,5	18,4	7	21	31
11032300	12,4	8,2	9,3	9,3	8,0	7,3	7,2	7,8	7,8	12,3	11,3	10,6	9,2	4,8	5,7	3,7		7,0	3,7	10,0	10,5	17,7	15,9	17,8	20,2	21,7	20,8	21,8	10,5	14,8	22,1	19,9	13,8	10,2	7,3	15,5	12,0	17,0	4	17	27
11032400	17,7	13,5	13,6	14,6	12,3	12,1	12,4	11,0	9,8	17,6	16,4	15,7	14,3	9,9	10,5	9,0	7,0		5,2	8,9	9,0	22,8	21,0	23,2	25,3	26,8	25,8	27,1	12,0	15,2	27,4	25,0	19,1	15,3	2,7	10,9	7,3	12,4	2	10	22
11032500	13,3	9,1	10,2	10,2	8,9	8,2	8,1	8,7	8,7	13,2	12,2	11,6	10,1	5,7	6,6	4,6	3,7	5,2		10,9	11,3	18,6	16,8	18,7	21,1	22,6	21,7	22,7	7,2	13,0	23,0	20,8	14,7	11,1	5,0	13,2	9,6	14,6	4	15	29
11032600	10,5	7,2	7,2	7,4	6,0	5,8	6,8	2,4	3,6	10,3	12,7	9,6	8,1	7,5	4,6	7,4	10,0	8,9	10,9		1,9	19,2	17,1	18,7	21,4	22,8	22,2	22,7	16,3	21,1	25,6	23,9	16,4	14,2	6,6	7,0	7,2	13,1	5	20	26
11032700	11,5	7,3	6,7	8,2	5,4	5,2	8,4	4,0	3,7	11,4	13,1	9,4	8,0	8,5	6,2	8,4	10,5	9,0	11,3	1,9		19,5	17,7	20,2	22,1	23,6	22,6	23,9	16,4	21,8	26,8	24,2	18,0	14,5	6,6	5,4	7,0	12,9	4	19	26
11080100	20,4	16,3	15,2	15,7	15,7	15,6	15,0	18,0	16,8	20,2	8,5	10,6	12,0	15,2	17,4	15,0	17,7	22,8	18,6	19,2	19,5		4,0	3,6	4,1	4,3	3,3	5,1	22,7	17,6	22,1	20,2	12,4	14,7	23,1	24,3	24,4	30,3	6	8	13
11080200	18,5	14,5	13,4	13,8	13,8	13,8	12,9	15,0	14,9	18,4	6,7	8,7	10,1	13,2	15,5	12,8	15,9	21,0	16,8	17,1	17,7	4,0		3,3	4,6	6,2	5,5	8,3	19,4	14,3	18,8	16,8	9,0	12,8	21,3	22,4	22,6	28,5	4	10	23
11080300	20,9	16,8	15,7	16,2	16,2	15,8	14,6	17,4	17,4	20,7	9,1	11,2	12,6	14,8	17,2	14,4	17,8	23,2	18,7	18,7	20,2	3,6	3,3		4,0	4,7	4,8	6,9	21,1	16,0	20,5	18,5	10,7	15,0	23,3	24,9	25,1	30,9	6	8	15
11080400	22,9	18,8	17,7	18,2	18,2	18,1	17,3	19,3	19,3	22,7	11,0	13,1	14,5	17,5	19,9	17,1	20,2	25,3	21,1	21,4	22,1	4,1	4,6	4,0		6,8	5,3	8,1	23,7	18,6	23,1	21,2	13,4	17,2	25,7	26,8	26,9	32,8	4	7	11
11080500	24,4	20,3	19,2	19,7	19,7	19,6	18,7	20,8	20,8	24,2	12,5	14,6	16,0	18,9	21,3	18,5	21,7	26,8	22,6	22,8	23,6	4,3	6,2	4,7	6,8		6,1	8,4	25,2	20,1	24,6	22,6	14,8	18,7	27,1	28,3	28,4	34,3	3	7	10
11080600	23,4	19,3	18,3	18,7	18,7	18,6	18,1	20,1	19,8	23,3	11,5	13,6	15,0	18,3	20,4	17,9	20,8	25,8	21,7	22,2	22,6	3,3	5,5	4,8	5,3	6,1		7,4	24,5	19,4	23,9	22,0	14,2	17,7	26,2	27,3	27,5	33,3	3	7	10
11080700	24,7	20,6	19,6	20,0	20,0	19,8	18,6	21,5	21,1	24,5	12,8	14,9	16,3	18,8	21,2	18,4	21,8	27,1	22,7	22,7	23,9	5,1	8,3	6,9	8,1	8,4	7,4		26,8	21,7	26,2	24,3	16,5	19,0	27,3	28,6	28,8	34,6	1	7	9
11240100	20,1	15,9	17,0	17,0	15,7	15,0	14,9	15,5	15,5	20,0	19,0	18,4	16,9	12,5	13,4	11,4	10,5	12,0	7,2	16,3	16,4	22,7	19,4	21,1	23,7	25,2	24,5	26,8		9,5	19,0	16,5	10,7	12,9	10,1	18,3	14,7	19,8	1	3	13
11240200	22,9	18,8	17,8	18,2	18,2	18,1	15,3	19,1	19,3	22,8	14,7	16,8	17,2	14,6	16,9	14,1	14,8	15,2	13,0	21,1	21,8	17,6	14,3	16,0	18,6	20,1	19,4	21,7	9,5		13,9	11,4	5,6	7,8	15,5	23,7	20,2	25,2	1	4	12
11240300	27,8	23,7	22,6	23,1	23,0	22,9	19,8	23,6	24,0	27,6	19,2	21,3	22,0	19,1	21,4	18,6	22,1	27,4	23,0	25,6	26,8	22,1	18,8	20,5	23,1	24,6	23,9	26,2	19,0	13,9		7,1	10,1	13,5	27,6	31,7	30,9	36,8	1	2	5
11240400	25,1	21,0	19,9	20,4	20,4	20,3	17,9	21,7	21,5	24,9	17,3	19,3	19,4	17,7	19,6	18,1	19,9	25,0	20,8	23,9	24,2	20,2	16,8	18,5	21,2	22,6	22,0	24,3	16,5	11,4	7,1		9,7	10,0	25,3	29,0	28,3	34,2	1	3	5
11240500	19,5	15,4	14,3	14,8	14,8	14,3	11,5	14,2	15,5	19,3	9,5	11,6	12,9	10,8	13,1	10,3	13,8	19,1	14,7	16,4	18,0	12,4	9,0	10,7	13,4	14,8	14,2	16,5	10,7	5,6	10,1	9,7		6,1	19,3	23,0	22,6	28,5	1	6	26
11240600	15,4	11,3	10,3	10,7	10,7	10,6	8,2	12,1	11,8	15,3	8,2	9,6	9,7	8,0	9,9	8,4	10,2	15,3	11,1	14,2	14,5	14,7	12,8	15,0	17,2	18,7	17,7	19,0	12,9	7,8	13,5	10,0	6,1		15,7	19,3	18,7	24,5	1	10	27
11270100	16,0	11,8	11,2	12,7	9,9	9,7	12,7	8,6	7,5	15,9	16,7	13,9	12,5	10,3	10,2	9,2	7,3	2,7	5,0	6,6	6,6	23,1	21,3	23,3	25,7	27,1	26,2	27,3	10,1	15,5	27,6	25,3	19,3	15,7		8,6	5,0	10,0	4	13	23
11270200	16,2	12,0	11,4	12,9	10,1	9,9	13,1	9,1	8,8	16,1	17,8	14,1	12,7	13,5	11,3	13,4	15,5	10,9	13,2	7,0	5,4	24,3	22,4	24,9	26,8	28,3	27,3	28,6	18,3	23,7	31,7	29,0	23,0	19,3	8,6		4,0	9,9	2	9	21
11270300	16,3	12,2	11,6	13,1	10,3	10,1	13,3	9,3	7,8	16,2	18,0	14,3	12,8	12,7	10,5	12,5	12,0	7,3	9,6	7,2	7,0	24,4	22,6	25,1	26,9	28,4	27,5	28,8	14,7	20,2	30,9	28,3	22,6	18,7	5,0	4,0		6,3	3	10	23
11270400	22,2	18,0	17,5	18,9	16,2	15,9	19,1	15,2	13,7	22,1	23,9	20,2	18,7	18,5	16,4	18,4	17,0	12,4	14,6	13,1	12,9	30,3	28,5	30,9	32,8	34,3	33,3	34,6	19,8	25,2	36,8	34,2	28,5	24,5	10,0	9,9	6,3		1	3	9
Total	547,1	407,5	391,6	410,5	386,6	379,2	387,3	411,7	393,7	542,4	445,5	400,6	381,3	381,3	400,0	379,1	445,3	559,8	455,1	444,5	460,9	581,4	522,1	582,7	658,2	707,3	676,5	729,1	615,6	631,1	834,1	755,3	529,9	479,3	528,0	604,2	578,3	785,0	172	504	822
Average	14,4	10,7	10,3	10,8	10,2	10,0	10,2	10,8	10,4	14,3	11,7	10,5	10,0	10,0	10,5	10,0	11,7	14,7	12,0	11,7	12,1	15,3	13,7	15,3	17,3	18,6	17,8	19,2	16,2	16,6	22,0	19,9	13,9	12,6	13,9	15,9	15,2	20,7	4,5	13,3	21,6
Median	13,6	9,5	9,8	9,7	9,1	8,7	8,7	9,1	8,6	13,5	11,2	10,2	9,4	9,3	9,8	9,1	10,5	13,5	11,0	9,8	9,9	16,0	14,0	16,2	18,4	19,9	19,0	20,3	16,3	17,4	22,9	20,3	14,2	11,9	12,1	13,4	13,0	18,8	4,0	12,5	26,0

The OD matrix shows access distances plus in-vehicle travel distances in km between STs.

Appendix 21 - ST IV travel time OD matrix

To/from	11030100	11030200	11030300	11030400	11030500	11030600	11030700	11030800	11030900	11031200	11031700	11031800	11031900	11032000	11032100	11032200	11032300	11032400	11032500	11032600	11032700	11080100	11080200	11080300	11080400	11080500	11080600	11080700	11240100	11240200	11240300	11240400	11240500	11240600	11270100	11270200	11270300	11270400	STs within 10 min	STs within 20 min	STs within 30 min
11030100		11,2	16,3	13,4	22,0	18,2	20,7	22,7	21,3	4,2	32,9	24,2	20,7	25,5	24,6	25,7	30,2	42,2	32,5	25,9	27,7	47,0	44,8	49,6	54,6	54,3	54,8	55,1	49,2	47,7	53,4	50,3	41,3	33,5	37,4	41,3	38,0	48,3	2	6	17
11030200	11,2		6,3	3,4	10,8	8,7	10,7	14,5	10,1	10,9	23,0	14,2	10,7	15,8	13,4	14,5	18,9	30,9	21,3	17,7	16,5	37,0	34,8	39,6	44,6	44,3	44,8	45,1	38,0	37,7	43,4	40,3	33,9	23,5	26,1	30,1	26,7	37,1	4	18	23
11030300	16,3	6,3		4,5	9,0	12,3	9,2	15,1	13,6	15,1	21,4	12,7	9,2	13,9	20,7	20,3	26,7	34,9	29,1	18,2	20,1	35,5	33,3	38,1	43,1	42,8	43,3	43,5	45,8	36,1	41,9	38,7	29,8	21,9	29,7	33,6	30,3	40,7	6	14	23
11030400	13,4	3,4	4,5		10,2	11,2	9,0	15,7	18,2	12,2	21,2	12,5	9,0	13,7	16,8	17,8	22,3	34,3	24,7	18,9	24,6	35,3	33,1	37,9	42,9	42,6	43,1	43,3	41,3	35,9	41,7	38,5	29,6	21,7	34,2	38,2	34,8	45,2	5	16	22
11030500	22,0	10,8	9,0	10,2		6,1	12,1	14,3	7,5	21,7	24,3	15,6	12,1	14,0	14,6	14,2	20,6	28,8	23,0	16,1	13,9	38,4	36,2	41,0	46,0	45,7	46,2	46,4	39,6	39,0	44,8	41,6	32,7	24,8	23,6	27,5	24,2	34,6	4	15	25
11030600	18,2	8,7	12,3	11,2	6,1		11,9	12,2	5,4	18,0	21,6	12,8	9,3	10,7	10,0	10,9	17,0	26,7	19,3	13,9	11,8	35,6	33,4	40,4	43,2	42,9	43,4	45,9	36,0	36,3	45,0	38,9	30,8	22,1	21,5	25,4	22,1	32,4	5	19	25
11030700	20,7	10,7	9,2	9,0	12,1	11,9		13,9	13,2	19,5	21,8	14,3	10,8	6,0	12,3	10,5	16,6	28,6	19,0	17,1	19,7	35,9	32,8	36,4	42,7	44,8	46,4	41,9	35,7	30,6	36,5	34,6	24,4	17,8	28,8	33,3	29,9	40,3	4	19	25
11030800	22,7	14,5	15,1	15,7	14,3	12,2	13,9		13,1	22,5	28,3	20,2	16,7	13,1	6,7	13,2	19,3	25,3	21,7	5,6	10,3	42,3	32,1	37,9	41,9	44,5	45,6	48,4	38,3	41,0	46,9	45,0	29,4	28,2	20,1	25,0	21,3	31,7	3	15	26
11030900	21,3	10,1	13,6	18,2	7,5	5,4	13,2	13,1		21,0	24,1	15,3	11,8	13,4	9,3	13,6	18,1	21,3	20,5	8,6	8,9	38,1	35,9	42,2	45,8	45,5	46,0	46,2	37,2	40,3	47,3	42,9	34,4	26,1	16,1	23,5	16,7	27,1	6	18	26
11031200	4,2	10,9	15,1	12,2	21,7	18,0	19,5	22,5	21,0		31,7	23,0	19,5	24,3	24,3	25,4	29,9	41,9	32,2	25,7	27,4	45,8	43,6	48,4	53,4	53,1	53,6	53,9	48,9	46,5	52,2	49,1	40,1	32,3	37,1	41,0	37,7	48,0	2	8	18
11031700	32,9	23,0	21,4	21,2	24,3	21,6	21,8	28,3	24,1	31,7		8,8	12,3	21,4	23,5	19,6	24,0	35,4	26,4	31,5	30,5	17,4	15,2	21,4	25,0	24,7	25,2	25,5	43,1	30,0	35,9	33,4	20,7	16,8	35,9	44,1	40,8	51,2	2	7	25
11031800	24,2	14,2	12,7	12,5	15,6	12,8	14,3	20,2	15,3	23,0	8,8		3,5	13,4	20,0	17,3	24,2	35,6	26,6	23,4	21,8	22,8	20,6	26,9	30,4	30,1	30,6	30,9	43,3	35,5	41,3	37,3	26,1	20,5	31,4	35,4	32,0	42,4	3	13	25
11031900	20,7	10,7	9,2	9,0	12,1	9,3	10,8	16,7	11,8	19,5	12,3	3,5		9,9	16,5	13,8	20,7	32,1	23,1	19,9	18,3	26,3	24,1	30,4	33,9	33,6	34,1	34,4	39,8	34,3	41,4	36,9	25,4	20,1	27,9	31,9	28,5	38,9	6	17	26
11032000	25,5	15,8	13,9	13,7	14,0	10,7	6,0	13,1	13,4	24,3	21,4	13,4	9,9		6,3	5,1	10,8	22,2	13,2	18,5	20,5	35,4	29,5	33,0	39,3	41,4	43,3	38,6	29,9	28,3	34,2	33,5	22,1	16,7	22,7	33,3	28,3	38,7	5	17	28
11032100	24,6	13,4	20,7	16,8	14,6	10,0	12,3	6,7	9,3	24,3	23,5	20,0	16,5	6,3		6,5	12,6	23,9	14,9	12,2	16,8	37,6	35,5	39,0	45,3	47,4	45,4	44,6	31,6	34,3	40,2	38,2	28,1	21,4	23,6	31,5	24,2	34,6	5	16	25
11032200	25,7	14,5	20,3	17,8	14,2	10,9	10,5	13,2	13,6	25,4	19,6	17,3	13,8	5,1	6,5		7,8	19,9	10,2	18,6	20,6	32,6	29,0	32,6	38,8	40,9	42,5	38,1	26,9	27,8	33,7	34,3	21,6	17,5	20,1	33,4	28,4	38,8	4	18	28
11032300	30,2	18,9	26,7	22,3	20,6	17,0	16,6	19,3	18,1	29,9	24,0	24,2	20,7	10,8	12,6	7,8		15,0	8,1	24,7	25,2	38,1	35,9	40,4	45,7	45,4	45,9	45,9	24,7	34,1	41,5	38,8	29,4	22,0	15,5	39,8	26,2	34,6	3	12	25
11032400	42,2	30,9	34,9	34,3	28,8	26,7	28,6	25,3	21,3	41,9	35,4	35,6	32,1	22,2	23,9	19,9	15,0		10,6	19,7	19,7	49,5	47,3	52,4	57,1	56,8	57,3	57,6	27,2	34,1	53,6	50,2	41,5	33,4	5,2	26,2	16,0	24,4	2	8	18
11032500	32,5	21,3	29,1	24,7	23,0	19,3	19,0	21,7	20,5	32,2	26,4	26,6	23,1	13,2	14,9	10,2	8,1	10,6		27,1	24,3	40,5	38,2	42,8	48,1	47,8	48,3	48,3	16,7	29,6	43,9	41,1	31,8	24,3	9,8	30,8	20,6	29,0	3	10	25
11032600	25,9	17,7	18,2	18,9	16,1	13,9	17,1	5,6	8,6	25,7	31,5	23,4	19,9	18,5	12,2	18,6	24,7	19,7	27,1		4,7	45,5	42,5	46,0	52,3	54,4	56,0	51,6	36,8	43,9	49,8	49,3	35,0	32,5	14,4	19,4	15,7	26,1	4	18	24
11032700	27,7	16,5	20,1	24,6	13,9	11,8	19,7	10,3	8,9	27,4	30,5	21,8	18,3	20,5	16,8	20,6	25,2	19,7	24,3	4,7		44,6	42,4	48,6	52,2	51,9	52,4	52,7	36,8	49,0	54,3	50,0	39,7	33,2	14,5	14,7	15,1	25,5	3	14	24
11080100	47,0	37,0	35,5	35,3	38,4	35,6	35,9	42,3	38,1	45,8	17,4	22,8	26,3	35,4	37,6	32,6	38,1	49,5	40,5	45,5	44,6		7,9	7,3	8,1	7,3	7,8	8,8	47,5	35,3	41,2	38,7	26,0	30,8	49,9	58,2	54,8	65,2	7	8	11
11080200	44,8	34,8	33,3	33,1	36,2	33,4	32,8	32,1	35,9	43,6	15,2	20,6	24,1	29,5	35,5	29,0	35,9	47,3	38,2	42,5	42,4	7,9		7,0	9,8	12,4	13,5	17,4	40,9	28,7	34,6	32,1	19,4	28,6	47,7	56,0	52,6	63,0	4	9	15
11080300	49,6	39,6	38,1	37,9	41,0	40,4	36,4	37,9	42,2	48,4	21,4	26,9	30,4	33,0	39,0	32,6	40,4	52,4	42,8	46,0	48,6	7,3	7,0		7,8	8,7	11,5	13,4	45,1	32,9	38,8	36,3	23,6	32,7	52,6	62,2	58,9	69,3	5	7	10
11080400	54,6	44,6	43,1	42,9	46,0	43,2	42,7	41,9	45,8	53,4	25,0	30,4	33,9	39,3	45,3	38,8	45,7	57,1	48,1	52,3	52,2	8,1	9,8	7,8		13,1	12,3	16,1	50,7	38,5	44,4	41,9	29,2	38,5	57,6	65,8	62,5	72,8	4	7	9
11080500	54,3	44,3	42,8	42,6	45,7	42,9	44,8	44,5	45,5	53,1	24,7	30,1	33,6	41,4	47,4	40,9	45,4	56,8	47,8	54,4	51,9	7,3	12,4	8,7	13,1		13,2	15,4	53,5	41,3	47,2	44,7	32,0	38,2	57,3	65,5	62,2	72,5	3	7	8
11080600	54,8	44,8	43,3	43,1	46,2	43,4	46,4	45,6	46,0	53,6	25,2	30,6	34,1	43,3	45,4	42,5	45,9	57,3	48,3	56,0	52,4	7,8	13,5	11,5	12,3	13,2		15,9	54,4	42,2	48,1	45,6	32,9	38,7	57,8	66,0	62,7	73,1	2	7	8
11080700	55,1	45,1	43,5	43,3	46,4	45,9	41,9	48,4	46,2	53,9	25,5	30,9	34,4	38,6	44,6	38,1	45,9	57,6	48,3	51,6	52,7	8,8	17,4	13,4	16,1	15,4	15,9		56,7	44,6	50,4	47,9	35,2	38,9	58,2	66,2	62,9	73,3	2	7	8
11240100	49,2	38,0	45,8	41,3	39,6	36,0	35,7	38,3	37,2	48,9	43,1	43,3	39,8	29,9	31,6	26,9	24,7	27,2	16,7	36,8	36,8	47,5	40,9	45,1	50,7	53,5	54,4	56,7		21,1	33,6	30,1	21,5	26,4	22,3	43,3	33,1	41,5	1	2	10
11240200	47,7	37,7	36,1	35,9	39,0	36,3	30,6	41,0	40,3	46,5	30,0	35,5	34,3	28,3	34,3	27,8	34,1	34,1	29,6	43,9	49,0	35,3	28,7	32,9	38,5	41,3	42,2	44,6	21,1		21,4	17,9	9,3	14,2	34,6	55,5	45,3	53,7	2	4	10
11240300	53,4	43,4	41,9	41,7	44,8	45,0	36,5	46,9	47,3	52,2	35,9	41,3	41,4	34,2	40,2	33,7	41,5	53,6	43,9	49,8	54,3	41,2	34,6	38,8	44,4	47,2	48,1	50,4	33,6	21,4		10,2	15,2	22,2	53,8	67,1	62,1	72,5	1	3	5
11240400	50,3	40,3	38,7	38,5	41,6	38,9	34,6	45,0	42,9	49,1	33,4	37,3	36,9	33,5	38,2	34,3	38,8	50,2	41,1	49,3	50,0	38,7	32,1	36,3	41,9	44,7	45,6	47,9	30,1	17,9	10,2		16,0	16,8	50,6	61,4	57,8	68,2	1	5	5
11240500	41,3	33,9	29,8	29,6	32,7	30,8	24,4	29,4	34,4	40,1	20,7	26,1	25,4	22,1	28,1	21,6	29,4	41,5	31,8	35,0	39,7	26,0	19,4	23,6	29,2	32,0	32,9	35,2	21,5	9,3	15,2	16,0		12,4	41,7	54,4	50,0	60,4	2	6	21
11240600	33,5	23,5	21,9	21,7	24,8	22,1	17,8	28,2	26,1	32,3	16,8	20,5	20,1	16,7	21,4	17,5	22,0	33,4	24,3	32,5	33,2	30,8	28,6	32,7	38,5	38,2	38,7	38,9	26,4	14,2	22,2	16,8	12,4		33,8	44,6	41,0	51,4	1	8	23
11270100	37,4	26,1	29,7	34,2	23,6	21,5	28,8	20,1	16,1	37,1	35,9	31,4	27,9	22,7	23,6	20,1	15,5	5,2	9,8	14,4	14,5	49,9	47,7	52,6	57,6	57,3	57,8	58,2	22,3	34,6	53,8	50,6	41,7	33,8		21,0	10,7	19,2	3	9	21
11270200	41,3	30,1	33,6	38,2	27,5	25,4	33,3	25,0	23,5	41,0	44,1	35,4	31,9	33,3	31,5	33,4	39,8	26,2	30,8	19,4	14,7	58,2	56,0	62,2	65,8	65,5	66,0	66,2	43,3	55,5	67,1	61,4	54,4	44,6	21,0		10,2	20,6	1	4	11
11270300	38,0	26,7	30,3	34,8	24,2	22,1	29,9	21,3	16,7	37,7	40,8	32,0	28,5	28,3	24,2	28,4	26,2	16,0	20,6	15,7	15,1	54,8	52,6	58,9	62,5	62,2	62,7	62,9	33,1	45,3	62,1	57,8	50,0	41,0	10,7	10,2		10,4	1	8	19
11270400	48,3	37,1	40,7	45,2	34,6	32,4	40,3	31,7	27,1	48,0	51,2	42,4	38,9	38,7	34,6	38,8	34,6	24,4	29,0	26,1	25,5	65,2	63,0	69,3	72,8	72,5	73,1	73,3	41,5	53,7	72,5	68,2	60,4	51,4	19,2	20,6	10,4		1	3	9
Total	1262,5	910,4	956,8	952,8	943,1	863,2	889,9	944,0	899,5	1234,9	990,2	896,9	841,6	839,9	908,5	842,4	996,8	1238,6	1019,5	1039,0	1061,0	1276,0	1191,6	1333,2	1495,5	1519,3	1544,3	1559,2	1388,6	1308,6	1585,9	1479,3	1127,0	1019,5	1164,3	1477,2	1294,8	1656,9	122	402	706
Average	33,2	24,0	25,2	25,1	24,8	22,7	23,4	24,8	23,7	32,5	26,1	23,6	22,1	22,1	23,9	22,2	26,2	32,6	26,8	27,3	27,9	33,6	31,4	35,1	39,4	40,0	40,6	41,0	36,5	34,4	41,7	38,9	29,7	26,8	30,6	38,9	34,1	43,6	3,2	10,6	18,6
Median	32,7	22,1	24,3	23,4	23,3	20,4	20,2	22,1	20,7	32,0	24,5	23,2	20,7	21,7	23,6	20,2	24,7	31,5	25,5	24,1	24,5	36,4	33,2	38,0	43,0	44,4	45,1	44,8	37,6	35,4	42,7	38,8	29,5	25,5	28,4	34,5	30,1	40,5	3,0	8,5	21,5

The OD matrix shows in-vehicle travel times in minutes between STs.

Appendix 22 - ST travel time OD matrix

To/from	11030100	11030200	11030300	11030400	11030500	11030600	11030700	11030800	11030900	11031200	11031700	11031800	11031900	11032000	11032100	11032200	11032300	11032400	11032500	11032600	11032700	11080100	11080200	11080300	11080400	11080500	11080600	11080700	11240100	11240200	11240300	11240400	11240500	11240600	11270100	11270200	11270300	11270400	STs within 10 min	STs within 20 min	STs within 30 min
11030100		14,8	19,2	16,3	25,0	21,4	24,0	25,6	24,1	7,6	36,9	28,4	24,7	28,6	28,1	29,0	34,0	45,9	36,6	29,5	30,9	50,1	48,2	53,9	58,8	58,3	58,3	58,1	53,6	54,2	58,4	53,3	44,9	37,2	41,0	44,5	42,2	52,3	2	5	16
11030200	14,8		9,7	6,7	14,3	12,3	14,5	17,9	13,3	14,8	27,4	18,9	15,1	19,4	17,4	18,3	23,2	35,1	25,8	21,8	20,2	40,6	38,6	44,4	49,2	48,8	48,8	48,5	42,9	44,7	48,8	43,7	37,9	27,6	30,3	33,7	31,4	41,5	3	15	21
11030300	19,2	9,7		7,3	11,8	15,2	12,4	17,8	16,3	18,3	25,3	16,8	13,0	17,0	24,1	23,5	30,4	38,5	33,0	21,8	23,1	38,5	36,5	42,2	47,1	46,6	46,7	46,4	50,1	42,6	46,7	41,6	33,2	25,5	33,2	36,7	34,4	44,5	3	13	19
11030400	16,3	6,7	7,3		13,0	14,1	12,1	18,4	20,7	15,4	25,0	16,5	12,7	16,7	20,1	21,0	25,9	37,8	28,5	22,3	27,6	38,2	36,2	41,9	46,8	46,3	46,4	46,1	45,6	42,3	46,4	41,3	32,9	25,2	37,7	41,1	38,8	48,9	3	12	21
11030500	25,0	14,3	11,8	13,0		9,1	15,3	17,1	10,2	25,0	28,2	19,7	15,9	17,1	18,0	17,4	24,3	32,4	26,9	19,6	17,0	41,4	39,4	45,1	50,0	49,6	49,6	49,3	44,0	45,5	49,6	44,5	36,2	28,4	27,1	30,6	28,3	38,4	2	15	23
11030600	21,4	12,3	15,2	14,1	9,1		15,2	15,1	8,2	21,5	25,5	17,0	13,3	13,9	13,5	14,2	20,8	30,4	23,4	17,6	15,0	38,8	36,8	44,6	47,4	46,9	46,9	48,9	40,5	42,8	50,0	41,9	34,4	25,8	25,1	28,6	26,3	36,4	3	15	24
11030700	24,0	14,5	12,4	12,1	15,3	15,2		17,0	16,3	23,1	26,0	18,8	15,0	9,4	16,0	14,1	20,7	32,6	23,3	21,0	23,1	39,3	36,4	40,9	47,0	48,9	50,1	45,2	40,3	37,4	41,6	37,9	28,2	21,8	32,7	36,6	34,4	44,5	2	13	22
11030800	25,6	17,9	17,8	18,4	17,1	15,1	17,0		15,7	25,7	32,1	24,2	20,5	16,0	10,0	16,3	22,9	28,8	25,5	9,0	13,3	45,3	35,2	41,9	45,8	48,2	48,9	51,2	42,5	47,4	51,6	47,7	32,7	31,6	23,5	27,9	25,3	35,4	2	13	23
11030900	24,1	13,3	16,3	20,7	10,2	8,2	16,3	15,7		24,1	27,8	19,3	15,5	16,3	12,6	16,6	21,7	24,7	24,3	11,9	11,8	41,0	39,0	46,1	49,6	49,1	49,2	48,9	41,3	46,6	51,9	45,6	37,6	29,5	19,4	26,3	20,6	30,7	2	15	25
11031200	7,6	14,8	18,3	15,4	25,0	21,5	23,1	25,7	24,1		36,0	27,5	23,8	27,7	28,1	29,0	34,0	45,9	36,6	29,6	30,9	49,3	47,3	53,0	57,9	57,4	57,4	57,2	53,6	53,3	57,5	52,4	44,0	36,3	41,0	44,5	42,2	52,3	2	5	16
11031700	36,9	27,4	25,3	25,0	28,2	25,5	26,0	32,1	27,8	36,0		13,9	17,1	25,4	27,9	23,8	28,7	40,0	31,3	36,0	34,6	21,4	19,5	26,6	30,0	29,6	29,6	29,3	48,4	37,5	41,7	37,3	25,2	21,4	40,4	48,2	45,9	56,0	1	4	22
11031800	28,4	18,9	16,8	16,5	19,7	17,0	18,8	24,2	19,3	27,5	13,9		8,6	17,7	24,6	21,7	29,2	40,5	31,8	28,2	26,1	27,1	25,1	32,2	35,7	35,2	35,3	35,0	48,8	43,1	47,4	41,5	30,8	25,4	36,2	39,6	37,4	47,5	2	11	22
11031900	24,7	15,1	13,0	12,7	15,9	13,3	15,0	20,5	15,5	23,8	17,1	8,6		13,9	20,9	18,0	25,4	36,7	28,0	24,4	22,3	30,3	28,4	35,5	38,9	38,5	38,5	38,3	45,1	41,8	47,1	40,8	29,8	24,7	32,5	35,9	33,6	43,7	2	12	23
11032000	28,6	19,4	17,0	16,7	17,1	13,9	9,4	16,0	16,3	27,7	25,4	17,7	13,9		9,9	8,5	14,7	26,0	17,3	22,2	23,8	38,6	32,9	37,3	43,5	45,4	46,8	41,6	34,3	34,9	39,2	36,6	25,7	20,5	26,4	36,5	32,6	42,7	4	15	24
11032100	28,1	17,4	24,1	20,1	18,0	13,5	16,0	10,0	12,6	28,1	27,9	24,6	20,9	9,9		10,2	16,8	28,0	19,4	16,2	20,4	41,1	39,3	43,7	49,8	51,8	49,3	48,0	36,5	41,3	45,5	41,7	32,0	25,5	27,7	35,1	28,9	38,9	2	12	24
11032200	29,0	18,3	23,5	21,0	17,4	14,2	14,1	16,3	16,6	29,0	23,8	21,7	18,0	8,5	10,2		11,9	23,8	14,5	22,5	24,1	36,0	32,6	37,0	43,2	45,1	46,3	41,3	31,6	34,6	38,9	37,5	25,4	21,4	24,0	36,8	32,9	43,0	2	12	24
11032300	34,0	23,2	30,4	25,9	24,3	20,8	20,7	22,9	21,7	34,0	28,7	29,2	25,4	14,7	16,8	11,9		19,5	12,8	29,1	29,1	41,9	40,0	45,4	50,6	50,1	50,1	49,7	29,9	41,4	47,2	42,5	33,7	26,4	19,9	43,7	31,1	39,3	1	7	21
11032400	45,9	35,1	38,5	37,8	32,4	30,4	32,6	28,8	24,7	45,9	40,0	40,5	36,7	26,0	28,0	23,8	19,5		15,2	23,9	23,5	53,3	51,3	57,3	61,9	61,4	61,4	61,2	32,3	41,3	59,1	53,8	45,6	37,7	9,5	30,0	20,8	28,9	2	4	14
11032500	36,6	25,8	33,0	28,5	26,9	23,4	23,3	25,5	24,3	36,6	31,3	31,8	28,0	17,3	19,4	14,5	12,8	15,2		31,7	28,5	44,6	42,6	48,0	53,2	52,7	52,7	52,3	22,1	37,1	49,8	45,1	36,3	29,0	14,4	34,9	25,7	33,9	1	7	19
11032600	29,5	21,8	21,8	22,3	19,6	17,6	21,0	9,0	11,9	29,6	36,0	28,2	24,4	22,2	16,2	22,5	29,1	23,9	31,7		8,4	49,2	46,4	50,8	57,0	58,9	60,1	55,1	41,8	51,1	55,3	52,9	39,1	36,8	18,7	23,1	20,5	30,6	3	8	22
11032700	30,9	20,2	23,1	27,6	17,0	15,0	23,1	13,3	11,8	30,9	34,6	26,1	22,3	23,8	20,4	24,1	29,1	23,5	28,5	8,4		47,8	45,9	53,0	56,4	56,0	56,0	55,8	41,4	55,7	59,4	53,1	43,3	37,0	18,3	18,0	19,4	29,5	2	9	22
11080100	50,1	40,6	38,5	38,2	41,4	38,8	39,3	45,3	41,0	49,3	21,4	27,1	30,3	38,6	41,1	36,0	41,9	53,3	44,6	49,2	47,8		11,3	11,6	12,3	11,3	11,4	11,9	52,0	41,9	46,2	41,8	29,6	34,6	53,7	61,4	59,1	69,2	1	7	10
11080200	48,2	38,6	36,5	36,2	39,4	36,8	36,4	35,2	39,0	47,3	19,5	25,1	28,4	32,9	39,3	32,6	40,0	51,3	42,6	46,4	45,9	11,3		11,5	14,2	16,6	17,3	20,7	45,6	35,5	39,8	35,4	23,2	32,6	51,7	59,4	57,1	67,2	1	7	11
11080300	53,9	44,4	42,2	41,9	45,1	44,6	40,9	41,9	46,1	53,0	26,6	32,2	35,5	37,3	43,7	37,0	45,4	57,3	48,0	50,8	53,0	11,6	11,5		13,1	13,9	16,1	17,5	50,7	40,6	44,9	40,5	28,3	37,5	57,4	66,5	64,2	74,3	1	7	9
11080400	58,8	49,2	47,1	46,8	50,0	47,4	47,0	45,8	49,6	57,9	30,0	35,7	38,9	43,5	49,8	43,2	50,6	61,9	53,2	57,0	56,4	12,3	14,2	13,1		18,2	16,8	20,2	56,2	46,1	50,3	45,9	33,8	43,2	62,3	70,0	67,7	77,8	1	6	7
11080500	58,3	48,8	46,6	46,3	49,6	46,9	48,9	48,2	49,1	57,4	29,6	35,2	38,5	45,4	51,8	45,1	50,1	61,4	52,7	58,9	56,0	11,3	16,6	13,9	18,2		17,6	19,2	58,8	48,7	53,0	48,6	36,4	42,7	61,8	69,5	67,2	77,3	1	7	8
11080600	58,3	48,8	46,7	46,4	49,6	46,9	50,1	48,9	49,2	57,4	29,6	35,3	38,5	46,8	49,3	46,3	50,1	61,4	52,7	60,1	56,0	11,4	17,3	16,1	16,8	17,6		19,3	59,2	49,2	53,4	49,0	36,9	42,8	61,8	69,6	67,3	77,4	1	7	8
11080700	58,1	48,5	46,4	46,1	49,3	48,9	45,2	51,2	48,9	57,2	29,3	35,0	38,3	41,6	48,0	41,3	49,7	61,2	52,3	55,1	55,8	11,9	20,7	17,5	20,2	19,2	19,3		61,1	51,0	55,2	50,8	38,7	42,5	61,7	69,3	67,0	77,1	1	5	8
11240100	53,6	42,9	50,1	45,6	44,0	40,5	40,3	42,5	41,3	53,6	48,4	48,8	45,1	34,3	36,5	31,6	29,9	32,3	22,1	41,8	41,4	52,0	45,6	50,7	56,2	58,8	59,2	61,1		28,9	39,8	34,4	26,4	31,4	27,3	47,8	38,6	46,7	1	1	6
11240200	54,2	44,7	42,6	42,3	45,5	42,8	37,4	47,4	46,6	53,3	37,5	43,1	41,8	34,9	41,3	34,6	41,4	41,3	37,1	51,1	55,7	41,9	35,5	40,6	46,1	48,7	49,2	51,0	28,9		29,8	24,3	16,3	21,4	41,7	62,1	53,0	61,1	1	2	6
11240300	58,4	48,8	46,7	46,4	49,6	50,0	41,6	51,6	51,9	57,5	41,7	47,4	47,1	39,2	45,5	38,9	47,2	59,1	49,8	55,3	59,4	46,2	39,8	44,9	50,3	53,0	53,4	55,2	39,8	29,8		15,1	20,6	27,8	59,2	72,1	68,2	78,3	1	2	5
11240400	53,3	43,7	41,6	41,3	44,5	41,9	37,9	47,7	45,6	52,4	37,3	41,5	40,8	36,6	41,7	37,5	42,5	53,8	45,1	52,9	53,1	41,8	35,4	40,5	45,9	48,6	49,0	50,8	34,4	24,3	15,1		19,5	20,4	54,2	64,5	61,9	72,0	1	3	5
11240500	44,9	37,9	33,2	32,9	36,2	34,4	28,2	32,7	37,6	44,0	25,2	30,8	29,8	25,7	32,0	25,4	33,7	45,6	36,3	39,1	43,3	29,6	23,2	28,3	33,8	36,4	36,9	38,7	26,4	16,3	20,6	19,5		16,5	45,8	58,0	54,7	64,8	1	4	14
11240600	37,2	27,6	25,5	25,2	28,4	25,8	21,8	31,6	29,5	36,3	21,4	25,4	24,7	20,5	25,5	21,4	26,4	37,7	29,0	36,8	37,0	34,6	32,6	37,5	43,2	42,7	42,8	42,5	31,4	21,4	27,8	20,4	16,5		38,1	48,4	45,8	55,9	1	2	20
11270100	41,0	30,3	33,2	37,7	27,1	25,1	32,7	23,5	19,4	41,0	40,4	36,2	32,5	26,4	27,7	24,0	19,9	9,5	14,4	18,7	18,3	53,7	51,7	57,4	62,3	61,8	61,8	61,7	27,3	41,7	59,2	54,2	45,8	38,1		24,7	15,5	23,6	2	8	17
11270200	44,5	33,7	36,7	41,1	30,6	28,6	36,6	27,9	26,3	44,5	48,2	39,6	35,9	36,5	35,1	36,8	43,7	30,0	34,9	23,1	18,0	61,4	59,4	66,5	70,0	69,5	69,6	69,3	47,8	62,1	72,1	64,5	58,0	48,4	24,7		14,5	24,6	1	3	10
11270300	42,2	31,4	34,4	38,8	28,3	26,3	34,4	25,3	20,6	42,2	45,9	37,4	33,6	32,6	28,9	32,9	31,1	20,8	25,7	20,5	19,4	59,1	57,1	64,2	67,7	67,2	67,3	67,0	38,6	53,0	68,2	61,9	54,7	45,8	15,5	14,5		15,4	1	5	13
11270400	52,3	41,5	44,5	48,9	38,4	36,4	44,5	35,4	30,7	52,3	56,0	47,5	43,7	42,7	38,9	43,0	39,3	28,9	33,9	30,6	29,5	69,2	67,2	74,3	77,8	77,3	77,4	77,1	46,7	61,1	78,3	72,0	64,8	55,9	23,6	24,6	15,4		1	2	6
Total	1397,8	1062,4	1087,2	1080,3	1074,3	998,8	1032,9	1071,0	1023,8	1381,1	1157,0	1072,5	1008,2	977,0	1058,3	986,1	1157,6	1396,0	1189,0	1194,0	1199,7	1413,0	1337,0	1509,5	1667,7	1685,8	1693,6	1690,7	1571,3	1568,4	1786,5	1610,9	1278,6	1176,0	1319,4	1614,5	1470,0	1821,7	64	300	610
Average	36,8	28,0	28,6	28,4	28,3	26,3	27,2	28,2	26,9	36,3	30,4	28,2	26,5	25,7	27,8	25,9	30,5	36,7	31,3	31,4	31,6	37,2	35,2	39,7	43,9	44,4	44,6	44,5	41,3	41,3	47,0	42,4	33,6	30,9	34,7	42,5	38,7	47,9	1,7	7,9	16,1
Total	36,8	26,6	28,0	26,7	27,0	24,3	23,7	25,5	24,1	36,1	29,0	27,8	25,0	25,6	27,8	23,9	29,1	35,9	30,2	28,6	28,0	40,8	36,5	42,1	47,1	48,7	49,0	48,7	42,1	42,1	48,1	42,2	33,5	29,2	32,6	38,2	34,4	44,5	1,5	7,0	18,0

The OD matrix shows access times plus in-vehicle travel times in minutes between STs.