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Developing approaches and strategies to promote increased active mobility in urban city neighbourhood

M Afshari[1], A Temeljotov Salaj[2], A Johansen[2] and J Lohne[2]

1 Department for Transport, Section Mobility, Trøndelag County Municipality, Fylkets hus Trondheim, Erling Skakkesgt. 14, 7013 Trondheim, Norway

2 Department of Civil and Environmental Engineering, Faculty of Engineering, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway

mahaf@trondelagfylke.no

Abstract. With the world's population expanding quickly, cities must deal with problems such as traffic jams, air pollution, car accidents, and urban sprawl. Walking and cycling are non-motorized modes of transport that require little infrastructure and don't utilize any fossil fuel energy. In comparison to motorized modes, they are easily adaptable and inexpensive to maintain for both users and governments. Therefore, the goal of this paper is to identify strategies for greater active mobility through non-motorized modes of transport. Through a document study, methods that can be utilized as incentives to improve walkability and bikeability in the Elgeseter neighbourhood of the City of Trondheim, Norway have been identified. The analysis addresses following research question: "What may persuade Elgeseter district commuters or travellers to modify their behaviour toward more walking and biking?" This study reveals five topics of interest: Identifying existing difficulties in the district, Evaluation of current pedestrian, bicycle, and vehicle links, as well as meeting places and open spaces, and identification of opportunities to improve them, How to outline planning concepts, Methods and design recommendations for enhancing walking and micro transportation, as well as The importance of accessibility, safety, and comfort in attracting people to active mobility. The main argument is that a multi-dimensional approach is required to persuade more people to choose environmentally friendly, sustainable modes of transportation as a lifestyle choice, and function better than compulsion. The research presented in this paper contributes to our understanding of the factors that influence commuters' decision to engage in active mobility in their urban city neighbourhood.

1. Introduction

1.1. Background

More than 30% of inhabitants in 122 countries were found to be physically inactive (Hallal et al., 2012). Sedentary and physically inactive lifestyles have been embraced by a sizable number of individuals worldwide (Van Dyck et al., 2013). The location, design, and operation of physical surroundings determine how frequently people walk, bike, take public transportation, or drive, as well as how pleasant or unpleasant their commute is. Many additional factors can influence people's travel behavior, such as geographical characteristics, cultural backgrounds, and knowledge of the impact of

travel on climate change. Walking and cycling, for example, may result in financial savings, lower CO2 emissions, less noise and air pollution, and less traffic congestion (Rabl et al., 2012).

Active mobility (also referred to as non-motorized mobility) is essential for the development of efficient and equitable transportation networks, as well as the transition to more sustainable communities (Victoria Transport Policy Institute, 2016). Active mobility may not only improve health by providing a source of physical activity, but it also aid in the achievement of social and environmental goals such as promoting social cohesion and lowering CO2 emissions by offsetting air pollution from motorized vehicles on such journeys (Afshari et al., 2022).

In September 2015, nations gathered in New York to agree on the Sustainable Development Goals (SDGs), a set of 17 global goals with 169 targets to be achieved by 2030 (UN, 2015). The SDGs concept has quickly gained traction due to the growing need for global sustainable development. Regardless of how it is defined, sustainable development includes the so-called triple bottom line approach to human well-being. Almost all cultures acknowledge that they seek a balance of economic progress, environmental sustainability, and social inclusion, though the specific goals vary globally, across countries, and within civilizations (Sachs, 2012).

This research is helping to achieve four of the Sustainable Development Goals: Good Health and Well-being (No. 3), Sustainable Cities and Communities (No. 11), Climate Action (No. 13), and Life on Land (No. 15).

1.2. Case study description

Elgeseter gate is an urban route in Trondheim, Norway. The road is a continuation of the major route running south from the city centre. The name Elgeseter district will be used in this paper to refer to the neighbourhood surrounding Elgeseter gate. The case study neighbourhood is depicted in Figure 1.

Figure 1: Focus area of the case study

The area is the innovation hub of the city of Trondheim, is home to Norway's largest university and main regional hospital, as well as various technology and other industries. The Elgeseter project serves multiple functions including achieving zero-emission status, consolidating sustainable lifestyles, improving mental and societal health, progressing toward innovation and development in an urban context, and achieving systemic change toward a sustainable society.

1.3. Scope of the study

The primary goal of this research is to identify the most important approaches that can promote active mobility in a city neighbourhood's strategic governing document. The investigation aims to identify incentives for boosting walkability and bikeability in the Elgeseter neighbourhood. Based on this, the study's research tackles the following key research question: "*What may persuade Elgeseter district commuters or travellers to modify their behaviour toward more walking and biking?"*

2. Methodology

Document study is a disciplined approach to analyzing or evaluating documents. It is a rigorous procedure for examining or evaluating printed and electronic information (computer-based and Internet-transmitted). Document study, like other qualitative research analytic techniques, demands the inspection and interpretation of data in order to extract meaning, gain insight, and generate empirical knowledge (Corbin & Strauss, 2008; see also Rapley, 2007). Document study is widely used in tandem with other qualitative research methodologies as a part of methodological triangulation (Denzin, 1970, p. 291).

Reports and internal correspondence, for example, might give empirical data for case studies (Mills, Bonner, & Francis, 2006). Furthermore, documentation of all types can help the researcher uncover meaning, improve expertise, and discover insights relevant to the research topic (Merriam, 1988, p. 118). This paper investigates and comprehends the contents of several documents using qualitative document study.

2.1. Selection of documents

This paper's document analysis is based on four main documents, one from a collaboration between Miljøpakken, Trøndelag County Municipality, The Directorate of Railways, Trondheim municipality, and Norwegian Public Roads Administration and the other three from Trondheim municipality.

All Trondheim municipality documents, as well as those on which Miljøpakken, Trøndelag County Municipality, The Directorate of Railways, Trondheim municipality, and Norwegian Public Roads Administration contributed, are freely accessible to the public and may be found by searching their titles. In addition to these four key sources, snowballing also occurred, suggesting that the authors of this paper did more in-depth research on some of the pertinent reports cited in these four papers.

2.2. Analysis of documents

The study of the materials began with a focus on the publication dates. So, first, the 2018 document, co-authored by Miljøpakken, Trøndelag County Municipality, The Directorate of Railways, Trondheim municipality, and Norwegian Public Roads Administration, was examined. The Trondheim municipality archives were then examined to learn how Trondheim municipality devised the process of creating the Elgeseter gate and the surrounding territory. Two of the 2019 documents were reviewed first, followed by the 2020 document, which focuses on walkability and ways to encourage people to walk more in the area.

Each document has covered different aspects of the study's theme, such as;

- Identifying existing difficulties in the Elgeseter district
- Municipality and related entity decisions
- Evaluation of current pedestrian, bicycle, and vehicle linkages, as well as meeting spots and open spaces, and identification of chances to enhance them
- Outlining some broad concepts of planning
- Methods for boosting mobility and transportation
- The importance of accessibility, safety, and comfort in attracting people to active mobility

2.3. Objectivity, Reliability, and Validity

One of the key advantages of doing a document study is that it allows researchers to investigate situations to which they do not have easy physical access. It also lacks responsiveness, which is particularly crucial when the information is being produced for another purpose.

According to Bowen (2009), it is an efficient, cost-effective, and reliable method for analyzing a wide range of materials. However, there are some drawbacks to this strategy. For example, because the data in a single document analysis is not intended to be used for research, it rarely contains comprehensive information that may be used to address research questions. Furthermore, finding the publications that have been studied may be difficult, making the approach untrustworthy. There is also the possibility that the papers being examined are biased, as they usually represent the opinions and attitudes of organizations wanting to depict themselves positively. Overall, the document analysis is thought to be genuine and trustworthy.

All resources used in the document analysis procedure for this paper were issued during the last four years and are considered up to date. This improves the document's reliability. Furthermore, the majority of the materials were generated by actors and persons who have professional proficiency in what they say, increasing their credibility. Efforts were taken throughout the process to assure the material's traceability and to investigate any potential bias in the articles. This enhances objectivity.

3. Results

The findings of the document analysis are presented in this chapter. The goal of the document analysis is to offer an overview of the region's existing plans and functions, as well as an evaluation of the key bikeability and walkability motivators and attractions that can increase inhabitants' propensity to bike and walk. Four main documents were examined in total: one from a collaboration between Miljøpakken, Trøndelag County Municipality, The Directorate of Railways, Trondheim municipality, and Norwegian Public Roads Administration (3.1) and three from Trondheim municipality (3.2, 3.3, and 3.4).

3.1. Plan program for Elgeseter gate and surrounding streets

Since the disused railway line became a street in 1882, Elgeseter gate has been an essential access point to the city center. Elgeseter gate is a historic and urban residential street that runs through one of Norway's most productive and imaginative university areas. Today, the road is ancient, noisy, and dusty, and because of the volume of traffic, it is seen as a barrier for the area's soft road users (Side 2 Plan program for Elgeseter gate, 2018).

All of the information in sections 3.1.1 and 3.1.2 is derived from the Side 2 Plan program for the Elgeseter gate (2018).

3.1.1. Elgeseter gate problems. Sidewalks are on both sides of Elgeseter gate, Prinsens gate, and Holtermanns veg. In certain places of the roadway, it is the large amount of traffic, long crossing wait times, and substantial distances between modified crossing stations.

Elgeseter gate is not presently bike-friendly. The principal bicycle network is housed on parallel streets to Elgeseter gate. Bicycle parking is limited to south of Elgeseter bridge and the east side of Elgeseter gate.

Several accidents involving soft road users have occurred inside the intended area. The vast majority of the injuries are minor (source: vegkart.no).

Many bikers assemble near the starting of the street, where they wander and wait for buses.

3.1.2. Decisions. In response to the concerns expressed above, different decisions were made, such as follows:

- Having a bus lane parallel to the west and a middle-class public transit lane. The City Council emphasized in its decision that both alternatives must stimulate walking and cycling, street life, commercial activities such as product delivery, and the preservation of historical assets in the metropolis.
- Central public transit lanes are available at Elgeseter gate. The streets are equipped with necessary speed restriction measures as well as measures that encourage the dispersal of automotive traffic so that buses have adequate access. The system transitions from the center to the side in a traffic-safe manner.
- St. Olav's hospital must be conveniently accessible, and emergency vehicles must be able to pass through safely.
- A safe and pleasant school road for children must be provided during the construction time.
- Elgeseter gate should be a pedestrian-friendly thoroughfare with safe crossings and cross-connections to key objective sites.
- System modifications should be developed in a reasonable and urban manner, with appropriate and safe solutions for all road users.
- To accomplish the zero-growth aim, improve street accessibility and attractiveness for walkers, cyclists, and public transportation.
- Prioritize walking, cycling, and public transportation above vehicle traffic access.
- Make public transit, commodities delivery, and emergency vehicles easily accessible.

- Reduce the street barrier impact for soft road users across the street; encourage more street life and a better living and urban environment along the street; and enhance traffic safety and security for all user categories.
- Ensure the feasibility of efficient products delivery and urban logistics
- Ensure that historical assets may be preserved and exploited as a resource for streets and the cityscape
- Seek flexibility to promote alternate, sustainable transportation choices
- Improved street environmental conditions (noise, dust, surface water, local temperature)
- Avoiding an increase in car-based traffic on streets and adjacent residential streets

3.2. Indicative plan for public spaces and connections in the city campus

For many years, one of Trondheim's most significant urban development endeavors has been the NTNU collection surrounding Gløshaugen campus. By 2030, Trondheim will have an open, attractive, and vibrant city campus. This will assist the city in becoming a more sustainable and internationally recognized city of technology and information, as well as the best study city in the Nordic region. Bycampus Elgeseter will be expanded further as a knowledge and creativity powerhouse, serving as a key foundation for the creation of future workplaces and communities on a local, regional, and national scale (bycampus.no).

Ragna Fagerli, Trondheim municipality's city planning manager, stated in the document that 10,000 pupils and 2,000 additional employees will travel to Gløshaugen campus instead of Dragvoll campus. This has the potential to improve city life, but it will put additional strain on public transportation and result in a considerable rise in the number of pedestrians and bikers. It is based on the assumption that no one else should drive an automobile. As a result, better, safer, and more secure walking and cycling connections must be constructed across the intended region. The urban environment is a crucial meeting place. High-quality urban areas offer appealing and unifying hubs that entice tourists to stay and engage in diverse meetings. It increases NTNU's prominence and promotes the city campus' identity (bycampus.no).

By giving this backdrop, the conclusions of this document's analysis are separated into four sections, as indicated below. All of the information in sections 3.2.1, 3.2.2, 3.2.3, and 3.2.4 comes from bycampus.no – “Indicative plan for public spaces and connections in the city campus”.

This guideline provides "design recommendations" for how pedestrian and bicycle connections should be developed and built, as well as "Urban space for stays, meetings, and recreations."

3.2.1. Pedestrian connections. In dense, interconnected networks, pedestrian linkages that are safe, appealing, and provide a rapid and clear route to important destination places must be built. The pedestrian network in emerging areas should be properly linked to the city's other paths. Pedestrians and automobiles should not be intermingled. If future traffic with autos and bicycles is modest and the speed is moderate (less than 30 km/h), joint usage is permissible. This should be avoided during peak hours on school routes and connections with traffic volumes above 100 vehicles. Municipal sidewalks must have an effective width of at least 2.5 meters.

In key pedestrian links, the pedestrian space must be dimensioned according to the volume of pedestrian traffic. There is also a furnishing zone, a necessary snow storage area, a wall zone, and a foundation. To encourage people to walk, sidewalk areas must be viewed as safe and inviting. Pedestrian connections must be created with good sightlines. Critical connections must be operational all year. It is necessary to light pedestrian links. Plants and seats should be provided where possible. Seating should be provided every 50 meters along heavily used pedestrian links. Seating should be provided every 100 meters for other connections. Ground-level active facades with outward-looking amenities and a facade design that encourages pedestrians to stroll or cycle there should be included in new buildings facing public connections.

3.2.2. Bicycle connections. Cycling links must be developed in such a way that they provide a clear path to significant destinations while also being compatible with the rest of the city's bicycle network. Connections with through bicycle traffic must be built as either a paved bike route or a bicycle lane in the roadway. Bicycle lanes on streets with automobile traffic can be replaced with red bicycle box markings if the speed is modest (less than 30 km/h) and the anticipated carload does not exceed 200 vehicles / hour during peak hour. When bicycle connections intersect pedestrian connections and foot traffic exceeds 300 times per hour, pedestrian traffic takes precedence. The junctions must be safe for traffic.

Bicycle lanes should be at least 1.7 meters wide at 30 km/h, and bicycle routes with pavements should be at least 3 + 2.5 meters wide. Where there are a lot of bikers and pedestrians, the width can be raised. Bicycle paths must be lit. Bicycle parking should be available at the main entrance for visitors to visitor-intensive events. Bicycle parking should be offered near critical access routes as well. Employee and student bicycle parking should be hidden, incorporated into buildings or below ground level when possible, and adjacent to cloakroom facilities. Where there is a regular need for large capacity bicycle parking, a portion of bicycle parking solutions can be integrated into urban furniture that otherwise provides living values. It is vital to plan for proper land use.

3.2.3. Urban space for stays, meetings, and recreations. New buildings must have active and live facades facing the urban space at street level. Entrance areas and service functions must be directed toward urban spaces and vital linkages. Windows facing streets and squares should reveal the activity inside in such a way that the activities of the building are visible to the public. A forecourt should be built between important entrances and sidewalks/streets that also meet the guidelines for safe exit. The forecourt should have benches and plants. Urban regions' limits must be properly defined.

Every site should have acceptable living conditions to accommodate both formal and casual meetings. This should be represented in the design of cities and surrounding structures. Planting will be employed to create healthy local climatic living zones. As much as possible, places should be decorated artistically. As much as possible, places and parks will be set aside for children and young people. While universal design and safety principles must be met, the traffic area should be constructed as an integral component of the space. Street and square separation and delimitation must be built with the clearest possible alignment in mind. Public spaces and neighbouring areas should have the most holistic feel possible, with plenty of room for plants, benches, and other street furniture. A separate design guide should be produced for larger projects.

3.2.4. Green connections. Green linkages must be protected and reinforced in order to increase biological variety and provide experience features. They must have a diversified and appropriate flora that can provide perfect habitats for birds and animals, as well as safe and sheltered local climatic zones for people who live and go outside. Green linkages will help to safeguard natural corridors. In general, large trees should be conserved. If alleys are deleted, they should be rebuilt. Cross connections must visually lead to green spaces in the surrounding landscape. This seeks to give optimal direction and readability while adhering to established Trondheim urban design norms.

3.3. Urban development strategy for Trondheim

The strategy for urban development provides strategies for more individuals in the city to walk, cycle, or ride the bus on a regular basis. Working carefully on this contributes to the city's more attractive and environmentally responsible expansion. The strategy builds on the municipal sub-plan for energy and climate, the municipal component of the municipal plan, and the urban environment and urban growth agreement. Building the city close and with a fine-grained network of services, meeting places, and connections will result in an increasing number of people having local destinations that are easily accessible without a car, greater mobility for both residents and businesses, and a more inclusive and diverse city (Urban development strategy “Byutviklingsstrategi” for Trondheim).

Given this backdrop, the study' conclusions in this document are particularly focused on mobility and transportation, as expressed in further depth in the sections below. All statistics in section 3.3.1 are sourced from Trondheim's Urban development strategy- a strategy for urban and transportation development from now to 2050 - Trondheim municipality.

3.3.1. Mobility and transport. As the population rises, there will be more travel every day. While private car use should be reduced, the mobility offer should be maintained, if not expanded. Developing infrastructure that makes it easy to select walking, cycling, or public transportation as a method of transportation for daily travel is part of this. This helps to achieve the zero-growth goal by making it easier to live an environmentally responsible lifestyle, and it can free up capacity on the road network, increasing commercial transportation mobility. Greater pedestrian and bicycle traffic has a number of positive effects on public health, including increased physical activity, social engagement, and pollution reduction.

Proximity to a variety of offers is required for increasing walking, cycling, and short public transportation, which is especially important for children and the elderly, who have a greater need to feel comfortable and secure than other demographic groups. Building the city close and with a fine-grained network of services, meeting places, and connections will result in an increasing number of people having local destinations that are easily accessible without a car, greater mobility for both residents and businesses, and a more inclusive and diverse city.

A visitor brought up the following point which has been added to the document on what should be within walking distance of the home in the New Year 2019: "... For it to be enjoyable to stroll, we think there must be green areas or trees along portions of the road, and pathways must be in order and plowed in the winter." "The most important thing is to be close to a grocery shop so you can simply acquire goods for home after work." The easier it is, the more people will take the bus to and from work, removing the need to drive a car, mostly to avoid the long trip from the store with heavy shopping bags. The bus stop is also conveniently positioned within walking distance of the residence, so getting about the city does not become a "measure"...

Soft road users are more common in downtown, smaller downtowns, and hubs. As a result, these locations must be accessible to all people, regardless of age or level of function, and contribute to everyone's capacity to move safely and securely. Building mobility points, among other things, will boost mobility. Individuals who walk and cycle, utilize public transit, and use necessary transportation must be prioritized above those who drive a private car in terms of accessibility and growth. The stations will accommodate pedestrians, bicyclists, and those with impairments. The centre’s concentration will be on public transit. The priority pyramid displays suggestions for prioritizing main road user groups in the development of Trondheim city centre and smaller city centres through 2050.

3.4. Walking-related planning

Walking is good for your health, the environment, and your social life. The urban environment improves as more people walk, becoming more beautiful, dynamic, and safe (Nasjonal gåstrategi del 2,kap 1 “National walking strategy part 2, chapter 1”). It is therefore vital to identify tactics and technology that encourage people to walk more. As a result, both beauty and security are emphasized as major motivators for greater walking (Gangfremmende planlegging, 2020 “Pace-promoting planning”).

Planning pedestrian connections include assuring the ideal placement of new connections, improving existing ones, and creating pedestrian-friendly settings. All key pedestrian links should be safe, pleasant, and appealing, as well as accessible and passable (Gangfremmende planlegging, 2020 “Pace-promoting planning”). The placement and design of intersections influence walkability. As a result, crossings must be constructed as part of the expansion of natural trails, in the proper location, kind, and design. On key pedestrian routes, pedestrians must take precedence over other traffic.

All of the information in sections 3.4.1, 3.4.2, 3.4.3, and 3.4.4 is taken from “Plan for How to make people walk more" (Gangfremmende planlegging.pdf, 2020 “Pace-promoting planning”).

3.4.1. Accessibility. The walkway's accessibility decides whether it offers a link ("Walking to/from stops" Gåing til/fra holdeplasser, 2018 "Walking to/from stops"). It may be viewed as both physical and mental accessibility (distance between locations and climbing conditions) (ability to orient oneself and read the structure).

Physical barriers or other limits that result in greater time consumption (Nasjonal gåstrategi, kap 5.8 "National walking strategy chapter 5.8") or other perceived disadvantages prevent pedestrians from reaching their destination in a timely and efficient way at all times of the year.

A dense, logical, and well-designed pedestrian network with short distances between objective sites provides good accessibility, allowing the pedestrian to quickly and easily locate his way regardless of functionality. A generally created walkway, for example, with proper slope conditions, allows adequate access for as many people as possible. The pedestrian area must be broad enough to support expected foot traffic in the connection, and all events taking place on the site must be taken into account. This can be utilized for snow storage, meeting spaces, and entrances with a forecourt. If walking is to be available throughout the year, the pathway area must be ensured in terms of breadth and winter operating preparedness.

The addition of a side section with rest and lodging options improves accessibility for persons with varied degrees of mobility difficulties, such as youngsters and the elderly. Furthermore, adequate lighting enhances accessibility at night.

3.4.2. Safety. Security includes both protection from other road users as well as protection from crime and violence. These are difficult criteria that do not always have simple solutions. Road user separation can increase traffic safety while maintaining social control (Gåing til/fra holdeplasser, 2018 "Walking to/from stops"). Experienced pedestrian safety can be important in deciding if walking is viewed as a viable means of transportation. This is especially important for youngsters, the elderly, and the disabled.

Most pedestrians believe that settings with a big number of people and a clear view of the target areas are safe. It is also necessary to have appropriate illumination and a dense network with access to many alternative routes (Plan for friluftsliv og grønne områder - Vedlegg 3 "Plan for outdoor life and green areas - Appendix 3"). Visibility also provides greater time to respond to threats.

The speed and amount of vehicle traffic influence pedestrians' feelings of safety on and near highways. It can also be hazardous if it is not large enough to operate during the winter, increasing the risk of sliding and falling (Helen et al., 2019). Lighting is critical for walking comfort (Helen et al., 2019). This contributes to the creation of a safe and secure environment All regulated pathways, as well as crossing places, must have illumination.

3.4.3. Comfort. Most walkers see a stroll as comfortable if it is protected from the elements, such as wind and rain, as well as pollution and noise. It is also critical that the promenade provides interesting experiences, provides several opportunities for rest breaks, and leads directly to the goal. The pedestrian zone must also be large enough and slanted enough to allow for uninterrupted walking. It can only be called pleasant if the pedestrian link is both accessible and safe (Gåing til/fra holdeplasser, 2018 "Walking to/from stops").

3.4.4. Attractiveness. Pedestrian links between different gathering areas, such as squares and cafés, are appealing. The same is true for parks and greenspaces, as well as benches and other such structures. A pleasant pedestrian environment is provided by lively and open first floors with audience-oriented activities, combined functions with housing, human size, and variation in façade expression. Visual contact with city landmarks aids with orientation. Walkways should preferably be placed in well-lit, densely inhabited areas. Ideally, via residential and retail zones, rather than thick woods or pristine business areas. Underpasses and footbridges typically produce many and lengthy detours, reducing pedestrian accessibility and flexibility. A thorough perspective of the surroundings and clear visibility to critical orientation points are required.

4. Discussion and conclusion

Trondheim's municipality has a vision of making Trondheim a model and collaborative arena for the development of green values and a climate-friendly lifestyle. Trondheim kommune (2017) has set a goal of reducing greenhouse gas emissions by 80% by 2030 compared to 1991 levels. If that goal is to be met, more walking and cycling are required. Increasing active mobility in the Elgeseter area will simultaneously address four sustainable development goals: good health and wellbeing, sustainable cities and communities, climate action, and land life.

Elgeseter, one of Trondheim's most important streets, is plagued by difficulties such as excessive traffic, hazardous pollutants, and noise pollution. Increased active mobility in the region can help to solve several of these problems. According to Temeljotov-Salaj and Lindkvist (2021), the contribution to health and well-being is critical in a holistic approach to urban space regeneration, which includes both physical causes and symptoms of poor health, as well as the social, economic, and environmental components of individual-community-, and overall well-being. In other words, the main goal of this paper is to find incentives that will encourage residents to change their behaviour and choose walkability and bikeability as a way to improve the quality of life in cities, particularly Trondheim in Norway, while also improving public and private health and lowering harmful emissions, traffic congestion, and noise associated with excessive automobility to respond to the study question, "*What may persuade Elgeseter district commuters or travelers to modify their behavior toward more walking and biking?"*

Identifying existing difficulties in the district, Evaluation of current pedestrian, bicycle, and vehicle links, as well as meeting places and open spaces, and identification of opportunities to improve them, How to outline planning concepts, Methods and design recommendations for enhancing walking and micro transportation, and The importance of accessibility, safety, and comfort in attracting people to active mobility are the key findings for answering the research question in this study. This approach is required in order to persuade more people to choose environmentally friendly, sustainable modes of transportation as a lifestyle choice rather than a necessity.

The walkability and bikeability indices are used to determine how convenient it is to walk and ride in a given neighbourhood, and they often include characteristics such as comfort and perceived safety. Walkable and bikeable communities are recognized as excellent places to live, work, and play because they provide recreational opportunities, more diverse and active transportation options, and opportunities to be physically active, all of which contribute to our overall health and wellbeing. Data suggest that understanding that various consumers have distinct travel habits and expectations is crucial. As a result, activities to promote walking and cycling should be tailored to meet the demands of all users, resulting in a greater number of prospective users.

As the paper's findings reveal that individuals care about the walking environment, several measures were presented in various ways. First, existing methodologies disregard urban design elements such as sidewalk quality, walking buffers, and other factors that impact people's walking behaviour. Second, understanding the area's purpose and, more crucially, local people's preferences for the walking environment is vital for evaluating walkability.

Urban development plans ought to be reconsidered and altered to improve traffic flow by including and supporting non-motorized, less polluting modes of transportation such as cycling and walking. In other words, the main route directly south of Trondheim city centre ought to be altered to contain walkways, crossing junctions, and unique bicycle and pedestrian lanes with end-to-end connections between Professor Brochs gate in the south and Klostergata in the north. Second, Trondheim municipality ought to construct a more inexpensive, accessible, and appealing transit system that is always available to commuters in the Elgeseter district in order to reduce dependency on unsustainable modes of transportation. Planners should emphasize creating routes to connect dwellings with services and investing in more recreational amenities within walking distances in rural locations where physical activity and active mobility alternatives are severely constrained.

Based on the above, it will be feasible to apply the ideas for more effective strategies to support and develop active forms of transportation in the Elgeseter area. As a result, infrastructure and

regulations ought to fulfil present and future user expectations in order to offer an acceptable walking and biking transportation network service and encourage people to utilize it. Furthermore, given the important public health, economic, and climatic implications of transportation behaviour, researchers and funders should prioritize creating specialized motivators for active mobility in the future.

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