Walking and cycling data

Practice, challenges, needs and gaps

RAMBØLL

Bright ideas.
Sustainable change.

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Dear Reader,

Thank you for your interest in this report about walking and cycling data. It's the fourth in our series of so-called green papers where we investigate a topic in the field of sustainable mobility and where our purpose is to contribute new knowledge to the industry and to spark discussion.

This report has been created in partnership with a total of 11 European public authorizes - The National Road Authority in Norway and The Netherlands, City of Trondheim and Grimstad in Norway, City of Lahti and Tampere in Finland, City of Malmö in Sweden, City of Copenhagen in Denmark, City of Ghent in Belgium, City of Rotterdam and the Province of Utrecht in The Netherlands – as well as the NGO's Walk21 and European Cyclists' Federation. Presentations of the partners can be found on page 6.
We would like to thank all the partners for their participating with resources, time, and input. Without these partners this report would not exist.

We also owe a big thank you to the 9 international cities and regions that have supported the report by participating in our survey and following in-depth interviews alongside our partners. Thank you for your time to City of Dresden and Munich in Germany, City of Tallinn in Estonia, Greater Manchester in the UK, City of Bordeaux in France, Quezon City in the Philippines and CWANZ, the organisation "Cycling and Walking Australia and New Zealand".

We also had the privilege to interview 8 walking and cycling data experts for this report. Their initial input was very valuable and laid the foundation for the survey and the interviews. A big thank you to international expert Jim Walker, Founder of Walk 21; Philippe Crist, Advisor at International Transport Forum, OECD; Holger Haubold, data expert at The European Cyclists' Federation; Dirk Lauwers, Professor at the University of Antwerp and the University of Ghent; Thérèse Steenberghen, Professor at KU Leuven; Stéphanie Mangin, responsible for French national cycling counting platform at Vélo & Territoires and Kevin Maine, CEO of the Cycling Industries and Matteo Candelari, CIE.

Last but not least we would like to thank the 46 public authorities who answered our online survey on walking and cycling data and helped us qualify our findings – on a global level.

Thank you from the international Ramboll Smart Mobility team behind the report,

- Kimmo Ylisiurunen, Finland – project manager
- Marianne Weinreich, Denmark – main author and lead survey and interviews
- Morten Agerlin Petersen, Denmark – data benchmarking
- Ronja Sørensen, Denmark – research and text
- Martijn Hollestelle, Finland - data expert
- Darius Colin, Finland - interviews
- Valtteri Karttunen, Finland - interviews
- Frida Anderson, Norway - interviews
- Valentin Kranz, Germany - interviews
- Bok Wee Leow, Singapore - interviews
- Ian McCarthy, Australia - workshop
- Utkarsh Sood, Australia – workshop
- Anna Søgaard, Denmark - survey

Content

Executive Summary

More and more people are walking and cycling in cities around the World – the trend was there already, but the COVID pandemic boosted both the need for and political focus on walking and cycling as a way of getting around our cities in our everyday lives achieving greener, more climate friendly, healthier, safer and more space efficient cities around the World.

But unlike cars, public transport, and new mobility solutions there's a lack of data about walking and cycling. Data on pedestrians and cyclists is not systematically collected, has limitations and can be difficult to compare and benchmark. But data on walking and cycling is important for cities in order to be able to set goals and targets, create the policies needed to reach these goals, to track progress and make decisions about investments in infrastructure and planning measures that support walking and cycling. Lack of data also means that walking and cycling is often missing or overlooked in the transport and mobility ecosystem – because what is not measured does not count. Often pedestrians and cyclists only become visible in data when they get hurt or die in accidents. Lack of data also means lack of knowledge about why different people are not walking and cycling – at all or in specific streets or areas. Data is put simply a way of creating awareness and making the invisible visible.

In Ramboll Smart Mobility we wanted to investigate how different public authorities work with walking and cycling data – what is the practise, needs and challenges in relation to walking and cycling data and benchmark the available data sources against the most common indicators.

The methodology

In order to answer the questions, we interviewed the following international walking and cycling data experts:

- Philippe Crist, advisor ITF OECD
- Dirk Lauwers, Professor, University of Antwerp & the University of Ghent
- Thérèse Steenberghen, Professor KU Leuven
- Stéphanie Mangin, bike observation project manager for the French national cycling counting platform at Vélo & Territoires
- Kevin Maine, CEO of Cycling Industries Europe (CIE)
- Matteo Candelari, Cycling Industries Europe (CIE)
- Jim Walker, Founder Walk21
- Holger Haubold, European Cycling Foundation

The interviews were the foundation for our partner and supporter survey and in-depth interviews and workshops. Our partner and supporter survey was also made public and we got about 50 international responses. Finally, we have mapped available walking and cycling data sources and benchmarked them against the most commonly used indicators.

Partners and supporters

We have partnered up with 11 public authorities of different geography, size and level of walking and cycling as well as the two leading NGO's for walking and cycling in Europe, Walk21 and ECF, the European Cyclists' Federation. The 11 public authorities are:

Belgium:

- City of Ghent and Cycling Embassy of Ghent

Denmark:

- City of Copenhagen

Finland:

- City of Lahti
- City of Tampere

The Netherlands:

- Tour de Force, The Dutch Road Administration / Ministry of Infrastructure and Waterworks
- Province of Utrecht
- City of Rotterdam

Norway:

- Norwegian Public Road Administration
- City of Trondheim
- City of Grimstad

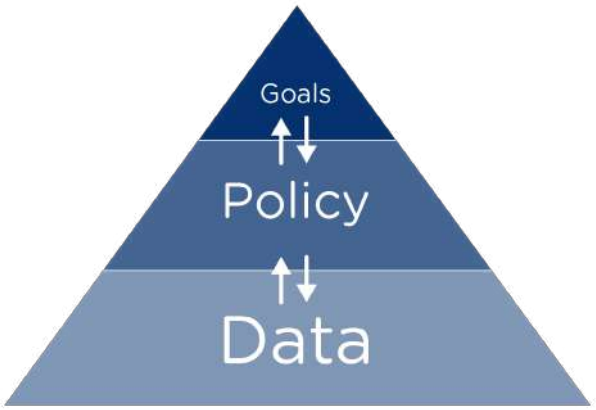
Sweden:

- City of Malmö

Since the core partnership is primarily public authorities from Northern Europe we also reached out to public authorities outside this geography and are very happy to include 7 additional cities and the organisation for walking and cycling in Australia and New Zealand as "supporters".

The supporters are:

- City of Dresden, Germany
- City of Munich, Germany
- Greater Manchester, UK
- City of Bordeaux, France
- City of Tallinn, Estonia
- Quezon City, Philippines
- Cycling and Walking Australia and New Zealand (CWANZ)



Key findings

According to the walking and cycling data experts the main purpose for collecting data should be the following:

- To guide and monitor change
- To make decisions about which policies to implement
- Planning
- Evaluation of measures
- To secure funding

As Philippe Crist, advisor ITF, OECD points out that data is not the main trigger for change, but it can and should guide change: "Using data should always be a response to a specific need or challenge you want to deal with. Data is not the solution, but a way to understand a problem better in order to develop the policies needed to create change". Data is what you need to guide the actions, that will deliver to the goals set. The vision should drive policies and actions, and these policies and actions should be guided by data.

The experts highlight that numbers related to walking and cycling activity are important, but that safety, satisfaction and understanding of who's cycling and who's not cycling and why is also very important data to collect. The experts have the following recommendations:

To Philippe Crist (ITF) safety data – both perceived and actual safety - as well as crash data are must-collect data. Numbers of cyclists are also very important in order to monitor the development, but he also emphasizes that cities should not make decisions about where to implement cycling infrastructure based solely on counting's of existing young, male cyclists' routes and behaviour. Collecting data to understand who's cycling and who's not cycling and why is key.

Professor Lauwers recommend that cities broaden their data collection in order to get a bigger picture – like understanding displacement and attraction from other streets.

Professor Thérèse Steenberghen's recommendation is that cities - as a minimum - collect data on the number of pedestrians and cyclists and map the quality of the infrastructure provided. However, the standard level of data should also include new micro-mobility solutions – data of usage and challenges caused and solved. On top of that cities can elaborate by including data on user satisfaction, user needs and user empowerment.

Stéphanie Mangin (Vélo & Territoires) recommends that cities start by asking what they need to know and then choose their data collection approach accordingly. In that process it's also important from the beginning to think about by who and how the data should be analyzed and then prioritize the data you want to collect.

"Start with the basics," recommends Holger Haubold (ECF). To him basic data sets are modal share of cycling and overview of infrastructure. Standard data should however be more detailed and include demographics, classification of infrastructure, satisfaction, and overview of investments. In the elaborate tier real time data for cyclist flow should be included and used for traffic management.

Kevin Mayne and Matteo Candelari (ECI) recommend that public authorities collect - as a minimum - data about the number of cyclists and what is changing. The next level is to understand what enables and drives the change. The top tier of data collection is comprehensive ITS (Intelligent Transport Systems) for cycling.

According to Jim Walker from Walk 21 there are many important datasets that can be and should be collected, to understand the relationship between walking behavior, perceptions, and the walkability of environments, but to stimulate interest in adopting such methods, a walking lens to existing datasets can give a quick insight into the existing experience. The most helpful data to get a snapshot of reality is to understand 'activity, safety, accessibility, comfort and satisfaction.

Walking and cycling data practice, needs and challenges

In order to map current walking and cycling data practice, needs and gaps we have conducted a survey and in-depth interviews with our partners and supporters and made the survey public to quantify the findings. We got 46 completed responses for walking and 42 for cycling from cities covering 11 countries.

We have focused on the following topics:
- Goals and strategy
- Policy and data collection
- Purpose for data collection
- Selected indicators
- Data sources
- Data challenges

All of the 18 partners and supporter authorities have a politically approved cycling strategy in place. For walking it's 13 out of the 18. That tendency that there's no goals for walking is even clearer in the global survey, where only 1/3 of the public authority's state to have political approved goals for walking while more than 2/3 have for cycling.

9 out of 10 partners and supporters have a cycling strategy, while only little over half have a walking strategy in place. In the global survey the tendency it even clearer with 6 out 10 having a cycling strategy while only 1 out of 10 has a walking strategy.

In relation to policies 9 out of 10 of the partners have policies in place for cycling while only 4 out of 10 have for walking. For walking it's about the same in the global survey, while here it's only about half that has cycling policies in place.

All of the partners and supporter authorities collect data on cycling, while 8 out of 10 do it for walking. In the global survey 7 out of 10 authorities collect data on cycling while less than 4 out og 10 do it for walking.

The primary purposes for the partners and supporters to collect data for walking

and cycling data are decision making, policy making, understanding walking and cycling better and to monitor change.

It's almost the same in the global survey except that "Planning" is the number one reason for cycling.

For walking the primary indicators selected by the authorities are primarily linked to safety and satisfaction, modal share and then number of pedestrians. For cycling number of cyclists and extent of cycling infrastructure are the main indicators followed by quality of cycling infrastructure, safety, and satisfaction.

In the global survey safety and number of pedestrians are the primary indicators for walking, while satisfaction is not a key indicator for walking. For cycling the selected indicators are similar among our partners and supporters and the global survey.

Travel surveys and manual countings are the key data sources for walking for our partners and supporters while for cycling different types of automatic counters are the key source for cycling data. Data from different kinds of operators – bike sharing, bicycle parking etc. – are also key sources.

In the global survey different types of automatic counters are also the dominant data source for cycling, while radar/ infrared, manual countings and travel surveys are the most used data source for walking.

Quality, comparability, validity, and lack of standards have been identified by both our partners and supporters as well as in the global survey as key challenges in relation to both walking and cycling data. But for walking the number one challenge is lack of understanding for the need for data about walking in the different authorities. For cycling is not so much about data need, but more about creating meaning out of the data that's a challenge.

Conclusions

Cycling and walking does not have the same political attention as car driving and public transport. It manifests in lack of goals, strategies, and policies - especially for walking.

But it also manifests in data collection. Walking is at the bottom of the mobility data hierarchy – it does not get the same attention and resources as cycling and the car is king in data collection. If data is collected for walking the scale is lower than for cycling both in terms of indicators and data sources used. Among the partners and supporters lack of understanding in their organizations of the need for collecting walking data is identified a key challenge. The question is - is walking (and cycling) underprioritized because we don't have that much data on walking or is walking data underprioritized because walking is overlooked?

In the article "The Hidden Deficit Holding Back Bike Infrastructure Investment? Streetlight Data looks at how lack of data on non-motorized travel slows bike and pedestrian investment in the US: "It's kind of scary actually, how little we know about our communities, when it comes to walking and biking transportation," says Bill Nesper, executive director of the League of American Bicyclists[1].

Since collecting data both according to our experts and the public authorities is about decision making, policies, planning and monitoring change lack of walking and cycling data means a poor foundation for policy making and planning for walking and cycling. Walking as well as cycling is both a sustainable and healthy way of moving in cities on it own, but also what connects and bring us to all other modes. Lack of focus, data and knowledge about walking has consequences for the experience of the whole mobility system and is thus a big challenge for creating a sustainable, attractive, multimodal mobility system that can challenge car dependency in cities.

Due to lack of standards for walking and cycling data the main challenges that planners experience are poor data quality, validity, and comparability. Establishing the needed common standards on both national and international level for collection of basic walking and cycling data is an important step towards securing good data and thus better policies for walking and cycling data.

Data collection for car driving is typically about making car driving more efficient, reduce stops and improve travel time. Travel time is not a key indicator and focus for walking and cycling. Number of cyclists and pedestrians, safety, the experience of walking and cycling, satisfaction with the conditions are the key indicators for walking and cycling. That means a need for both quantitative and qualitative data related to safety, experience and satisfaction with walking and cycling. It also means a need for data about individual characteristics of pedestrians and cyclists – who are experiencing what and where in order to improve the conditions for those groups. These data can only be obtained by actively involving the users which makes them harder and more resourceful to collect. Understanding how to collect and analyse these data as well as understanding potential data bias when analysing the data makes it challenging and costly for public authorities to collect these data.

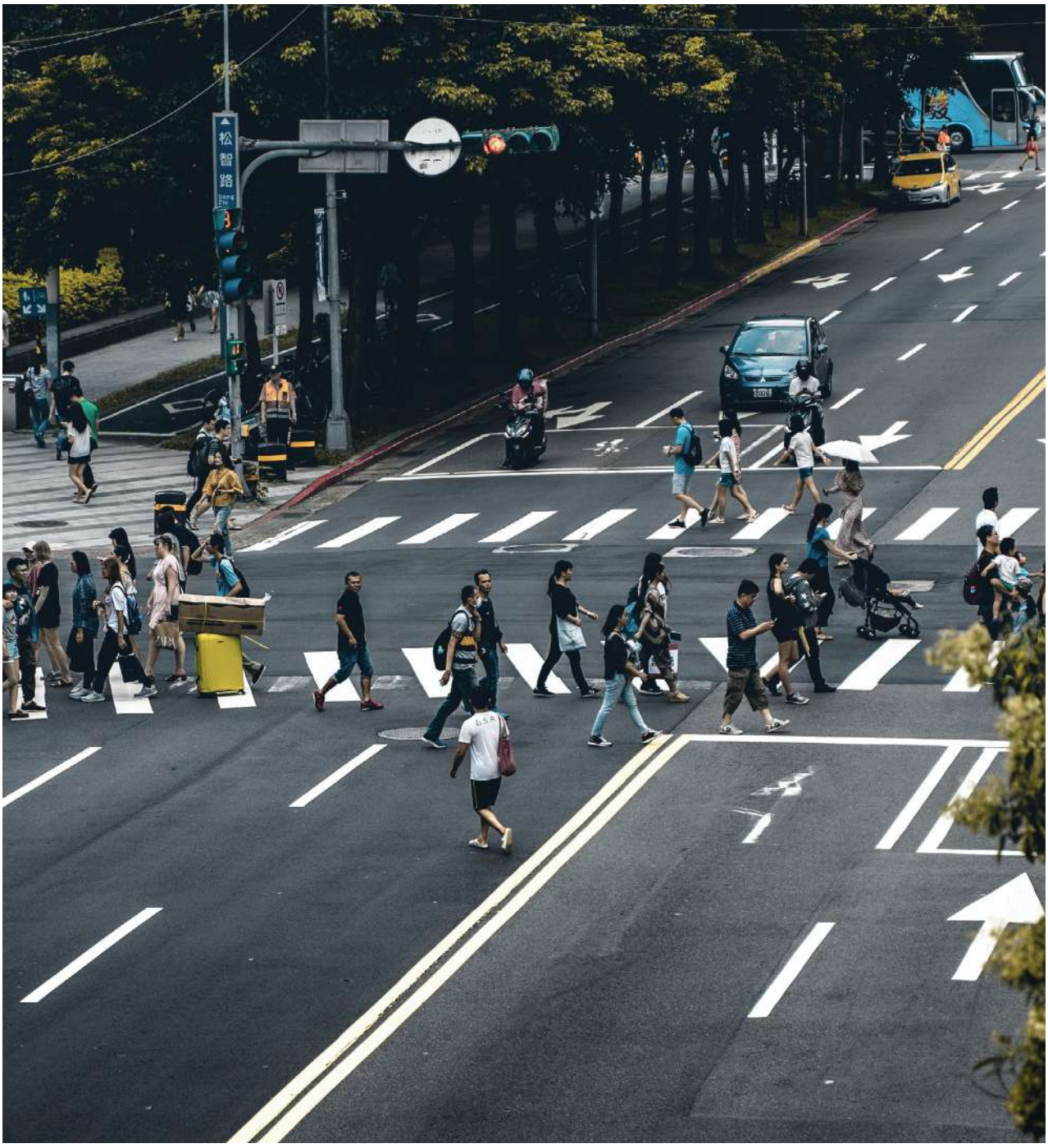
GDPR[2] and privacy is also a challenge for both walking and cycling data collection – especially in relation to understanding how different groups experience walking and cycling.

Another aspect repeated among the public authorities interviewed is that the fact that the movements of people walking, and cycling are more natural, fluid, and unpredictable compared to the more structured flows of for example car traffic. That means that it's more challenging to collect data about pedestrians and cyclists. GDPR and privacy legislation is also a challenge in relation GPS and trace data. Access to trace data about the actual movement of people walking and cycling is very high on the authority's wish list and identified as a gap in the market.

[1] https://www.streetlightdata.com/bike-infrastructure-data-deficit-changing/

[2] The General Data Protection Regulation (GDPR) is a legal framework that sets guidelines for the collection and processing of personal information from individuals who live and outside of the European Union (EU). Approved in 2016, the GDPR went into full effect two years later. https://www.investopedia.com/terms/g/general-data-protection-regulation-gdpr.asp

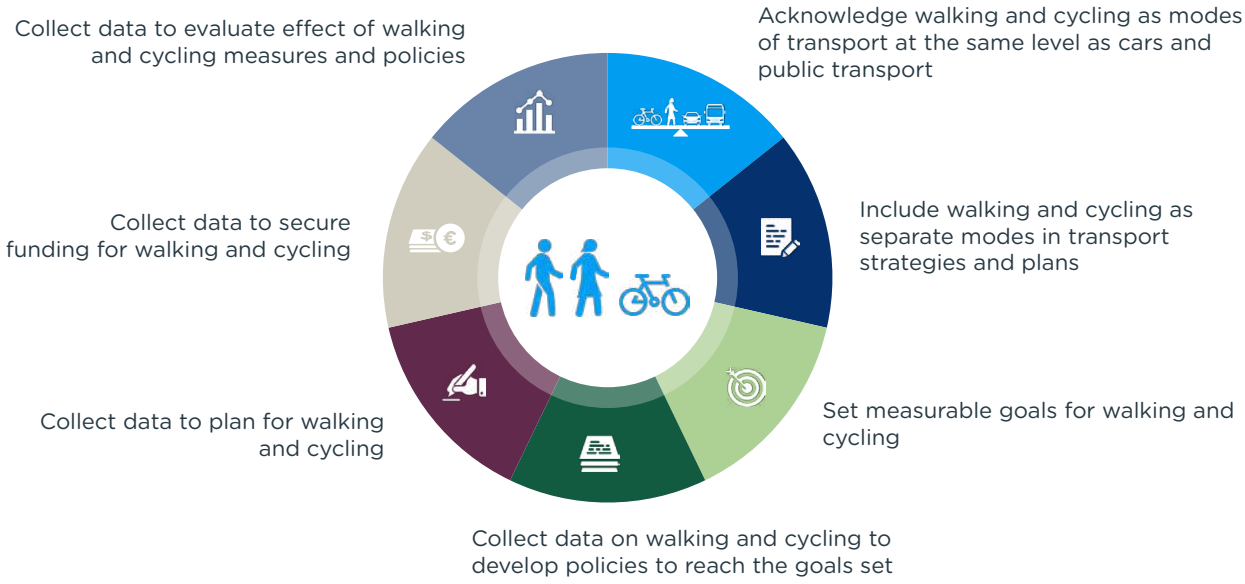
Another key challenge is that some of the most important data – why are people not walking and cycling - are invisible and needs to be made visible and collected through more resource heavy ways – like interviews and surveys.



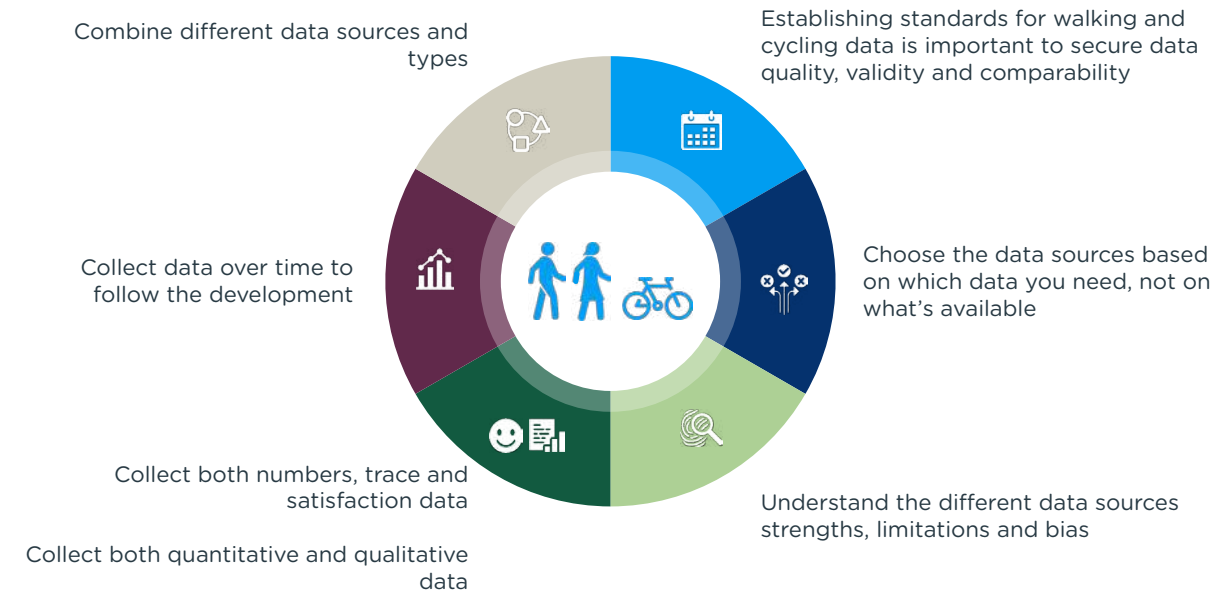
Recommendations

On the basis of the expert interviews, the 18 partner and supporter surveys and in-depth interviews and the global survey the following recommendations have been developed by the partnership:

Policy & data



How to collect meaningful data



Minimum data to collect for walking

Indicators should always be linked to the goals

Benefits
- Health benefits of walking
- Economic benefits of walking
- Emissions and noise benefits

Activity
- Average minutes spent walking per day disaggregated by age, ability and gender
- Number of people lingering/spending time in selected public spaces

Comfort & Satisfaction
- Percentage of streets with minimum 3 star pedestrian standard
- Pedestrian satisfaction with the existing walking experience disaggregated by age, ability and gender
- Who's NOT walking and why

Safety
- Number of pedestrians killed pr. 100,000 inhabitants disaggregated by age, ability, gender.

Accessibility
- The percentage of people living within 500m of public transport disaggregated by age, ability, gender

Minimum data to collect for cycling

Indicators should always be linked to the goals

Benefits
- Health benefits of cycling
- Economic benefits of cycling
- Emissions and noise benefits

Activity
- Number of cyclists
- Modal split - ideally captured for trips, distance, and time
- Trip purpose
- Break down by gender, age and other demographics

Satisfaction
- Cyclist satisfaction with infrastructure, bicycle parking, facilities and policies
- Where is it a good experience to cycle and where is it not
- Who's NOT cycling and why
- Break down by gender, age ability, and income

Safety
- Number of injured and killed (include single accidents)
- Risk factor - accidents in relations to trips

Accessibility
- Network: Length, status and quality
- Bicycle parking: Number, locations, capacity and quality
- Public transport: Accessibility to public transport, bicycle parking and first/ last mile solutions

Benchmarking of data sources

In the last section we benchmark the data sources that has been identified in our mapping of data sources as the most typical available and used data sources by public authorities against the most commonly identified indicators and describe the possibilities and limitations of the different data sources for walking and cycling.

The benchmark covers the following data sources:

Infrastructure and facilities
- Official maps
- Crowd sourcing (Open street maps)
- Other crowd-sources infrastructure data
- Quality/safety apps/online maps
- Computer vision

Quantities at point locations
- Counters
- Cameras
- Mobile phones and other portable electronics

Routes
- Mobile phones and other portable electronics
- Tracking apps
- Citybike / Bike sharing data

Surveys, stop interviews and observations
- Travel surveys
- Stop interviews

Statistics
- Police accident data
- Hospital and prehospital accident data
- Bicycle registers
- Insurance company data
- Bicycle parking facilities
- Bicycle industry/ shops

A green stoplight means that data usually will be attainable while a yellow stoplight means that data might be relevant but may need further processing and/or possible combination with other data to add any insight.

Please go to the benchmark section.

Introduction

More and more people are walking and cycling in cities around the World – the trend was there already, but the COVID pandemic boosted both the need for and political focus on walking and cycling as a way of getting around our cities in our everyday lives, as well as achieving greener, more climate friendly, healthier, safer and more space efficient cities around the World.

But unlike cars, public transport, and new mobility solutions there's a lack of data about walking and cycling. Data on pedestrians and cyclists is not systematically collected, has limitations and can be difficult to compare and benchmark. But data on walking and cycling is important for cities in order to be able to set goals and targets, create the policies needed to reach these goals, to track progress and make decisions about investments in infrastructure and planning measures that support walking and cycling. Lack of data also means that walking and cycling is often missing or overlooked in the transport and mobility ecosystem – because what is not measured does not count. Often pedestrians and cyclists only become visible in data when they get hurt or die in accidents. Lack of data also means lack of knowledge about why different people are not walking and cycling – at all or in specific streets or areas. Data is put simply a way of creating awareness and making the invisible visible.

In Ramboll Smart Mobility we wanted to investigate how different public authorities work with walking and cycling data and answer the following questions:

- What kind of walking and cycling data do cities of different sizes, geographies and level of walking and cycling already collect, what data do they need and wish they had and for what?
- What kind of walking and cycling data are available for cities currently, what are the available data suitable and not suitable for and are there gaps in the market?
- Which data should cities of different size and walking and cycling maturity collect and how should they use data to reach their sustainable mobility goals?

Partners

In order to answer these questions, we partnered up with 11 public authorities of different geography, size and level of walking and cycling as well as the two leading NGO's for walking and cycling in Europe, Walk21 and ECF, the European Cyclists' Federation. The 13 organisations in the partnership are presented in the following pages.

Belgium

City of Gent and Cycling Embassy of Gent

Name of organisation: City of Gent
Country: Belgium
Population: 264 666 (2022)
Responsibility of the organisation: The Mobility Department at the City of Ghent are responsible for sustainable transport in the city. The Cycling embassy of Ghent stimulates and facilitates the use of the bicycle as a sustainable mode of transport in Ghent".
Modal share of walking: 15% in 2021
Modal share of cycling: 34% in 2021

Credit: Jeroen Willems

Credit: Ursula Bach

Denmark

City of Copenhagen

Name of organisation: City of Copenhagen
Country: Denmark
Population: 644.425 (2022)
Responsibility of the organisation: The City is via the Technical and Environmental Administration responsible for sustainable transport in Copenhagen.
Modal share of walking*: 35 % (2022)
Modal share of cycling*: 21% (2022)

*Note to the Copenhagen's modal share: Modal share consists of all trips to, from and in Copenhagen (all purposes, both residents and non-residents). For Copenhageners trips only, the distribution is different: 41% walking and 22% cycling in 2021.

Finland
City of Lahti

Name of organisation: City of Lahti
Country: Finland
Population: 120 027 (2021 source)
Responsibility of the organisation: The focus on cycling and walking are part of the city's SUMP and represent Lahti's efforts to increase the share of sustainable modes of transport to more than 50 per cent by 2030.
Modal share of walking: 26% (2016)
Modal share of cycling: 9% in 2016 (source)

Credit: Lauri Rotko 2019

LAHTI

Credit: Laura Vanzo

TAMPERE

Finland
City of Tampere

Name of organisation: City of Tampere
Country: Finland
Population: 239 206 (2021 data)
Responsibility of the organisation: Within the Urban Environment Service area, the Transport system planning unit is responsible for sustainable transport in the City of Tampere.
Modal share of walking: 31% in 2016 (source)
Modal share of cycling: 7% in 2016 (source)

Norway
City of Trondheim

Name of organisation: City of Trondheim
Country: Norway
Population: 211 246 inhabitants (2022 data)
Responsibility of the organisation: The city is via the "Miljøpakken" partnership responsible for sustainable transport in the Trondheim region.
Modal share of walking: 29,5% (2020)
Modal share of cycling: 7,4% (2020)

Credits: Glen Musk/Miljøpakken

Source: Bodø by Lars Christensen

Norway
Norwegian Public Road Administration

Name of organisation: Norwegian Public Road Administration
Country: Norway
Population: 5 455 582 (2022)
Responsibility of the organisation: NPRA (Norwegian Public Road Administration) is a state agency responsible for the construction and maintenance of national roads and the supervision of vehicles and all road users. They have also sector responsibility for holistically urban policy (sustainable mobility).
Modal share of walking: 22% for all of Norway (2021)

Norway
City of Grimstad

Name of organisation: City of Grimstad
Country: Norway
Population: 24 089 (2022 data)
Responsibility of the organisation: Agder fylkeskommune and the Norwegian Public Road Administration are responsible for planning for walking and cycling together with Grimstad kommune. Agder fylkeskommune is the owner of several important roads and cyclepaths.
Modal share of walking: 20 % (2014)
Modal share of cycling: 6% (2014)

Credit: Hanne Feyling

Grimstad

Credit: Apelöga

City of Malmö

Sweden
City of Malmö

Name of organisation: City of Malmö
Country: Sweden
Population: 351,749 (2021 data)
Responsibility of the organisation: The city is via the real estate and street office responsible for sustainable transport in Malmö.
Modal share of walking: 14% in 2018 (source)
Modal share of cycling: 26% in 2018 (source)

The Netherlands
City of Rotterdam

Name of organisation: City of Rotterdam
Country: The Netherlands
Population: 651 631 (2021 data)
Responsibility of the organisation: Rotterdam's City Development Department are responsible for sustainable transport in the city.
Modal share of walking*: 34 % (2021)
Modal share of cycling*+: 21% (2021)

Credit: Peter Schmidt

City of Rotterdam

* There are 2 ways they analyse a modal split in Rotterdam, based on trips ('verplaatsing' in Dutch) or based on each individual leg of a trip ('rit' in Dutch). With the trip method they assign one main form of transport to the entire trip (from origin to destination). This gives 23% biking and 30% walking. The other option is to distinguish between every mode change in the chain between the origin and destination. This gives 21 % bike and 34% walking)

Credit: Province of Utrecht

PROVINCIE :: UTRECHT

The Netherlands
Province of Utrecht

Name of organisation: Province of Utrecht
Country: The Netherlands
Population: 1 361 153 (2021)
Responsibility of the organisation: Sustainable spatial development, including water management, Vital countryside, Regional accessibility and regional public transport, road safety.
Modal share of walking: 25% (2021)
Modal share of cycling: 29% (2021)

The Netherlands

Dutch Road Administration (Tour de Force)

Name of organisation: Tour de Force, representing 23 governmental and non-governmental organisations. Represented by the Dutch Road Administration / Ministry of Infrastructure and Waterworks.
Country: The Netherlands
Population: 17 720 275 (2022)
Responsibility of the organisation: Tour de Force is a collaboration between governments, private parties, knowledge institutions and platforms, all which are committed to empower the cycling policy in the Netherlands. Complex Issues like cycling data are handled collectively in the TdF. The Dutch Road Administration is part of the Ministry of Infrastructure and Water Management (Rijkswaterstaat) and is responsible for good infrastructure of the roads, canals and watersystems.
Modal share of walking: 18% (2016)
Modal share of cycling: 26% (2016)

NGOs

European Cyclists' Federation (ECF)

Name of organisation:
European Cyclists' Federation
Country: European association based in Belgium
Geography and number of member organisations:
ECF has more than 60 member organisations in over 40 countries.
Responsibility /work the organisation is doing:
Founded in 1983, the European Cyclists' Federation is a Brussels-based independent non-profit association dedicated to achieving more and better cycling for all in Europe. As the European umbrella organisation for both transportation and leisure cycling, ECF unites the European cycling movements as the only civil society voice at the pan-European level, and as the world's largest and best-known cyclists' advocacy organisation.

Credit: ECF

Walk21

Name of organisation:
Walk21 Foundation (registered in the UK) and Walk21 Europe (registered in The Netherlands)
Country: Registered in the UK and the Netherlands
Geography and number of member organisations:
Walk21 Foundation and Walk21 Europe are active in every continent and work in partnership with governments, communities, academics, experts and supportive organisations to grow the walking movement. They coordinate a network of more than 5,000 people.
Responsibility of the organisation:
Walk21 helps walking to be measured, valued and appropriately provided for so that everyone in the world can choose to walk and enjoy the experience.

Credit: Jim Walker

Supporting organisations

Since the core partnership is primarily cities from Northern Europe we reached out to cities outside this geography and are very happy to also include 7 additional cities from southern and Eastern Europe, the UK, Asia and the organisation for walking and cycling in Australia and New Zealand CWANZ as “supporters”.

City of Bordeaux/FR

Name of organisation: Bordeaux Metropole
Country: France
Population: 814 049 inhabitants (2019)
Responsibility /work the organisation is doing:
The Metropole is via the Department of Mobilities Multimodality responsible for sustainable transport in Bordeaux.
Modal share of walking: 29% (2017)
Modal share of cycling: 8% (2017)

City of Dresden/DE

Name of organisation: City of Dresden
Country: Germany
Population: 561.002 (2021)
Responsibility /work the organisation is doing:
The Office "Urban Planning and Mobility" in the "Department of Urban Development, Construction, Transport and Real Estate is responsible for sustainable transport in Dresden.
Modal share of walking: 26% in 2018 (source)
Modal share of cycling: 18% in 2018 (source)

City of Tallinn/EE

Name of organisation: City of Tallinn
Country: Estonia
Population: 454 162 (2022)
Responsibility /work the organisation is doing:
One of the duties of Tallinn Urban Environment and Public Works Department and the Tallinn Urban Planning Department is planning and building cycling infrastructure in Tallinn city.
Modal share of walking: approx. 25% (approximate values for 2022)
Modal share of cycling: 2% (2017)

Greater Manchester/UK

Name of organisation: Transport for Greater Manchester
Country: United Kingdom
Population: 2,867,800 (2021)
Responsibility /work the organisation is doing:
Transport for Greater Manchester (TfGM) is the transport delivery arm for the Greater Manchester Combined Authority (GMCA). TfGM oversees transport and travel across Greater Manchester.
Modal share of walking: 32% (2021)
Modal share of cycling: 2% (2021)

Quezon City/ PH

Name of organisation: Quezon City
Country: Philippines
Population: 3,121,477 (projected population 2022)
Responsibility /work the organisation is doing:
The Department of Public Order and Safety - Green Transport Office are responsible for sustainable transport in Quezon City.
Modal share of walking: No local data on modal share of walking.
Modal share of cycling: No local data on modal share of cycling.

CWANZ/AU

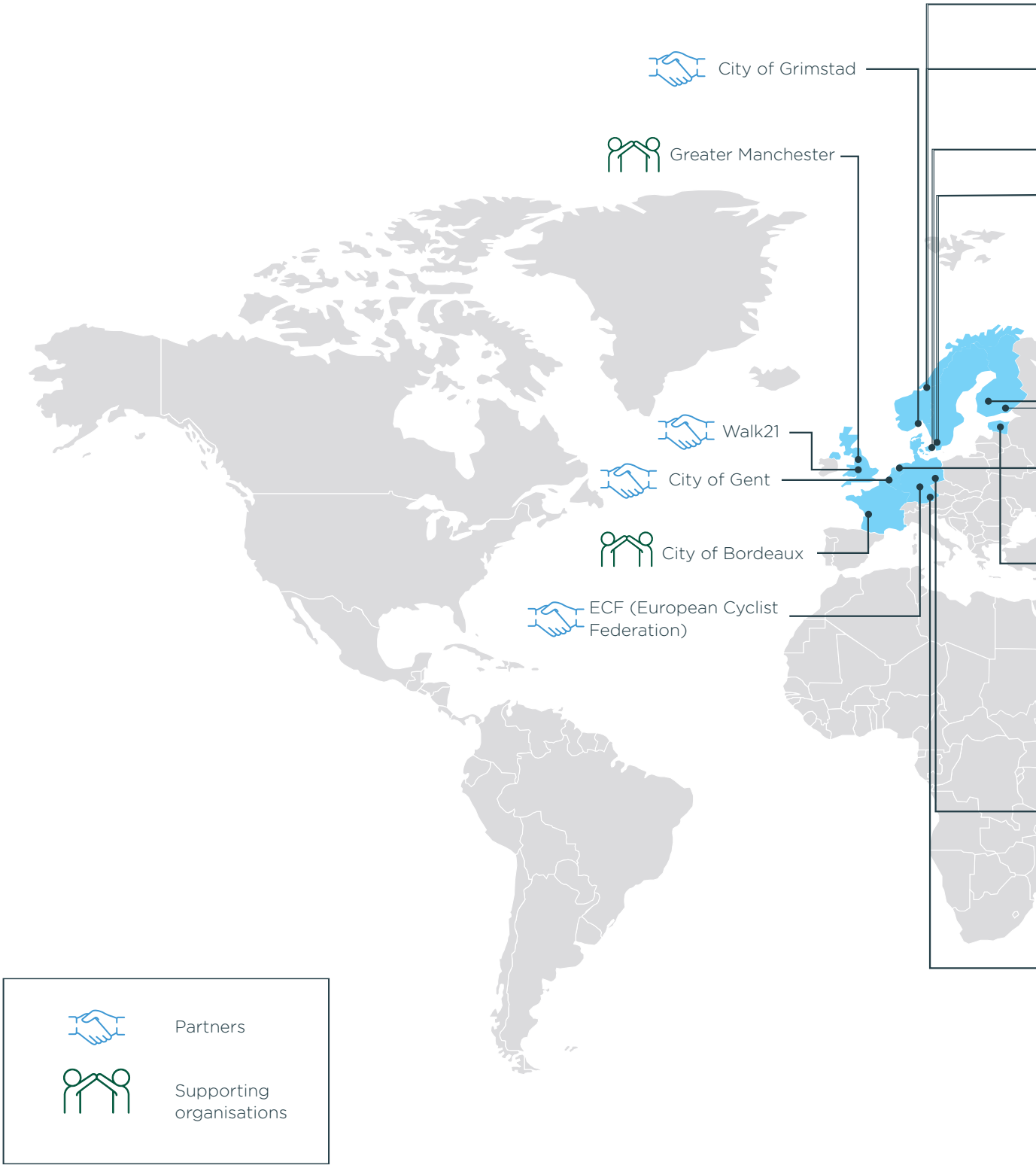
Name of organisation: Cycling and Walking Australia and New Zealand (CWANZ)
Country it's based: Australia and New Zealand
Population: 31.127.332 (2022)
Geography and number of member organisations:
CWANZ counts 21 members across Australia and New Zealand, which consists of senior and executive level leaders from all Australian state and territory transport agencies, New Zealand Transport Agency, local government representatives and leading representative organisations for walking, cycling, health and mobility.
Responsibility /work the organisation is doing:
CWANZ provides a collaborative forum across Australia and New Zealand to share knowledge and innovation on strategic initiatives and projects that enhance outcomes for walking and cycling.
Modal share of walking: NZ 10%, Aus 4%
Modal share of cycling: NZ 1.8%, Aus 1.1-2.8% [3]

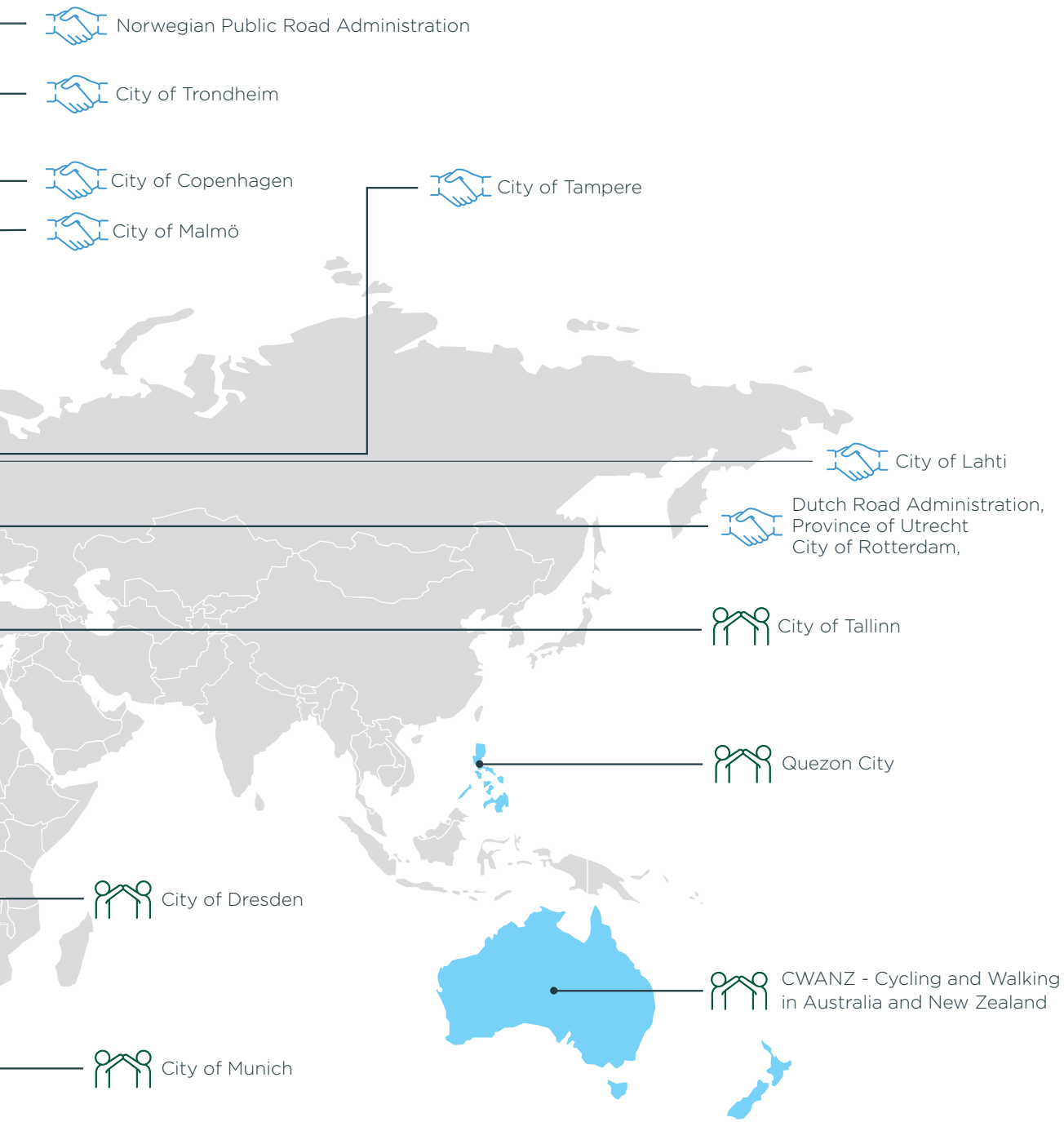
City of Munich/DE

Name of organisation: City of Munich
Country: Germany
Population: 1.583.149 (2022)
Responsibility /work the organisation is doing:
The city is via the Department of Mobility (MOR) responsible for sustainable transport in Munich.
Modal share of walking: 24% (2017)
Modal share of cycling: 18% (2017)

[3] NZ reference: https://www.transport.govt.nz/statistics-and-insights/household-travel/ Aus reference: https://www.atap.gov.au/mode-specific-guidance/active-travel/2-key-characteristics-of-active-travel

Both partners and supporting organisations are shown in this map:




Norwegian Public Road Administration
City of Trondheim
City of Copenhagen
City of Malmö
City of Tampere
City of Lahti
Dutch Road Administration,
Province of Utrecht
City of Rotterdam,
City of Tallinn
Quezon City
City of Dresden
CWANZ - Cycling and Walking
in Australia and New Zealand
City of Munich


Miss Blanche
SCOTCH&SODA
BAKKERIJ
BLANCHE

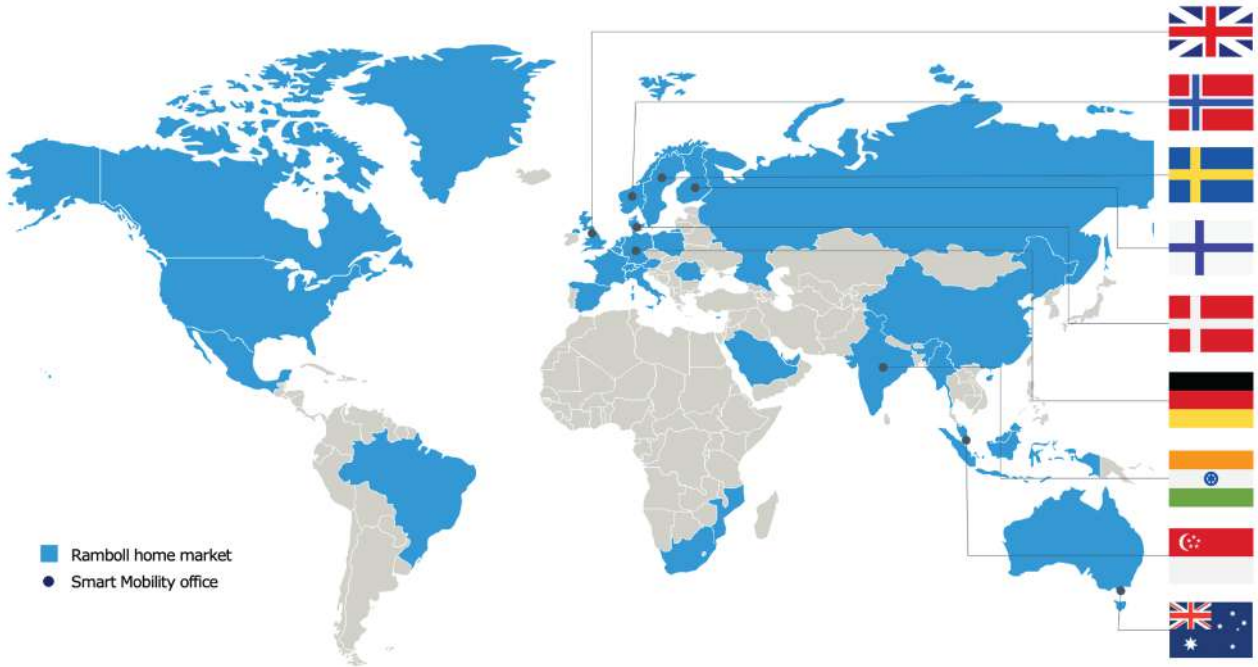
Methodology

In order to map the current practice, challenges, needs and gaps related to walking and cycling data we used different methodologies:

- Interviews with 8 international walking and cycling experts
- A survey among walking and cycling planners in the 18 partner and supporting cities about walking and cycling data collection.
- Online workshop with the members of "CWANZ - Cycling and Walking in Australia and New Zealand" about walking and cycling data collection.
- In-depth interviews with the 18 partner and supporting cities about walking and cycling data collection.
- International survey of public administrations walking and cycling data collection.
- Benchmark of currently available data sources and description of the possibilities and the limitations of the different data sources in relation to a list of identified walking and cycling indicators
- Meetings and workshops with the project partners

The Team

The project was kicked off in February 2022 and this report has been prepared by an international team of Ramboll experts from our Smart Mobility offices in Norway, Sweden, Finland, Denmark, Germany, Singapore, and Australia.



Walking and cycling data

In 2021 Christian Werner and Martin Loidl from the University of Salzburg in Austria published findings from an international survey among professionals in the cycling domain "Bicycle mobility data: current use and future potential. An international survey of domain professionals."

Their key findings from the survey that included 325 responses from 32 countries were the following:

- 84% of domain professionals attribute high importance to cycling data
- 89% state that they currently cannot or only partly solve their tasks with the data available to them[4].

Cycling professionals attribute high importance to cycling data, but only 11% of the respondents feel able to solve their tasks with the data available to them.

With this report we have tried to look a little deeper into the gap between current practice and demands in cycling data that Werner and Loidl identified. But we added walking as our impression was that walking was even more challenged than cycling in relation to data collection and availability.

Experts

We identified a number of key experts to get their thoughts on walking and cycling data. The identified experts are:

Jim Walker, Walk21

Jim Walker is the founder of the NGO Walk21[5]. He's an international policy advisor, communications expert, and special projects manager to enable more people to walk and ensure they have safe, attractive, and accessible environments to walk in. He specialises in developing national policy and quality standards to benefit pedestrians as well as managing national campaigns and sustainable transport, active health and accessible recreation projects. His advice has helped 13 of the top 20 places to be independently accredited as the most liveable places in the world. His current walking project portfolio is active in 83 countries.

Holger Haubold, European Cycling Foundation

Holger Haubold is Director of Intellectual Property & Data Collection at ECF. He holds a Master's degree in European Economics from the Université Libre de Bruxelles, and a Bachelor in International Relations from the Technical University of Dresden. Prior to joining ECF, he worked at the General Secretariat of the Council of the European Union in Brussels.

[4] Werner, C.; Loidl, M. Bicycle Mobility Data: Current Use and Future Potential. An International Survey of Domain Professionals. Data 2021, 6, 121. https://doi.org/10.3390/ data6110121 Academic Editor: Marco Helbich Received: 30 September 2021 Accepted: 12 November 2021 Published: 18 November 2021.
[5] https://walk21.com/

Philippe Crist, advisor at International Transport Forum, OECD

Philippe Crist leads ITF work on data governance and how to leverage the new and rapidly growing data sources to improve transport decision-making and is investigating how policy and regulation might adapt to an increasingly algorithmically driven world. His work also encompasses leveraging data governance to enable Mobility as a Service helping public authorities think about how public space allocation, including curb management, will change under new travel practices and business models. He is a recognized world expert on cycling safety and policy, and in 2016 he was awarded the Cycling Embassy of Denmark's Leadership Award for Cycling Promotion.

Thérèse Steenberghen, Professor KU Leuven, Belgium

Thérèse Steenberghen is professor at KU Leuven Institute for Mobility. Her research focus is on spatial analyses related to urban and regional development, transport and mobility, and tourism destination development and management. She was the academic lead for the European Commission's Support study on data collection and analysis of active modes use and infrastructure in Europe[6]. The study addresses the lack of comparable statistics concerning walking and cycling in the EU. In the study, the European median daily walking and cycling distances and number of trips were estimated and the results were compared with statistics derived from EU surveys. Professor Thérèse Steenberghen has also done extensive work on pedestrians and the quality needs for pedestrians.

Dirk Lauwers, Professor, University of Antwerp and the University of Ghent

Professor Dirk Lauwers is a civil engineer and MSc in spatial planning and urban design with a working experience of more than 40 years. He is visiting professor at Ghent University and University of Antwerp, where he teaches and acts as research promoter in the fields of Mobility Planning and Traffic Engineering Design. He was a lead consultant for the World Business Council for Sustainable Development and the development of the Urban Sustainable Mobility Indicators. He was also a member of the Scientific Committee of EC SUMI project and the development of Sustainable Urban Mobility Indicators.

[6] European Commission, Directorate-General for Mobility and Transport, Steenberghen, T., Tavares, T., Richardson, J., et al., Support study on data collection and analysis of active modes use and infrastructure in Europe: final report, Publications Office, 2017, https://data.europa.eu/doi/10.2832/762677

Stéphanie Mangin, bike observation project manager for the French national cycling counting platform at Vélo & Territoires

Stéphanie Mangin has a master's degree in International Tourism from the "École Supérieure de Commerce de Montpellier" (GSCM) in Commerce, Management and Administration. She is an experienced project manager within the field of data analysis, observational studies, tourism, management and market research. Stéphanie Mangin is project manager of the bike observation project for the French national cycling counting platform at Vélo & Territoires[7] and supports the development and support of the ÉVA-VÉLO method.

Kevin Maine, CEO of Cycling Industries Europe (CIE)

Kevin Maine is the Chief Executive of Cycling Industries Europe. Kevin has been a leading figure in cycling advocacy for over 20 years. Prior to joining CIE he worked as Development Director at The European Cyclists' Federation where he was responsible for relations with the bicycle industry, fundraising and communications. He also led ECF's work on Cycling as a new technology which identifies the contribution cycling can make to smarter, connected mobility.

Matteo Candelari, Programme coordinator, Cycling Industries Europe

Matteo Candelari holds a Master's degree in European Studies at the Université Libre de Bruxelles. He works as Programme Coordinator at CIE, dealing with the implementation of EU projects, and coordinating the work in Market Intelligence, Cargo Bikes and ITS Expert Groups.

Walking and cycling data insights and perspectives from 8 experts

The focus in our conversations with the 8 data experts was getting their views on 5 main topics:

- The primary purposes for collecting data on walking and cycling
- The most important indicators to measure
- The best and primary data sources
- The most important issues to be aware of
- Recommendations for collection of walking and cycling data

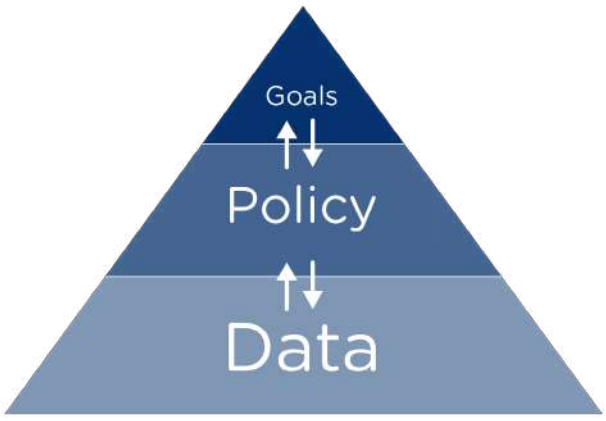
The experts' insights and perspectives are presented in the following.

[7] Vélo & Territoires https://data.eco-counter.com/ParcPublic/?id=891

Purpose

"Using data should always be a response to a specific need or challenge you deal with. Data is not the solution, but a way to understand a problem better in order to develop the policies needed to create change."
Philippe Crist, advisor ITF, OECD

"Data driven decision-making" has become part of the conversation in transport and mobility, but Philippe Crist, ITF, OECD points out that we must keep in mind, that we did not get to where we are today by responding to data. Our current system is a result of political choices made in response to the challenges we have faced and in communication with the citizens. Data is not the main trigger for change, but it can and should **guide change:** "Using data should always be a response to a specific need or challenge you want to deal with. Data is not the solution, but a way to understand a problem better in order to develop the policies needed to create change". Data is what you need to guide the actions, that will deliver to the goals set. The vision should drive policies and actions, and these policies and actions should be guided by data.



The 8 experts all agree that **planning** is one of the key purposes for collecting data on walking and cycling. For Professor Thérèse Steenberghen the main purpose of collecting data on walking and cycling is to understand cycling and the cyclists better - routes, maintenance, and parking needs etc. in order to better plan for it. But she also points out that bottlenecks and, especially for walking, missing links are often overlooked by planners. Microlevel passages, underpasses, and shortcuts for pedestrians are often not visible in data – the barriers are small and very context dependent.

Evaluation of actions and measures is another of the main purposes identified by our experts, but Stéphanie Mangin from Vélo & Territoires point out that the "why" for data collection is highly dependant on where the city is in their cycling and walking development. In the beginning, data can be used to make your case for cycling, to secure funding for developing cycling infrastructure and other policy actions. Later on, data can be used to maintain and develop cycling infrastructure and services, follow the progress of development and evaluate the effects of policies and measures implemented.

For Jim Walker, Founder of Walk21 data is an important tool to **make the invisible visible,** because what is not counted does not count! Even though most of us walk every day, walking is often invisible in mobility and traffic planning. Pedestrians too often only become visible in data when killed or injured in our streets. And sometimes the response to the dangers of walking is simply to "remove" the problem by making it impossible to walk in specific places.

Jim Walker also points out "On the footpaths we are all equal. Walking only requires shoes and in some places not even that. Walking is too cheap, too simple, and too low tech and simple solutions are almost never promoted as forward thinking." Walker also points to another challenge for walking: "Transport planning is all about time savings, optimization, and efficiency. But walking does not fit into that paradigm because walking, provides an opportunity to be positively distracted by nature, other people and life, which enhances the experience beyond a predictable monotonous trip and of course is fundamental to retail spend."

Philippe Crist from ITF also addresses that walking and cycling are often not counted as traffic and that means that collection of data on walking and cycling is often not normalized and systemized. Walking and cycling data is simply often not an integrated part of the traffic and mobility data ecosystem. The car is king – also in data collection.

Like Walker, Crist also addresses that time savings often is the focus in relation to data collection of public transport and cars. But Crist argues that data collection that focuses on time savings of seconds is actually not meaningful. Those two seconds saved in morning traffic does not **add value or meaning** for the individual car driver. But by making it possible for 50.000 people to save 20 minutes in the morning and afternoon by putting in place critical bicycle infrastructure or a cycling bridge that is valuable for the individual as well as for society. Data should be used to create meaningful policies and solutions. "It's not just about collecting data, it's how they are managed and used," Crist says.

Kevin Mayne and Matteo Candelari from Cycling Industries Europe (CIE) also agree that cycling data is very important for public decision and policy making in relation to cycling planning. But cycling data is also important for the private sector for both products and services – for example data on what impact the introduction of e-bikes have on behavior and ITS services, bikeshare and multimodal travel planning doesn't work without data. "Data is what enables these services," says Kevin Mayne. Last but not least data is also a commercial product in itself. It can be the main product, or it can be a biproduct of another product, but data has a **commercial value** of its own.

Indicators

"We have to go beyond counting and start caring"
Jim Walker, Founder Walk21

For Jim Walker, founder of Walk21 walking is a key indicator for how livable a city is – all the top cities in the livability rankings are also great cities for walking. New Zealand has developed one of the most comprehensive systems for measuring walking, but it is very complex and time consuming, so it's so it's not being picked up by other countries and cities.

Walk21 has worked extensively to identify the right indicators, but always ended with a large number of indicators (36) to ensure the full range of measures are evaluated.

Reality on the other hand is often too simple – if indicators for walking are included in traffic indicators it is often related to length of footpath. But that indicator says nothing about walking in the city – it does not address the quality of the footpaths, if they are in the right place, if they are safe, or if they are used. According to Walker the most meaningful indicators is citizens satisfaction with the walking experience.

To reduce complexity, but still collect meaningful data Walk21 has identified the following key outcome indicators for walking, by looking at existing datasets through a walking lens:

- Activity
  Average minutes spent walking per day disaggregated by age, ability and gender[8].
- Safety
  Number of pedestrians killed pr. 100,000 inhabitants disaggregated by age, ability, gender[9].
- Accessibility
  The percentage of people living within 500m of public transport disaggregated by age, ability, gender[10].
- Comfort
  Percentage of streets with minimum 3 star pedestrian standard[11].
- Satisfaction
  Community satisfaction reports on the existing walking experience disaggregated by age, ability and gender[12].

"Cities that measure cycling and count cyclists demonstrate that they take them seriously," says Haubold from ECF. The collected data often serves as proof to implement new cycling policies and infrastructure. They make municipalities aware of existing practices in their cities; preferred routes (commute or school runs during the week/ recreational rides during the weekend), number and type of cyclists (on sunny/rainy days), average and top speed (rush hour or not), waiting times and delays at crossroads or strategical nodes, top destinations (useful for parking policies), and specific problems on the bike path"[13].

For Holger Haubold, ECF, modal share of cycling is the most important and basic indicator that should be supplemented by the following indicators:

- Modal split - ideally captured for trips, distance, and time
- Infrastructure, length and network status
- Trip purpose
- Demographics
- Bicycle parking
- Accidents
- CO2-reduction
- Health
- Cyclist satisfaction
- Investments in cycling

[8] Based on WHO GPAC question and also the international walking data standard: http://files.designer.hoststar.ch/hoststar10546/file/1-internat_walking_data_standard_summary.pdf
[9] Based on WHO Road Safety standards
[10] Based on SDG11.2 Metadata Methodology
[11] Based on IRAP Road Safety Toolkit
[12] Based on Walkability App reporting
[13] https://ecf.com/what-we-do/urban-mobility/cycling-data-collection

Haubold also addresses that indicators for investments in cycling are often missing, but that these are important figures that are also easy to benchmark. As an example, Haubold mention that the Dutch invest 33€ pr. citizen pr. year in cycling. The German national cycling strategy includes an ambition of 30€ pr. citizen.

In relation to the question about which indicators are important to monitor, Crist underlines that it is not so much about which indicators to select, but about whether the selected indicators relate directly to the vision and the goals set. "It's important to know which questions you need answers to," he says. It can sound obvious, but often data is not collected to answer specific questions but collected and used because it's what can be done or is available.

Besides agreeing that the list of cycling indicators he was presented were all relevant Crist added space consumption, near crashes, exposure to air pollution, including fine particulate matter and noise as important indicators. How much space is allocated to different modes in the city and how does that correspond with the vision and goals? Where do a lot of near crashes involving cyclists occur, what happens and why? What levels of levels of air pollution, including fine particulate matter and noise are people exposed to in different part of the city?

Last but not least Crist points to the blind spot – things that are not there to count. It's important to know why people are not cycling or walking or have stopped walking and cycling in a specific street, area, or part of a city. That's very useful data that needs to be included.

Professor Dirk Lauwers like Crist also points to the necessary link between the indicators and the goals, policies, or standards the city has put in place. It's not enough to collect data for length of network, you also need to know how much of it corresponds with the quality standards. And it's also important to include other types of walking and cycling friendly infrastructure like cycling streets, car free streets, low speed zones etc.

Professor Lauwers also points to the fact that as visions and goals change, the indicators need to change as well – e.g. changing modal split indicators to related to time traveled instead of distance or purpose when introducing 10-, 15- or 20-minutes cities.

For Stéphanie Mangin, Vélo & Territoires the number of cyclists in the streets are the most important indicator for cycling. "Modal split is difficult to calculate and is related to other modes. But by counting cyclists 24-7 365 days a year it's possible to follow the development closely." After the number of cyclists modal split, routes and accidents are the primary indicators to collect data in relation to according to her.

In France, when it comes to data on demographics of cyclists, one difficulty has to be faced. It is the length beetween each national transport surveys because they are conducted only every ten years. But it is not the only challenge. The other example is data on accidents involving cyclists that covers only accidents registered by the Police. That means huge dark numbers in those data as many accidents involving cyclists are not reported to the Police. This is not only a problem in France, but everywhere where data on accidents with cyclists are only based on Police data.

Stéphanie Mangin, Vélo & Territoires is responsible for the national counting platform in France. Since 2013 the platform have collected and shared data from 1400 permanent cyclist counters all over France. To ease cycling traffic data collection Vélo & Territoires worked with the french PAN to design a national standard. This standard is currently under deployment by traffic counters providers. It will help data sharing with the national

platform and also improve sharing in open data systems.

“These data have been and are extremely valuable. During the pandemic we could show how the number of cyclists grew fast and where. Without these data there would not be a national cycling plan on the way,” says Mangin. “Data is also important to get funding – both for mobility cycling and for long distance touristic cycling. It can also be used to make the case for better services and intermodality – like convincing the train operators to invest in embarking bike on trains.

Mangin is also aware that counting data has its limitations. The data does not provide any information about who the cyclists are, their routes, the distances they cover their comfort or satisfaction. She’s therefore also interested in trace data from GPS based sources, like apps etc., but are also very aware of the limitations and biases of the apps. But for her the goal is to combine the app data with the counters and extrapolate.

La Plateforme nationale des fréquentation (PNF)

is a cycling traffic data platform run by Vélo & Territoires, which collects, aggregates, and disseminates cycling data at national level based on locally collected data. The platform was launched in 2013 and contains data from 1343 bicycle counters collected by over 100 contributors. The PNF is co-financed by the Interministerial Coordination for the Development of Bicycle Use and was supported by Ademe (the French Agency for Ecological Transition) for its launch. The French walking and cycling counters provider Eco-Counter developed the platform.

PNF makes it possible to aggregate raw data from local communities of contributors who own automatic counters. Each of these communities can share their data dynamically through the tool or submit it periodically for manual import in particular when counters are not from Eco-Counter.

PNF only takes into account data from permanent meter readings, i.e. data covering the entire year, 24 hours a day. This data must clearly identify bicycle passages and therefore distinguish between different uses if it is a multi-usage counter. To produce its annual analysis report, Vélo & Territoires validates the data each year, in order to guarantee the quality of the data transmitted.

The PNF provides access to counting data for contributors and members of Vélo & Territoires. They can thus easily develop simple indicators to gauge potential and compare their figures beyond their territory.

The PNF provides a real-time overview of how much, especially the most popular, French cycle routes are used. According to the National cycle route plan (Schéma national des véloroutes) there are 58 routes, including 10 EuroVelo, with a total length of 25,670 km.

Knowing the number of cyclists fulfills a threefold objective:

- Provide a quantified overview of bicycle traffic on a national level and promote analyzes on a relevant scale and comparisons between territories

Chiffres Clés 2022

Du 1er Janvier au 04 septembre

Par rapport à 2021

+11% de passages de vélos

+14% en semaine

+3% le week-end

Par rapport à 2021
et par milieu

+14% en urbain

-1% en périurbain

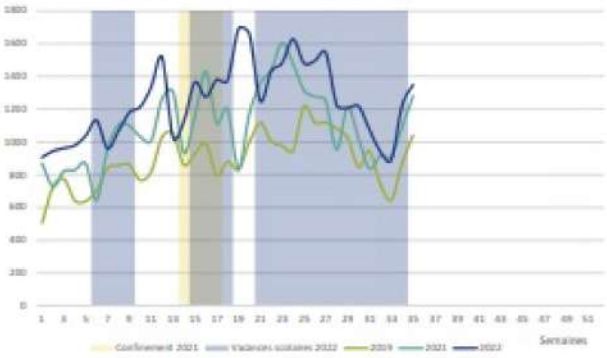
+0% en rural

- PNF follows the development of cycle path use both locally and internationally and participates in the relevant networks on a national and European scale.
- PNF communicates the annual results to promote the development of the use of bicycles and bicycle routes.

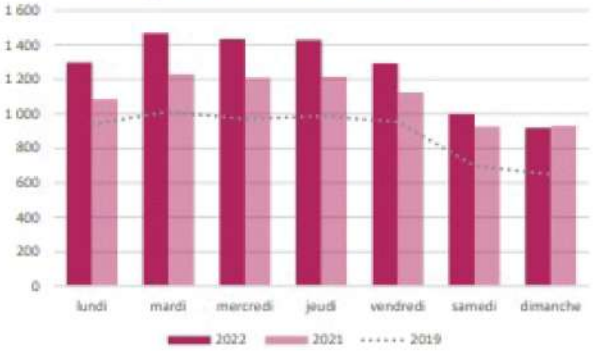
Status Report September 2022
Since the beginning of the year, bicycle traffic has increased by 11% compared to 2021. This is 33% more than in 2019, a year of reference before Covid.

YCLABLE EN MILIEU URBAIN

Comparaison avec 2019 et 2021
(à échantillon comparable)



Fréquentation selon
les jours de la semaine



en 2022 par rapport à 2021 avec une fréquentation qui progresse plus
le week-end (+6 %). Ce résultat demeure nettement supérieur à 2019

Kevin Mayne from CIE also believes that numbers are important – to secure funding for investments and to understand what changes. But the number of cyclists cannot stand alone according to Mayne: "We need to know who's making the trips, what's changing and what's enabling the change". Mayne also underlines that we need standards in cycling data. Bike sharing providers are leading when it comes to international data standards. We need international standards and not just national standards and in Europe we need EU to come behind that.

Crist also reflects on the need for standards: "Standards are not a need in relation to policy making, but necessary for operation."

Professor Thérèse Steenberghen points out that we also need to be able to adapt to changes and introduce new indicators. As an example, she mentions that Covid made distance between people an important indicator and crowed management became an import tool in relation to pedestrians. The introduction of e-bikes, e-scooters and other new vehicles has also made data about the different users and the vehicles using walking and cycling infrastructure even more relevant.

Data Sources

"The most powerful data sets we have are the indicators of change - we did this, and something changed, we did that and something changed. If you do this you can then start to explore cause and effect or analyse cost-benefit, but if you can't measure change then you're wasting your time!"
Kevin Mayne, Cycling Industry Europe

The experts also shared their thoughts on different sources for walking and cycling data.

Crist underlines that Police data on injuries involving pedestrians and cyclists are seriously underreported and most self-crashes are not reported at all. We need to expand the traffic safety data from Police to hospitals and health care facilities to shed light on the dark numbers.

Besides Police, hospitals, and doctors he also points to the fact that technology can help us in relation to traffic safety. As an example artificial intelligence cameras are now able to film public space and categorize and count them without saving the actual footage. That means that we can extract meaningful data about what causes accidents without violating people's privacy.

Besides the dark numbers in Police data on accidents Professor Lauwers also points to the fact that the national travel survey data that cities use often have very low number of local respondents which makes them non representative on local level. In relation to tracking data and smart phones he calls for more collaboration between the providers on European level to secure standards.

Mangin elaborates on the use of counting and tracking apps "Counting and trace data from mobile apps are both important, but their importance are different in different areas – in dense cities and metropolitan areas counting works very well, but in rural areas tracking aps and GPS are important as the number of cyclists are lower and the territories to evaluate are often wider."

To Professor Steenberghen combining counting data with data from smart watches, phones, OSM etc. is the way forward to get a better and more nuanced picture of pedestrians and cyclists. In her opinion counters and tracking devices will make surveys redundant in the future.

Holger Haubold from ECF recognizes that the use of surveys is expensive and time consuming, but also that the data you can get from surveys are very versatile. He also underlines that it's very important to be aware of the biases of the different tracking apps – the data represent the users of the app, not "cyclists" in general. But in combination with other data, it can add value.

To Haubold counters are good for capturing changes over time in real time. He highlights France as an example of how a national counting system is generating valuable data. Haubold also recognizes the value of visible counters as cycling promotion in cities where cycling is starting to grow: "Counters not only count cyclists, they also show cyclists that they count!"

To Kevin Mayne and Matteo Candelari from Cycling Industry Europe it does not really matter where the data come from.

The magic happens when you put data together you can see the story. “The fun starts when you put a timeline against the data. The most powerful data we have are the indicators of change - we did this, and something changed, we did that and something changed. If you do this you can afterward start to explore cause and effect and cost benefit and those kinds of things, but if you can’t measure change then you’re wasting your time!” Kevin Mayne, Cycling Industry Europe.

Challenges

"We have to be mindful that lot of what is important in cities isn't necessarily digitalized."
Philippe Crist, ITF

For professor Dirk Lauwers one of the challenges that need to be addressed is that the limitations of data are not always addressed. He uses Zone30 evaluations as an example. When measuring the effect of Zone30 cities have installed counters and counted the number of cars before and after implementation in the Zone30 and found that the number of cars has decreased. But that's not the full picture – by also looking at GPS data from cars they show that the cars did not disappear but moved to the surrounding local streets.

Professor Thérèse Steenberghen addresses several challenges in relation to walking and cycling data. For her privacy issues are the biggest challenge especially for research. It's not GDPR that's the problem according to her. It's how the rules are applied and interpreted differently in different places and that overregulation makes it hard to maneuver in. She also mentions that especially user satisfaction is important to empower pedestrians and cyclists to engage but can be difficult to carry out. It's important to understand where people feel safe and where they don't.

Another challenge addressed by Mangin in relation to surveys and GPS data is bias in data. We need to understand the biases in the data – like the fact that different cycling app data does not represent "cyclists" in general, but the users of the app. That challenge can however be mitigated by aggregating data and combining different data sources. For Mangin data quality is key - "you can make the wrong conclusion if the data is bad – you need time to clean the data", she says.

Haubold addresses many of the same challenges and already mentioned, but especially two challenges are key to him. The first is accessibility to private sector data. There's so much data collected that could be meaningful for public authorities, but it's not available to them or organisations like ECF. The other key challenge is lack of standards. According to Haubold we need international data standards to improve quality of data and our ability to analyze and compare walking and cycling data.

Kevin Mayne and Matteo Candelari (CIE) also emphasis lack of cycling data standards as a huge challenge. It's a problem for public authorities who constantly reinvent the wheel and it's also a problem for private sector as it kills added value from sharing the data and maximizing the commercial value.

Mayne mention NAPCORE (National Access Point Coordination Organisation for Europe), the world's largest cooperation initiative to coordinate and harmonize more than 30 mobility data platforms across Europe[14] as an example of how EU can take the lead in establishing mobility data standards. But Mayne also highlights that we need stronger national commitment to publish data in the first place. CIE and other stakeholders know that there are issues related to the cost burden for cities, but automation of data collection is one solution in the future.

To Crist the biggest challenge is that walking and cycling data are not seen as important. They are not need to have,

[14] https://napcore.eu/ and https://transport.ec.europa.eu/transport-themes/intelligent-transport-systems/road/action-plan-and-directive/national-access-points_en

they are often just nice to have." There's a bias in the system. Walking and cycling data are not seen as important. It's an education, training, and awareness issue among engineers. Addressing the bias and the need for walking and cycling data is important", Crist says.

He also returns to the issue of meaningfulness of the data and of the digital data trap that we risk falling into. He explains what he means with a story about a drunk guy and a lamp post:

"A drunk guy leaves a bar late at night and drops his keys on his way home. Another guy passes the guy searching for his keys under a lamp post and asks him what the problem is. "I've lost my keys. I can't find them", he says. The other guy starts helping him search under the lamp post. After a while the second guy says: "What did you do when you left the bar?" The drunk guy answers: "I walked up the street this way. And I think I lost them over there." "And then you came back here and started looking for them here? Why did you come here?" the second guy asked. The drunk guy answered: "It where the light is!"

The point according to Crist is that the data we need may be found in a different place, but we're looking in the digital data stream, because that's where the light is. "We have to be mindful that lot of what is important in cities isn't necessarily digitalized," Crist says.

The point according to Crist is that the data we need may be found in a different place, but we're looking in the digital data stream, because that's where the light is. "We have to be mindful that lot of what is important in cities isn't necessarily digitalized," Crist says.

Jim Walker (Walk21) highlights the importance of securing clarity and accuracy in the collection and reporting of walking data and comparability of data between different travel surveys. Travel also needs to be both manageable and affordable and support a broad range of citizen participation in the sample. But issues like reporting period, days of week as well as weather and season are factors that influence walking. Finally, Walker mentions the challenge of survey "fatigue" which means that people are tired of answering, especially if nothing gets done in response, resulting in gaps and bias in the data.

Expert's recommendations

Last but not least we asked the experts for their recommendations in relation to public authorities' collection of walking and cycling data.

To Philippe Crist (ITF) safety data – both perceived and actual safety - as well as crash data are must-collect data. Traffic counts are also very important in order to monitor the development, but he also emphasizes that cities should not make decisions about where to implement cycling infrastructure based solely on counting's of existing young, male cyclists' routes and behavior.
Professor Lauwers recommend that cities broaden their data collection in order to get a bigger picture – like understanding displacement to and attraction from other streets.

Professor Thérèse Steenberghen's recommendation is that cities - as a minimum - collect data on the number of pedestrians and cyclists and map the quality of the infrastructure provided. However, the standard level of data should also include new micro-mobility solutions – data of usage and challenges caused and solved. On top of that cities can elaborate by including data on user satisfaction, user needs and user empowerment.

Stéphanie Mangin (Vélo & Territoires) recommends that cities start by asking what they need to know and then choose their data collection approach accordingly. In that process it's also important from the beginning to think about by who and how the data should be analyzed and then prioritize the data you want to collect.

"Start with the basics," recommends Holger Haubold (ECF). To him basic data sets are modal share of cycling and overview of infrastructure. Standard data should however be more detailed and include demographics, classification of infrastructure, satisfaction, and overview of investments. In the elaborate tier real time data for cyclist flow should be included and used for traffic management. Kevin Mayne and Matteo Candelari (ECI) recommend that public authorities collect - as a minimum - data about the number of cyclists and what is changing. The next level is to understand what enables and drives the change. The top tier of data collection is comprehensive ITS (Intelligent Transport Systems) for cycling.

According to Jim Walker from Walk 21 there are many important datasets that can be and should be collected, to understand the relationship between walking behavior, perceptions, and the walkability of environments, but to stimulate interest in adopting such methods, a walking lens to existing datasets can give a quick insight into the existing experience. The most helpful data to get a snapshot of reality is to understand 'activity, safety, accessibility, comfort and satisfaction.

National Data Warehouse for Traffic Information (NDW) in The Netherlands

In the Netherlands, traffic and mobility data are handled in a special national collaboration called the National Data Warehouse for Traffic Information (NDW). NDW collects, analyzes and disseminates real-time data. This data is used to provide traffic information, to ensure effective traffic management, and to conduct accurate traffic analyses. NDW ensures that the collection and processing of data is standardized and quality assured, and that data is publicly available.

Its aim is to gather traffic data and to make it accessible for all stake-holding parties (road authorities, service providers, research institutes, etc.). As a consequence of this development, the process of traffic information provision changes quite drastically: more (regional) information becomes available, because of the increasing number of monitoring points, and also the quality of the data increases.

By applying the right data, it is possible to obtain optimal traffic management and to provide road users with the best possible information resulting in less congestion, lower emissions of CO2 and other pollutants, and improved safety. The NDW it is an alliance in which 19 public Dutch authorities work together, learn from each other, and consolidate their data and other resources. The partners in NDW are: the central government, all the provinces, all the urban regions, and the municipalities of Amsterdam, Rotterdam, The Hague and Utrecht.

https://dutchmobilityinnovations.com/spaces/86/dutch-mobility-innovations/wiki/view/11889/ndw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Walking – practice, challenges and needs

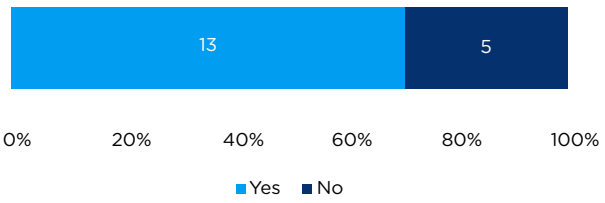
In order to map public authorities' current practice, challenges and needs in relation to walking data collection the 18 partners and supporters filled in a survey before we conducted in-dept interviews. The results of the survey formed the basis for the interviews where we could elaborate on the answers from the survey.

The results of the walking survey and interviews are presented in the following.

Politically approved goals, strategy and policies

13 of the 18 authorities have politically approved goals for walking. The goals are primarily about reaching a specific percentage of modal share or improving the modal share of walking with a specific percentage. But for some of the local authorities the development is hard to measure as the walking data is inadequate – they need a baseline etc. The 5 without goals are primarily local authorities.

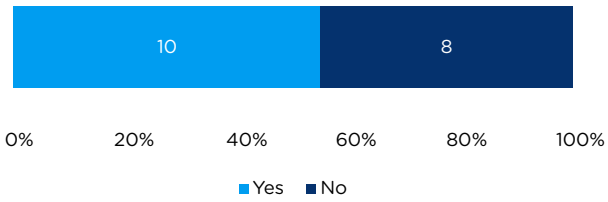
Do you have politically approved goals for walking? N= 18



10 of the 18 authorities have a walking strategy. The strategies are either specific walking strategies or walking is part of a larger transport and mobility strategy or a SUMP.

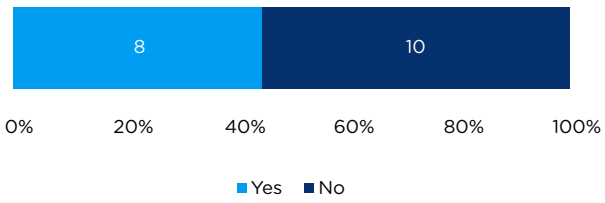
City of Rotterdam is one of the cities with a specific plan for walking, it's called "Rotterdam is walking". The vision is that Rotterdam becomes "a healthy, accessible, and convenient city for pedestrians, in the streets, parks, squares and buildings. So that it becomes more pleasant for people to walk in Rotterdam" [15].

Do you have a walking strategy in place? N=18



8 of the 18 authorities have walking policies in place. The focus in the policies differ, but a unifying theme is making walking safer and more pleasant. In Bordeaux they have a focus on improving local neighbourhoods by implementing more walkable areas, declutter sidewalks, street for kids' and walk to school programs, making public transport stops

Do you have walking policies in place linked to the strategy and goals? N= 18



[15] https://www.rotterdam.nl/vrije-tijd/lopen/

more accessible and secure, identifying and making walking shortcuts and travel times visible and securing feeling of safety while walking at night[16].

Most of the public authorities say that there's very little or no political focus on walking. Walking is often overlooked or seen in combination with cycling as "active transport" and in that case cycling often get all the attention. In some cases, politicians like walking (and cycling) better before elections than after.

As one of the planners from Copenhagen says: "Walking is a paradox –it's so natural for us as humans that it's taken for granted. Walking is just something you do. It's hard to anchor the narratives around walking in transport and mobility. Walking is simply not seen as a trip. We have seen some changes after the pandemic, but walking is generally not viewed at the same level as cycling, public transport and driving".

When there's some focus on walking it's often related to traffic safety and/or as part of public transport. But there are also cities where there's growing political focus on walking – like City of Ghent, City of Rotterdam, Greater Manchester, Bordeaux Metropole, and City of Trondheim in Norway.

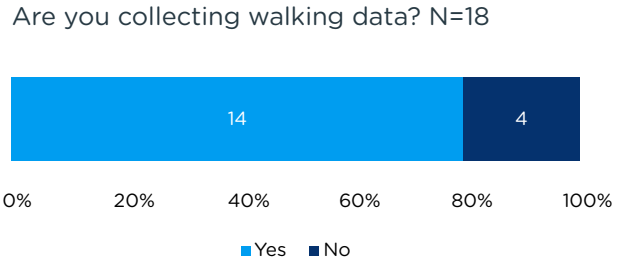
Not surprisingly there's a direct link between the political focus and the administrative focus on walking. In Ghent there has for 2,5 years been a dedicated team for walking in place.

And in some cities, there is a strategy in place that should guide the work in the administration, but when concrete decisions are made the decision is not necessarily based on the strategy, but more related to current politics.

According to the interviews there's at this moment not a big demand for walking data from decision makers, and when they do request data, they prefer data that supports their standpoint.

Collection of data

14 of the 18 authorities are collecting walking data. The 4 who are not collecting data are primarily the national and regional authorities.

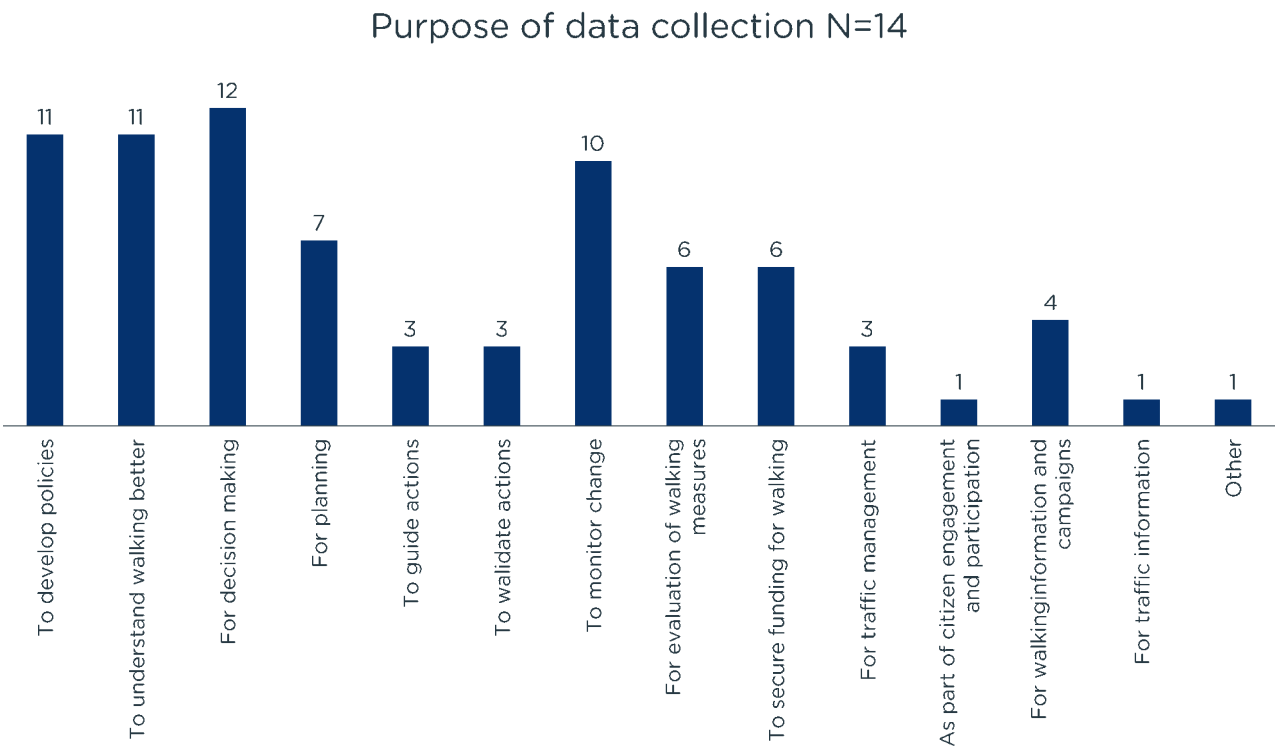


It means that all levels – national, regional, and local - have goals, strategies, and policies in place, but data collection primarily at local level.

It varies a lot between the 14 partners how data collection is organised – in some cities it's more ad hoc and linked to specific projects, in some cities there's a fixed data set-up with counting points and travel surveys, and in a few cities, there are people dedicated to collecting and analysing walking data within the transport and mobility departments – like in Ghent and Malmö. In Tallinn they have centralized data collection in a new IT data warehouse to professionalize data collection and analysis. The transport engineers then go to who ask the data analysts for help. In all 14 cities the scope of and budget for data collection for walking is however less than for cycling and cars.

[16] https://www.bordeaux-metropole.fr/content/download/145436/1819188/version/1/file/%5B0159%5D%201er%20Plan%20marche%20m%C3%A9tropolitain%20D%C3%A9cision%20Adoption.pdf

Purpose for collecting data



The primary purposes for collecting walking data that the authorities highlight are decision making, to develop policies, to understand walking better and to monitor change.

These purposes can both stand alone and overlap. City of Ghent shared a good example of how the purposes overlap: They have implemented measures to regulate the night life street in Ghent as a 'woonerf' (home zone) and are doing before and after pedestrian countings – both in day and nighttime to monitor the effects. Afterwards the data can then be used for policy making across the city.

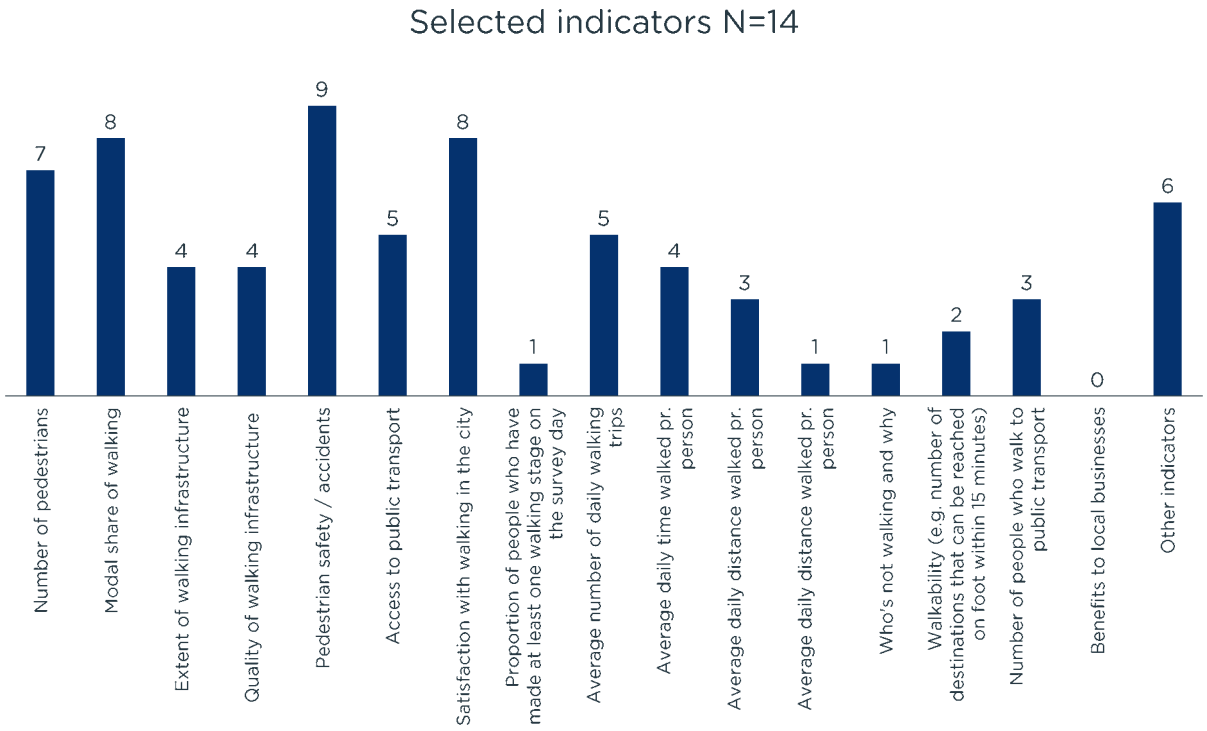
In Rotterdam they are also using data for decision making about what to implement in the first place - like whether there is a need for a new pedestrian crossing at a specific location etc. As they say in Trondheim: "We need to be able to answer the question "Where is the greatest potential for increased walking shares?" to reach our goals.

Data is also a way of making walking visible for politicians and other decision makers. They are used to asking for and using data in relation to car and cycling planning but planning for walking and using walking data is still new to many politicians. "Walking data collection is still premature in many cities. Measuring methods are not yet predefined and this gives room to experiments and safeguard the quality of data before it is shared," as one of the interviewed planners put it.

Visibility of walking is necessary for getting funding for walking projects and measures. And collecting walking data thus a way of securing funding for improvement of the conditions for pedestrians.

In Trondheim the most important purpose of collecting data about walking is to be able to map whether more people are walking compared to before, in order to be able to address the political goals. But also to be able to follow if the right measures are being prioritized.

Indicators



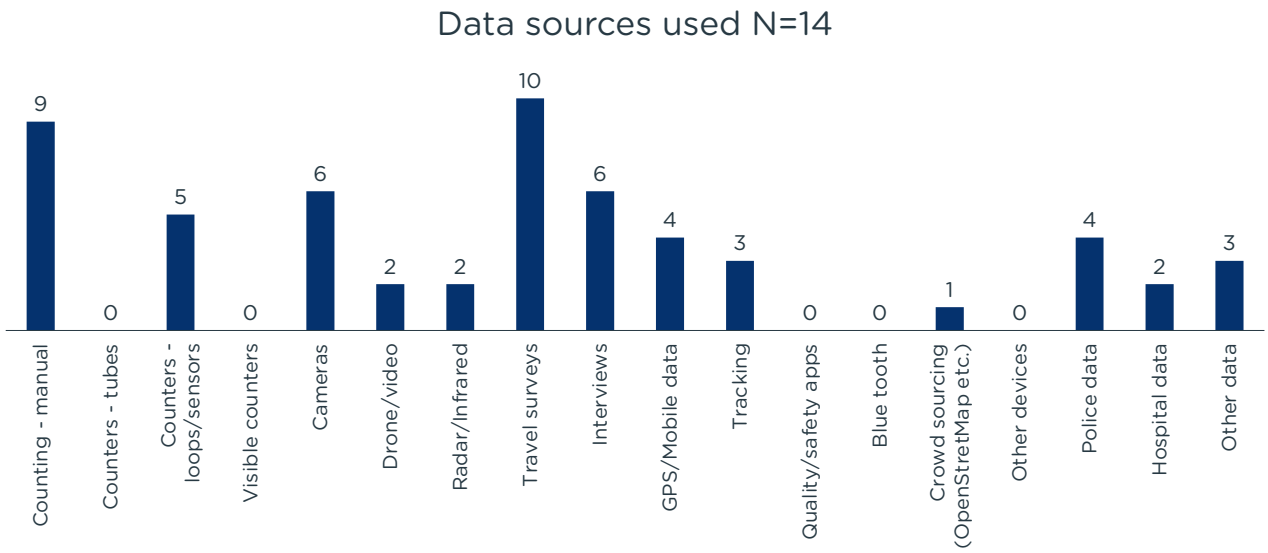
The primary indicators that the 14 authorities have selected for walking are pedestrian safety, satisfaction with walking, modal share of walking and number of pedestrians.

The indicators have in most cases been selected based on two main considerations – the local goals and prioritizations available of data. Lack of walking data is probably linked to the fact that walking is often overlooked and underprioritized and that the demand for walking data is still low and premature. The ideal is that the walking goals should define the indicators and not availably of data. In Tampere in Finland, they encountered the problem that they did not have the data they needed to follow the selected indicators. But instead of changing the indicators they are now developing data the systems needed to collect the data needed.

But as City of Grimstad points out it's generally a matter of prioritization and small municipalities often do not have neither the resources nor the knowledge to collect data for multiple indicators.

Traffic safety is not only the main indicator it's also the one indicator that's more likely to be subcategorized and split by severeness of accident, gender, age, type

Sources



The primary data sources used by the 14 public authorities that collect walking data are travel surveys, manual counting's, interviews, and cameras.

When it comes to deciding which data sources to use it comes down to a couple of main factors – cost, availability and how easy it is for the planners to access and analyze the data provided. The authorities often depend on external and often private companies to provide the data they need. And it can be difficult to choose between different providers. For walking another problem is that there's not that much to choose from. Sharing experiences between cities nationally and internationally is seen as a good way figure out what to choose.

In Ghent they say: "Choices are limited in data collection for walking. We often choose cameras for data collection as it's very reliable and has high accuracy. But these sources are also time consuming and have high costs, and we can't put cameras everywhere due to the image this creates of surveillance."

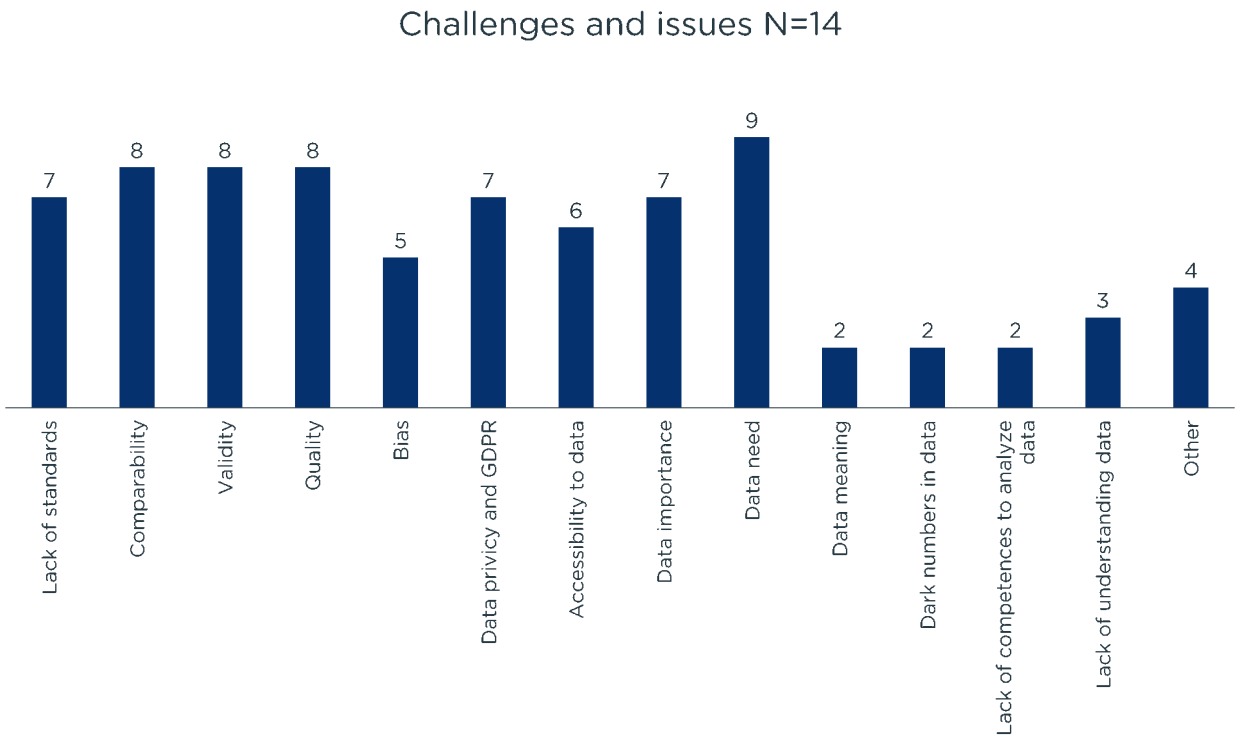
A more low-cost solution is sensor counter that is moved around. It makes it possible to follow trends over time, but the downside is that the sensors have a relatively high margin of error (30%-40%).

It's also mentioned that it seems harder and that there's less options to collect data about pedestrians than cyclists. Trace data from apps or phone data is given as an example. With a grid of 500 m x 500 meters phone data is not detailed enough for pedestrians.

In relation to travel surveys they are very important, but also very expensive and time consuming, so they are not often conducted on a yearly basis. They are also often conducted on national level, which means that the local sample of respondents is small and insufficient for local use.

Besides countings City of Copenhagen also uses more anthropological methods in specific projects, where they work closely with specific target groups to identify the challenges they face – how accessible is it for elderly, people with reduced mobility or visually impaired. Are there physical barriers, enough benches or places to linger, or if women feel safe walking in a specific area.

Challenges and issues



The main challenge that the public authorities report facing is a lack of understanding the need for data. But they are also facing issues with validating and securing the quality of the walking data and comparability of the data. Lack of standards as well as GDPR regulation are also challenging.

In relation to the need for data one planner says: “Data collection for walking is very scattered and more ad hoc compared to data collection for other modes. It is often just a byproduct.”

The planners also point out that data collected as traffic models often do not include walking – which results basically that people are ‘teleporting’ to and from their cars in the models, which again means that walking is underestimated in the models.

Another challenge identified is that pedestrians are not restricted to move in a predictable and structured way and that makes them harder to measure and count compared to cars that move in a much more organized way.

Counting stations does, however, not provide information about how pedestrians move around the city, their routes, stops and activities. This data is available for car traffic through GPS trace data and other digital tools linked to the cars. But there is a very limited availability of trace data for walking, and privacy is a huge challenge for usage of trace data for walking. For car trips privacy is secured by cutting a piece of the trip in the beginning and the end of the trip. But as walking is often shorter trips it’s a problem to cut up the trip. The lack of data basically means that unlike car traffic the overall walking picture is missing in many places.

In tracking data users usually have the give permission or to opt out. Opting out is however not a an option for camera monitoring. Because of that Rotterdam are very careful with vision based camera monitoring in public spaces. Even if the privacy risks can be mitigated by technical processes there is still the active discussion if having an ever-expanding network of cameras in the public space for the monitoring of traffic data is desirable and proportional. All filming of individuals brings with it an inherent privacy aspect and there is discussion if traffic monitoring provides a strong enough basis to use this this technique on a large scale. However, for pedestrian's camera monitoring is for many locations one of the few practical ways to gather large amount of count data. This provides a challenge and is one of the reasons Rotterdam are pivoting towards a more hybrid model-based approach for pedestrian counts.

Quality of data is also one of the main challenges identified by the planners: "We are aware that certain data sources are less accurate. But methods that have high accuracy are usually time consuming, which means compromises must be made," reflects one of the interviewed planners.

Quality in terms of number of counting points, time of measuring walking and how reliability issues limit the use of walking data are also mentioned challenges - "We do not want to come to the wrong conclusions," says one of the interviewed planners.

Lack of understanding the need for and importance of walking data also means that sufficient resources for walking data are rarely allocated. Travel surveys, interviews, manual countings and use of cameras are the main sources for walking data and they all need lots of resources. In a small municipality this kind of resources, both in terms of hours and money are a challenge according to the interviews.

Dark numbers in accident data due to underreporting of accidents to the Police is also a problem. In Norway, they previously received data from the hospitals over a 10-year period, but this was stopped due to lack of resources and GDPR restrictions.

But car data also get a lot of attention simply because cars take up a lot of space in cities – "Car data get more focus than walking and cycling because it is takes up the biggest share of our transport system, says one of the planners. "But there's also more data and many different data sources available for car traffic – parking data, traffic lights, ANPR cameras tec. etc[17].

It's also very different how many human resources are available to plan for the different modes. In Ghent there's a team allocated to each mode. "It's all about the overall goal of being a liveable city. That means that we have people dedicated to walking as well as cycling, public transport and cars."

Several planners also point out that big data companies like Google have the data they need but are not willing or able to share the data related to walking with the public authorities.

It's also mentioned that there's a big push for car data from the car industry in relation to self-driving cars – "It's important that we safeguard that data on the basic mode walking is continuously collected. There's a real risk that walking as well as cycling data is sidelined", says one of the planners.

[17] License plate recognition systems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Rotterdam pedestrian priority maps and pedestrian monitoring

The City of Rotterdam has developed a pedestrian monitor using a multidisciplinary approach, whereby priority maps are created based on evidence and data. It's a way of combining different data sets which may not be meaningful on their own and creating meaning when in combination.

In 2019 Rotterdam presented its Mobility approach in which reversing the mobility pyramid was paramount. The pedestrians were to be seen at the centre of the city and street design. In order to answer where and in what way pedestrians should be prioritised, it became apparent that different data were necessary. Accordingly, the city created priority maps, where focus was on pedestrians' point of view and on a network scale. Both objective (e.g., accidents and casualties) and subjective (citizens' mapping of where in the city they like or dislike to walk) data was collected. Expert-judgments from different fields were furthermore used to create a strong message and vision of where and how to make the most impact for the pedestrian.

The City of Rotterdam has made 4 maps, looking at different themes and way to improve Rotterdam for pedestrians:

- Children going to school safely
- How to make the streets more healthy
- How to transform more streets for people (and active use)
- The public transport accessibility across the city

As an example, to create the map focused on the environmental quality of streets, the city used 3 different data sets, namely data on the amount of greenery (trees, bushes, parks, etc.), the noise levels and temperatures on streets, see Figure 19. Based on research and expert-judgment the city argues that:

- Low greenery: results in worse walking experience, low stress reduction effect and low attractiveness
- Noise: leads to bad health. Constant exposure to high noise levels can result in restlessness, annoyance, bad quality of sleep as well as contribute to stress related heart conditions
- Heat: exposures to high temperatures especially affect the elderly and children as well as people with existing health conditions

Accordingly, the city made a map, Figure 20, representing how healthy or unhealthy it is to walk in Rotterdam.

The City of Rotterdam have thus made use of these priority maps to highlight problems, such as the identification of 22 streets around schools which are unsafe for children, and the fact that 15% of Rotterdam's residences have more than 800 m to public transport. As well as

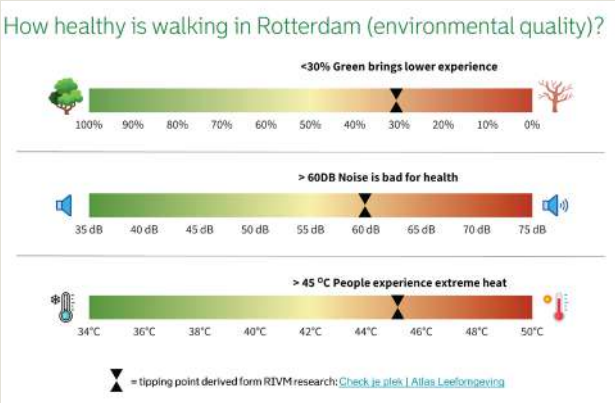
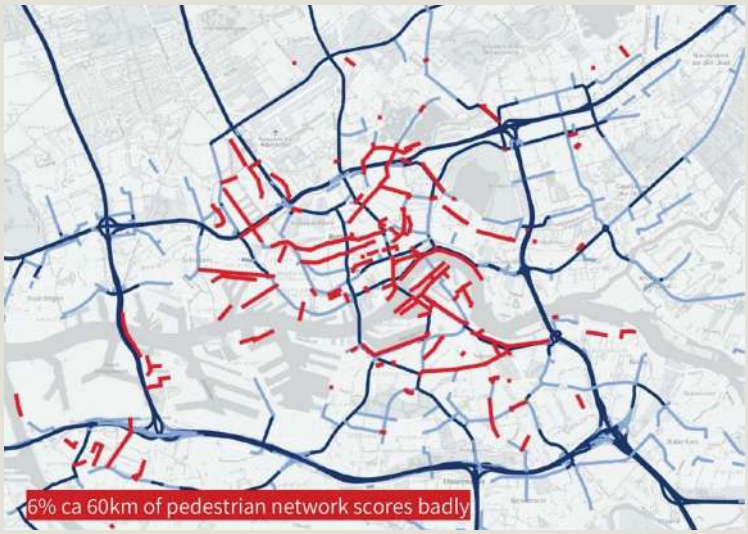


Figure 19: Overview of tipping points of when a street becomes "unhealthy" for pedestrians based on parameters such as greenery, noise, and temperature. Credit: City of Rotterdam

identifying 99 points of improvement and easy fixes, their study has made it clear that data relevant for pedestrians is still not available on certain issues, such as accessibility of the network.

Accordingly, the City of Rotterdam recommends that we also have to turn around the pyramid for the collection of data.

As well as developing the priority maps, the City of Rotterdam has, in collaboration



The **streets in red** are the unhealthy streets with a bad environmental quality (on all 3 aspects) within the main pedestrian network of the city.
The **light blue streets** have >10.000 Vehicles per day.
The **dark blue** are streets which have >20.000 Vehicles per day. Here it is presumed that due to the busyness of the street, there are barriers and bad air quality.

Figure 20: Priority Map of unhealthy and busy streets in Rotterdam
Credit: City of Rotterdam

with the engineering bureau Witteveen & Bos, developed a pedestrian monitor. Since traffic models were invented to regulate (car) capacity, pedestrians have historically been made invisible. The City of Rotterdam thus wanted to make a model which shows pedestrian networks based, amongst others, on data from pedestrian counts, literature study of spatial (street) characteristics and the thereby identified quantitative variables, see Figure 21. The model helps to predict pedestrian intensity on all street segments within central Rotterdam. The maps created help the city define which streets and areas are paramount for pedestrians, and those who are not. This allows them to define missing-links, what-if scenarios and to forecast the consequences of adding residential towers for instance. The City aims to expand the model by installing counting points across the city so they can analyse the conditions for pedestrians in the whole city.

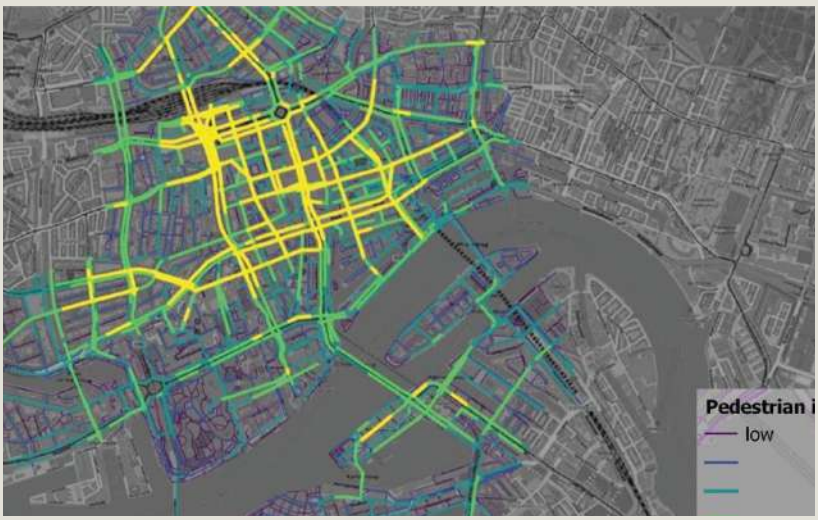


Figure 21: Map showing the intensity of pedestrians on certain streets of Rotterdam.
Credit: City of Rotterdam

Public Availability

10 out of 14 public authorities that are collecting data are making the collected data publicly available. The ones that don't make data public primarily don't do that due to concerns about validity of the low amount of data available. The ones sharing data are publishing it online in different formats – either as part of public reports, "rawer" counting data via data interfaces or via dashboards for transport and mobility data.

Are the data public? N=14

Cycling – practice, challenges and needs

In order to map public authorities' current practice, challenges and needs in relation to cycling data collection the 18 partners and supporters filled in a survey before we conducted in-dept interviews. The results of the survey formed the basis for the interviews where we could elaborate on the answers from the survey.

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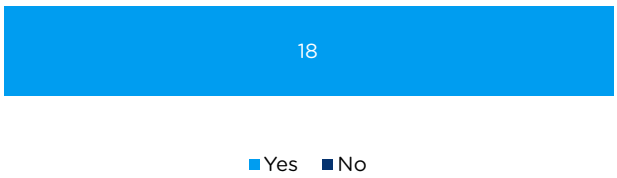
Politically approved goals, strategy and policies

Do you have politically approved goals for cycling? N=18



All of the 18 authorities have politically approved goals for cycling. The goals are primarily related to reaching a specific percentage of modal share or improving the modal share of cycling of all trips or commuting trips with a specific percentage. But several of the cities have several detailed goals related to other aspects than modal share.

By 2025, the City of Copenhagen has the following goals:

- Decrease cars' modal share to a maximum of 25% of all trips to, from and in Copenhagen, whilst public transport, cycling and walking should each make up at least 25%
- 50% bicycle modal share to work and education in Copenhagen
- 0 seriously injured cyclists and 0 traffic fatalities (killed and seriously injured) per year
- 80% share of PLUS-net bicycle paths with three lanes
- 15% reduction of cycling travel time (compared to 2010)
- 90% of cycling Copenhageners feel safe while cycling
- 80% of cycling Copenhageners are satisfied with cycle track maintenance and with cycling cultures impact on urban life
- 70% of cycling Copenhageners are satisfied with bicycle parking
- 423 km cycle tracks, 18 km cycle lanes, 115 km of green cycle routes and 145 km of Cycle Superhighways are planned for by 2025
- Expand the number of bicycle parking spaces by 37.000-72.000 annually during the plan period[18]

The City of Rotterdam issued a vision on cycling in 2019 called "Fietskoers 2025"[19] – the "Direction Bikes 2025" with 4 accelerator goals for cycling:

- Make room for both fast and slow cyclists
- Mobility-hubs, shared mobility and improvement of bicycle parking
- More focus on new cyclists and safe cycling
- "Fietsalliantie", the bicycle alliance - a cooperation of companies and organizations to promote cycling

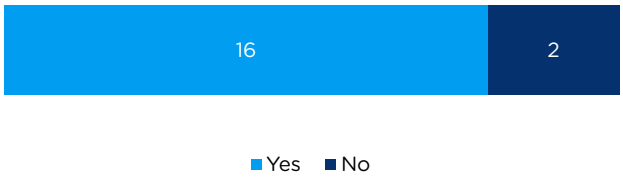
[18] Strategic framework publications about bicycle planning in Copenhagen: Bicycle strategy 2011-2025: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=823
Prioritisation plan for cycle tracks 2017-2025 (in Danish only) https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1620%20Mid-term Evaluation of Cycle track prioritisation plan 2017-2025 (in Danish only) https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=2220
Prioritisation plan for bicycle parking 2018-2025 (in Danish only) https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1797
Cycling superhighways strategic plan 2021-2045 (in Danish only) https://supercykelstier.dk/wp-content/uploads/2022/01/Ruteoversigt-Visionsplan-2021-Endelig.pdf
[19] https://www.rotterdam.nl/wonen-leven/fietsstad/Fietskoers_2025_Gemeente-Rotterdam.pdf

Rotterdam has an objective of accommodating the growing number of cyclists which is expected to increase up to 32% in 2030 and 34% in 2040.

In Malmö, the city's traffic and mobility plan and the Bicycle Programme (2012-2019) states that the proportion of all trips made by bicycle must increase to at least 30% by the year 2030 at the latest, today the figure is 26% [20].

6 of the 18 authorities have a cycling strategy.

Do you have politically approved strategy for cycling? N=18



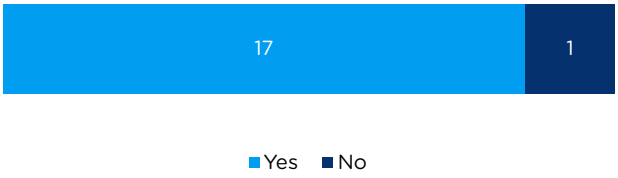
The strategies are either specific cycling strategies or cycling is part of a larger transport and mobility strategy or a SUMP.

City of Copenhagen's Bicycle strategy 2011-2025 contains the actions needed to reach the overall vision of being the best cycling city in the world as well as the goals – like 50% of all commuter trips to and in Copenhagen are made by bicycle. The focus is on making the city safe, fast, and comfortable for everyone, no matter how experienced the cyclist is. The cycling strategy also includes realisation of a PLUS-net, a prioritised network of cycling connections with especially high requirements for cycle track width, maintenance, and snow clearance[21].

City of Tampere's development plan for cycling and walking has targets for 2030 to achieve objectives set for the future decarbonized city development. Cycling is highlighted in several strategy level plans like in Carbon Neutral Tampere 2030, in City's Sustainable Urban Mobility Plan (SUMP) and in regional cycling and walking development plan. The vision for cycling aims at that cycling in the city is fluent, attractive and safe for cyclists of all ages. The main objective is to have a minimum of 15% modal share of cycling in 2030. To achieve this, improvements in cycling infrastructure and environment will be introduced together with a more cycling minded transport culture. Use of data is also mentioned to be used especially for decision making.

17 of the 18 have cycling policies in place. The focus in the policies differ a bit, but a unifying theme is making cycling safer and more pleasant and accessible for more people by building more cycling infrastructure, creating more bicycle parking etc.

Do you have politicies in place linked to the strategy and goals? N=18



In Malmö, increased cycling in combination with an expected continued population increase is expected to lead to the city's cycle paths becoming increasingly crowded[22]. Accordingly, the City of Malmö is investing in developing super cycle paths to, through a new, higher standard in the cycle network, create greater comfort and capacity and thereby provide the conditions for more people to choose the bicycle in the future Malmö.

There's an increased focus on cycling, active travel, and sustainable mobility in general in the partners and supporting authorities. And cycling is in general given much more attention and budget than walking. As one of the interviewed planners put it: "There is more focus on cycling at the political level and cycling has a higher status than walking. The bicycle also has its own interest

[20] https://malmo.se/Stadsutveckling/Tema/Resande-och-infrastruktur/Supercykel.html
[21] https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=823
[22] https://malmo.se/Stadsutveckling/Tema/Resande-och-infrastruktur/Hallbar-mobilitet.html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organization, which contributes to increased buzz and puts pressure on politicians and decision-makers."

For some of the national authorities there's a change in focus: "Historically there was never a lot of focus on walking and cycling within national transport politics. The notion has been that this should be dealt with on a local level by the municipalities. But recently this has started to change. One of the reasons for this is because of cycling's contributions to reaching climate goals," explains one of the national planners.

But there are partner cities where cycling is not on the political agenda "Political focus depends a lot on the specific politicians in office. Currently there is little political focus, even less for cycling compared to walking," say a planner from one of the smaller cities.

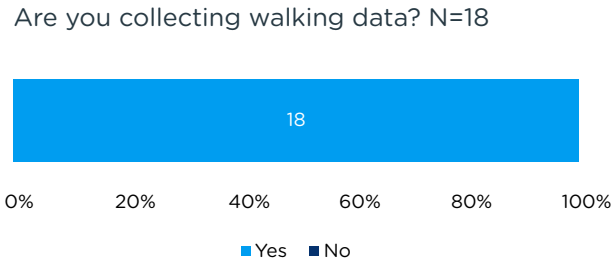
The goals and strategies for cycling to a large extent steer the cycling planners daily work, but to a different degree in the different 18 authorities.

"They [the goals] are guiding principles. The strategy, policies and goals were developed by the staff of the municipality and clearly stated how they as an organization would like to work. The politicians then committed to this. This political acknowledgement is particularly helpful in getting other parts of the organization on board. Data helps to support the goals and policy," explains one of the planners.

Another planner state: "There is often a difference between the priorities that are mentioned and how money is actually allocated. There is a risk that the money only goes to the bigger transport projects."

A third planner state: "Improving conditions for anything that isn't car transport meets resistance at the moment."

Collection of data



Like all of the authorities have goals for cycling they are also all collecting cycling data.

The collected data are used and prioritized differently in the 18 authorities. In some of the authority's car data is prioritized over other type of data – like cycling data. Especially "smart mobility" data like "connected cars", traffic lights and other road users. But there seem to be a lack of understanding about which data is actually relevant.

In some cities the politicians do request data e.g., number of cyclists or number of parking places for bicycles. But it is often unclear to the planners how the data is actually used in decision making. It's also mentioned that data that support the decisionmaker's agenda is well received while data that don't are questioned. As one planner put it: "Data can't always help persuade decisionmakers to make sustainable choices. But when the data support the person's agenda, they are more likely to be believed."

But there's also authorities where cycling data is very important. In the Province of Utrecht, the planners say: "We work actively on the emancipation of cycling within the field of data. It does not mean that cycling should be seen as more important but rather that data on cycling should be given the same amount of attention."

In City of Copenhagen cycling data is an important part of planning for cycling:

"We are very data driven and we have a huge amount of historic data. We often use data to argue for our solutions and recommendations to the politicians."

Rotterdam also has a lot of historic data. For example, they have been counting bicycle traffic in specific locations for over 25 years. Data collection is organised within its own cluster which is part of the mobility department. There is dedicated and secure budget for mobility data and these are collected in a structured way and aims to have a strategic baseline of data within three areas:

- Traffic volumes (counts)
- Experiences and behaviour (surveys)
- Traffic models and forecasts

The responsibility for data collection differs in the organisations – in some it's unclear who's responsible, in some a specific person or a specific team is responsible and in some organisations the responsibility for data collection is outsourced, but in most organisations the responsibility lays within the authority.

It also differs between the organisations weather there's a fixed budget or not, but often cycling data is part of a more general budget for traffic data collection. But in many cases data collection is also done in relation to a specific project. Mostly the budget is spent on procurement of cycling data or cycling data equipment, while the traffic planners in the department analyze the data.

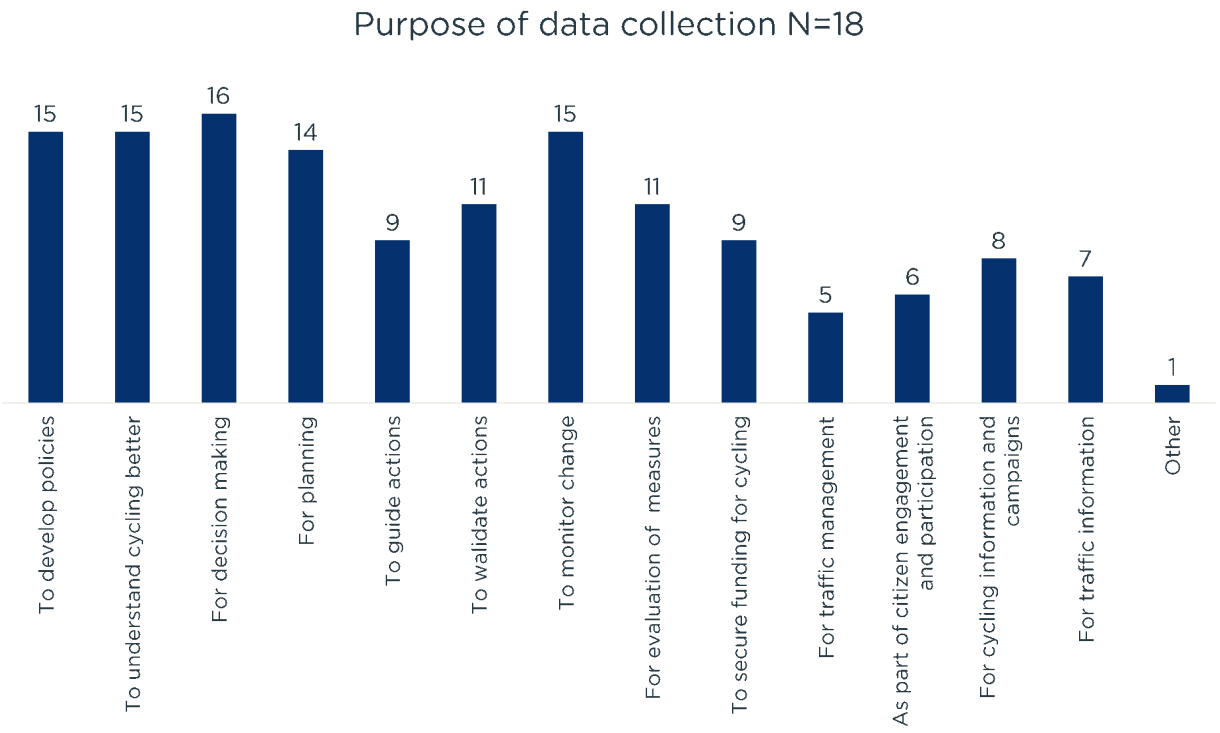
Rotterdam gets their cycling data from the National Data Warehouse in The Netherlands. NDW request data suppliers to sell their data to the National Data Warehouse (NDW). The municipality then buys the data from the National Data Warehouse. This ensures that the collection and processing of data is done according to a standardized process, ensures that data is publicly available, and that data extends beyond municipality borders.

In Copenhagen they use both the national collected travel survey data for Copenhagen and carry out cycling specific surveys every second year. Besides the collected travel survey data that the mobility department collects there's a special data unit that oversee all traffic counts – including counting cyclists. And in addition to these data, they collect data related to specific projects.

Lastly, Copenhagen has their own traffic model (Compass) that covers the whole region and includes both walking and cycling.

In Norway the Norwegian Public Roads Administration has an annual budget for bicycle counts. Regions that have been awarded urban growth agreements also receive increased funding to be able to collect cycling data.

Purpose for collecting data



The primary purposes for collecting cycling data are the same as for walking - decision making, to develop policies, to understand cycling better and to monitor change.

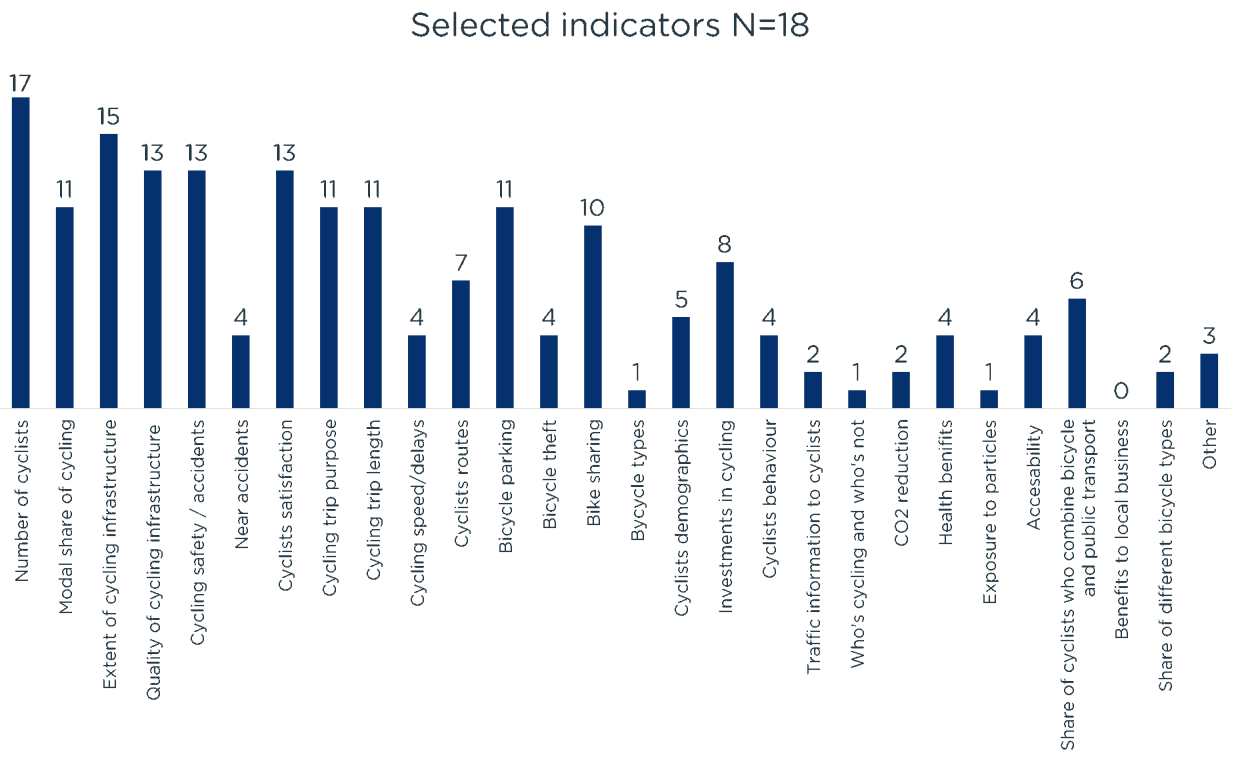
Cycling data is generally collected to support policy making – it can be very concrete like counting the number of bicycles parked outside parking facilities to make the case for funding for more bicycle parking facilities, or number of cyclists waiting at signalized crossing to argue for more green time.

But also more general – like one of the planners from Malmö put it: "We use data to see if we are heading in the right direction. To understand the current situation but also to understand how things are developing. And as more and more people are cycling, we also collect data to anticipate problems with capacity."

In The Province of Utrecht the primary purpose for data collection is monitoring to be able to confirm or adjust policies. And data can be used in two ways to do that - data can confirm afterwards that measures were correct, but data can also be used beforehand to justify the need for measures.

Several planners mention than cycling projects often require more data to convince decision makers about the need for the investment than other transport projects, both on local, regional, and national level – even in on national level in the Netherlands: "In the end it is about justifying (future) investments in cycling. Investments in cycling are seen as something extra and are therefore more scrutinized and questioned than more 'default' investments in car infrastructure. This makes justifying the investments extra important."

Indicators



Number of cyclists is a primary indicator for cycling – 17 out of the 18 public authorities have selected that as an indicator. After number of cyclists the extent of the cycling infrastructure comes second, followed by quality of the cycling infrastructure, cycling safety and cyclist satisfaction.

The indicators are primarily selected on the basis of the goals and policies. But sometimes the indicators simply reflect which data is available and easy to obtain. But in some cases the indicators have required development of new methodologies to collect data. In Tampere in Finland for instance the indicators are linked to the 5 goals in the development plan for cycling and walking. But data was at first not available, but methodologies are now being developed.

And sometimes cities must develop indicators and collect data more ad hoc, simply because of innovation in services or methodologies during a strategy period.

An example of that is micro-mobility solutions like e-scooters which suddenly appeared in the streets. In Copenhagen e-scooters and bicycles have to share the bike paths and it became relevant to collect data in relation to indicators like numbers, accidents and behavior change in relation to e-scooters.

In terms of subcategorizing the indicators, it's primarily data on cyclist safety and satisfaction that's broken down. Cyclist safety is subcategorized in relation to severeness of the accident and in Copenhagen also in relation to cyclists' feelings of safety and security. Satisfaction is also broken down to satisfaction with specific elements – like infrastructure, bicycle parking etc. But factors like gender, age etc. are included in relation to travel or behaviour surveys, but are often not used actively, if at all even though gender is an very important factor in transport and mobility and cycling especially[23].

[23] https://ramboll.com/-/media/files/rgr/documents/markets/transport/g/gender-and-mobility_report.pdf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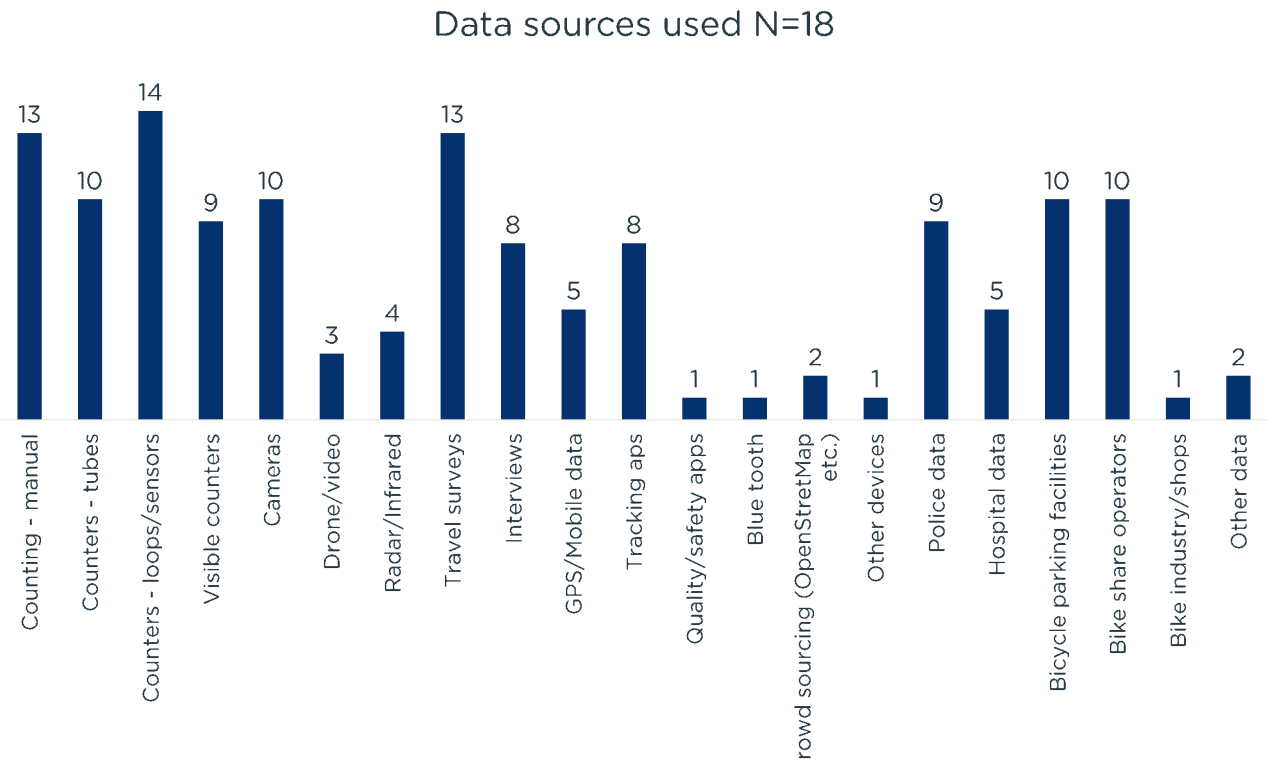
Sources



The primary data sources used by the surveyed public authorities are counters (loops and sensors driven), manual countings and travel surveys. There are no special criteria that govern the choice of data sources, but mostly the choices are linked to being able to follow the chosen indicators.

Manual countings and travel surveys are both resource heavy data sources and especially for travel surveys local administrations often depend on national travel surveys. These are done with different intervals in different countries. And in some cases the local data is not statistically valid. One example is Grimstad in Norway where the latest statistically valid survey is from 2014 making it statistically valid, but also outdated.

In Lahti in Finland cycling satisfaction has been surveyed three times (2018, 2020, 2022) so the results can be compared. They have also done many so-called Maptionnaires where citizens can answer specific questions with a map interface. That has provided the city with very valuable information.

Price is an important factor for many public authorities when selecting which sources to use e.g. for automatic cyclist counters there's a price difference between providers and different pricing models – leasing vs. ownership etc. But also financing and establishing power supply to the counters is challenging – especially in the smaller and less developed cycling towns and cities. That means that in some places they are not always located in the right places, but where it works. Data accuracy is also pointed out as a challenge related to counting data by several of the public authorities.

For the Norwegian Road Administration accuracy is very important: "The accuracy of available data largely determines what

is selected. Before a data source is used, a check is made against manual counts.

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For the Norwegian Road Administration accuracy is very important: "The accuracy of available data largely determines what is selected. Before a data source is used, a check is made against manual counts. In order to be used at www.Trafikkdata.no , the counts must be correct in excess of a certain percentage (slightly above 90%). Several new data sources have been tested, but do not reach this. For example, video recordings have been tested, but do not give good enough results. What is important in the data varies according to the purpose, both historical and real-time data are important. Development over time is interesting to see if the number of cyclists increases over time to be able to meet the goals."

In the Province of Utrecht money is however not a challenge. Here the choice of data sources is based on the quality of data that the sources offer, the availability in time and place and then the cost.

The Police is the primary provider for data on cyclist safety and accidents. But it commonly known that the Police statistics are not showing the full picture as accidents with cyclists are very underreported.

Operators also provide data to public authorities – primarily bicycle parking facilities and micro-mobility operators share by request data about the user's behavior with the public authority. But manual counting is also carried out – e.g. in Grimstad they register number of parked bicycles in the spring and autumn at schools and universities. They register how many racks are used and type of bicycles / scooters etc. and use this to plan bicycle parking and to set new parking norms in the municipal plans.

"The selection of sources has developed organically. First counters. Later came surveys. Now also data from bike share operators. Methods are used on strategic corridors based on practical or technical possibilities/challenges," explains our planners from City of Ghent.

It's also pointed out that planners and policy people don't necessarily have sufficient knowledge on data and data collection. It's therefore important that policy people and data people work closely together the find the right suppliers for the right data to get the most value. And as the data expert from City of Rotterdam says: "We constantly need to work to stay up to date. We are leading on walking and cycling data in the Netherlands together with Amsterdam, perhaps even on a global level. But each day now possibilities arrive. We must keep track of that. We talk to suppliers about possibilities and innovations. And try out different solutions within pilot projects."

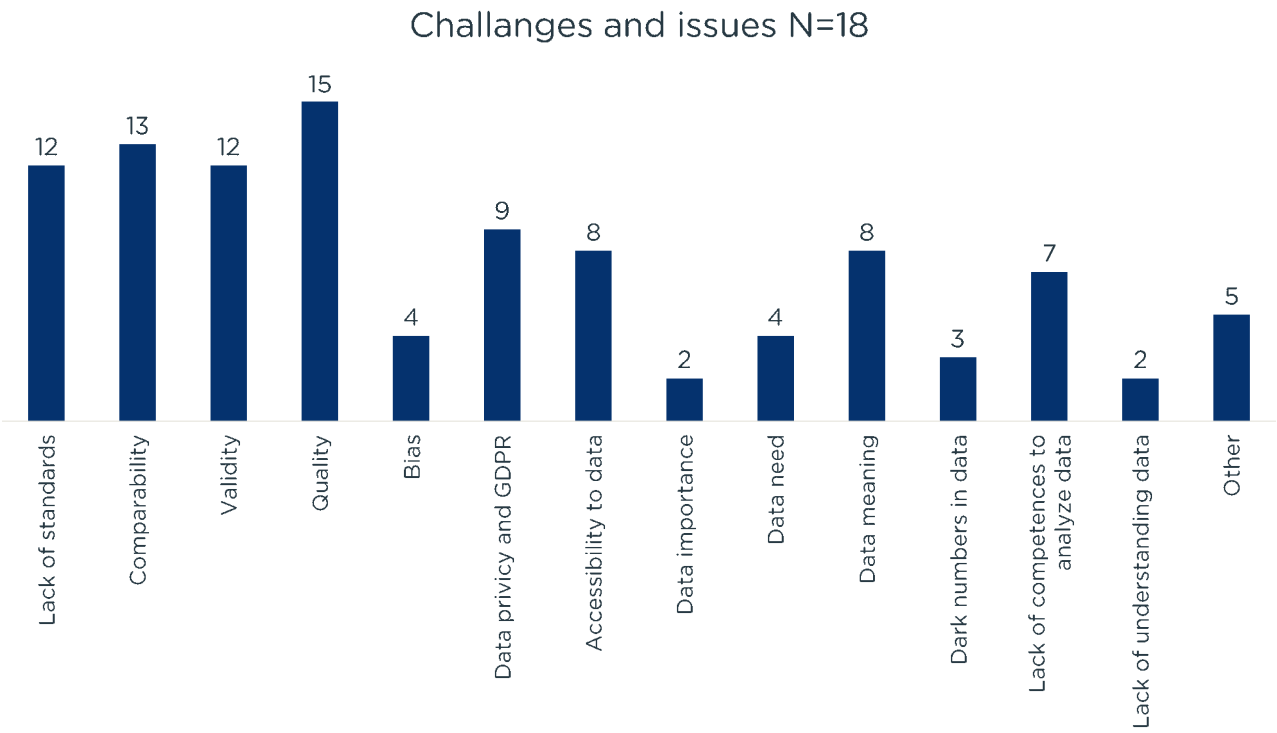
Tour de Force in the Netherlands has a good overview of what data is available and how reliable the different data sources are. But choosing which data sources to use also depends on whether or not this data is publicly available. Point data is often publicly available, but this is not the case for trace data.

Tour de Force is thus also trying to secure that data is publicly available and standardize data sources such as a cycling trace standard for bike share services (https://dashboarddeelmobiliteit.nl/)

The City of Copenhagen has a long history of collecting cycling data, and thus a large amount of historical data. Therefore, it is a balance between sticking to the same methodologies and considering new types of data. In that relation high quality, validity and representation is very important. Especially related to real time trace data for cyclists which are hard to get due to the movement patterns of cyclists. "Good data can give us a better picture of who´s cycling where and what challenges cyclists encounter. It is important that data creates a better understanding and is meaningful. Data must first and foremost enable improved and safer cycling in Copenhagen," explain the planners.

Cities also try out different tools and apps in relation to specific projects or campaigns, but this data collection is often stand-alone and not continued and follow-up.

Challenges and issues



The primary challenges identified by the public authorities for cycling data are quality, lack of comparability, standards, and low validity of data.

For Quezon City as well as the majority of the other public authorities lack of standards means that it's hard to compare data. Lack of competence and training in choosing and analyzing cycling data also means that the quality of the cycling data is not as high as the data for cars and public transport. Generally, the public authorities across national, regional, and local level request a common set of cycling data standards.

On national level in the Netherlands Tour de Force attempts to structure and standardize the collection of cycling data so that it is easier to compare. There are agreements on a national level about which data is collected and how. But in the end the responsibility lies with the individual road authorities. "There is a challenge with standardization. Every organization has their own way of working. Also regarding how money is attributed. Tendering processes can make it difficult to allow sharing and collaborating on data that has been purchased locally. Wish for more open data."

Tour de Force has for instance developed a protocol to count cyclist to determine the effectiveness of cycling superhighways based on the combined experience across the country. The standardization of data collection applies primarily to point-data. The next step is to also standardize how trace-data would be collected. Both for apps that people use voluntary specifically for this purpose and for apps where trace data is a byproduct like behavior and reward apps.

It can be challenging that the data collection is done by the individual road authorities. Sometimes municipalities

deviate in the data collection. Partly because they are not aware that there are existing protocols but also because they get specific demands from local politics.

Rijkswaterstaat is one of the road authorities connected to Tour de Force. There is a chief information officer at Rijkswaterstaat but this role has a responsibility that is much broader than just cycling data

Several of the authorities mention creating “meaningfulness of data” as a big challenge. They address that just because they collect data, they don’t necessarily get meaningful and valuable information from that data. A planner from Quezon city put it this way: “Cycling is very different from the usual car traffic patterns. Even the professional traffic engineers in national agencies lack the capacity to collect cycling data in a way that would be ideal and meaningful.”

In Copenhagen they deal with the same challenge: ”Our biggest challenge is to create the full picture of cycling in the city. We have good counting data, but we can do so much better in relation to modeling and simulations of and understanding how cyclists behave and why.” And the planners continue: “Also in relation to developments projects and more long-term traffic prognosis we have challenges in relation to cycling. We have well established methodologies for forecasting for cars based on demand, but these methodologies do not include cycling. And in relation to our goals for cycling we

should not use forecasting, but instead use back casting to understand how we reach our long-term goals."

In some of the public authorities there's also lack of financial resources to collect and analyze cycling data. Some of them believe that if the data collection process can be more standardized, it will be easier to justify why data collection requires more funding allocation and therefore data quality/validity can be improved subsequently.

Another challenge mentioned by some of the authorities is that it can be hard to acquire data from the private operators. Some of them fear losing competitive edge over others, some have technical difficulties providing the data in a format that the authority can work with, but data collection is also complicated since it often involves many different service providers.

Accuracy in data is also mentioned as a challenge - the Norwegian Public Roads Administration has set a requirement for an accuracy for counters of over 90%. Only a few types of counters can do this. They also see that many counters do not manage well enough to distinguish between walking and cycling or prams for example. "The counters that exist today are limited by the fact that they are in a fixed place. Cyclists (and pedestrians) are very volatile and are affected by many small and big things (holes in the ground, people in the road, closed further ahead, insecurity etc.). The counters cannot take this into account and variations in data can therefore have natural explanations that the person reading the data does not know," explains the Norwegian Road Department.

For The Province of Utrecht privacy is by far the biggest barrier. "We can hardly use trace data because we have to be absolutely sure that someone cannot trace back individual user. An example is the Ik fiets-app. We currently only use this trace data to track movements on a small scale, such as at intersections, but due to privacy challenges we do not dare to use it to get insights on how people travel across the province (e.g. origin-destination data). We miss out on the potential." Privacy is generally a challenge in relation to trace data. Due to privacy the first and last couple of 100 meters are cut of in order to comply with privacy laws, but since cycling trips are shorter this is a big challenge.

Several authorities also mention that collecting data and monitoring cycling is not the same as monitoring cars or public transport. Car driving is more structured in route choice and speed which make it easier to monitor. Data on cycling needs to take more and other factors into account. Speed of the cyclists depends on the individuals' gender, age, physical abilities, feeling of safety as well as external conditions like headwind, topography, type of bicycle etc. It means that for cycling as well as walking the characteristics of individual people also need to be included. An older person would for example cycle at a slower pace. For walking and cycling you need to focus much more on the human factor. This requires more work from the organisations that collect data but also from the people whose data is being collected e.g. through having to fill in more detailed surveys.

In general, it's seen as a challenge that cycling data as well as walking data is not an integral part of the data eco system – cycling and walking are often not included in transport models, car data get more financing and priority in many of the authorities, and they experience that there's simply more data about cars available than on cycling.

Public Availability

16 of the 18 authorities make the collected data publicly available. It's done in many different ways. Some cities make their counter data available.

Are the collected data publicly available? N=18

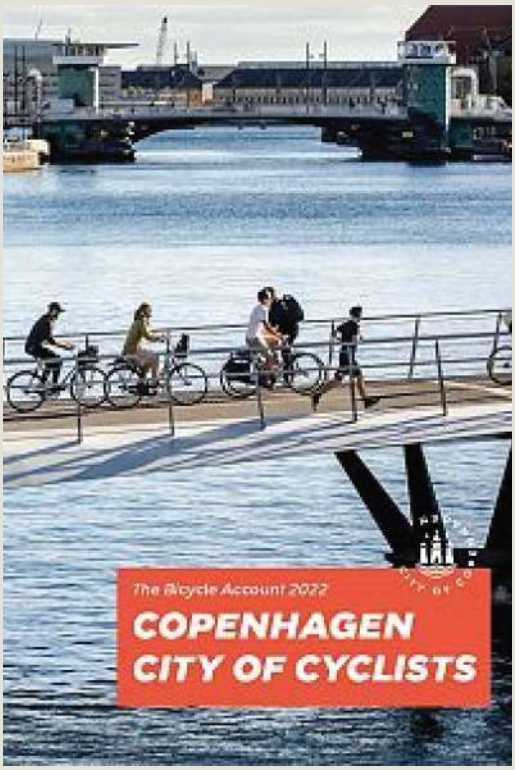
Example

Copenhagen bicycle accounts

Every two years, the City of Copenhagen prepares a so-called bicycle account. In these, the city follows up on the goals in the cycling strategy. The bicycle account has been published since 1995 and provides an overview of the status and highlights some of the improvements for cyclists the last two years.

The bicycle accounts present key cycling data in an easy accessible format. The document serves as both an internal status document for the administration as well as the politicians while it at the same time serves as public communication with both the press, citizens and cycling professionals. The bicycle accounts make cycling data visible and communicable, enabling conversations on a common ground[24].

Currently numerous Danish municipalities make bicycle accounts, and the Capital Region of Denmark has published the first interactive and live updated bicycle account for all municipalities in the region[25].



[24] https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=2420
[25] https://www.regionh.dk/til-fagfolk/trafik/cykler/Sider/Regionalt-cykelregnskab.aspx

Australia and New Zealand transport agencies

Across Australia and New Zealand transport agencies have a mixed record on the quantity and quality of walking and cycling data which is captured. Typically, agencies have collected data on walking and cycling participation although in many cases the maturity of this information was low, almost half of the state transport agencies flagged walking data as a gap in their current data collection practices, in part because walking often comes under the jurisdiction of local council. Agencies however recognise the importance of walking not just as a standalone mode but as part of longer journeys utilising more modes and highlighted the ongoing efforts to increase the collection and availability of walking data.

Agencies actively collecting data on walking and cycling highlighted the importance of utilising unbiased data sources, such as number of cyclists on a given link, to support the planning and evidence the benefits of improved walking and cycling infrastructure and participation. These absolute data sources offered information on walking and cycling participation which is comparable with the base information available for all other modes allowing walking and cycling participation to be contrasted and compared on a level playing field. Only when these unbiased data sources are available should we consider gathering some of the more challenging information types such as rider satisfaction.

One of the key challenges in obtaining these unbiased data sources is what's the infrastructure cost to capture this information reliably, and the lack of granularity and categorization in the data collected by these methods. This may be addressed in future through better use of GPS or mobile data sources however, as yet this information is not readily available or is unreliable. As these new data sources and collection methods come out it was highlighted that there is a need to generate standards to ensure conformity in how these data sources and the information captured across different agencies and jurisdictions to allow accurate comparison of information and standardisation of interrogation tools.

https://www.cwanz.com.au/

Walking and cycling data key findings

In the following we sum up on the findings from the partner and supporter survey and in-depth interviews.

The findings will be compared to results of the global version of the partner and supporter survey we carried out in September 2022. Link to the questionnaire was shared on social media and through different walking, cycling and city networks. We have 46 complete responses for walking and 42 complete for cycling.

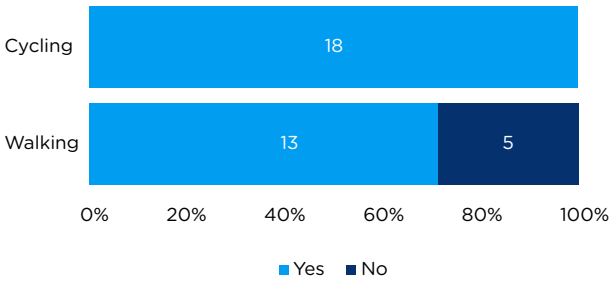
For walking we have 46 complete responses from public authorities from the following countries:

Denmark: 19
Finland: 11
Norway: 6
The Netherlands: 4
Sweden: 1
Italy: 1
Germany: 1
Ireland: 1
Spain: 1
Singapore: 1

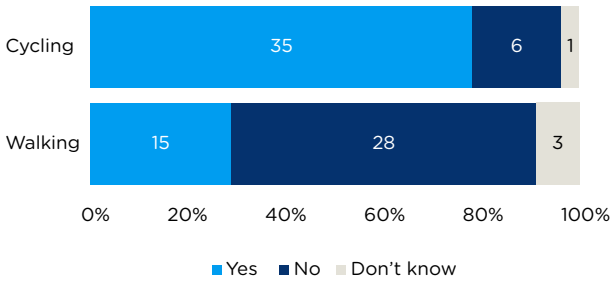
For cycling we have 42 complete responses from public authorities from the following countries:

Finland: 13
Denmark: 11
The Netherlands: 10
Norway: 3
Sweden: 2
UK: 1
Ireland: 2

Partners and suppoters:
Politically approved goals N=18



Global survey:
Politically approved goals N=42 and 46

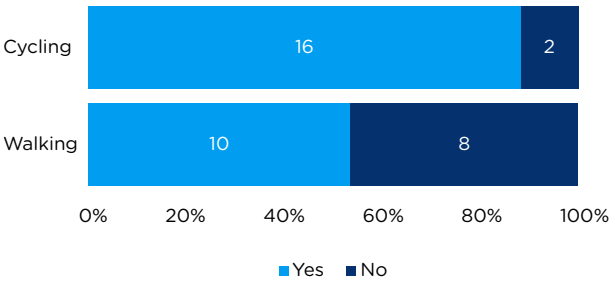


From the interviews with our 18 public partners and supporters it's clear that cycling has more political focus than walking. We also find that in the survey related to the presence of politically approved goals, strategies and policies related to walking and cycling.

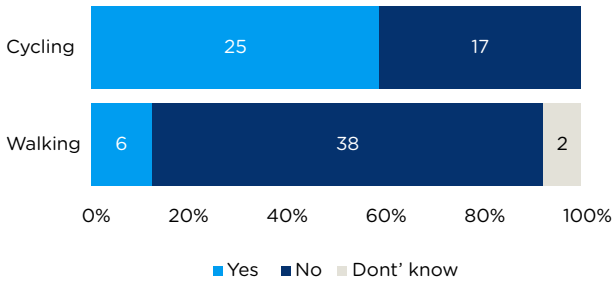
All of the 18 partners and supporter authorities have a politically approved cycling strategy in place. For walking it's 13 out of the 18. That tendency is even clearer in the

global survey, where only 1/3 of the public authorities have political approved goals for walking while more than 2/3 have for cycling.

Partners and suppoters:
Politically approved strategy N=18

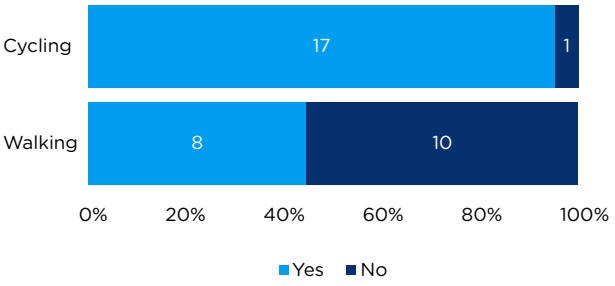


Global survey:
Politically approved strategy N=42 and 46

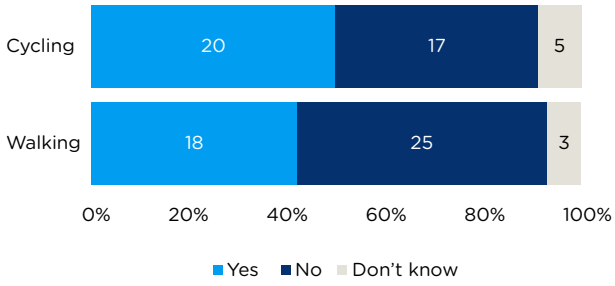


9 out of 10 partners and supporters have a cycling strategy, while only little over half have a walking strategy in place. In the global survey the tendency it even clearer with 6 out 10 having a cycling strategy while only 1 out of 10 has a walking strategy.

Partners and suppoters:
Policies in place N=18

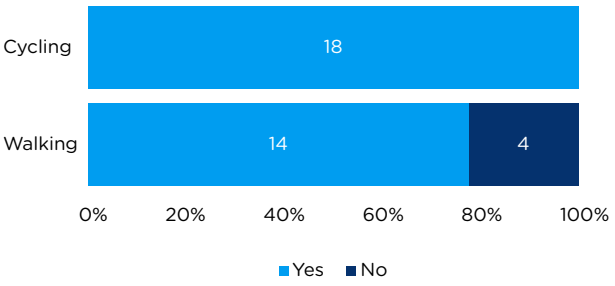


Global survey: Policies in place N=42 and 46

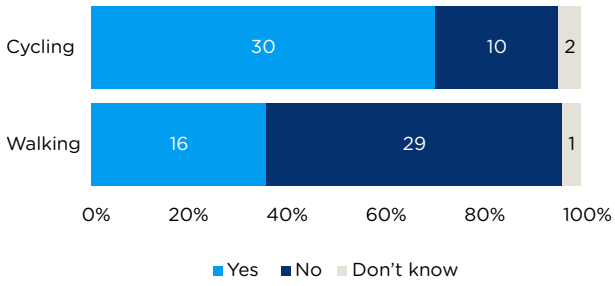


In relation to policies 9 out of 10 of the partners have policies in place for cycling while only 4 out of 10 have for walking. For walking it's about the same in the global survey, while it's only about half that has cycling policies in place.

Partners and suppoters: Collecting data N=18

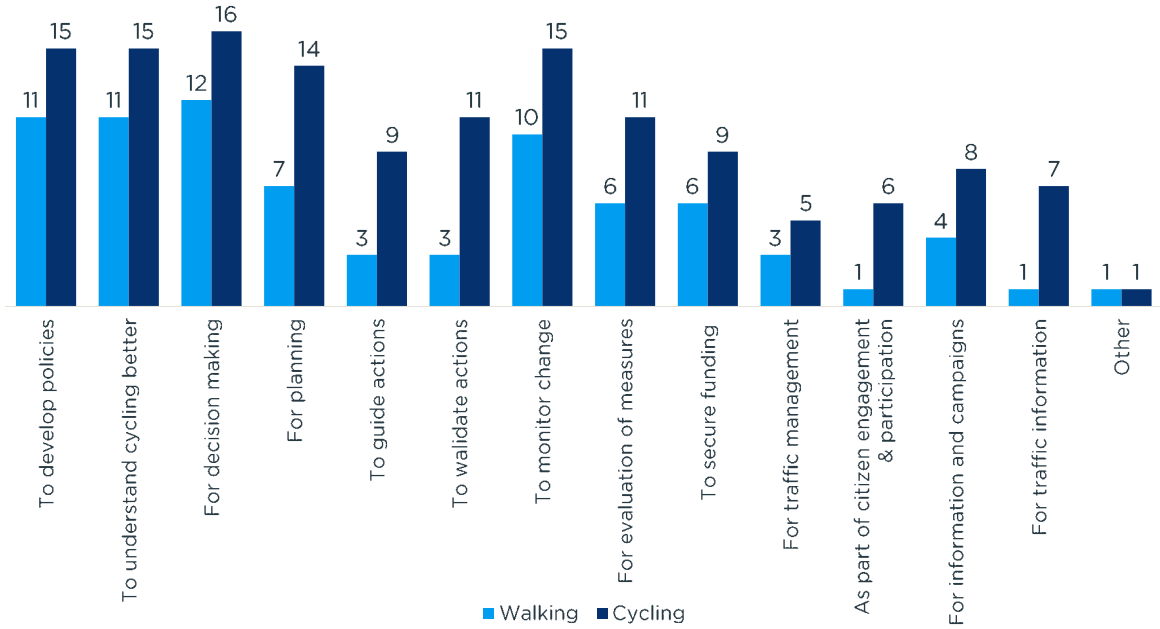


Global survey: Collecting data N=42 and 46



All of the partners and supporter authorities collect data on cycling, while 8 out of 10 do it for walking. In the global survey 7 out of 10 authorities collect data on cycling while less than 4 out og 10 do it for walking.

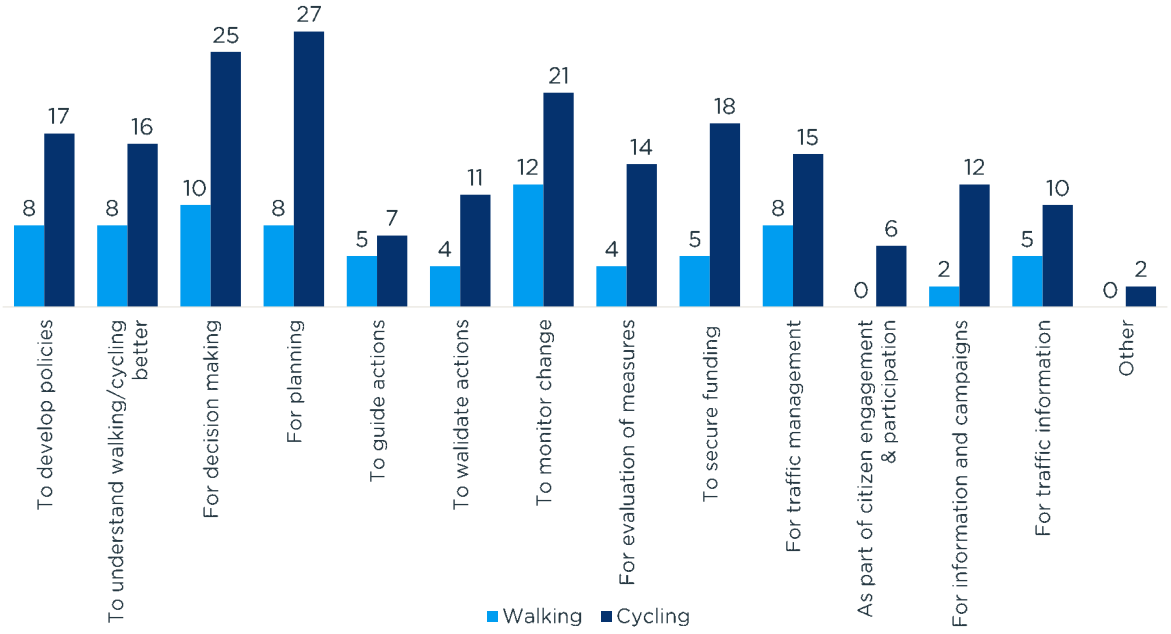
Partners and supporters: Purpose for data collection N=14 & 18



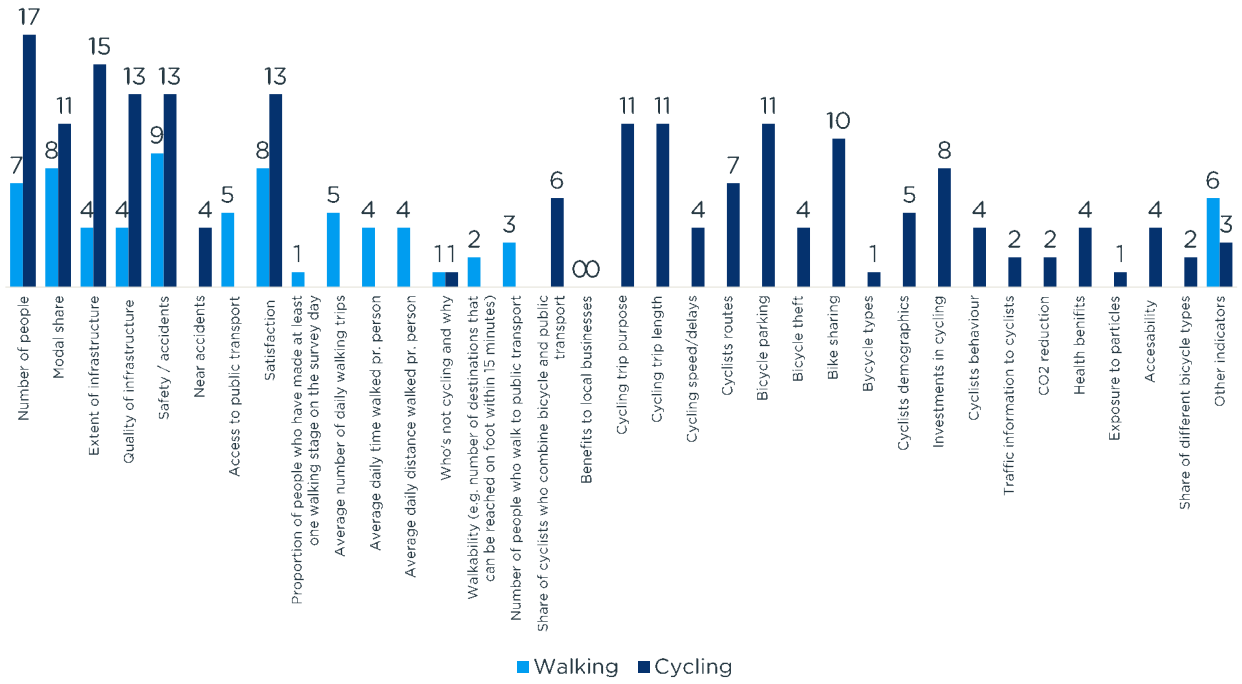
The primary purposes for the partners and supporters to collect data for walking and cycling data are decision making, policy making, understanding walking and cycling better and to monitor change.

It's almost the same in the global survey except that "Planning" is the number one reason for cycling".

Global survey: purpose for collecting data N=16 & 30

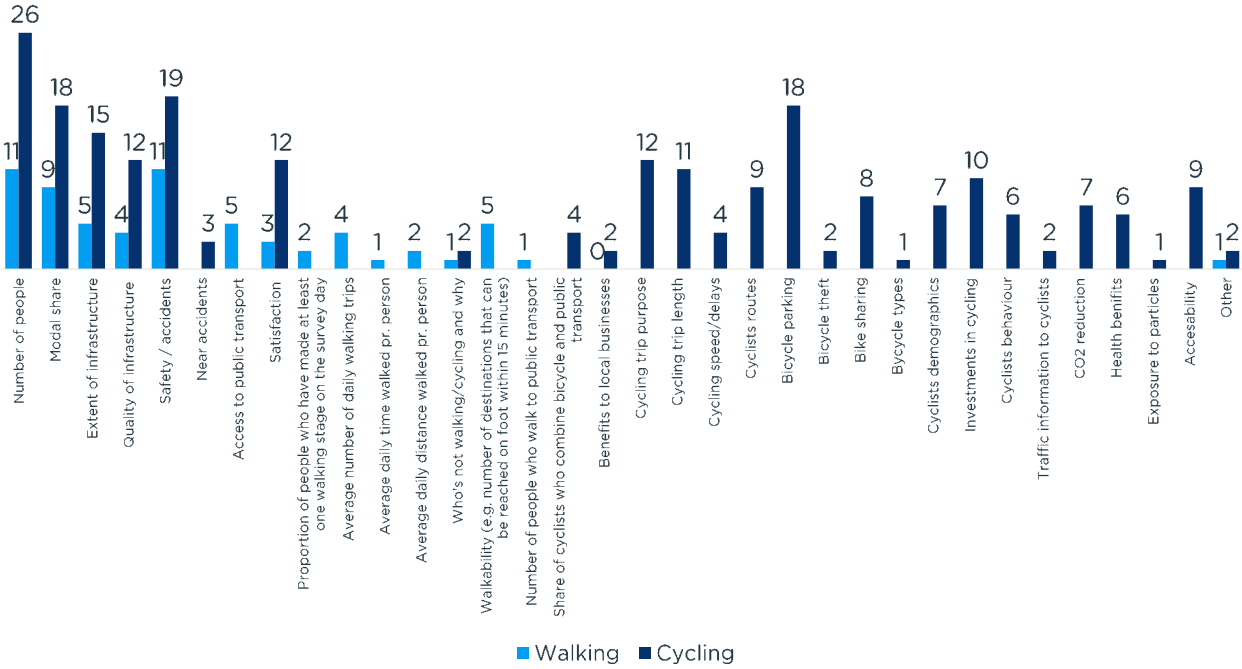


Partners & supporters: Selected indicators N=14 & 18

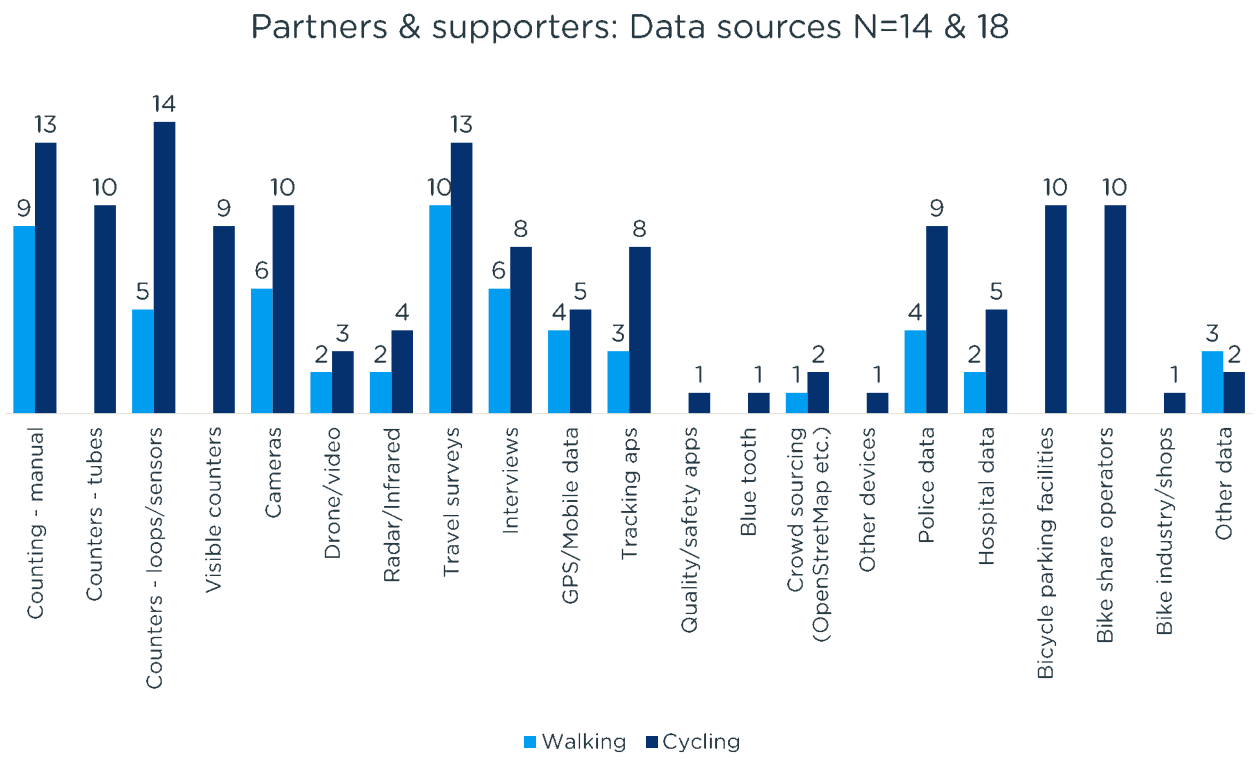


For walking the primary indicators selected by the authorities are primarily linked to safety and satisfaction, modal share and then number of pedestrians. For cycling number of cyclists and extent of cycling infrastructure are the main indicators followed by quality of cycling infrastructure, safety and satisfaction.

Global survey: selected indicators N=16 & 30

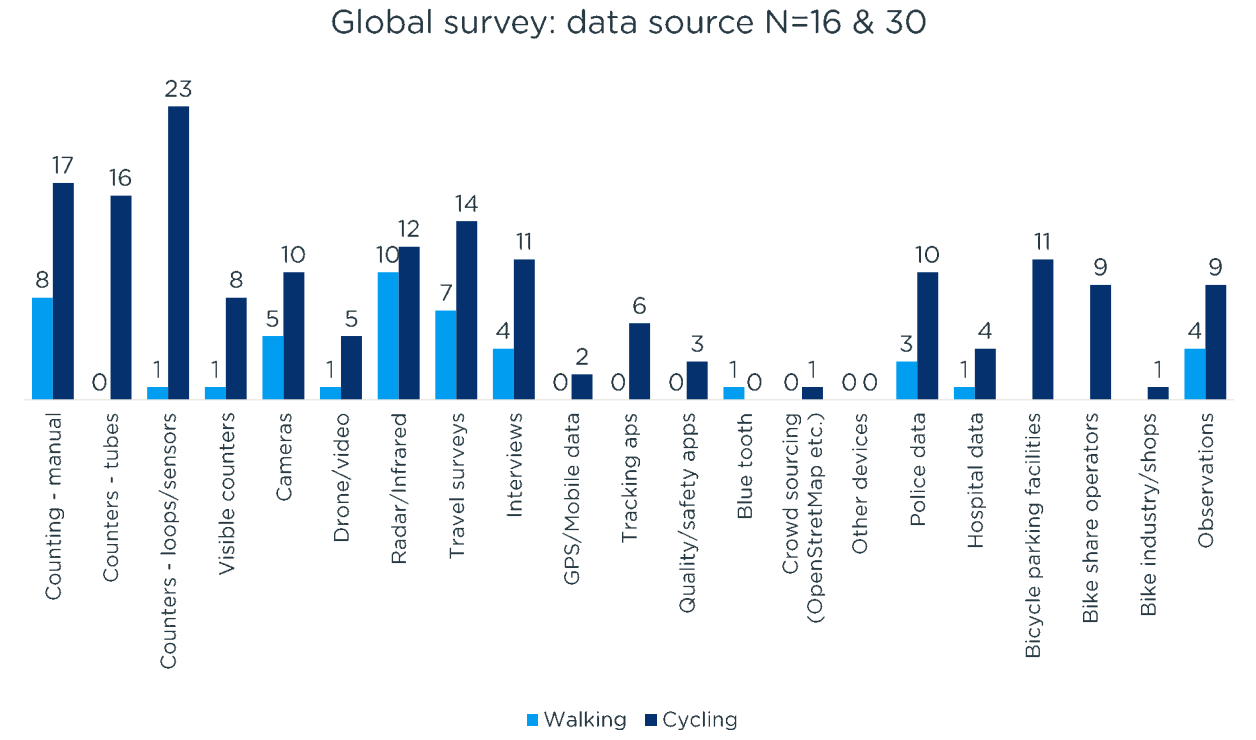


In the global survey safety and number of pedestrians are the primary indicators for walking, while satisfaction is not a key indicator for walking. For cycling the selected indicators are similar among our partners and supporters and the global survey.

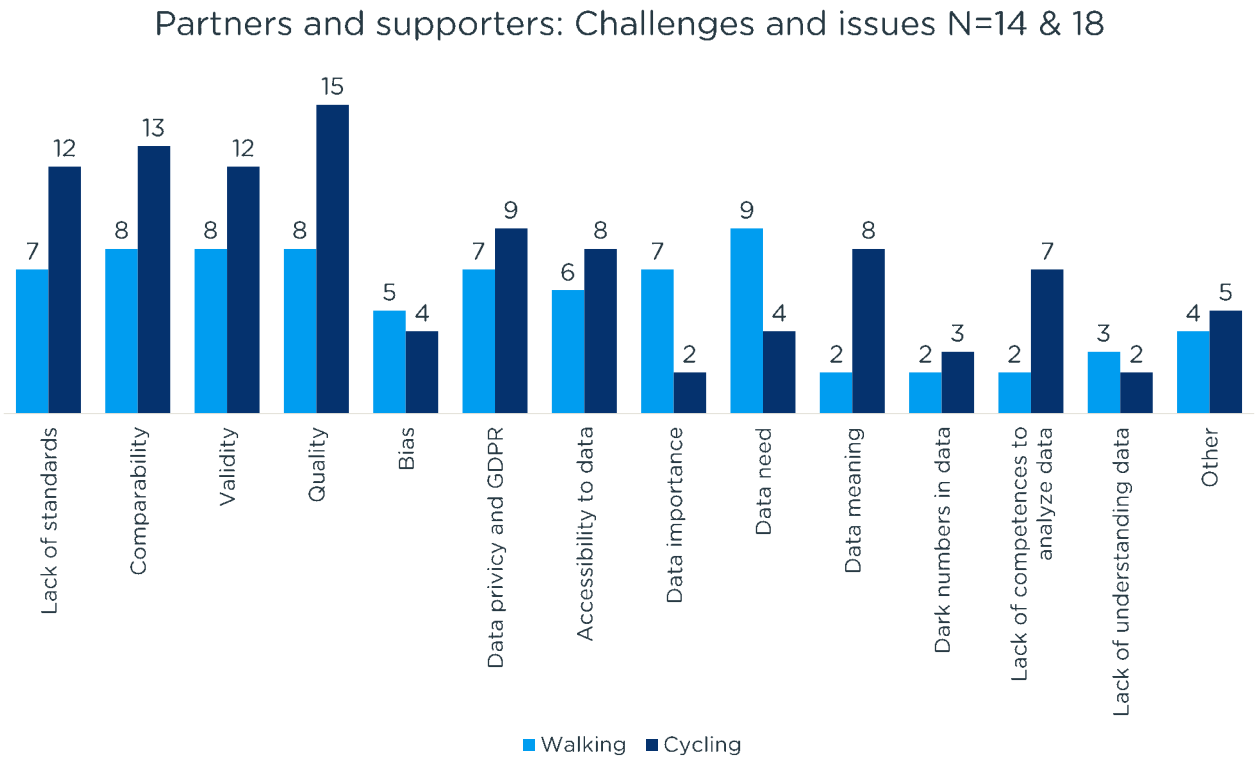


Travel surveys and manual countings are the key data sources for walking for our partners and supporters – these sources are also key for cycling, but different types of automatic counters the key source for cycling data.

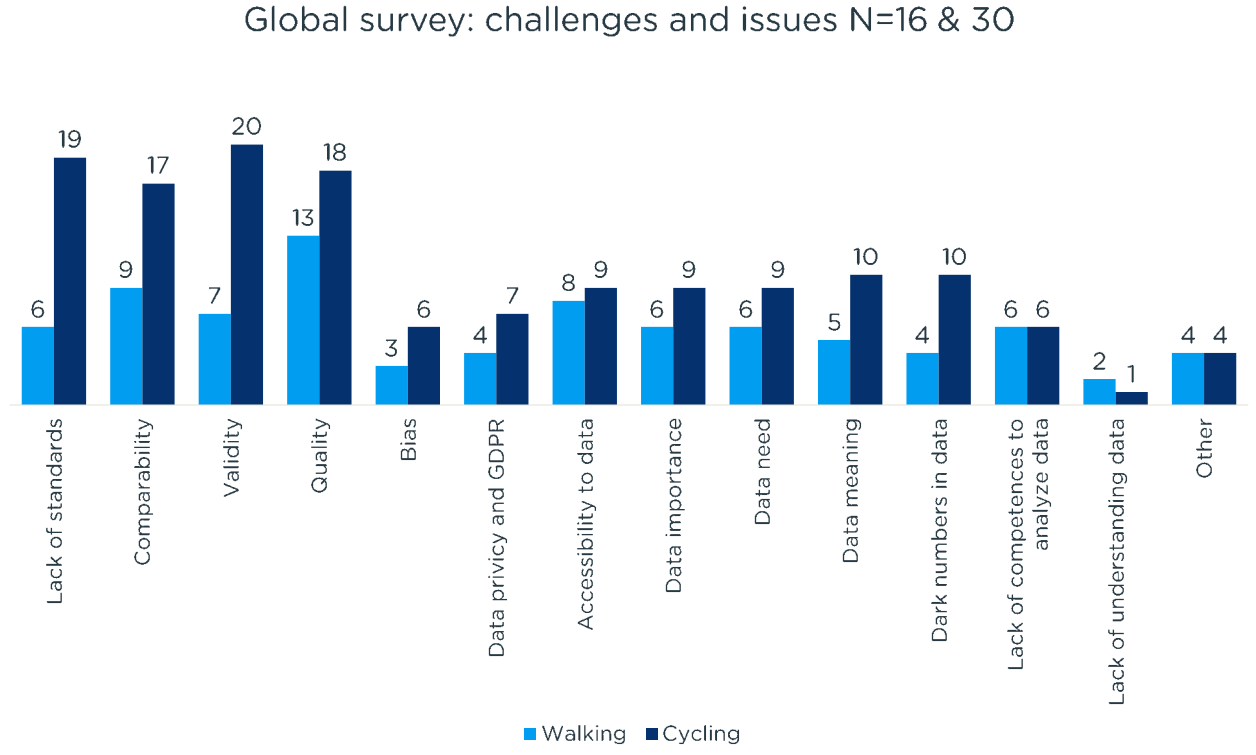
For cycling data from different kinds of operators – bike sharing, bicycle parking etc. – are also key sources.



In the global survey different types of automatic counters are also the dominant data source for cycling, while Radar/Infrared, manual countings and travel surveys are the most used data source for walking.



Quality, comparability, validity and lack of standards have been identified both by our partners and supporters and in the global survey as key challenges in relation to both walking and cycling data. But for walking the number one challenge is lack of understanding for the need for data about walking in the different authorities. For cycling is not so much about need, but more about creating meaning out of the data.



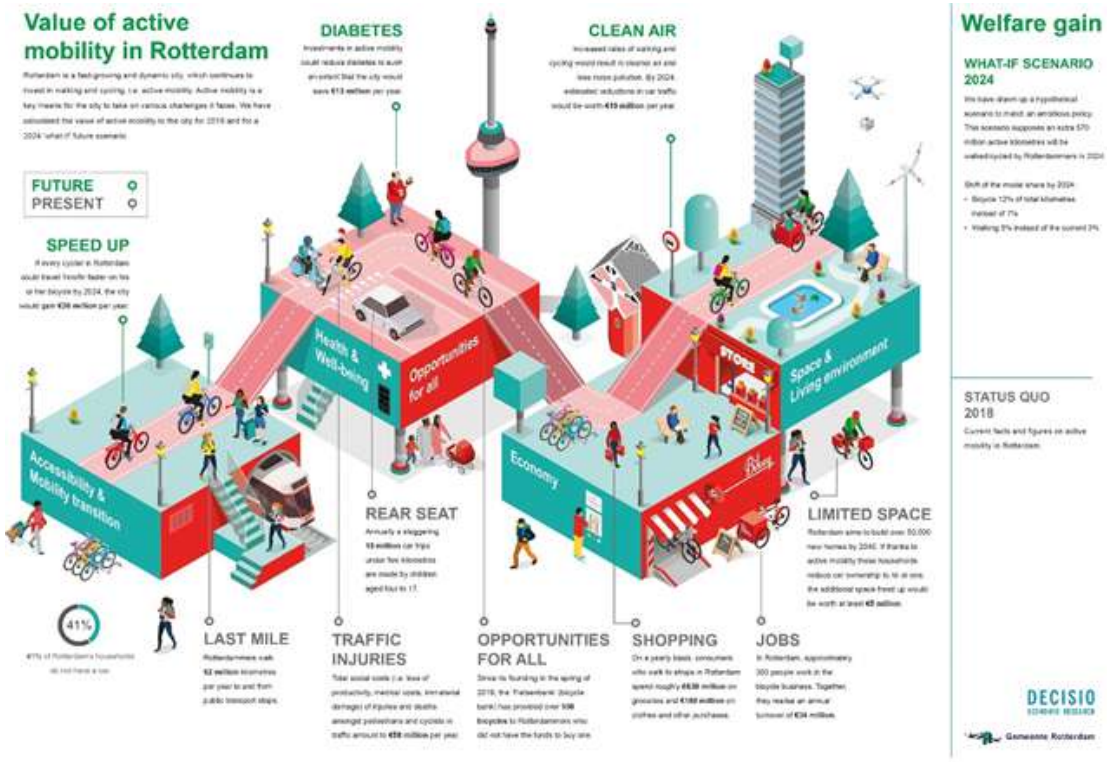
Cycling and walking does not have the same political attention as car driving and public transport. It manifests in lack of goals, strategies, and policies - especially for walking.

But it also manifests in data collection. Walking is at the bottom of the mobility data hierarchy – it does not get the same attention and resources as cycling and the car is king in data collection. If data is collected for walking the scale is lower than for cycling both in terms of indicators and data sources used. Among the partners and supporters lack of understanding in their organizations of the need for collecting walking data is identified a key challenge. The question is - is walking (and cycling) underprioritized because we don't have that much data on walking or is walking data underprioritized because walking is overlooked?

In the article "The Hidden Deficit Holding Back Bike Infrastructure Investment? Streetlight Data looks at how lack of data on non-motorized travel slows bike and pedestrian investment in the US: "It's kind of scary actually, how little we know about our communities, when it comes to walking and biking transportation," says Bill Nesper, executive director of the League of American Bicyclists[26].

Since collecting data both according to our experts and the public authorities is about decision making, policies, planning and monitoring change lack of walking and cycling data means a poor foundation for policy making and planning for walking and cycling. Walking as well as cycling is both a sustainable and healthy way of moving in cities on it own, but also what connects and bring us to all other modes. Lack of focus, data and knowledge about walking has consequences for the experience of the whole mobility system and is thus a big challenge for creating a sustainable, attractive, multimodal mobility system that can challenge car dependency in cities.

But walking is not only about movement in and around our cities, it's also closely linked to placemaking, dwelling and public life as well as health and wellbeing of the citizens. In Rotterdam they have calculated the different benefits linked to walking and cycling when they reach their walking and cycling goals and illustrated the numbers in this infographic:



[26] https://www.streetlightdata.com/bike-infrastructure-data-deficit-changing/

This is a good example of how data can be used to illustrate the benefits to people, place and society that comes with walking and cycling.

Due to lack of standards for walking and cycling data the main challenges that planners experience are poor data quality, validity, and comparability. Establishing the needed common standards on both national and international level for collection of basic walking and cycling data is an important step towards securing good data and thus better policies for walking and cycling data.

In France they have established a national data base on cycling infrastructure. La Base Nationale de Aménagements Cyclables (BNAC) is a data base with information on cycling infrastructure and the use thereof and has been created within a larger framework set to improve access to travel data. The data structure has been built in collaboration with Vélo & Territoires, data producers and users. A key objective has been the standardization of data on cycling infrastructure, and further to make the information available as detailed as possible.

The access to this type of data has been made mandatory due to an EU law (2017/1926) regarding the publishing of multimodal data by each member state. These obligations are further fleshed out through a French law stipulating the government organs that are to update the platform on transport.data.gouv.fr.

This dataset includes in particular:
- the INSEE code of the municipality
- the geolocation of cycling facilities
- the type of cycling facilities
- the speed of motorized vehicles in the adjacent traffic

The dataset does not include bicycle parking[27].

Data collection for car driving is typically about making car driving more efficient, reduce stops and improve travel time. Travel time is not a key indicator and focus for walking and cycling. Number of cyclists and pedestrians, safety, the experience of walking and cycling, satisfaction with the conditions are the key indicators for walking and cycling. That means a need for both quantitative and qualitative data related to safety, experience and satisfaction with walking and cycling. It also means a need for data about individual characteristics of pedestrians and cyclists – who are experiencing what where in order to improve the conditions for those groups. These data can only be obtained by actively involving the users which makes them harder and more resourceful to collect. Understanding how to collect and analyse these data as well as understanding potential data bias when analysing the data makes it challenging and costly for public authorities to collect these data.

Another aspect repeated among the authorities interviewed is that the fact that the movements of people walking, and cycling are more natural, fluid, and unpredictable compared to the more structured flows of for example car traffic. That means that it's more challenging to collect data about pedestrians and cyclists. GDPR and privacy legislation is also a challenge in relation to that.

Access to trace data about the actual movement of people walking and cycling is very high on the authority's wish list and identified as a gap in the market.

Another challenge highlighted in the interviews is the challenge of creating meaning of the available cycling data and having the competences to analyse the collected data. GDPR and privacy is also a challenge for both walking and cycling data – especially since understanding how different groups experience cycling.

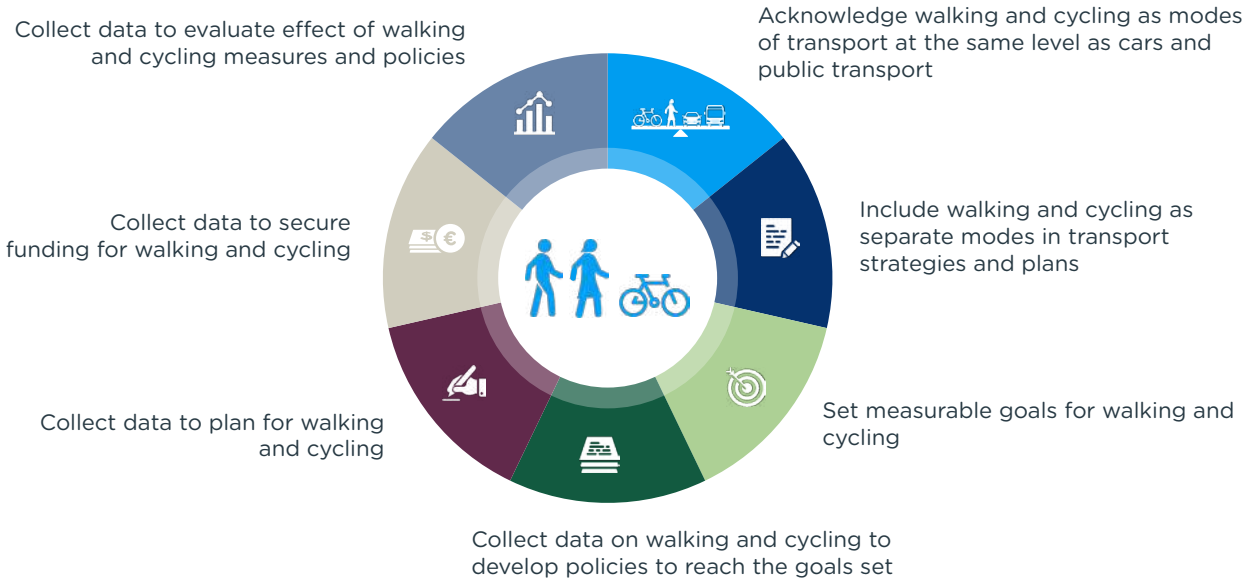
Another challenge is that some of the most important data – why are people not walking and cycling - are invisible and needs to be collected through more resource heavy ways – like interviews and surveys.

[27] https://schema.data.gouv.fr/etalab/schema-stationnement-cyclable/latest.html

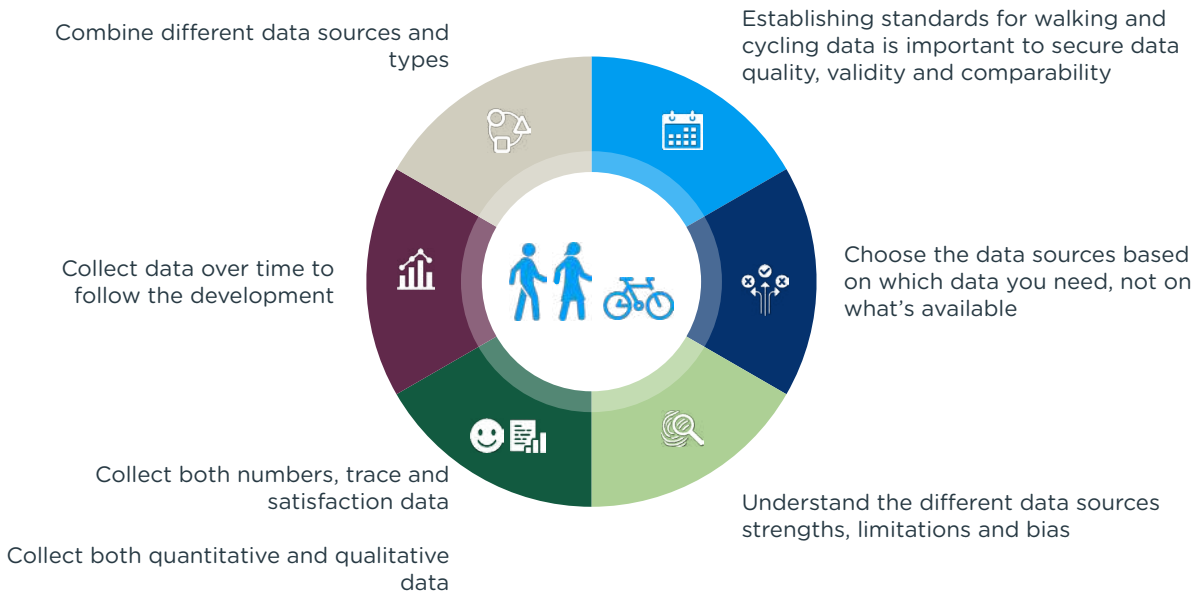
Recommendations

On the basis of the expert interviews, the 18 partner and supporter surveys and in-depth interviews and the global survey the following recommendations have been developed by the partnership:

Policy & data



How to collect meaningful data



Minimum data to collect for walking

Indicators should always be linked to the goals

Benefits
- Health benefits of walking
- Economic benefits of walking
- Emissions and noise benefits

Activity
- Average minutes spent walking per day disaggregated by age, ability and gender
- Number of people lingering/spending time in selected public spaces

Comfort & Satisfaction
- Percentage of streets with minimum 3 star pedestrian standard
- Pedestrian satisfaction with the existing walking experience disaggregated by age, ability and gender
- Who's NOT walking and why

Safety
- Number of pedestrians killed pr. 100,000 inhabitants disaggregated by age, ability, gender.

Accessibility
- The percentage of people living within 500m of public transport disaggregated by age, ability, gender

Minimum data to collect for cycling

Indicators should always be linked to the goals

Benefits
- Health benefits of cycling
- Economic benefits of cycling
- Emissions and noise benefits

Activity
- Number of cyclists
- Modal split - ideally captured for trips, distance, and time
- Trip purpose
- Break down by gender, age and other demographics

Satisfaction
- Cyclist satisfaction with infrastructure, bicycle parking, facilities and policies
- Where is it a good experience to cycle and where is it not
- Who's NOT cycling and why
- Break down by gender, age ability, and income

Safety
- Number of injured and killed (include single accidents)
- Risk factor - accidents in relations to trips

Accessibility
- Network: Length, status and quality
- Bicycle parking: Number, locations, capacity and quality
- Public transport: Accessibility to public transport, bicycle parking and first/ last mile solutions

Benchmarking of data sources

In this section we benchmark the data sources that has been identified in our mapping as the most typical available and used data sources against the identified indicators and describe the possibilities and limitations of the different data sources for walking and cycling.

Infrastructure and facilities

This section describes possible data sources for describing indicators on infrastructure and facilities for cycling and/or walking (C/W).

In Table 1 it is indicated what types of indicators for cycling and walking that is attainable from data mainly describing infrastructure and facilities.

A green stoplight means that data usually will be attainable while a yellow stoplight means that data might be relevant but may need further processing and/or possible combination with other data to add any insight.

Indicator Green: Direct information, Yellow: Useful together with other data	Data Source							
	Official Maps		Crowd sourcing (OpenStreetMap)		Quality/safety apps/online maps		Computer vision	
	🚲	🚶	🚲	🚶	🚲	🚶	🚲	🚶
Access to public transport			●	●				
Accessibility (e.g. number of destinations that can be reached by C/W within a certain time)			●	●				
Average daily distance C/W pr. person								
Average daily time C/W pr. person								
Average number of daily C/W trips								
C/W safety – accidents								
C/W safety – near accidents								
C/W trip length	●	●	●	●				
C/W trip purpose								
C/W's demographics								
Benefits to local businesses (e.g. planned and spontaneous visits)	●	●	●	●				
Bicycle parking (availability/capacity, dead bicycles)	●		●		●		●	
Bicycle sharing			●					
Bicycle theft					●			
CO2 reduction								
Travel speed / delays					●		●	
C/W behaviour								
C/W exposure to particles					●		●	
Data on investment in C/W (e.g., investment pr. capita pr. year)	●	●	●	●				
Extent of C/W infrastructure	●	●	●	●			●	●
Health benefits of C/W								
Mapping of C/W routes	●		●					
Modal share of C/W								
Number of C/W's								
Number of people who combine C/W with public transport								
Proportion of people who have made at least one C/W stage on the survey day								
Quality of C/W infrastructure			●	●	●	●	●	●
Satisfaction with C/W in the city					●	●		
Share of different bicycle types								
Traffic information			●	●	●	●		
Who's not C/W and why?								

Table 1 Indicators and possible data sources on infrastructure and facilities

Official Maps

Local, regional, or national authorities may have maps that include bicycle and/or walking infrastructure.

As an example, in Denmark there is nationwide map called GeoDanmark where all Danish municipalities keep track of the physics like buildings and roads.

From here the extent of paths split in different types can be extracted as shown in Figure 1.

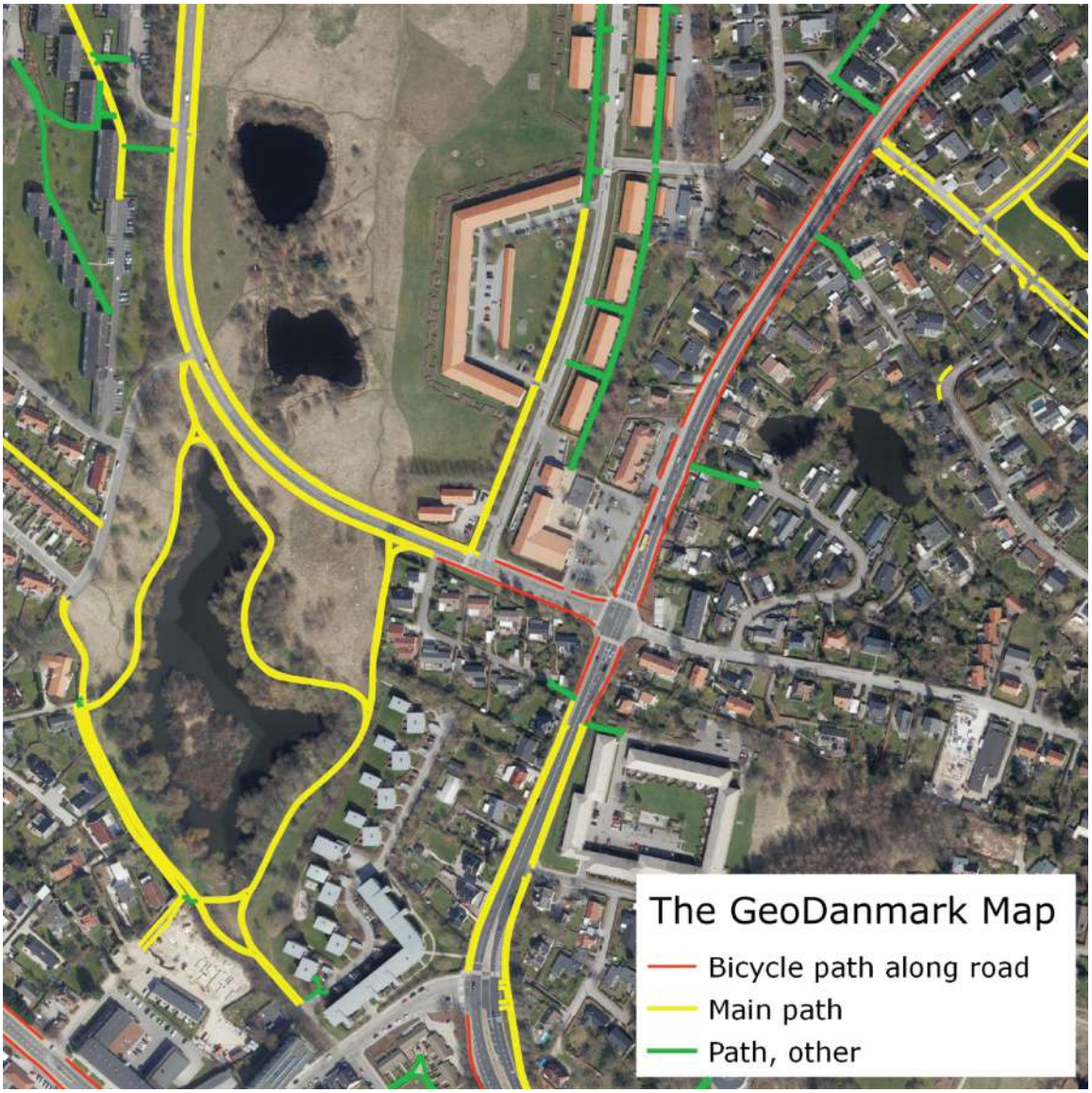


Figure 1 : The GeoDanmark Map (Source: Data from the GeoDanmark map)[28]

Since 2021, the Netherlands collects data in cycling infrastructure in the national road dataset (Nationaal Wegenbestand) too. Prior, only cycling infrastructure with its own name was included. The dataset is nowadays updated to include solitary bicycle paths[29]. This means that cycling lanes and shared streets are not explicitly included.

[28] https://www.geodanmark.dk/ (in Danish only)
[29] https://www.nationaalwegenbestand.nl/nieuws/30000-km-fietspad-toegevoegd-aan-het-nwb

Crowd sourcing (OpenStreetMap)

OpenStreetMap (OSM) is a collaborative global map that was built by volunteers and is maintained in a Wikipedia-like style, where anybody with some technical insight can add features to the map using e.g. the online editor.

Several bicycle- and walking oriented presentations of OSM are available and the data behind OSM can also be downloaded for use in GIS programs.

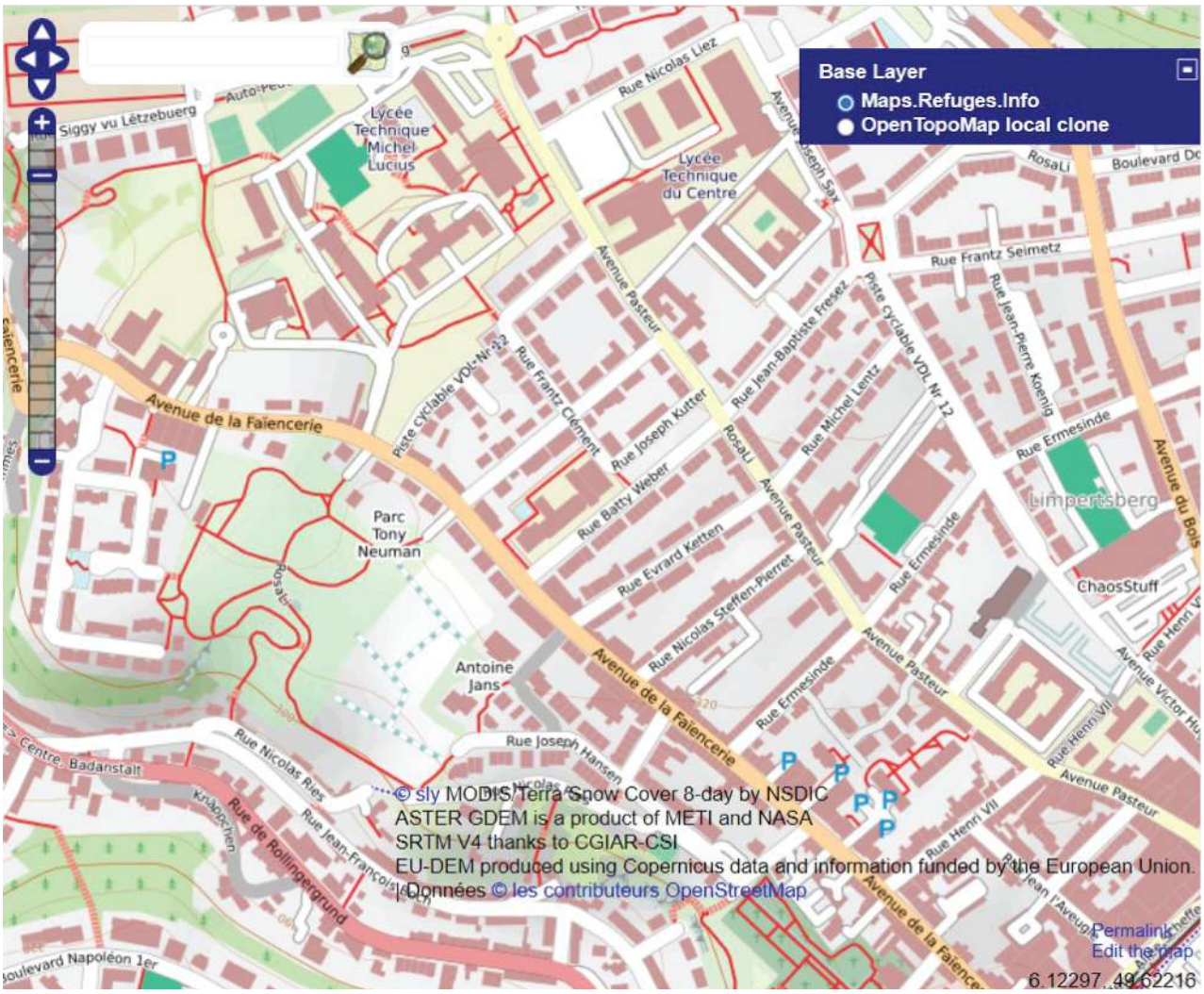


Figure 2 : OSM walking links presented at maps.refuges.info

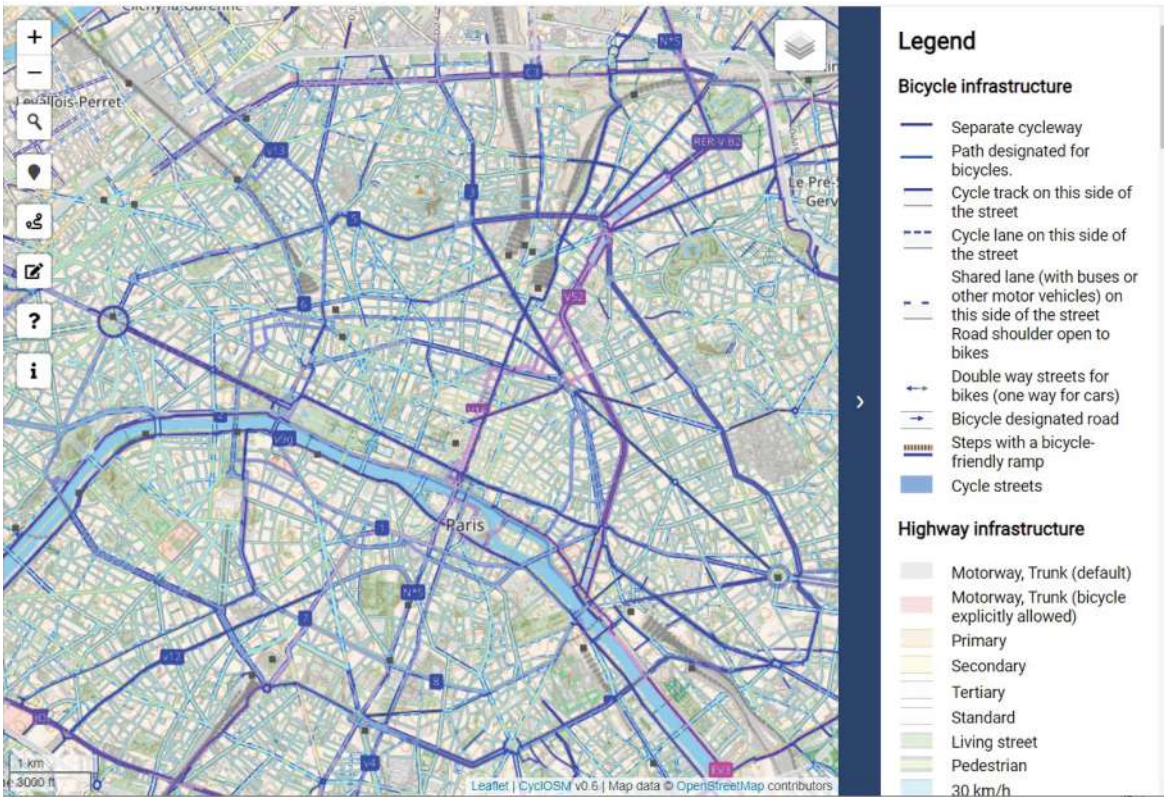


Figure 3 : OSM bicycle data presented at CyclOSM.org

The Wikipedia like structure means that nobody is responsible for adding features to OSM, so in some areas contents could in theory be sparse and it will be important to validate the content in the relevant selected geography.

It is worth noting that much of the data in OpenStreetMap originates from public data sources, even though the service depends on contributors. For example, certain attributes of OpenStreetMap in Finland are derived from Digiroad (Finland's National Road and Street Database) and this dataset is therefore mentioned as the source. This illustrates the potential of how road and street data from datasets managed by public bodies can trickle down – and therefore improve – crowd sources platforms like OpenStreetMap.

Researchers have compared OSM bicycling infrastructure in six Canadian cities with municipal open data[30]. They concluded that:

- The concordance in terms of total length of OSM infrastructure to open data infrastructure was very high in two of the six cities (< ±2%), and reasonably high in all cities (maximum difference ±30%)
- Concordance for infrastructure categories was highest for on-street bicycle lanes, which were the most common, and easily identifiable type of bicycle infrastructure in the OSM data, and lowest for cycle tracks and local street bikeways, both of which are new or relatively rare infrastructure types in some Canadian cities.
- In some cases, OSM was more detailed and timelier than open data.
- A challenge in OSM is consistent tagging of bicycle infrastructure types.

It can probably be assumed, that concordance will be higher in more cycling oriented countries than Canada.

[30] https://www.tandfonline.com/doi/full/10.1080/15568318.2018.1519746?scroll=top&needAccess=true

OSM cycling data

OSM structure contains cycling data as described below[31], but due to the Wikipedia like concept one cannot be sure that all tags are used or used consistently.

Links can have bicycle relevant attributes like:

- Cycle lanes: A lane marked on a portion of a carriageway (UK), roadway or shoulder (USA), designated for cyclist use.
- Cycle tracks: Road (UK) or path (USA, Canada) dedicated to cyclists on separate right of way.
- Cycle streets and bicycle roads: A cycle street is a street designed for bicycle with low motor traffic
- Pedestrian streets
- Off-road and outdoor

Attributes used to describe cycling possibilities and/or attractiveness on links:

- Surface on the link
- Speed limit on the link
- Bicycles allowed or not
- Designated for bicyclists
- Indication on whether the oneway rules for cyclists differ from the general oneway restriction
- Indication on traffic calming

Facilities for bicyclists:

- Bicycle parking
- Bicycle rental
- Bicycle shop
- Bicycle service
- Bicycle self-repair station
- Bicycle pump
- Electric bike charging stations
- Bicycle routes

Bicycle stats:

- Location of bicycle counters with display in situ

OSM walking data

OSM contains walking data as described below[32]. In the use of OSM walking data focus in many maps or apps are on hiking – like cross country walking with a backpack. But much of the data should be usable in relation to walking in general:

Links can have attributes relevant for walking like:

- Sidewalks: Right side, left side, both sides or no sidewalk
- Pedestrian streets
- Footway: For designated footpaths, i.e. mainly/exclusively for pedestrians
- Path: Preferably used for a hiking path/ trail
- Steps: Marks stair, ramps, escalators etc. Additional attributes on accessibility are available
- Track: Rough roads normally used for agricultural or forestry uses etc.
- Restrictions for pedestrians: Allowed, prohibited, designated
- Pedestrian crossings: segregated, signals, type of markings, kerb types, possible tactile paving

- Attributes used to describe walking possibilities and/or attractiveness on links:
  - Surface on the link
  - Smoothness (the physical usability of a way for wheeled vehicles)
  - Incline: For marking a way's incline (or steepness/slope)
  - Indication on traffic calming

  Additional facilities are not sorted out specific for pedestrians. Most amenities and points of interest can be relevant for pedestrians.

  All the above cycling and walking data can be extracted from OSM and used in GIS map software for different kinds of analyses, for example:
  - Accessibility analysis to the nearest train station (Figure 4).
  - Understanding attractiveness of infrastructure for cyclists and pedestrians.
  - Studying possible routes to take from one area to another.

[31] https://wiki.openstreetmap.org/wiki/Bicycle
[32] Based on https://wiki.openstreetmap.org/wiki/Hiking, https://wiki.openstreetmap.org/wiki/Pedestrian and https://wiki.openstreetmap.org/wiki/Key:crossing

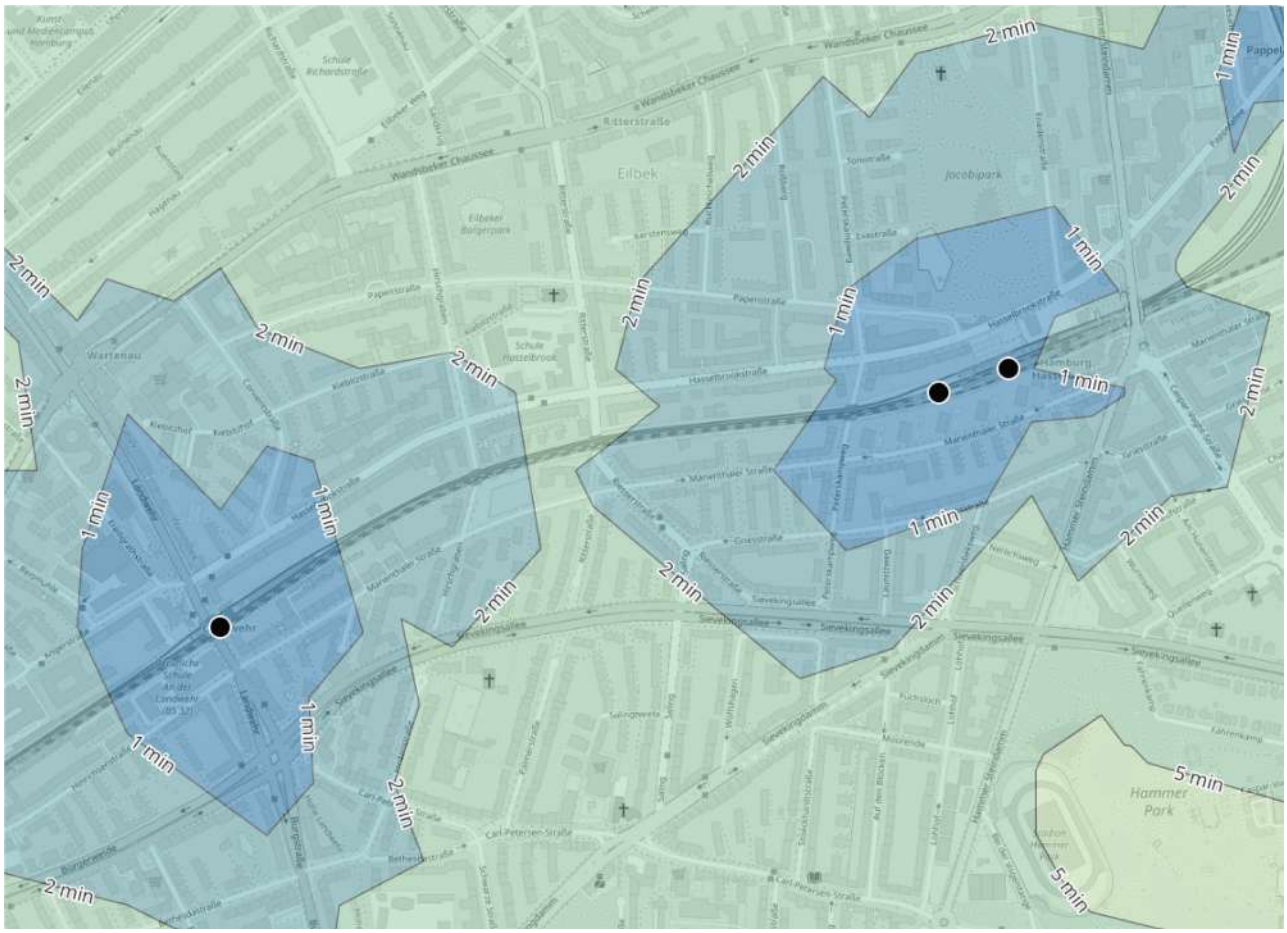


Figure 4: Example on using bikeable links in OSM to calculate cycling time to nearest train station in GIS (Source: Data from OSM)

Other crowd-sources infrastructure data

The Dutch cyclist Union (Fietsersbond) provides a bicycle route planner which is supported by their own network dataset which is being maintained by a group of volunteers. Hundreds of volunteers map new and missing bicycle paths, add information on road characteristics (type or road and pavement, but also quality, attractiveness and characteristics of the surroundings). The wide range of features is used to generate bicycle routes for all kinds of different routes such as a route that uses as much dedicated bicycle infrastructure and continuous routes as possible, or routes ideal for sport cyclists (Figure 5).

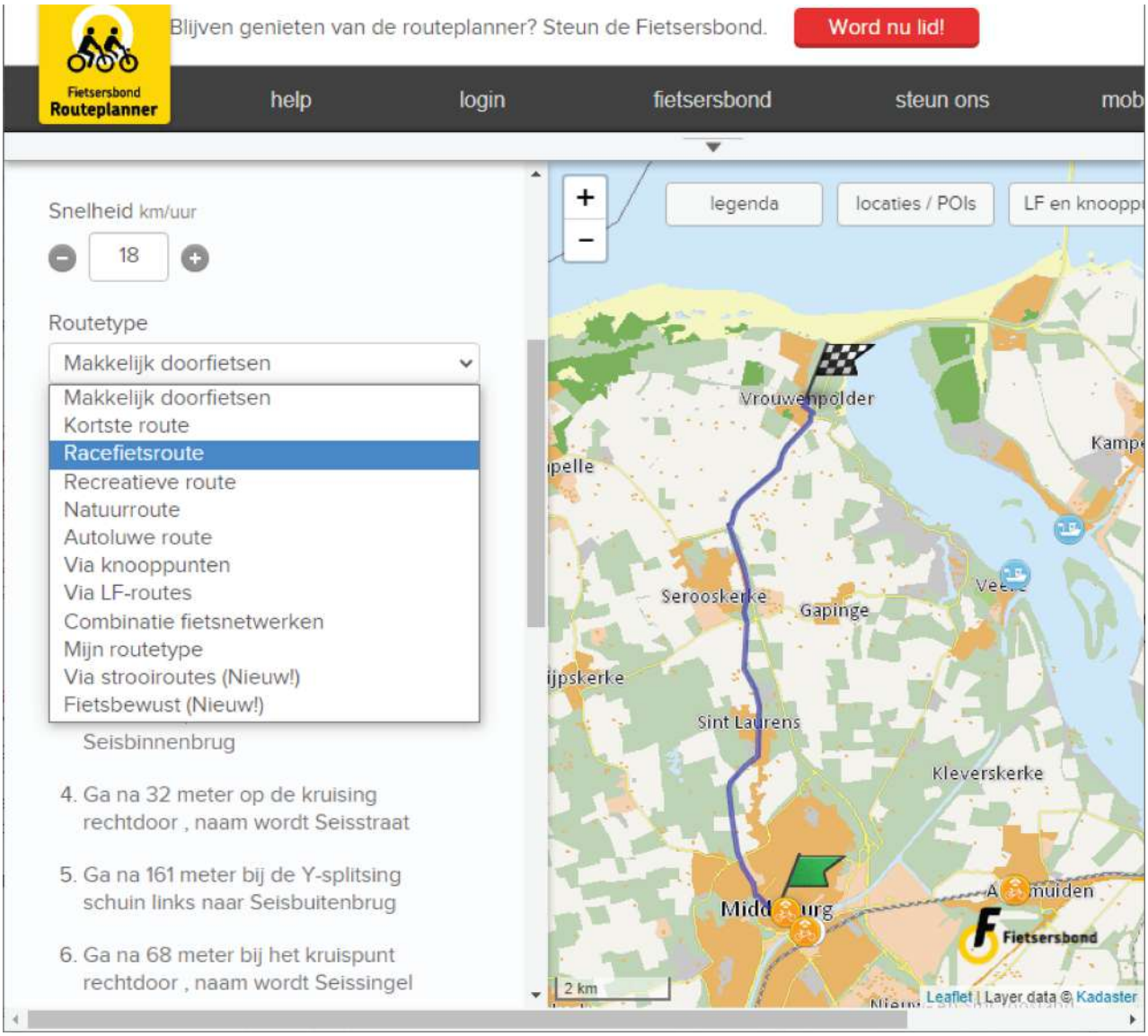


Figure 5: Example of the route planner of the Dutch Fietsersbond, with the possible route types to choose from.

Quality/safety apps/online maps

Mobile phone apps and/or websites can be used to make it possible for infrastructure users to report or give feedback. Apps typically makes it possible to report faults like potholes or missing light and the reports will typically get GPS coordinates applied and images can be added. The data portal connected to the app at the authority issuing the app typically show the reported issues directly on a map for further action to be taken.

The app typically will handle elements of infrastructure like:

- Surface
- Lighting
- Drainage
- Cleaning
- Snow removal

Or it can be more of a dialogue platform for general feedback.

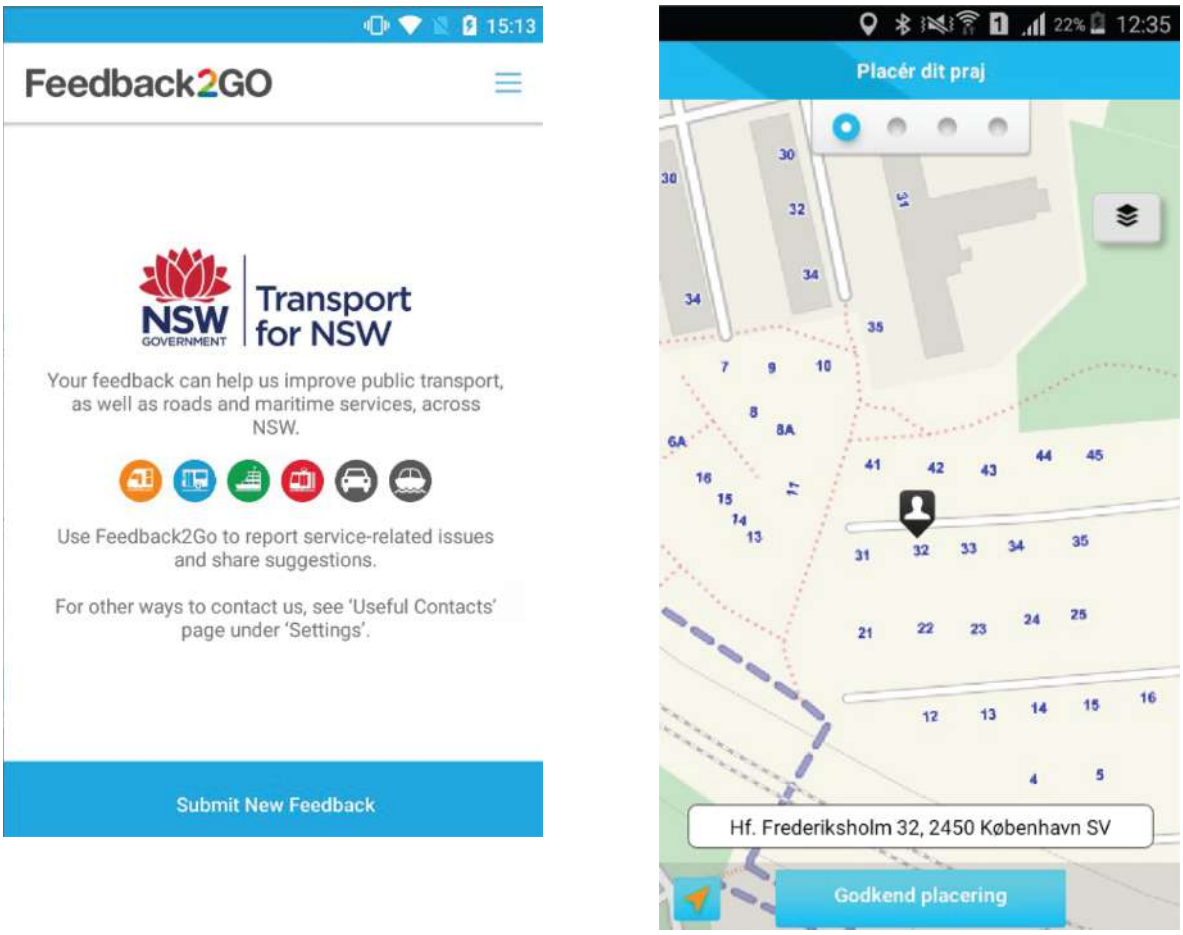


Figure 6 : Examples of mobile apps for reporting feedback on transport infrastructure (Source: play.google.com)

Web based online maps may have same functionalities as the apps described above – the interface will just be a website instead.

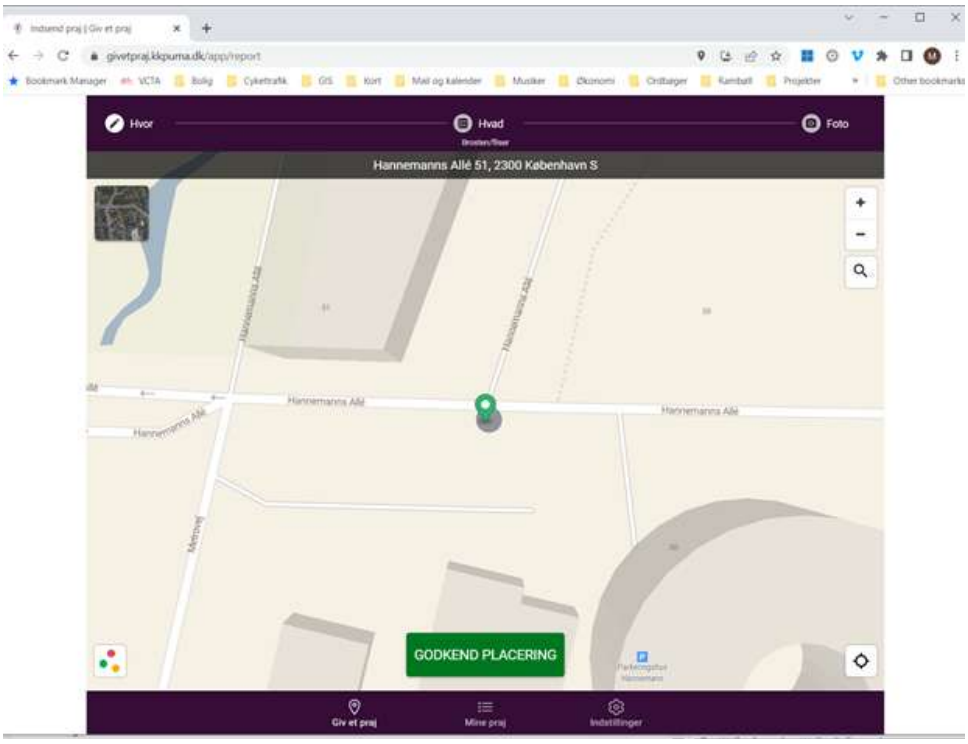


Figure 7: "Give a hint" website for the City of Copenhagen (Source: givetpraj.kkpuma.dk)

Computer vision

In recent years, computer vision has improved, and it has become possible to extract information on road quality and facilities. Various companies provide (high-quality) imagery collected through vehicles equipped with cameras. An example of such company is Cyclomedia.

Also Google StreetView could be considered. Data by Cyclomedia has been used to enhance information on bicycle paths in Utrecht's traffic safety model[33]. The Finnish company Crowdsorsa provides a gaming experience to incentivize cars with a dashcam to drive certain streets and has setup and has helped various cities in Finland to map the condition of bicycle lanes.

All such collected imagery (potentially) can be used to collect information. One must however realize that these data are collected from the perspective of a camera-equipped vehicle and may therefore lack the ability to capture all relevant information for cycling and walking.

Conclusions

Both Danish and Dutch example of public data sets illustrate that data on cycling facilities on road stretches shared with other road users are often not mapped. OpenStreetMap on the other hand, offers enclosing such information with its elaborate tag system. However, quality and coverage are not ensured or validated in a similar way as official datasets.

The infrastructure datasets do not describe the condition of the infrastructure by default. Furthermore, the condition can naturally change over time and the mutation rate of the infrastructure dataset often does not account for that. That is where crowd-sourced information can provide helpful to collect data in a timely process.

[33] https://www.cyclomedia.com/en/node/280

Quantities at point locations

Indicator Green: Direct information, Yellow: Useful together with other data	Counters Manual		Counters Temporary tubes	
	🚲	🚶	🚲	🚶
Access to public transport	🟢	🟢	🟡	
Accessibility (e.g. number of destinations that can be reached by C/W within a certain time)				
Average daily distance C/W pr. person				
Average daily time C/W pr. person				
Average number of daily C/W trips	🟡	🟡	🟡	
C/W safety – accidents				
C/W safety – near accidents				
C/W trip length				
C/W trip purpose				
C/W's demographics				
Benefits to local businesses (e.g. planned and spontaneous visits)	🟢	🟢	🟢	
Bicycle parking (availability/capacity, dead bicycles)	🟢	🟢	🟡	
Bicycle sharing				
Bicycle theft				
CO2 reduction	🟡	🟡	🟡	
Travel speed / delays	🟡	🟡	🟡	
C/W behaviour	🟡	🟡		
C/W exposure to particles	🟡	🟡	🟡	
Data on investment in C/W (e.g., investment pr. capita pr. year)				
Extent of C/W infrastructure				
Health benefits of C/W	🟡	🟡	🟡	
Mapping of C/W routes				
Modal share of C/W				
Number of C/W's	🟢	🟢	🟢	
Number of people who combine C/W with public transport	🟡	🟡	🟡	
Proportion of people who have made at least one C/W stage on the survey day				
Quality of C/W infrastructure				
Satisfaction with C/W in the city				
Share of different bicycle types	🟢			
Traffic information				
Who's not C/W and why?				

Table 2: Indicators and possible data sources on traffic numbers

This section describes possible methods to collect data on number of pedestrians and/or bicyclists at point locations - In short: How to count traffic volumes.

In Table 2 below it is indicated what types of indicators for cycling and walking that is attainable from different methods of traffic counting.

Data Source									
Counters Permanent Loops/Sensors		Counter display		Cameras (Still, Video, Drone)		Radar/Infra red		BlueTooth	
🚲	🚶	🚲	🚶	🚲	🚶	🚲	🚶	🚲	🚶
●				●	●	●	●	●	●
●		●		●	●	●	●	●	●
●				●	●	●	●	●	●
●				●	●	●	●	●	●
●				●	●	●	●	●	●
●				●	●	●	●	●	●
				●	●	●	●	●	●
●				●	●	●	●	●	●
●		●		●	●	●	●	●	●
				●	●	●	●	●	●
				●	●	●	●	●	●
●		●		●	●	●	●	●	●
●				●	●	●	●	●	●
				●					
●		●		●	●	●	●	●	●

Keeping track of “the numbers” is a basic thing in transport planning and these numbers are often a base for further analysis. Counts will tell the number of cyclists or pedestrians passing a certain point but not necessarily give any more information like trip purpose or used routes.

Especially for pedestrians one needs to make clear how “a trip” is defined when counting.

- A walk in your own garden is probably not a trip
- Is walking the dog a trip?
- How is a walk to the nearest bus stop defined? As a walking trip or as (a part of) a public transport trip?

In the following sections some methods for counting cyclists and pedestrians are described.

Counters

Simple counts can be done like:

- Manual counts, where personnel at the location counts either using pen and paper or mobile apps. With manual counts also other attributes may be recorded like type of bicycle or turning movements in a junction
- Temporary counts using tubes. Placing tubes across a bicycle lane will make it possible to count passing bicycles and to register the driving speed of the bikes. Tubes cannot be used for counting pedestrians
- Permanent counters using loops and other sensors. Such counters usually react on passing masses of metal and cannot count pedestrians

Counter displays are displaying the numbers usually counted by permanent loops/sensors and do mostly have a branding effect.

Count data can be enclosed in various ways but are not always public. Sometimes they can be found on open data portals from (local) governments, especially when it concerns information from permanent count points.

Cameras

Video analysis is becoming increasingly common in traffic analysis, with several companies offering such services/ software[34]. Different types of cameras can be used for counting either temporarily or permanent. The post processing of the video stream can count numbers split on vehicle types, turning movements etc. and processing based on artificial intelligence can record different types of interaction between travellers.

- Video cameras can either be used temporarily to do registrations for a certain project or theycan be permanent installations found in large train stations and airports or sometimes on main streets, mainly for the purpose of crowd management.
- Drone video recording: Unless the drone is powered by a cable from ground, the recording time is limited by battery capacity. Post processing of videos may count different types of vehicles, turning movements, number of parked bicycles etc.
- Lidar: Functioning like a radar but uses reflection of laser beams instead. Is better suited for counting bicyclists and pedestrians
- Infrared: Registers attributes of reflected infrared light. Is good at detecting people

Mobile phones and other portable electronics

Mobile phones and other portable electronics like tablets and GPS units emits different types of information, that can be used for surveying a sample of people.

[34] https://datafromsky.com/pedestrian-cyclist-monitoring/, https://marshallai.com/smart-city/traffic-safety/

Units with BlueTooth turned on will typically emit a unique identifier. This makes it possible to both count at single locations and to possibly re-find the same id later at another survey location and map traveling between the points.

Phones with wifi turned on will send out unique Media Access Control (MAC) address as a probe request for wifi-connection. These data can be used for counting too.

This is used in London Underground, several other railway stations, event parks and airports to keep track of passenger flows and keeping track of service times[35].

Conclusions

Challenges with count data are that they are often collected on a temporary basis and that the geographical coverage is limited. And if for example a route parallel to the one with a counter is improved, cycling and walking traffic on route with the counter might decrease, while cycling/walking in the area as a whole increases. However, counts are often collected including time information, so that it gives insights in different cycling and pedestrian numbers throughout the day and between different days.

Furthermore, counts at locations are often the only type of data collection where you can sample ALL trips during a certain period so even if the collected information is limited to pedestrian or bicyclist numbers, these numbers are often needed for scaling other types of data collection where only samples of travellers are recorded.

Technical innovations allow to associate more data with counts than conventional static counts. Data collection of cell phone signals enables connecting the same person to various counts at different locations. Video counts can tell things about interaction with infrastructure and other road users.

Routes

This section describes possible methods to collect data on routes used by pedestrians and/or bicyclists.

In Table 4 below it is indicated what types of indicators for cycling and walking that is attainable from different sources of routes.

[35] https://veovo.com/discover/news/netherlands-railways-veovo-technology-to-improve-traveler-experience/
https://veovo.com/discover/news/universe-science-park-embraces-veovo-flow-management-solution/
https://www.wired.co.uk/article/london-underground-wifi-tracking

Indicator Green: Direct information, Yellow: Useful together with other data	Data Source					
	GPS/Mobile data		Tracking apps		City/bike sharing data	
	🚲	🚶	🚲	🚶	🚲	🚶
Access to public transport	🟡	🟡	🟡	🟡		
Accessibility (e.g. number of destinations that can be reached by C/W within a certain time)						
Average daily distance C/W pr. person	🟢	🟢	🟢	🟢	🟡	
Average daily time C/W pr. person	🟢	🟢	🟢	🟢	🟡	
Average number of daily C/W trips	🟡	🟡	🟡	🟡		
C/W safety – accidents			🟢			
C/W safety – near accidents	🟢		🟢			
C/W trip length	🟢	🟢	🟢	🟢	🟡	
C/W trip purpose			🟡	🟡		
C/W's demographics					🟡	
Benefits to local businesses (e.g. planned and spontaneous visits)	🟡	🟡	🟡	🟡		
Bicycle parking (availability/capacity, dead bicycles)	🟡		🟡			
Bicycle sharing	🟡		🟡		🟢	
Bicycle theft	🟡					
CO2 reduction	🟡	🟡	🟡	🟡	🟡	
Travel speed / delays	🟢	🟢	🟢	🟢	🟢	
C/W behaviour	🟡	🟡	🟡	🟡	🟡	
C/W exposure to particles	🟡	🟡	🟡	🟡	🟡	
Data on investment in C/W (e.g., investment pr. capita pr. year)						
Extent of C/W infrastructure						
Health benefits of C/W	🟢	🟢	🟢	🟢	🟢	
Mapping of C/W routes	🟢	🟢	🟢	🟢	🟢	
Modal share of C/W	🟡	🟡	🟡	🟡	🟡	
Number of C/W's	🟡	🟡	🟡	🟡	🟡	
Number of people who combine C/W with public transport	🟡	🟡	🟡	🟡	🟡	
Proportion of people who have made at least one C/W stage on the survey day						
Quality of C/W infrastructure						
Satisfaction with C/W in the city						
Share of different bicycle types			🟡			
Traffic information	🟡	🟡	🟡	🟡		
Who's not C/W and why?						

Table 3: Indicators and possible data sources on routing

In opposition to the counts described in section 2, the data on routes will tell which route a pedestrian or bicyclist have used. But often only a smaller sample of travellers will be recorded so the routes need to be combined with counts for scaling to the total number of travellers.

Mobile phones and other portable electronics

When mobile phones connect to the mobile network it will use one of a set of nearby mobile phone masts and the phone company will know which mast the phone is connected to. The density of mobile phone masts determines the accuracy of the location and the accuracy will usually be best in more dense built-up areas. Phone companies using these data typically have algorithms trying to identify trips and the modes used mostly based on travel speed – it can make identification of bicycle trips hard as travel speed on bicycle and in a bus can be alike.

When using mobile phone data, the GDPR regulations[36] need to be followed inside the EU and other similar regulations outside EU may exist.

The data from mobile phones can be used to describe only a sample of persons travelling - they will not be able to register all persons travelling, as not all persons have mobile phones, or have them turned on or are using the actual operator. So the

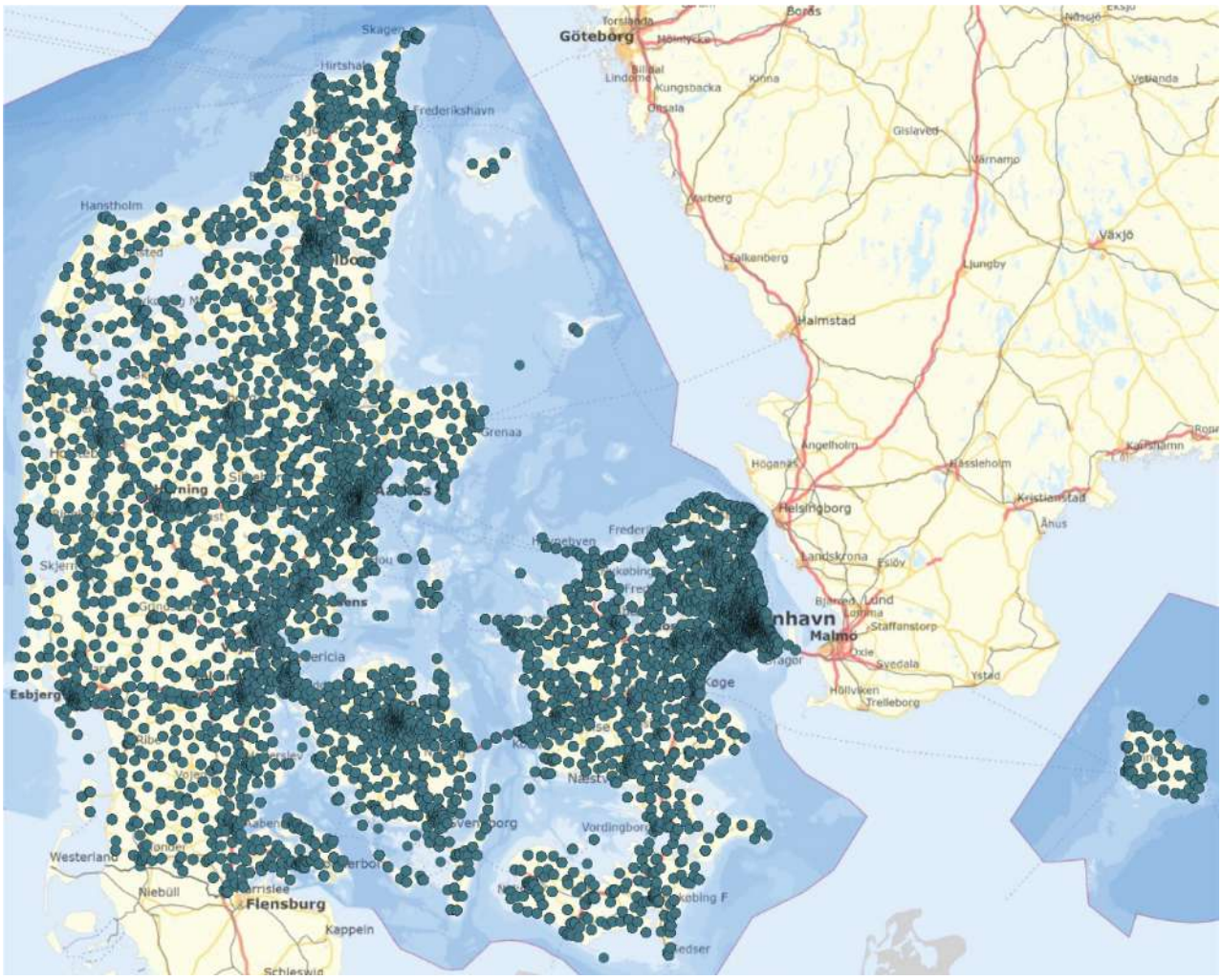


Figure 8: Density of mobile phone masts in Denmark
(Source: https://www.mastedatabasen.dk/viskort/PageMap.aspx)

[36] https://gdpr.eu/

data can be used for describing routes and other travel behaviour but other types of counting will be needed to scale the sample to match the whole population of a certain geography.

A shortcoming of data from mobile network operators is that short trips are oftentimes not captured, mainly for the reason that such trips fall within the reach of one (or two) cell phone towers. This is particularly relevant for walking and cycling trips as these trips are typically shorter than trips by public transport or car.

What the data may lack in accuracy is to some extend counterbalanced by the huge amount of data available – having data for a large number of a mobile phones from a certain telephony provider for every day perhaps over a year is a huge amount of data compared to for instance a travel survey where you may have asked something like ten thousand persons. The possible huge amount of accessible data may help to solve GDPR issues – even in sparsely populated areas data covering perhaps a year may hold sufficient data records to make it possible to anonymize data.

Tracking apps

Most tracking apps will be based on GPS data but they may also give additional information on the user provided via the user profile in the app. It may be attributes like age, gender, body weight and trip purpose.

Examples of apps that also collect data usable by planners are:

- Strava (strava.com)
- BikeCitizens (bikecitizens.net/government)
- Hövding (hovding.com) (have until now only shared data with researchers though)
- Custom apps for campaigns. Local authorities, institutions or private companies invite cyclists (and/or

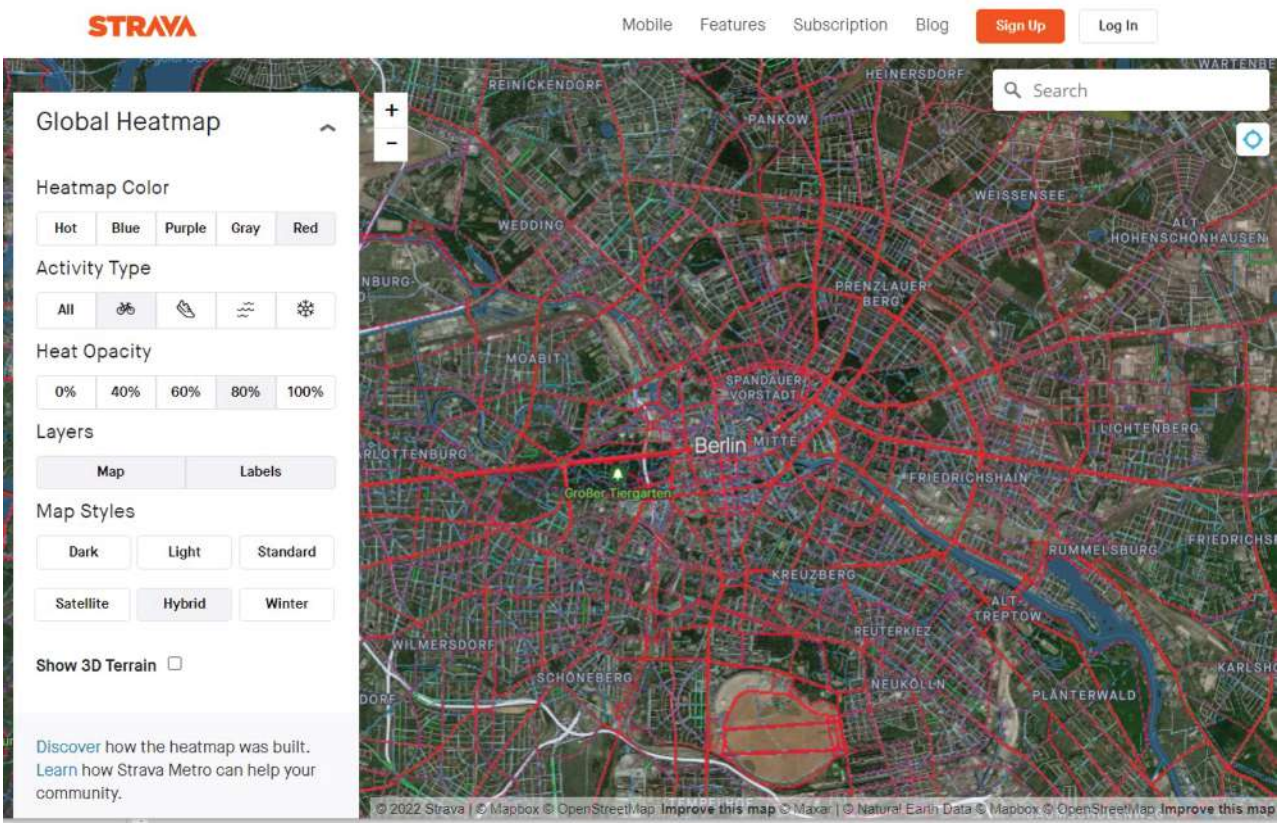


Figure 9: Heatmap showing trips from the Strava app (https://www.strava.com/heatmap)

pedestrians) to use an app during a certain time period (usually a campaign). Some examples are: The Nationale Fietstelweek (NL) and the fahrradwoche in Münster
- OpenStreetMap contains a large dataset of GPS traces[37] which can be visualized on the map. However, little additional information is available on how to use it. We will therefore not elaborate on this further.

Strava started out as a training app but has now built up a community on "Better cities for cyclists and pedestrians" (metro.strava.com) where they share their collected data with partners like municipalities. A heatmap shoving registered trips is freely available at https://www.strava.com/heatmap.

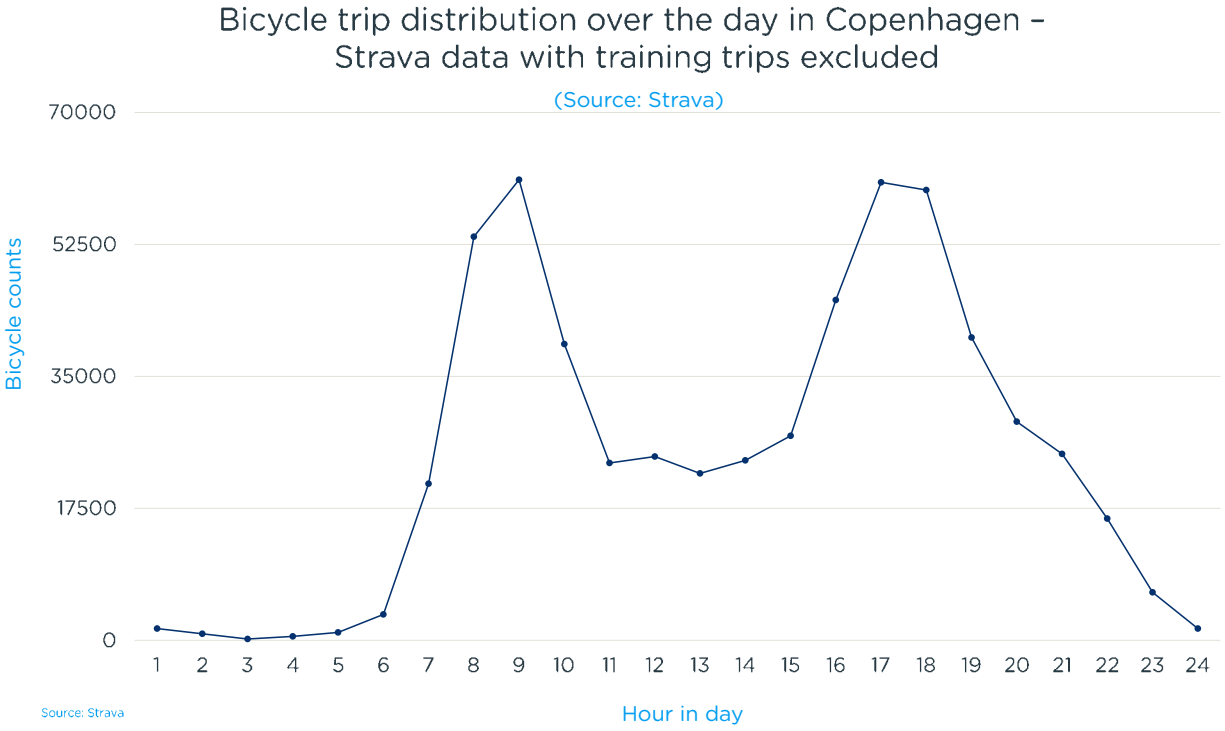
It is a common concern that data from tracking apps are not considered representative for the daily/commuting bicyclist (or pedestrian) because the purpose of the apps often is related to training.

Originating from use for training there may be an overrepresentation of male users and certain younger age groups who may have other route choice strategies than the average bicyclist.

Strava does a filtering of their data in commute and other trips based on:
- Trip purpose stated by the user in the app.
- Training trips will very often be round trips starting and ending at same point
- Repetitiveness of a trip – going from A to B every weekday is probably commuting

Strava data has been validated to counts in both Denmark and Finland. At both locations the variations over time in the Strava data match the variations over time of the traffic counts done by the local authorities (see Figure 10 and Figure 11) indicating that the bicyclists in Strava to some extents are comparable to bicyclists in general.

Bike street counts weekday by hour



[37] https://www.openstreetmap.org/traces

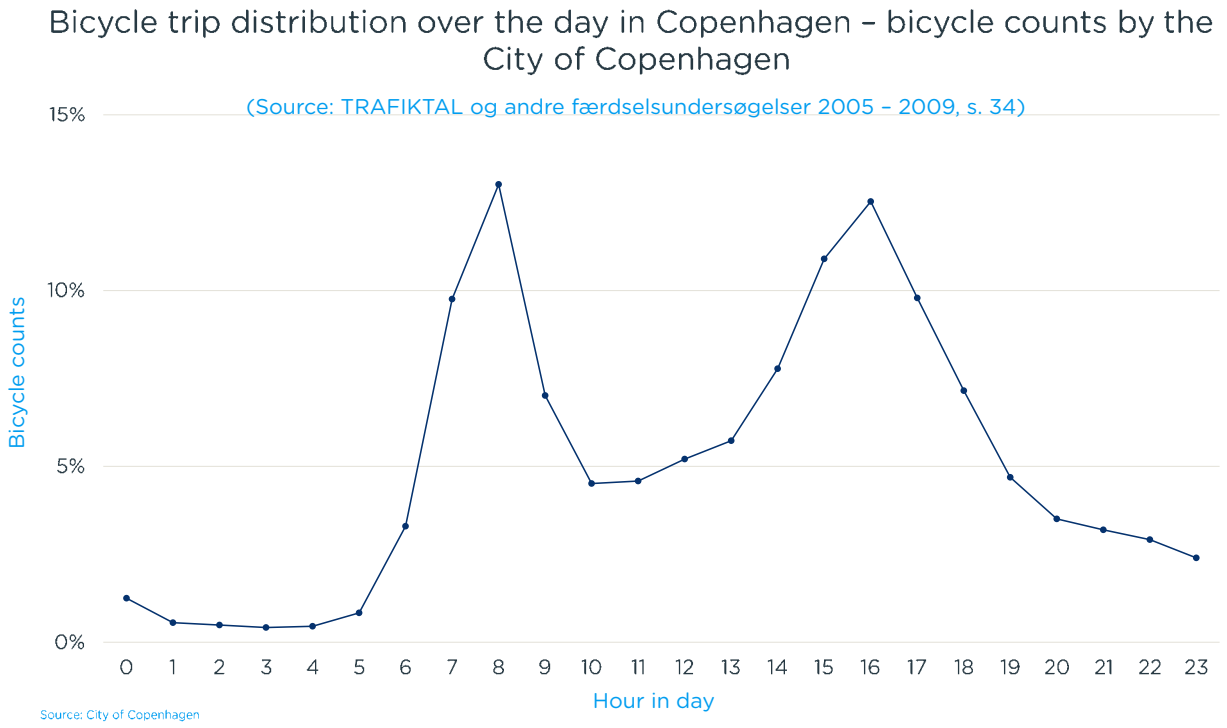


Figure 10: Comparison of Strava data and bicycle counts for the City of Copenhagen on a weekday

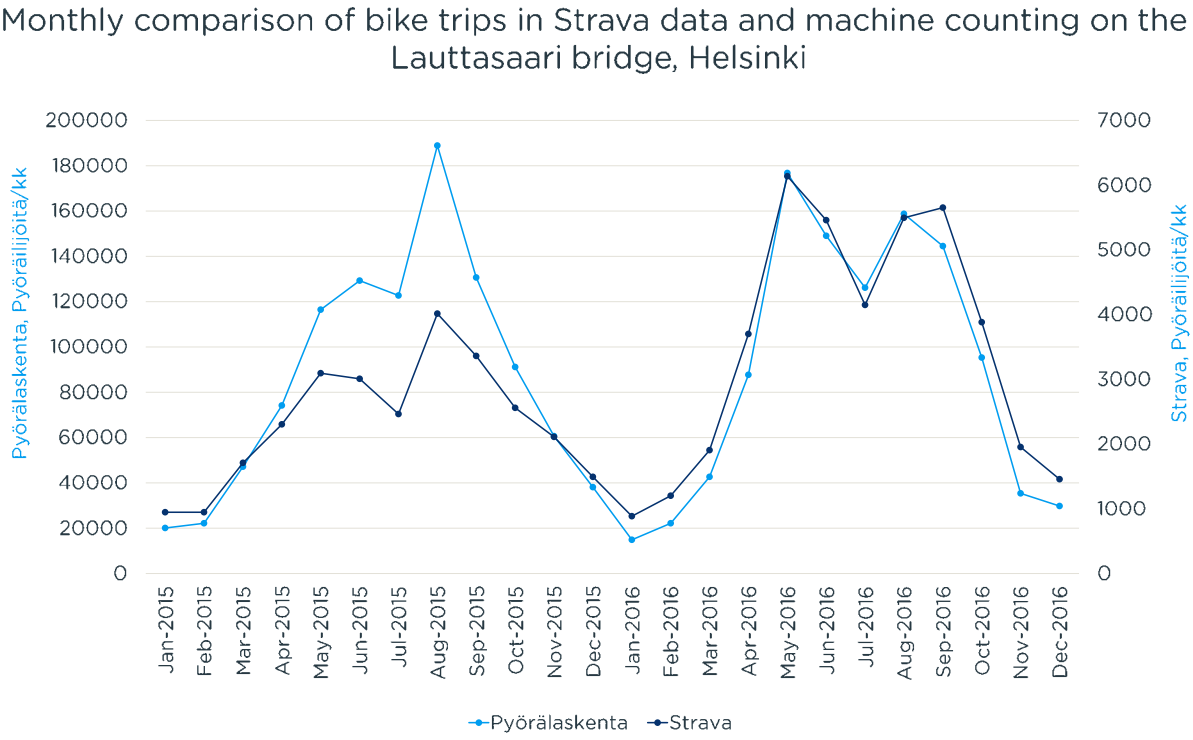


Figure 11 Monthly comparison of bike trips in Strava data and machine counting on the Lauttasaari bridge, Helsinki[38]

[38] https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-16-17.pdf

Strava data from Helsinki shows as expected an overrepresentation of younger men, but still, Strava gives quite a good match to count data at a regional level. Zooming in to specific streets gives a less consistent good match though.

The Hövding airbag-like bicycle helmet comes with an app that both collects gps tracks and “abnormal” accelerations. The latter is in the end used for deciding when to fire the airbag or not but Hövding claims it will also be usable for determining nearby accidents. Currently Hövding have only shared their data with researchers though.

Figure 12: The safety part of the Hövding app (Source: play.google.com)

Various (regional) governments, institutions or companies organize campaigns where people are incentivized to download an app and track their cycling (for a limited time). These data can be used either as GPS traces or OD-matrices for various use cases.

Limitations with any of these data collected through GPS enabled apps is data privacy. Therefore, Strava for example only provides aggregated data. No information on individual routes is provided. Other apps may provide individual GPS traces but anonymize these by no enclosing socio-economic background information of the person making the trip. Also trip endpoints are often trimmed so that the final origin and destination is not revealed. Although understandable, this can be considered a significant drawback. Personal characteristics are very important for the choices people make regarding active mobility compared to motorized traffic.

Some common insights that can be derived from data collected through apps are:

- Which roads are used how much within the network
- Identify missing links or unattractive infrastructure by observing underused/ avoided road sections (Figure 13).

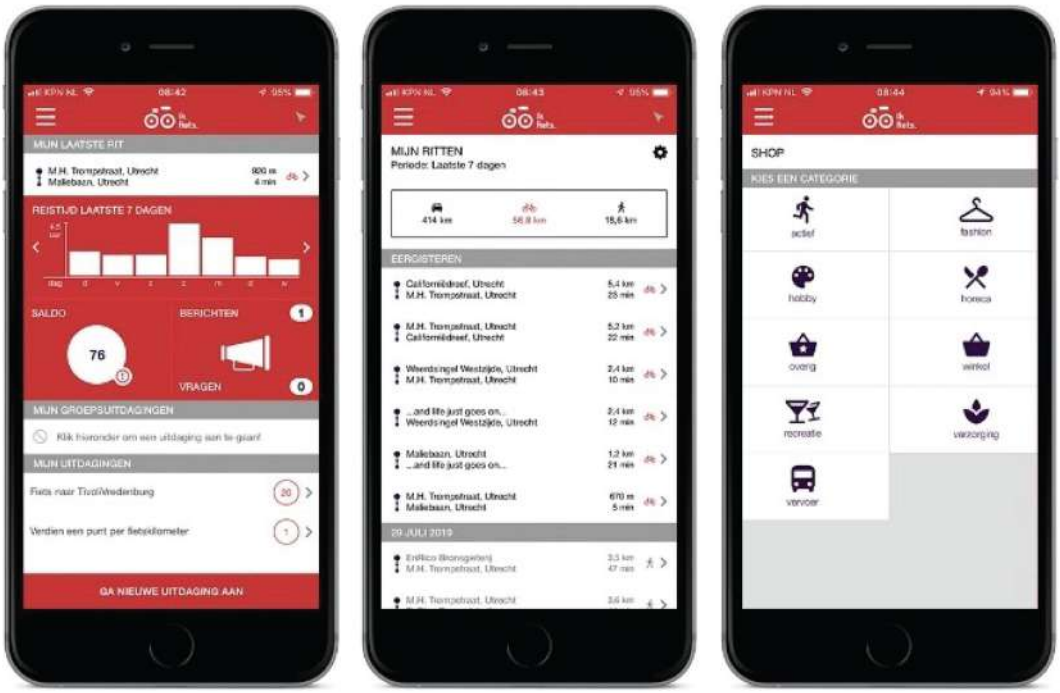


Figure 13: ikfiets app for the Province of Utrecht

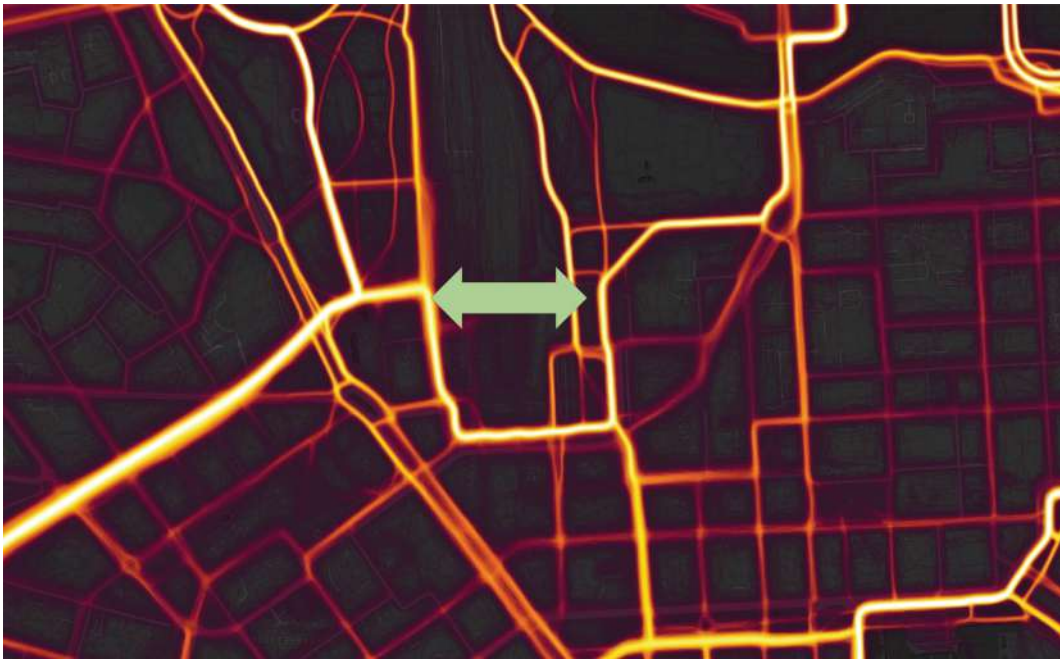


Figure 14: Example of a missing link in Helsinki based on Strava's heatmap

Citybike / Bike sharing data

Citybikes and bike sharing schemes usually will collect data on location of their equipment and they could also be able to provide origin/destination trip matrices for their bikes as wells as data showing hotspots for the use of the bikes, driving speed and similar activity and/or user data.

The data are usually owned by a private company and for reasons of competition they might be hard to get hold on.

On the other hand, the bike share may be an official concept arranged by a local authority and they could possibly get access to the data.

In case of a scheme running under a local authority like an official citybike scheme these data will probably be available for use in bicycle planning for the authority.

Conclusions

Mobile phones and their apps are becoming increasingly important as data collection devices for walking and cycling. However, one must be aware that data collected are only a sample of walking and cycling trips – a sample that needs to be scaled to match the actual number of pedestrians and bicyclists.

Data obtained through apps provides rich information in routes people make but may faces challenges regarding data privacy constraints. The strength lies in coverage of large areas and structural data collection for a longer period. Therefore, these datasets are often large and allow for deriving valuable conclusions.

For all data collection based on mobile phones and other portable electronics there may be a bias which may need to be taken care of - for instance an underrepresentation of children and elderly people.

Surveys, stop interviews and observations

This section describes what kind of indicators can be covered by direct interaction with the traveller by surveys, stop interviews or observations on street.

In Table 4 below it is indicated what types of indicators for cycling and walking that is attainable from different types or surveys.

Indicator Green: Direct information, Yellow: Useful together with other data	Data Source					
	Travel Surveys		Stop Interviews		Observations	
	🚲	🚶	🚲	🚶	🚲	🚶
Access to public transport	●	●	●	●	●	●
Accessibility (e.g. number of destinations that can be reached by C/W within a certain time)						
Average daily distance C/W pr. person	●	●	●	●		
Average daily time C/W pr. person	●	●	●	●		
Average number of daily C/W trips	●	●	●	●		
C/W safety – accidents	●	●	●	●	●	●
C/W safety – near accidents	●	●	●	●	●	●
C/W trip length	●	●	●	●		
C/W trip purpose	●	●	●	●		
C/W's demographics	●	●	●	●		
Benefits to local businesses (e.g. planned and spontaneous visits)					●	●
Bicycle parking (availability/capacity, dead bicycles)	●		●		●	
Bicycle sharing	●		●		●	
Bicycle theft	●		●		●	
CO2 reduction	●	●	●	●		
Travel speed / delays	●	●	●	●	●	●
C/W behaviour	●	●	●	●	●	●
C/W exposure to particles	●	●	●	●		
Data on investment in C/W (e.g., investment pr. capita pr. year)						
Extent of C/W infrastructure					●	●
Health benefits of C/W	●	●	●	●		
Mapping of C/W routes						
Modal share of C/W	●	●	●	●	●	●
Number of C/W's	●	●	●	●	●	●
Number of people who combine C/W with public transport	●	●	●	●	●	●
Proportion of people who have made at least one C/W stage on the survey day	●	●	●	●		
Quality of C/W infrastructure	●	●	●	●	●	●
Satisfaction with C/W in the city	●	●	●	●		
Share of different bicycle types	●		●		●	
Traffic information						
Who's not C/W and why?	●	●	●	●		

Table 4: Indicators and possible methods of surveying

When interacting directly with people in a survey or an interview it is possible to ask almost anything. And besides factual data it is also possible to ask for reasons and opinions – both on current state and possible future situations.

But it is recommended to keep surveys/ interview as short as possible – keep the "need to know" and leave out the "nice to know". The respondent's interest in the subjects asked may be low and there is a risk they will not finish the survey.

Travel surveys and stop interviews are very alike, but travel surveys are typically more general while stop interviews typically are dealing with the location where interviews are performed.

Travel surveys

Travel surveys can be general surveys performed at regular intervals and perhaps covering a whole country like "The Danish National Travel Survey"[39] or it can be a more local survey related to a specific project and geographical area.

Travel surveys are usually conducted in such a way that they represent the population accurately, either through a correct sample or through scaling factors.

Dependent on local culture travel surveys can be performed as household visits, by phone or via a web portal. Often combinations of the methods can be used. Respondents answering by themselves via a web portal after receiving an invitation is often the most cost-effective way, but the share of replies may be low. Missing responds may be followed up by phone calls or even by home visits.

Challenges in travel surveys are keeping up a sufficient response rates. In "The Danish National Travel Survey" the rate is quite high at 60%. This is achieved by contacting directly by phone. At the end 20% of responses come from internet and 80% from phone.

Often a travel survey will consist of a travel diary recording all trips done by the respondent in a certain time frame before the survey day. As the survey rely on the memory of the respondent it is important not to use to big a time frame. People may forget reporting shorter trips, as they are considered minor. That is why some travel surveys may underrepresent walking and cycling.

Strengths of travel surveys is that they are rich in socio-economic background information and therefore allow more detailed understanding in personal preferences. Also, these surveys focus on all modes of transport. This can help researchers and planners understand why people choose using one mode over another. Such understanding can be crucial to make walking and cycling more attractive.

GPS tracking devices are sometimes also used for travel surveys, which has the potential to make them much more precise than self-reporting through diaries.

Stop interviews

Stop interviews are typically shorter than travel surveys and are often related to a specific location where the interviews will be performed.

When planning a stop interview it is important to consider how much the survey will interact with traffic flows to both avoid disturbing the traffic and to avoid adding bias to the survey itself.

In many countries it will be necessary to involve the local police if stopping traffic in the streets.

Conclusions

Collecting data through interaction with travellers is work intensive and requires good sample sizes to be able to draw statistically significant conclusions. However, its richness in detail is nowadays still a valuable source for much transport related research.

[39] https://www.cta.man.dtu.dk/english/national-travel-survey

Statistics

Indicator Green: Direct information, Yellow: Useful together with other data	Police accident data		Hospital hospital acc
	🚲	🚶	🚲
Access to public transport			
Accessibility (e.g. number of destinations that can be reached by C/W within a certain time)			
Average daily distance C/W pr. person			
Average daily time C/W pr. person			
Average number of daily C/W trips			
C/W safety – accidents			
C/W safety – near accidents	●	●	●
C/W trip length			
C/W trip purpose			
C/W's demographics			
Benefits to local businesses (e.g. planned and spontaneous visits)			
Bicycle parking (availability/capacity, dead bicycles)			
Bicycle sharing			
Bicycle theft			
CO2 reduction			
Travel speed / delays			
C/W behaviour			
C/W exposure to particles			
Data on investment in C/W (e.g., investment pr. capita pr. year)			
Extent of C/W infrastructure			
Health benefits of C/W			
Mapping of C/W routes			
Modal share of C/W			
Number of C/W's			
Number of people who combine C/W with public transport			
Proportion of people who have made at least one C/W stage on the survey day			
Quality of C/W infrastructure			
Satisfaction with C/W in the city			
Share of different bicycle types			
Traffic information			
Who's not C/W and why?			

Table 5: Indicators and possible data from statistics

This section describes different types of available statistics that may hold data relevant for bicycle and/or pedestrian planning.

In Table 5 below it is indicated what types of indicators for cycling and walking that is attainable from different methods of traffic counting.

Data Source								
and pre-cident data	Bicycle registers		Insurance company data		Bicycle parking facilities		Bike industry / shops	
🚶	🚲	🚶	🚲	🚶	🚲	🚶	🚲	🚶
●			●	●				
	●	●	●		●			
	●	●			●		●	
					●			
	●	●					●	
					●			

General statistics relevant for bicycle or pedestrian planning may be available at a number of sources, as described below.

Police accident data

In most countries the police data are the official statistics when it comes to traffic accidents and violations of the rules of traffic. But many minor accidents involving bicyclists and/or pedestrians may not lead to involvement by the police, and they will not appear in these statistics so other sources of data finding these accidents can be needed.

Hospital and prehospital accident data

Accidents with personal injuries will often be registered at an emergency phone central, at the emergency departments of hospitals or at private doctors and in some countries the hospitals keep statistics on such.

In Denmark only test projects on hospital accident data have been run but results from a Danish research project[40] indicates that as many as 96% of accidents are not registered in the official database run by the police. And a large portion of the unregistered accidents are bicycle and pedestrian accidents. As single person accidents with pedestrians by definition is not a traffic accident in Denmark, the share of pedestrian accidents being reported by the police is even lower.

Bicycle registers

Many countries have bicycle registers to keep track of ownership and possible theft. Some registers are official registers where every bicycle must be registered (like in Denmark and Japan), some are commercial registers, and some are run by non-profit organisations.

[40] https://www.build.aau.dk/web/fra-skade-til-forebyggelse/om-projektet


ZONE
ROKIN
CENTRUM
Heineken
Tobacco
6 m
2,3m

Table 6: Examples on bicycle registers (Source: Wikipedia)[41]

Australia	• National Bike Register, operated by DataDot Technology Ltd • Australian Bike Vault, operated by non-profit organisation Stolen Bicycles Australia Ltd
Belgium	• Gevondenfietsen, free bicycle register, found bike website for local authorities and police forces • MyBike.brussels, free bicycle register
Brazil	• Bike Registrada
Bulgaria	• VELOregister.BG, a commercial register
Denmark	• Danish bicycle VIN-system, the unique VIN number of a bicycle can be looked up in the "Politi" smartphone application to see if a bicycle is reported as stolen
France	• Mandatory registration since 2020: https://www.service-public.fr/particuliers/actualites/A14495
Germany	• Bike-ID bicycle registry, Bike-ID UG, a commercial register • EIN - a different approach, which does not need registration, but does create a code for the owner, which can be decoded by the police
Great Britain	• BikeRegister - The National Cycle Database, operated by Selectamark Security Systems • Bike Shepherd (formerly Bike Revolution), based in London, United Kingdom (and California, U.S.). As of June 2018 currently inactive • Stolen Bikes in the UK, UK Peer-based bike register • Immobilise, a free UK National Property Register for bicycles and more.
Hungary	• BikeSafe.hu - paid service recommended and used by national police. Bike registration provides an ownership certificate for verified purchases - similar to car documents.
Japan	• In Japan it is mandatory to register every bicycle with the police as an anti-theft measure
New Zealand	• New Zealand Bicycle Registry, a free registration service with the openly available list of currently stolen bicycles
Norway	• Bikemember, a commercial FG-approved register • Falck og Securmark Sykkelregister, a commercial FG-approved register • Sykkelreg.no, a free peer-to-peer based register
Romania	• RegistruldeBiciclete.ro, free bicycle register
South Africa	• National Bicycle Registry of South Africa, a non-profit register with free registration
Sweden	• Cykelregister.se, free bicycle register
USA and Canada	• Bike Index (Chicago, Illinois) is a free, nonprofit, peer-to-peer service with the international target audience. Bike Index was founded in 2013 and merged with Stolen Bike Registry in 2014.[3] Bike Index has an openly available list of stolen bikes. Unlike most other registers, Bike Index has an accessible API where data is wide open to anybody who wants to use it to find and return stolen bikes • BikeRegistry.com - Global Bike Registration (Houston, Texas), has free signup and an international target audience. Their list of stolen bikes is openly available • National Bike Registry (NBR, originally based in California) is a free bicycle register. In 2017 NBR was purchased and merged with 529 Garage (based in Seattle, Washington) • Once a bike is stolen the police can list it in National Crime Information Center • 529 Garage is now coming into use across Canada. In Victoria, BC, for example, it has completely replaced the Victoria Police Department's bike registry

[41] https://en.wikipedia.org/wiki/List_of_bicycle_registers

Insurance company data

Insurance companies may keep track of two types of relevant data:

- Bicycle theft
- Personal injuries covered by an accident insurance

These data are basically private data owned by the insurance company, but in some countries insurance companies contribute to research in traffic safety.

Finnish example on use of insurance data on the cause of single bicycle accidents

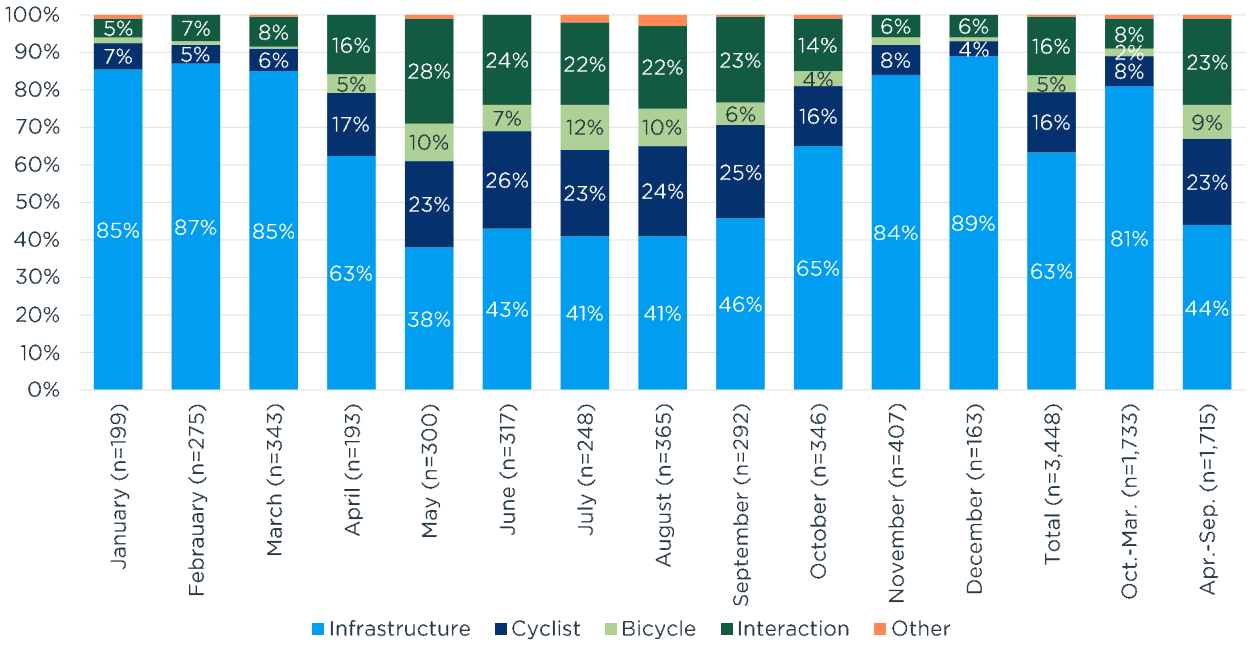


Figure 15: Finnish example on use of insurance data on the cause of single bicycle accidents (Source: www.mdpi.com/2313-576X/6/1/13/pdf)

Figure 16: The app for the Copenhagen Bike Share (Source: https://play.google.com/store/apps/details?id=com.vaimoo.by-cyklen&hl=en)

Bicycle parking facilities

Automated/locked/paid bicycle parking facilities will probably keep track on the use – probably time of start and duration of parking will be collected.

The general availability of the data may depend on the owner at the facility being either a private company or a public authority.

Also operators of traditional bicycle parking facilities may have statistics for example on number of “dead bicycles” they will have to remove from their facility.

Bicycle industry / shops

Bicycle industry and industry associations may be able to provide information on number of sold bicycles split on different types of bicycles.

Also national statistics may be available on production, import and export from the bicycle industry.

These numbers may be blurred a bit by possible private internet shopping of bicycles in other countries.

Figure 17: The Utrecht Stationsstalling with automated data collection and electric light signs to indicate vacant spaces (Source: https://www.welovecycling.com/wide/2019/09/30/worlds-biggest-cycling-garage-opens-obviously-in-the-netherlands/)

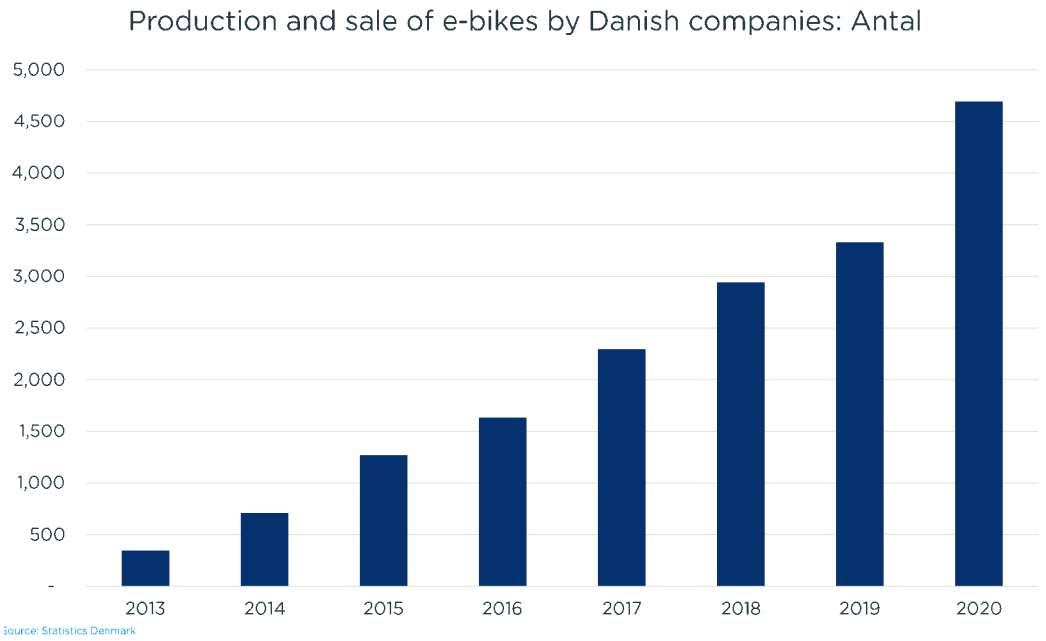


Figure 18: Production and sale of e-bikes by Danish companies (Source: Statistics Denmark[42])

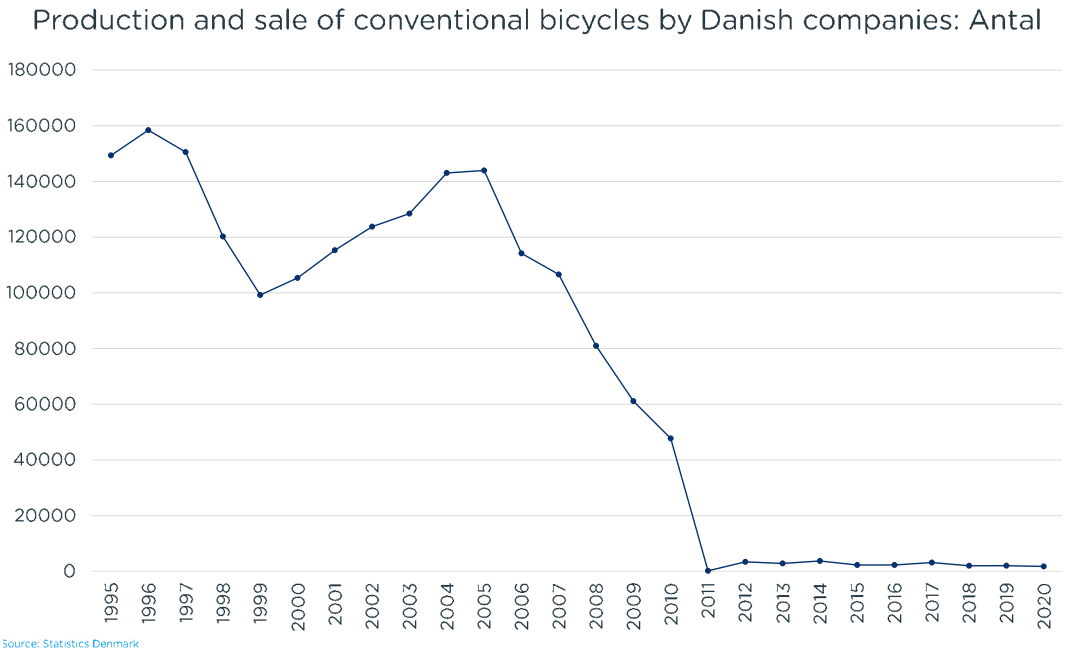


Figure 19: Production and sale of conventional bicycles by Danish companies (Source: Statistics Denmark)

Conclusions

Not many statistics hold deeper data on biking and walking but some of the above listed types of data may apply additional knowledge to other data sources like the information on cycling and walking accidents from hospitals.

[42] https://www.dst.dk/da/Statistik/nyheder-analyser-publ/bagtal/2019/2019-05-10-elcykler-vinder-frem-paa-det-danske-cykelmarked))