MegaBITS

Mobilizing Europe's Green Ambition through Bicycles and Intelligent Transport Systems

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THE FLOATING BIKE DATA PLAYBOOK

A Practical Guide for Smarter Cycling Policy

MegaBITS

Interreg North Sea

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Introduction

Turning cycling data into action

Across Europe, cities are reimagining mobility in pursuit of more sustainable, liveable urban environments. Cycling – a clean, efficient, and inclusive mode of transport – is a cornerstone of this transition. In recent years, a growing number of European initiatives have focused on modernising the cycling sector, aiming to bring progress in cycling on par with that of other transport modes.

Europe's Roadmap for Smart Cycling, published in May 2025, sets out a clear vision for integrating digital tools and data-driven approaches into cycling infrastructure and policy. It encourages cities, regions, and national authorities to embrace innovation, harness technology, and place cycling at the heart of their mobility systems.

Turning this vision into reality, however, requires informed decision-making based on robust, timely, and relevant data. Policymakers and planners need to understand not only how people cycle, but also where, when, and why they ride. This insight is essential for identifying infrastructure gaps, improving safety, and evaluating the impact of interventions.

Floating Bike Data (FBD) can play a key role in meeting these needs. FBD refers to geo-located movement data collected from bicycles, offering insights into routes, speeds, and travel patterns. When used effectively, these data allow cities to move beyond assumptions and anecdotal evidence, supporting more targeted and responsive cycling policies and investments.

Despite this potential, the practical use of FBD in policy and planning remains limited. Many public authorities face technical, organisational, or resource-related barriers that make it difficult to collect, analyse, and apply these data effectively.

The Floating Bike Data Playbook, developed within the MegaBITS project, was created to address these challenges. It offers practical guidance for local governments, mobility planners, and service providers, drawing on both theoretical and real-world use cases from across Europe.

The Playbook outlines when and how FBD may add value, shares best practices on data sourcing and analysis, and provides guidance on procurement and provider selection. Above all, it aims to inspire experimentation, collaboration, and more confident use of data in cycling policy.

We invite you to explore the chapters ahead, learn from the experiences of others, and discover how FBD can support the transition toward smarter, safer, and more sustainable cycling systems.

This structured encyclopaedia of Floating Bike Data applications serves as a foundation for policymakers and planners – helping them design informed tenders and relevant use cases. It can also be used as a reference for data providers, guiding them in refining their products and services.

1. Introducing Floating Bike Data

1.1 Floating Bike Data as an emerging opportunity

> Floating Bike Data (FBD) are geo-located movement data collected from bicycles, often through GPS on smartphones or built-in trackers on shared bikes. These data provide insights into cyclist behaviour, such as origin-destination patterns, speeds, and popular routes, which can be used to improve urban planning, traffic management, and cycling policies.

FBD are currently generated and shared by a diverse mix of actors, including government agencies, non-profit organisations, and private companies. The commercial market for these data remains relatively small, with few strong business cases beyond well-known sports and fitness platforms such as Strava and Komoot.

Policymakers and mobility planners increasingly recognise the potential of FBD to improve planning and operations. However, many lack the expertise and tools needed to collect, analyse, and interpret these data effectively, a challenge often compounded by staff turnover and reliance on short-term consultancy. Data providers, meanwhile, clearly see the value of FBD but struggle to convince public administrations to invest, partly due to fragmented responsibilities and uncertainty about the data's added value.

As a result, policymakers and planners are constrained, as the insights they rely on remain difficult to access. Data providers also miss opportunities to bring their solutions to market. Cyclists, however, lose out the most, as infrastructure and traffic systems continue to prioritise motorised transport.

Bridging this gap requires clearer, well-defined use cases that guide the collaboration between data providers and data users. This is precisely the aim of this *Floating Bike Data Playbook*: to provide practical examples and targeted guidance that help stakeholders translate FBD into tangible improvements in infrastructure planning, cyclist safety, and network efficiency.

1.2 Current challenges in working with Floating Bike Data

The field of intelligent cycling tools based on harvested FBD is evolving rapidly but remains relatively young. As with many emerging data-driven technologies, the development of these tools comes with a range of challenges inherent to collecting, processing, and applying newly available data:

Inconsistent data quality and representativeness

The quality of FBD varies widely, and many datasets overlook segments of the cycling population. This limits the accuracy and undermines efforts to develop inclusive, evidence-based cycling policies. Achieving high-quality FBD will require minimum

standards and practical frameworks for evaluating the data accuracy, completeness, and representativeness.

Lack of data standardization

Cycling data lacks shared standards for formats, terminology, and exchange, making integration difficult. Without harmonization, cities cannot easily combine datasets or use FBD effectively in larger mobility systems. Developing shared standards would therefore unlock significant value.

Hardware and software variability

FBD originates from diverse sources – apps, connected bikes, and sensors – with different strengths and technical limitations. Integrating these varied data streams would be highly advantageous but will demand significant technical effort and investment in data fusion.

Lack of a data governance framework

Data access is often constrained by legal uncertainties, privacy concerns, and varying levels of (un)willingness to share detailed data. A clear governance framework is needed to define roles, responsibilities, and privacy standards so data can be shared safely and effectively.

For a deeper dive into FBD standardisation and specification, please refer to the MegaBITS study *Recommendations on a specification for Floating Bicycle Data*.

Misalignment between public needs and commercial offerings

Public administrations and commercial data providers often struggle to align on the value and application of FBD. Cities are unsure how FBD may add value, or they may lack the expertise to interpret FBD effectively. Meanwhile, providers face difficulties convincing public buyers to invest, particularly in administrative environments where no single department is responsible for cycling data or smart mobility initiatives.

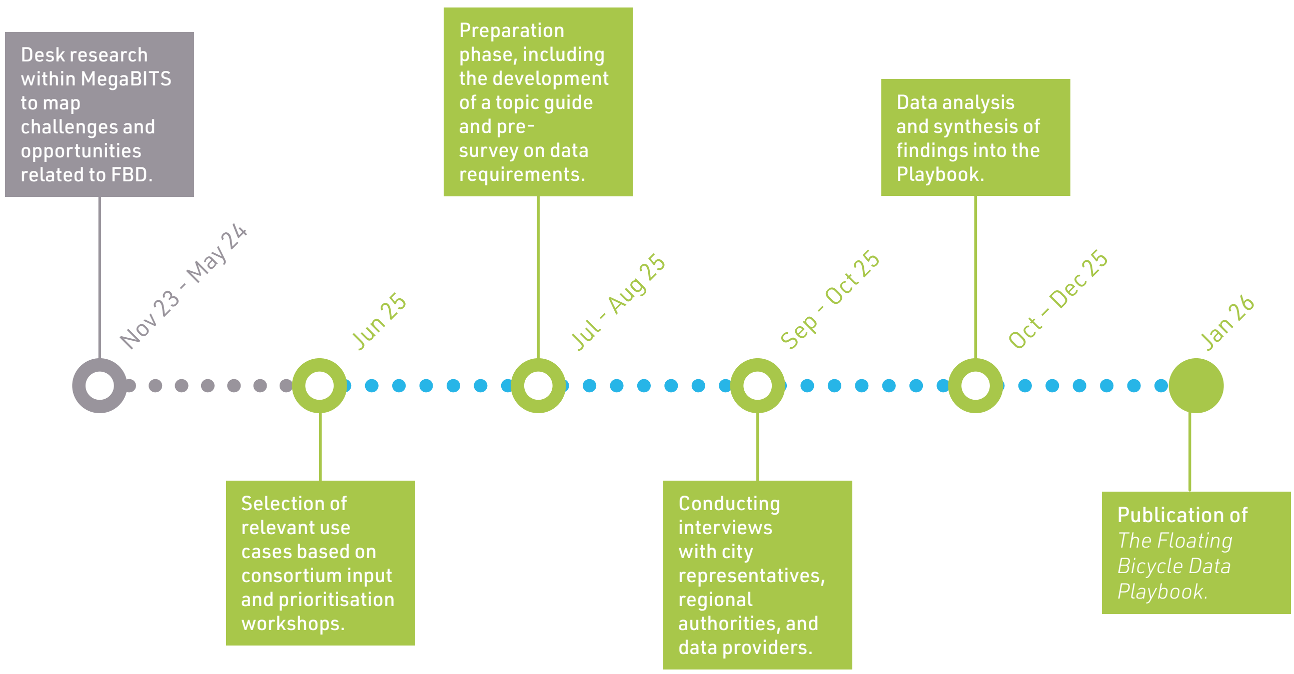
This gap is compounded by differences in expectations: often, commercial providers offer only raw or aggregated data, while policymakers need actionable insights tailored to specific use cases.

This Playbook aims to help policymakers better understand the possibilities and limitations of FBD, while also clarifying for data providers what policymakers look for when issuing tenders or selecting partners.

Despite the challenges still surrounding FBD, cities and municipalities should not wait until every technical issue is resolved. Instead, they are encouraged to start experimenting and integrating FBD into existing practices wherever it adds value.

1.3 How this Playbook was made

The research behind this Playbook evolved over two years, from November 2023 to December 2025, moving through several key stages:



This research was built on preceding efforts under the BITS and MegaBITS projects. The MegaBITS studies – including *Recommendations for the Specification of Floating Bicycle Data* (May 2024) and the *Whitepaper on Bicycle Data Spaces* (October 2023) – primarily examined technical challenges and opportunities from the perspective of data providers and standardisation experts.

In contrast, this Playbook addresses the perspective of public authorities: How can they practically and effectively collect and apply FBD for policymaking and planning? This question was addressed through a round of qualitative research focused on the experiences of the public-sector, combining use case analysis with expert interviews and a supporting survey.

The researchers first developed a range of theoretical FBD use cases based on desk research and workshops within the MegaBITS consortium. Next, they identified real-life FBD implementations through research and recommendations from consortium members and POLIS. Then, the organisations responsible for these use cases were invited to participate in an interview and survey.

In total, 16 interviews were conducted with representatives from 12 organisations, including 10 public-sector authorities and 2 data providers. Prior to the interviews, the participants completed a survey on their data needs, covering data types, sources, and formats.

The participants included mobility and innovation managers, GIS specialists, and policy advisors, representing both data seekers (public authorities) and data providers (industry and intermediaries). This diversity ensured that the findings capture perspectives from across the FBD ecosystem.

ORGANISATION	TYPE	ORGANISATION	INTERVIEWEE(S)	ROLE
Copenhagen	Public Authority	City of Copenhagen	Maria Risom Laursen Christian Anders Stavnsbjerg	Project Manager Traffic Engineer
Sarajevo	Public Authority	CSO Giro di Sarajevo	Damir Margeta	Transportation Engineer
Antwerp	Public Authority	City of Antwerp	Emilie Couwenberg	Team Coordinator Team Modal Shift
Antwerp	Public Authority	Province of Antwerp	Steven Soetens	GIS Specialist
Enschede	Public Authority	City of Enschede	Benjamin Groenewolt	Mobility Policy Advisor
Stockholm	Public Authority	Chamber of Commerce	Emily Nagler	Policy Analyst
Dublin (Dún Laoghaire)	Public Authority	Dún Laoghaire Rathdown County Council	Amber Desprets Ronan Herron Vijit Singh	Innovation & engagement lead Digital Strategy Officer Information System Technical Officer
Groningen	Public Authority	Groningen Bereikbaar	Niek Panman	Mobility Manager
Overijssel	Public Authority	Province of Overijssel	Renske Graafland	Project Manager
Helmond	Public Authority	City of Helmond	Luuk Misdom	Team Manager Urban Innovation
Mobidot	Provider	Solution Provider	Marcel Bijlsma	Founder & Product Manager
InfraSense	Provider	Solution Provider	Daniel Schlitt Joel Kluber	Pro Project manager & Team Lead Data Services (Worldiety) Transportation Consultant (Planungsbüro VIA)

For further details on the research design, interview materials, and use case documentation, see Annex B.

2. From theory to practice–exploring use cases

This chapter brings together a selection of potential and real-life use cases that illustrate how cities and regions have approached the use of FBD in different contexts. Rather than offering prescriptive solutions, these examples are intended to provide inspiration and practical reference points. They show how FBD can be applied in practice, what they can realistically deliver, and what considerations may arise along the way, helping you reflect on how similar approaches might fit your own city or community.

2.1 Potential use cases supported by Floating Bike Data

Before diving into the real-life implementations, it is worth taking a step back to explore the broader potential of FBD: the theoretical use cases, ideas and applications where FBD could provide valuable insights or even help solve persistent mobility challenges.

Some of these have already been prototyped in local or EU projects, but many were not subjected to rigorous analysis, meaning there is still much to learn about what works best. But that is precisely where the opportunity lies. For cities, regions, or organisations that seek data or that are eager to innovate, these use cases offer a starting point for data harvesting, experimentation, a chance to pilot new approaches, explore emerging technologies, and help shape the future of data-driven cycling policies.

Route choice and path analysis

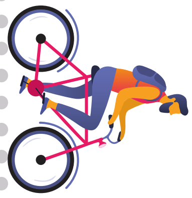
By comparing planned, expected, and actual cycling routes, FBD reveal how people truly move through the network. These insights help identify missing links or popular detours, enabling cities to plan infrastructure that reflects real cyclist behaviour rather than assumptions.

Origin–destination pattern analysis

FBD can map where cycling trips begin and end, revealing key trip generators and attractors across a city or region. These insights help planners understand travel patterns over time, identify high-traffic corridors, supporting better connection design, and targeted infrastructure investments. Take into account, however, that data providers may deliberately reduce the resolution of origin-destination data to protect users' privacy. For some use case, this may have a significant impact, for others less so.

Speed and travel time analysis

FBD may enable detailed insight into cyclists' speeds and travel times across the network, by time of day, weather, or cyclist type. By identifying areas of delay or congestion, cities can pinpoint where infrastructure improvements or signal optimizations are most needed to ensure smoother, safer cycling flows.



Traffic volume and flow measurement

Using FBD, cities can monitor relative cycling volumes across routes and time periods. This helps identify peak usage patterns and trends, assess the impact of infrastructure and policy changes, and prioritize investments where cycling demand is highest. Consider that such trend monitoring requires larger datasets than most FBD providers can offer. This can be addressed by combining FBD with complementary data sources, such as traditional traffic counts.

Traffic signal and intersection flow

FBD can reveal how cyclists behave at intersections, including stop frequency and waiting times at traffic lights. These insights support smarter signal timing and intersection design, reducing delays and improving safety and comfort for cyclists.

Network capacity and congestion analysis

FBD may help identify bottlenecks and capacity limits within the cycling network. By measuring how efficiently routes are used, planners can target investments to relieve congestion, improve flow, and make better use of the existing infrastructure.

Network coverage

FBD can highlight gaps and weak spots in the cycling network by showing where cyclists struggle to find safe or direct routes. These insights help assess network completeness and guide investment priorities for new or improved infrastructure.

Performance monitoring and quality control

FBD may support the monitoring of continuous data sources such as sensors or fixed counters. Comparing FBD with data from these counters may help detect anomalies and ensure that baseline measurements remain reliable, which can be used for maintenance or corrective actions.

Intermodal and multi-modal integration

FBD allows understanding how cycling connects with public transport, analysing bike-and-ride patterns, identifying optimal locations for bike parking near transit stations, or studying multi-modal trip chains. This is useful for transit integration planning, parking facility placement, or promoting sustainable transport combinations.

Parking and end-of-trip facility analysis

FBD can reveal where cyclists start and end their trips, helping cities identify demand hotspots for bike parking and related facilities. These insights support the planning of secure, convenient parking and end-of-trip services where they are needed most. As with O/D pattern analysis, beware that data providers may deliberately reduce the accuracy of these data to protect users' privacy.

Corridor and route performance analysis

FBD enable the evaluation of key cycling corridors by tracking speed, flow, and reliability. These performance metrics help cities monitor priority routes, assess improvements over time, ensure corridors meet expected service levels, and determine where targeted investments are needed.

Safety and black spot analysis

FBD help identify locations with frequent slowdowns, abrupt stops, or unusual detours, which may indicate potential safety risks. By pinpointing these black spots, cities can target hazardous areas for detailed investigation and safety improvements.

Virtual infrastructure and synthetic data

FBD can be used in combination with fixed sensors to generate additional synthetic data for areas lacking coverage, creating virtual counting points that fill data gaps. This approach allows cities to estimate cycling activity and monitor network performance without extensive additional hardware investments.

Cyclist segmentation and behaviour analysis

FBD enable cities to distinguish between different types of cyclists such as commuters, recreational riders, and delivery cyclists, by analysing travel patterns and behaviours. These insights support more tailored policies, infrastructure design, and targeted mobility initiatives.

Although many of these use cases were designed with a single city or municipality in mind, their potential benefits could be even greater at a regional or national level. Access to multimodal insights across borders can help optimize the connectivity between cycling, public transport, and other mobility options, delivering real added value for commuters and public sector actors alike.

2.2 Real-world use cases supported by FBD

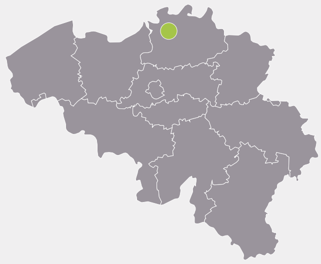
This section presents 12 real-world use cases from across Europe: ten from the perspective of a public sector user and two from a provider perspective. The examples vary widely in scope, budget, and maturity, reflecting the diverse contexts in which cities, regions, and agencies are working.

The public sector cases range from small, bottom-up initiatives (e.g., Sarajevo) to city-led projects (e.g., Antwerp, Copenhagen), industry-supported efforts (e.g., Dublin, Stockholm), and a major nationwide procurement process in the Netherlands. Readers interested in the Dutch pioneering role in this domain may look at the cases of Enschede, Groningen, Helmond, and Overijssel, which collectively showcase a long-standing, coordinated commitment to advancing FBD.

To complement the demand-side perspectives, the section also includes two examples of providers. They illustrate two separate ways of creating and processing FBD and are therefore suited for different use cases. InfraSense, a young start-up, demonstrates how hardware-based FBD can support infrastructure planning, while Mobidot, a well-established mobility app provider, offers insights into behaviour-focused FBD applications and is widely used by Dutch public authorities.

The use cases are presented in a consistent format to support easy comparison and to inspire readers exploring similar applications. Each case is summarised along a set of common parameters, such as goals, budget, timeline, key learnings, and data needs. While real-world projects are inevitably more complex than what can be captured here, these descriptions provide a solid starting point for inspiration and learning.

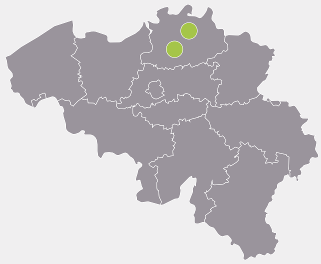
City of Antwerp, Belgium



The City of Antwerp implemented its Smart Cycling project as part of the EU-funded SynchroniCity initiative, alongside pilot cities Dublin and Manchester. Antwerp's goals were twofold: to test its mobility-focused IoT architecture and to explore how FBD could support infrastructure validation, cyclist behaviour analysis, and safety assessments.

For this pilot, the city partnered with See.Sense, a provider of smart bike lights equipped with sensors. The lights were linked to a mobile app and collected GPS, acceleration, braking, and selected environmental data from approximately 400 city employees over a three-month summer period. The resulting insights helped Antwerp evaluate the use and performance of key infrastructure, including the Merksem bike bridge and newly introduced route markings.

Location	City of Antwerp (Belgium)	
Organisations involved and responsibilities	City of Antwerp, Mobility Department	Project coordination (as part of Synchronicity)
		Communication and recruitment
	Digipolis, IT partner of city of Antwerp	Project coordination (as part of Synchronicity)
	See.Sense, data provider (UK)	Data collection, analysis and visualisation
Time frame	2019-2020	Data collection during the Summer of 2019 (3 months)
		Part of Synchronicity project (2017-2019)
Number of users	400	Recruited among the city's own employees
Intended beneficiaries	Primary	Antwerp's mobility department and See.Sense
	Secondary	Political decision makers
Status of project	Completed, no continuation planned	
Problems and Goals	The project's use of FBD was exploratory, not problem-driven	Explore the feasibility of using FBD for mobility planning
		Validate the infrastructure's use and safety
		Assess the behaviour and routes choices of cyclists
Time spent (est.)	0.1 FTE from the city for the See.Sense project	
	0.15 FTE from IT partner Digipolis	
	Most of the work was done by the data provider (See.Sense)	
Cost (est.)	£ 14,000 (£ 35 per bike light)	
	Additional effort by See.Sense	
Results and key learnings	Positive evaluation of FBD for validation and hypothesis testing	
	Negative evaluation of FBD for policy decisions when used as only source. FBD must be used in conjunction with other data sources (e.g., surveys).	
	Enthusiasm among users (e.g., about the bike light performance)	
	Recruitment and user engagement are more challenging than anticipated	
Data needs and requirements (insights)	Data sources	Primary: See.Sense (sensor and app data)
		Secondary: participation survey and own city data
	Data formats	Raw data, anonymized .csv files
	Personal data collected via the survey, based on consent	Socio-demographic data (gender, age, home address)
		Frequency of bike use
		Main driver for bike use (recreational, commute...)



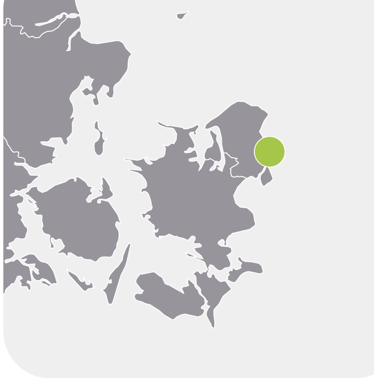
Province of Antwerp, Belgium

The Province of Antwerp set out to identify safety and infrastructure issues along the F106 cycling highway between Herentals and Aarschot, as part of a broader redesign effort. To support this process, the project collected objective movement data via the Geovelo app, which automatically tracked routes, speeds, stops, and braking behaviour of participating cyclists. In parallel, a survey captured cyclists' subjective perceptions of risk, such as dangerous intersections and uncomfortable segments.

This dual-method approach was designed to evaluate how FBD compares with user-reported experiences in terms of data quality, relevance, and practical value for infrastructure planning. By looking at both perspectives side by side, the project aimed to understand the strengths and limitations of each method and to assess whether FBD have an added value over traditional consultation-based processes.

The results showed that while FBD can provide useful insights into infrastructure issues, they are not always the most cost-effective option. The survey proved cheaper, faster, and in several cases more insightful, highlighting additional problem areas not visible in the app-based data. Moreover, concerns about the data quality and representativeness limited the added value of the FBD.

Location	F106 cycling highway between Herentals and Aarschot (Belgium)	
Organisations involved and responsibilities	Province of Antwerp, Mobility Department	Project coordination
		Additional data analysis
		Communication and recruitment
	Geovelo (data provider, France)	Data collection and visualisation in a dashboard
Time frame	September 2024 – March 2025	
Number of users	220	Recruited by the province, in collaboration with a cycling association
		10 users generated over 50% of data, which may affect the data quality
Intended beneficiaries	Primary	Province of Antwerp, to inform policy and infrastructure decisions
	Secondary	Local municipalities adjacent to the F106 highway
		Geovelo, to learn how to further develop functionality
		Cyclists, an opportunity to gain individual insights via the app
		Study bureau, to do an infrastructure redesign based on the insights
Status of project	Completed, no continuation planned	
Problems and Goals	Primary	Identify safety issues related to the cycling highway infrastructure based on objective data
	Secondary	Compare objective FBD with subjective survey data
Time spent (est.)	Province of Antwerp: 0.2 FTE	
Cost (est.)	€ 10,000 for Geovelo (license for the platform)	
	Minimal internal costs for communication (flyers, signalisation with QR-code for recruitment)	
Results and key learnings	FBD are useful for the identification of infrastructure issues, but are not cost-effective.	
	The survey was cheaper, faster, and sometimes more insightful: additional problems that did not appear from the FBD were flagged. Also, comparing the subjective data from the survey showed little difference in terms of data quality and actionability of the data.	
Data needs and requirements (insights)	Data sources	Geovelo app
		Survey
	Data types	Origin-destination information available but considered not useful
	Data formats	Raw data, anonymized .csv files
	Personal data collected via the survey, based on consent	Socio-demographic data: gender, age, ZIP code
		Via app: number of km biked per user
	Metadata	Limited, more metadata would have been useful (e.g. type of bike, trip purpose)



City of Copenhagen (Denmark)

The City of Copenhagen launched this MegaBITS use case to improve traffic signal strategies and cycling policies using empirical data. Previously, the city lacked reliable information on actual cycling speeds, number of stops, and travel times. This limited its ability to evaluate interventions or detect areas that need improvement.

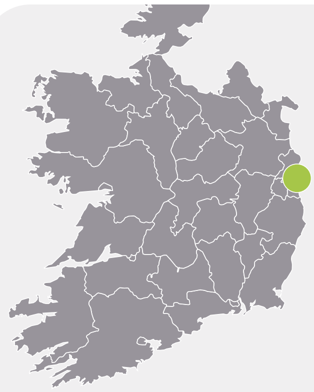
For the project, FINDRS provided bike-mounted sensors and a companion app that collected data from 400 cyclists across four major corridors. The system captured speeds, stops, and travel times, offering a detailed view of real-world cycling behaviour. The results revealed a new category of data called "induced delay," making it possible to estimate cyclists' preferred speeds and the resulting delays caused by traffic signals, narrow bike lanes, and general congestion. This approach helps identify where along the corridors interventions could deliver the greatest benefits.

The resulting dataset will be used to validate assumptions about cyclist behaviour, support infrastructure planning, identify problematic intersections, and detect emerging route patterns.

Location	City of Copenhagen, Denmark	
Organisations involved and responsibilities	Copenhagen Solution Lab	Provider selection and procurement (incl. legal compliance)
	Traffic Department (City of Copenhagen)	Project coordination and implementation
		Additional data analysis
	FINDRS	Hardware (sensor) and app provider
		Recruitment
		Data collection and analysis
	Hermes Traffic Intelligence	Data analysis (comparing the value of single-source vs. multi-source FBD)
		Data fusion (data from FINDRS and rental bike app - planned but not executed)
Time frame	2024-current	
	Data collection: May to September 2025	
Number of users	400 unique users across 4 corridors	The original target was 3,000 users, which was deemed unrealistic
		Number of users to be increased in the future
Intended beneficiaries	Primary	City of Copenhagen, primarily the traffic engineers, looking for traffic light optimization
	Secondary	Political decision makers (validate traffic strategy)
		Infrastructure operators
		Cyclists
Status of project	Data collection completed as of September 2025	
	Data analysis and evaluation planned for Q1 2026	
Problems and Goals	Validate the traffic strategy and optimize traffic signals	
	Optionally calibrate the city's BikeSim traffic model (currently based on synthetic data) to improve its accuracy and utility	
	Support policymaking with empirical data	
	Explore new insights (e.g., problematic nodes, alternative/new routes)	
Time spent (est.)	Provider selection and procurement: 0.3-0.4 FTE per year (Copenhagen Solution Lab)	
	Implementation: <0.1 FTE per year (City of Copenhagen, Traffic Department)	
Cost (est.)	€ 50,000 in total for both providers (FINDRS and Hermes)	
Results and key learnings	Not applicable, the project is still in its implementation (analysis) phase	

Data needs and requirements (insights)	Data sources	FINDRS (sensor and app)
		Rental bike app data (for Hermes data fusion project)
	Data types	FBD data on speed, number of stops, travel time, induced delay, ...
		Other types of data (road surface quality, sudden braking...) available but not needed
	Data formats	Aggregated data
	No personal data were used due to privacy concerns	Anonymization/aggregation by the provider(s)
	Metadata	Required: Type of bike (to identify e-bikes), based on survey (by provider) and extrapolation of data
		Optional: Trip purpose / motivation

District of Sandyford, Dublin (Ireland)



The Sandyford Pedal Pulse project was an FBD pilot in Dublin's suburb Sandyford, located in county Dún Laoghaire–Rathdown. Its goal was to improve cycling safety and guide infrastructure planning by gathering detailed data from 170 participants equipped with See.Sense smart bike lights.

The project focused on two objectives: collecting information on road conditions, route choices, and near-miss incidents to support safety improvements; and exploring whether targeted safety measures could influence participants' active travel behaviour.

In total, more than 50,000 kilometres of cycling data were collected, offering a valuable supplement to traditional data sources. By comparing these results with Strava Metro data, the team plan to examine gender differences in cycling patterns.

Location	District of Sandyford, Dublin (Ireland)	
Organisations involved and responsibilities	Smart Dún Laoghaire, Innovation Department	Funding
		Recruitment
		Project coordination
		Additional data analysis
	Dún Laoghaire-Rathdown County Council (DLRCC), Smart Sandyford, Sandyford Business Innovation District	Funding
	See.Sense, provider	Hardware (sensor) and app
		Data collection
		Data analysis
		Data visualization
Time frame	July 2024 – end of August 2025 (originally until July, but extended by 2 months)	
Number of users	170	Original target: 200
Intended beneficiaries	Internal	Governmental actors
	External	Researchers (local universities such as Trinity College Dublin)
		Cycling industry (See.Sense was partner in the project)
Status of project	Implementation phase	Data collection finished as of August 2025
		Data analysis and evaluation planned for September-October 2025
Problems and Goals	Improve the safety of cyclists by identifying dangerous cycling conditions (e.g. infrastructure issues)	
	Collect granular data on cyclist behaviour, including a potential gender bias in bicycle use and behaviour	
	Indirectly: promote active travel by increasing bike safety	

Time spent (est.)	Project coordination and recruitment: 1 FTE	
	Internal data analyst: 0.3 FTE	
	Overall coordination, provider selection and procurement: 0.2 FTE	
Cost (est.)	£ 40,600 for hardware and services delivered by the data provider (See.Sense)	
Results and key learnings	FBD provided meaningful insights into previously undocumented topics (gender bias, infrastructure issues). However, the limited representativeness put some constraints on the usefulness of these insights.	
	Sustaining the user engagement over an extended period (beyond six months) proved difficult. Technical issues exacerbated the challenges for continued user involvement.	
Data needs and requirements (insights):	Data sources	Primary: See.Sense sensor and app data
		Secondary (for comparison): Strava, Bolt, Mobike app data (from a different project)
	Data types (provided by See.Sense)	FBD on positioning, stops, speeds...
		Some additional data types were desired but not available (e.g., origin/destination matrices, full trip trajectories, trip motivation...)
	Data formats	No raw data, only aggregated data
		API access was desired but not available
	Personal data were used, based on consent and legitimate interest	Socio-demographic data (gender, age)
	Metadata	Contextual data (e.g., road works, public transport) were not readily available but could be useful for contextual modelling

City of Sarajevo (Bosnia and Herzegovina)

Sarajevo's urban mobility system faces several structural challenges, including a fragmented administrative landscape, a car-dependent transport culture, and a valley-based geography that restricts movement. At the same time, micromobility has grown quickly, with rising use of bikes and e-scooters. However, the city lacks the data needed to translate these trends into targeted investments and safety measures.

To address this, Sarajevo joined the EIT-funded SCREEN project. One of its aims was to develop an integrated platform for cycling insights using both FBD and complementary datasets. Working with civil society, European start-ups and urban mobility companies, the city deployed an AI-based sensor box to assess road surface quality, incorporated historical cycling data, and added bike-sharing data, manual counts, and accident records, creating its first consolidated cycling database.

The resulting platform, hosted by VeloVision, visualised cycling patterns and infrastructure gaps and helped quantify the modal shift from cars to bikes and e-scooters while incorporating its CycleRAP-based safety analysis. This enabled more evidence-based planning and strengthened policy advocacy for safer, more sustainable urban mobility.

Location	City of Sarajevo, Bosnia and Herzegovina	
Organisations involved and responsibilities	Department of Sustainable Development (City of Sarajevo)	Project coordination
		Data collection
	FACTUAL, consultant	Project lead
		Data collection
		Infrastructure and CycleRAP analysis
	Damir Margeta, CSO Giro di Sarajevo, cycling advocate, traffic engineer and consultant for the city	Data collection
		Expert advice
	Social Tech Project, provider	Hardware (sensor box)
		Data collection
	Flucto, provider	VeloVision platform
		Data visualization
		Data collection (via API)

Time frame	June 2024 through March 2025	
Number of users	80-100 public bikes (NextBike sharing system)	
	1,500 citizen surveys (from 2022)	
	Volunteers for manual counting and sensor box data collection	
Intended beneficiaries	Primary	City of Sarajevo, Department of Sustainable Development
		Canton of Sarajevo, Ministry of Transport
	Secondary	Cyclists and civic society
		Research institutions
Status of project	Continuation phase	Collection and integration of additional data (Q4 2025)
		Analysis expected in December 2025
Problems and Goals	Problems	No structural means of collecting micromobility data in Sarajevo and fragmentation of available data between civil society, private sector and governmental actors.
		Limited internal data expertise within the City of Sarajevo.
	Goals	Build a central platform with various integrated data sources to better quantify micromobility trends.
		Increase the visibility of bikes and e-scooters as a mode of transport to relevant authorities with decision-making power.
Time spent (est.)	Damir Margeta (consultant): 0.4 FTE during project runtime	
	City of Sarajevo: 0.1 FTE across 4 people	
Cost (est.)	Total project cost was € 500,000 (EIT-funded), of which approx. € 10,000 for the City of Sarajevo for the subcontracting of a consultant and for data collection	
Results and key learnings	Tailoring the scope to local needs can lead to meaningful impact, even in low-resource settings	Partnering with external actors (e.g., civil society and advocacy groups) is a valuable and cost-effective means of data collection for smaller cities.
		Small, bottom-up projects can be of high value in contexts where both the cycling infrastructure and the data maturity are limited.
	An open data mindset and collaborative approach helped build trust and a lasting collaboration both across city departments and with the civil society.	
Data needs and requirements (insights)	Data types and data sources	Trip and stop counts (sensor data Nextbike)
		GPS and route data (citizen survey)
		Road surface and bike infrastructure quality (sensor box)
		Road segments (manual input)
		Air quality and weather data (weather institute)
		Car traffic data (Ministry of Transport)
		Accident data (police reports, first responders)
	Data formats	Raw data (via API or manual downloads)
		Interactive dashboard (VeloVision)
	Personal data were used, based on consent or legitimate interest	
	Metadata	Created manually
		Used for validation and integration of data

City of Enschede (the Netherlands)

The Enschede use case centres on *Enschede Fietst*, a long-running app designed to promote sustainable mobility through behavioural change. Enschede was an early pioneer in using FBD: the idea first emerged in 2009, when the city faced severe peaks in rush hour traffic volume but lacked the funds to widen a bridge and tunnel on a key access road. Instead of building new infrastructure, Enschede opted for a digital approach aimed at influencing the behaviour of traffic participants.

Launched in 2012 in collaboration with Mobidot as *SMART*, the app encouraged residents to avoid using cars during peak-hours car by rewarding cycling. Rebranded as *Enschede Fietst* in 2020, it automatically tracks trips, provides vouchers for local shops, and uses experience sampling and push notifications to keep users engaged. The app currently has around 2,000 daily active users.

The current platform will be discontinued in 2026 and replaced by *Da's Zo Gefietst*, a new national app developed through a joint tender issued by several Dutch provinces.

Location	The municipality of Enschede (The Netherlands)	
Organisations involved and responsibilities	City of Enschede (policy advisor mobility)	Project coordination
		Data analysis and modelling
		Challenge and reward definition (strategy)
	Mobidot, provider	App provider
		Data collection
		Data visualization (upon request)
	Communication agency	User and partner recruitment
		Challenge and reward definition (operational)
Time frame	2009: Idea for the app	
	2012: Launch of app "SMART" (multimodal focus)	
	2018: Integration of app data into traffic light controllers for cyclist prioritisation	
	2020: Rebranding of app to "Enschede Fietst" (cycling focus)	
	2026: Replacement of local app by shared app "Da's Zo Gefietst"	
Number of users	2.000 active daily users (≥1 movement each day)	
Intended beneficiaries	Primary	Policy makers (own policy department)
		Users (app)
	Secondary	Research institutions (upon request, for specific research questions)
Status of project	Completed, discontinued	Transitioning to new app "Da's Zo Gefietst". The data sets are not compatible between the apps, so a new user base will have to be recruited.
Problems and Goals	Initial goal (2009): resolve an infrastructure capacity issue by reducing car usage.	
	Long-term goal: encourage a modal shift from cars to bikes (or other sustainable) alternatives.	
Time spent (est.)	City of Enschede	1 FTE per year (across 5 staff members)
	Data provider (Mobidot)	Very high initial investment to develop app
		Efforts are now spread across different clients (see also: use case Mobidot)
	Communication agency	0.5 FTE / year
Cost (est.)	€ 120,000 / year (recurring)	€ 110,000 for the data provider
		€ 10,000 for the communication agency
	Excluding ad hoc expenses for campaign or challenges	

Results and key learnings	In general, the FBD were positively evaluated (hence the continued investment and partnership).		
	For the initial set-up		Very high cost per user (pioneering role).
			Rollout on national level of communal *Da's Zo Gefietst* app is expected to lead to a significant reduction in the average cost per user.
Data needs and requirements (insights)	Data sources	Primary	Enschede Fietst app
		Secondary	Fixed counter data (fused with behavioural data from app to measure the impact of traffic plans)
			Behavioural surveys
			Weather station for weather data (matched to each trip)
			Strava is not used due to the sample bias (recreational cyclists).
	Data types		FBD such as positioning data, stops, speeds, O/D matrices, routes, trip duration
			Weather data
			Theft and incident reports are available but not used
	Data formats and output		Aggregated data
			Maps upon request
			Dashboard not available
	No personal data collected		Privacy-by-design as core principle of app
			Personal data are occasionally collected via surveys to answer a specific research question
	Metadata included in datasets	Modality	Manual input or automatic via an algorithm
			Metadata on the inference method of the modality
		Stay data (location of where people stop during trip pauses)	
		Motivation (recreational vs. commute)	
		Indicator Data Quality. The Mobidot app assesses the quality (i.e., reliability) of a certain datapoint. Very low-quality data will automatically be supressed form the data set	

City of Groningen (the Netherlands)

By promoting cycling as an alternative to car travel, this use case led by Groningen Bereikbaar, aimed to encourage a change of behaviour during the final phase of the 2024 road reconstruction of the southern ring.

From March to September 2024, the project used a gamified cycling app developed by Toogether Cycles. It rewarded participants with an incentive in the form of points and allowed them to join challenges and donate rewards to selected charities. This incentive model proved highly effective. While the app also produced FBD, this was a secondary outcome rather than a core objective.

Groningen Bereikbaar handled the recruitment of participants and the communication, while the app provider delivered data analytics and dashboarding. The recruitment targeted employers in the area and resulted in around 1,000 participants.

The project was judged successful, but the generated FBD lacked the accuracy needed for long-term policy use. From 2026 onward, Groningen will transition to the new national app Da's Zo Gefietst to make fuller and more consistent use of FBD.

<table>
<tr><td>Location</td><td colspan="3">City of Groningen (the Netherlands)</td></tr>
<tr><td rowspan="7">Organisations involved and responsibilities</td><td rowspan="3" colspan="2">Groningen Bereikbaar, a cooperation between various private and public sector actors in and around Groningen</td><td>Project coordination</td></tr>
<tr><td>Recruitment and communication</td></tr>
<tr><td>Challenges and rewards definition</td></tr>
<tr><td rowspan="4" colspan="2">Toogethr Cycles, provider</td><td>Data collection (app)</td></tr>
<tr><td>Data analytics</td></tr>
<tr><td>Data visualisation (dashboards)</td></tr>
<tr><td>Technical support</td></tr>
<tr><td rowspan="2">Time frame</td><td rowspan="2" colspan="2">September 2023 – September 2024</td><td>Preparation (market study): September 2023</td></tr>
<tr><td>Implementation: March – September 2024</td></tr>
<tr><td>Number of users</td><td colspan="3">1,000 participants (commuters / employees)</td></tr>
<tr><td rowspan="3">Intended beneficiaries</td><td colspan="2">Primary</td><td>Groningen Bereikbaar and partners (municipality of Groningen, infrastructure operators…)</td></tr>
<tr><td rowspan="2" colspan="2">Secondary</td><td>Industry (employers and mobility advisors), to support modal shift</td></tr>
<tr><td>Policy makers, to inform decision-making</td></tr>
<tr><td rowspan="2">Status of project</td><td rowspan="2" colspan="2">Completed</td><td>App no longer in use</td></tr>
<tr><td>Data analysis completed</td></tr>
<tr><td rowspan="2">Problems and Goals</td><td rowspan="2" colspan="2">Encourage a modal shift from cars to bikes during the final phase of the ring road construction around Groningen (2024)</td><td>Collecting FBD was not the primary goal, but a byproduct of the project's target.</td></tr>
<tr><td>The need for a short-term solution informed the choice for an existing app.</td></tr>
<tr><td rowspan="2">Time spent (est.)</td><td colspan="3">Groningen Bereikbaar, project coordination and recruitment: 0.1 FTE / year</td></tr>
<tr><td colspan="3">Toogethr Cycles: estimate not available</td></tr>
<tr><td rowspan="2">Cost (est.)</td><td colspan="3">Exact budget not disclosed</td></tr>
<tr><td colspan="3">The funding for the incentives (e.g., donations to charities) came from Groningen Bereikbaar's own resources</td></tr>
<tr><td rowspan="4">Results and key learnings</td><td colspan="3">Since FBD was a byproduct and not the goal, the data were of limited value for further policy decisions (data quality and representativeness issues).</td></tr>
<tr><td colspan="3">Recruiting and engaging users via employers located in the impacted area was very performant.</td></tr>
<tr><td colspan="3">Sample bias limited the effectiveness of the project in converting car users to bikes (most were already cyclists before participating).</td></tr>
<tr><td colspan="3">The project roadmap was affected by the technical roadmap of the provider, who pushed a software update that affected the data collection results.</td></tr>
<tr><td rowspan="4">Data needs and requirements (insights)</td><td colspan="3">No requirements (FBD were a byproduct of the main goal: behavioural change). The data were not directly consulted, only via the dashboard provided by the provider.</td></tr>
<tr><td colspan="3">Personal data were used in a limited way, based on consent. An example was the employer's name used for gamification purposes (building challenges and competition between companies).</td></tr>
<tr><td rowspan="2">Metadata</td><td rowspan="2">Type of bike</td><td>Participants could manually input their default type of bike upon registration and change it when necessary.</td></tr>
<tr><td>Speed data were used to validate the type of bike. If the speed did not match the declared type, the data were not processed.</td></tr>
</table>

City of Helmond (the Netherlands)

Since 2018, the City of Helmond has explored the value of FBD through a series of pilots and projects. Its most advanced use case focuses on encouraging cycling and improving cyclist safety by using app-based FBD to adapt traffic light operations.

Cyclists either send continuous positional data to intelligent traffic lights (iVRI) or they trigger a signal when entering a designated geofenced zone (VRI). Helmond uses this information to modify the duration of green lights based on the presence of a cyclist or group of cyclists.

Alongside the real-time GPS data from the *Schwung* app, the city also integrates historical cycling behaviour data from the *B-riders* programme into its Digital Twin. As of 2025, Helmond is analysing how this combined dataset can offer deeper insights into infrastructure performance and urban design.

In parallel, the city is evaluating FBD supplied directly by bicycle manufacturers, which could provide more accurate geolocation data and further increase the effectiveness and user appeal of the traffic light coordination.

Location	City of Helmond (The Netherlands)	
Organisations involved and responsibilities	Urban Innovation Tem (City of Helmond)	Project coordination
		Technical support traffic lights (Infrastructure Department)
		Recruitment and communication
	Vialis, provider	*Schwung* app
		Data collection (real-time GPS data)
	Argaleo, provider	Digital twin of Helmond
		Data integration
		Data visualization
	B-riders, a bike loyalty and reward system managed by the province of North Brabant.	Data collection
Time frame	As of 2018: Optimisation of traffic lights	
	As of 2025: Helmond is experimenting with bike manufacturer data as an alternative to data sourced from an external app.	
	As of 2025: Urban design and evaluation of infrastructure usage	
	In 2026, Helmond will switch to the *Da's Zo Gefiets* app following the regional tender (see also Overijssel)	
Number of users	Not available	
Intended beneficiaries	Primary	Cyclists (beneficiaries of traffic light adjustments)
	Secondary	Internally, for the mobility department and infrastructure department (traffic lights)
		Technology providers
Status of project	Traffic light use case: continuation phase. Since 2019, the use case has been integrated in the city's everyday operations.	
	Urban design and infrastructure evaluation use case (Digital twin): implementation phase	
	Bike manufacturer data use case: preparation phase	
Problems and Goals	Primary	Promote the use of bikes as a means of transport and validate the policy choices made to achieve this goal.
	Secondary	Optimize traffic light systems with real-time FBD to improve the traffic flow and safety of cyclists.
		Improve the city's urban planning and cycling infrastructure through data-driven insights on infrastructure quality and usage.
		Compare the quality of GPS coordinates between app-based and hardware-based solutions.
Time spent (est.)	Part of a larger strategic initiative; cannot separate the time spent.	
Cost (est.)	Part of a larger strategic initiative; cannot separate the costs.	

Results and key learnings	Using FBD for traffic light management has proven to be a success and is part of the city's daily operations.	
	Challenges with user trust	GPS signals may deflect on building and road surfaces, especially in dense urban areas.
		To counter this, the current implementation of the traffic light use case incorporates a 'GPS signal accuracy estimate'. If this coefficient is too low, a request sent from a cyclist's app is declined by the system.
		When requests get rejected, cyclist tend to be disappointed and lose trust (no priority/green light).
		A hardware-based solution (i.e. bike manufacturer data) or mixed approach may be preferrable to app-sourced georeferenced data for this use case.
	Successful set-up of a framework for the future integration of FBD in the Digital Twin.	
Data needs and requirements (insights)	Data sources	App data (*Schwung*)
		B-riders data (via province)
		Future: bike manufacturer data
	Data types	FBD on routes with geopoints, trips, stops, speeds, O/D matrices... via app
		Note: exact end point (destination) is not available out of privacy concerns, but would be beneficial for parking place optimization
	Data formats	Real-time data: CAM standard
		Historical data: no standard
	Personal data is not used	Ride IDs are not matched to specific users
		Personal data (age, trip motivation...) are a nice-to-have but not a must-have
	Metadata are used	Data period (which period is covered by the data set)
		Data source / collection method
		Type of bike
		Trip motivation

City of Stockholm (Sweden)

The Stockholm use case demonstrates how a creative, well-focused use of FBD can generate meaningful impact even with limited resources. It originated when a member of the Stockholm Chamber of Commerce with a bike-repair business repeatedly heard complaints about missing links in the cycling network. In response to these complaints, the city's Chamber of Commerce funded an FBD project to map these gaps, to propose low-cost "quick fixes," and to encourage policymakers to make cycling more attractive.

Given the exploratory nature of the project, the Chamber of Commerce chose a hands-on, budget-friendly approach with easy and quick-to-implement solutions. It made use of Strava Metro data to study cyclist behaviour in areas lacking dedicated bike lanes. The Chamber identified missing links and proposed tactical urbanism interventions – such as pop-up bike lanes – to address them. The project culminated in a report featuring a distinctive "tube map" of Stockholm's cycling network, a visualisation that that caught the attention of the Stockholm region and gained international interest. While the city did not adopt the temporary pop-up measures, several permanent improvements aligned with the report's recommendations have since been implemented.

Location	City of Stockholm (Sweden)	
Organisations involved and responsibilities	Stockholm Chamber of Commerce, Policy Analyst	Project coordination
		Funding
		Data analysis
		Data visualization
	Strava, provider	Data collection (app)

<table>
<tr><td rowspan="3">Time frame</td><td colspan="2" rowspan="3">March 2023 to June 2023</td><td colspan="2">Data reference period: January – December 2022</td></tr>
<tr><td colspan="2">Data analysis and visualization: March 2023</td></tr>
<tr><td colspan="2">Report: June 2023</td></tr>
<tr><td>Number of users</td><td colspan="2">Unique users: 21,197 over 1-year period (2022)</td><td colspan="2">Unique trips: 616,060</td></tr>
<tr><td rowspan="3">Intended beneficiaries</td><td colspan="2" rowspan="2">Primary</td><td colspan="2">Cycling industry (project initiator)</td></tr>
<tr><td colspan="2">Other industries (transportation and logistics, real estate...)</td></tr>
<tr><td colspan="2">Secondary</td><td colspan="2">Political decision-makers, to affect policy change and initiate infrastructure investments</td></tr>
<tr><td>Status of project</td><td colspan="2">Completed</td><td colspan="2">Follow-up research (to validate the impact of infrastructure on bike use) was planned but not executed</td></tr>
<tr><td rowspan="4">Problem and goals</td><td colspan="2">Low modal share of cycling in commutes (+-6%) compared to similar Nordic cities (such as Copenhagen).</td><td colspan="2">Driven by excellent public transport but also by the high modal share of cars.</td></tr>
<tr><td colspan="2">Existing cycling network suffers from missing links and poor connectivity.</td><td colspan="2">No FBD available to get the granular insights needed to understand them.</td></tr>
<tr><td colspan="2" rowspan="2">Goal: to inspire policy actors to act and support the modal shift by improving the cycling network</td><td colspan="2">By identifying and visualizing missing links.</td></tr>
<tr><td colspan="2">By proposing quick pop-up infrastructure solutions (tactical urbanism).</td></tr>
<tr><td rowspan="2">Time spent (est.)</td><td colspan="2" rowspan="2">Stockholm Chamber of Commerce</td><td colspan="2">Project coordination, data analysis, data visualization, reporting</td></tr>
<tr><td colspan="2">+- 6 weeks (< 0.1 FTE)</td></tr>
<tr><td>Cost (est.)</td><td colspan="4">No direct costs; free access to Strava Metro data</td></tr>
<tr><td rowspan="7">Results and key learnings</td><td colspan="2" rowspan="2">High value for a minimal investment:</td><td colspan="2">Effective use of FBD for a low-budget proof-of-concept.</td></tr>
<tr><td colspan="2">Successful identification of gaps in cycling network</td></tr>
<tr><td colspan="2" rowspan="3">Strava data were useful for initial insights, but are too limited for deeper analysis:</td><td colspan="2">Inherent bias in the sample (recreational focus) affects the representativeness and quality of the data</td></tr>
<tr><td colspan="2">Limited granularity</td></tr>
<tr><td colspan="2">Tip: combine Strava data with data from other sources for validation</td></tr>
<tr><td colspan="2">Smart visual storytelling helps generate impact</td><td colspan="2">The "tube map" visualization of the Stockholm cycling network was picked up by regional policy makers and generated significant international interest.</td></tr>
<tr><td colspan="4">While direct impact is unclear, the city has made infrastructure changes that align with recommendations from the report.</td></tr>
<tr><td rowspan="8">Data needs and requirements (insights)</td><td>Data sources</td><td colspan="3">Strava Metro (availability and geographic coverage)</td></tr>
<tr><td rowspan="2">Data types</td><td colspan="2">FBD such as GPS coordinates, trips and route patterns...</td><td>Granularity: data available per 10-meter road segment</td></tr>
<tr><td colspan="2">Accident data were desired but not available</td><td>Would have improved the analysis by matching incidents to missing links in the network.</td></tr>
<tr><td rowspan="2">Data formats</td><td colspan="3">No raw data (limited by Strava's T&C)</td></tr>
<tr><td colspan="3">.csv and shapefiles</td></tr>
<tr><td rowspan="2">Limited personal data was used</td><td colspan="3">Age brackets (18-34, 35-54, 55-64, 65+), no data for users <18 available due to privacy concerns</td></tr>
<tr><td colspan="3">Gender data desired but not available from Strava</td></tr>
<tr><td>Metadata</td><td colspan="3">Type of bike is available but was not relevant</td></tr>
</table>

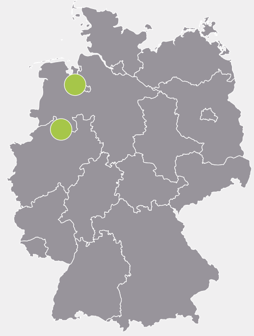
Province of Overijssel (the Netherlands)

In 2024, the province of Overijssel coordinated a joint tender with four other Dutch provinces. Building on their shared FBD experience, they wanted to procure a scalable solution that would reduce the cost per user for municipalities, cities, and regions across the Netherlands. In addition, another seven Dutch provinces have since signed declarations of intent that will allow them to join the project at a later point according to the same conditions.

The tender sought an app-based system that could both collect diverse types of FBD and actively encourage cycling as part of a broader strategy to promote sustainable mobility and support a national shift toward cycling.

In March 2025, the contract was awarded to Mobidot and its Da's Zo Gefietst app, which enables users to join challenges, earn points for rides, and redeem them for rewards or charitable donations. Several public actors are now transitioning to the app as it rolls out nationwide with the aim of creating a smoother, cross-regional user experience and more harmonized data collection across public sector actors.

Location	Province of Overijssel (the Netherlands)	
Organisations involved and responsibilities	Province of Overijssel	Lead contracting authority
	Provinces of Utrecht, South Holland and North Brabant	Co-authors of joint tender
	Mobidot, awarded provider	*Da's Zo Gefietst* app
		Data collection
Time frame	Joint tender: 2024-2025	3-year contract awarded to Mobidot (2025-2028)
		Extendable per year, for a maximum of 7 years (2035)
Number of users	Roll-out in progress, see use case Mobidot.	
Intended beneficiaries	Primary	Policy advisors
		Local municipalities: will get access to insights via dashboard
	Secondary	Cyclists (users)
		Traffic agencies
Status of project	Demonstration phase	Roll-out and data collection since June 2025
Problem and goals	Support modal shift	Fragmentation of FBD across (municipal) borders
		High cost-per-user for most FBD solutions
		No standardisation or harmonisation between sources of FBD, which hinders comparisons
Time spent (est.)	0.4 FTE per province (one year) to prepare the tender	
Cost (est.)	Joint tender translated into purchasing agreement worth €250-300k per year for Mobidot.	
Results and key learnings	Process	Drawing up a joint tender is very labour-intensive due to the need for internal alignment between the partners.
		Involve key departments (legal, IT) early to integrate their input into the tender requirements.
		Define clear standards for data (e.g., definitions) upfront.
	Collaborative tendering improves knowledge sharing and cost efficiency.	Stronger negotiation power translates into a significantly lower cost per user.
		Knowledge sharing leads to a better definition of requirements.
Data needs and requirements (insights)	Data ownership is shared between provinces.	
	Personal data are collected based on consent	Privacy-sensitive information is either anonymized or aggregated.
		A DPI (Data Protection Impact) and BI (Business Impact) assessment is required.
	No raw data access; only processed (aggregated) data.	



InfraSense (Provider, Germany)

InfraSense was established in 2021 as part of a three-year nationally funded project, building on the earlier EcoSense initiative (2019). Its goal was to improve cycling infrastructure by combining FBD from 250 sensor boxes – distributed to volunteers in Oldenburg and Osnabrück – with data from a mobile app. Objective metrics such as surface vibrations and waiting times at intersections were complemented by participants' subjective ratings, creating a holistic view of infrastructure performance.

All insights can be accessed through the BIQEmonitor platform, where users can also track their personal ride metrics. The project is now available as a commercial solution for municipalities in Germany and abroad. It supports cities and municipalities in prioritising investments where they matter most.

Location	Oldenburg and Osnabrück (Germany)	
Organisations involved and responsibilities	Worldiety	Project coordination
		Software development
		Data management
	CoSynt	Sensor box
		Software-hardware integration
	University of Oldenburg	Data analytics and external data integration
	MeinDienstRad.de	Recruitment of participants
	Planungsbüro VIA	Data interpretation and policy advice
Time frame	2021-2024	
Number of users	250 participants per city (sensor box)	
Intended beneficiaries	Primary	Political decision-makers (focus on investment prioritization)
	Secondary	Infrastructure operators
		Cyclists (via BIQEmonitor insights)
		Research institutions
Status of project	Completed	InfraSense is now available as a commercial solution for public sector actors
Context and goals	Lack of dynamic, usage-based cycling data for infrastructure in Germany	Static data lack granularity, they cannot be used for infrastructure planning
	Collect and visualize objective quality metrics to help guide infrastructure investments.	
Time spent (est.)	4.8 to 6.8 FTE annually to develop the solution	Worldiety: 1.8 FTE
		VIA: 1-2 FTE
		University: 1 FTE
		CoSynth: 0.5-1 FTE
		MeinDienstRad.de: 0.5-1 FTE
Cost (est.)	€ 1.6 million (75% funded)	
	Pricing	Est. € 20,000 for field test and data collection for a small city (+/- 150k inhabitants).
		Additional budget required for recruitment and analysis services.
Results and key learnings	Cost-benefit result of the project considered positive because:	Access to data and insights that are otherwise unavailable (e.g. time loss)
		High investment but a scalable solution that can be deployed in other cities and municipalities.
	Key learnings	Recruitment is major bottleneck
		Build on existing apps to gain efficiency and avoid fragmentation for users
		Focus on cities with high data literacy
		Need for higher data quality standards for FBD

Data needs and requirements (insights)	Data sources	Sensor box
		App data, including participant ratings
		External data (e.g. weather, accident reports...), integrated by University of Oldenburg
	Data types	FBD such as GPS positional data, accelerometer data, vibrations, waiting times...
	Data formats	Aggregated data
		Real-time data were available but not used (not relevant for the use case)
		Dashboard via BIQEmonitor platform
	Personal data available, based on consent	Contact details (name, address): for recruitment and sample distribution
		Origin-destination data available (anonymized by trimming 100m from the locations)
	Metadata	Available; required for integration of datasets
	Data quality	Sample size is the main bottleneck due to recruitment issues
		Location accuracy of GPS signals is not always sufficiently accurate to determine if people are using bike lanes or parallel car roads.

Mobidot (Provider, the Netherlands)

Mobidot is a Dutch mobility data and service provider specialising in multimodal and intermodal mobility insights. Since its founding in 2013, it has pioneered app-based solutions that promote sustainable travel behaviour – particularly cycling – through gamification and reward systems. Users earn points for their rides, which can be redeemed for prizes or charitable donations.

By combining smartphone-based tracking with advanced data modelling, Mobidot provides high-quality data that connects day-to-day mobility patterns with actionable policy insights. In addition and to address concerns about representativeness, Mobidot regularly benchmarks its modal-use data against a national panel in which participants manually track and report their transport modes through a digital diary.

Mobidot is now a trusted partner for public authorities and corporate mobility actors across the Netherlands. In 2025, the centrally procured national cycling app Da's Zo Gefietst began rolling out, consolidating regional initiatives into a single scalable platform. The cycling data generated through this app will feed into the government-funded Nationaal Dataportaal Wegverkeer (NDW), giving participating municipalities access to aggregated insights that can be used across a range of policy-driven applications.

Markets	Primary: the Netherlands	
	Secondary: Belgium, UK, Scandinavia, Australia, Canada, Florida (US)	
Customers and partners	Clients	Public authorities (focus: mobility departments)
		Corporate clients (focus: mobility advisors or fleet management)
		Research institutions (international clients, data collection)
	Partners	Communication agencies, for recruitment
		Advisory firms, for detailed analysis and policy advice
Milestones	2009-2012: development of first app as part of a European research project (see Enschede use case)	
	2013: Official foundation (spin-out of Telematica Instituut)	
	2025: awarded the cross-regional joint tender in the Netherlands (*Da's Zo Gefietst* app)	
Number of users:	10,000 active users as of Q4 2025	Continued growth expected as national rollout progresses

<table>
<tr><td rowspan="2">Status of project</td><td rowspan="2">Demonstration phase</td><td colspan="2">National rollout of *Da's Zo Gefietst* app as of June 2025</td></tr>
<tr><td colspan="2">Contract until 2028 (with possibility of extension)</td></tr>
<tr><td>Context and goals</td><td colspan="3">*See Enschede use case for historical background*</td></tr>
<tr><td rowspan="2">Project runtime</td><td colspan="3">Targeted campaigns (e.g., corporate challenges): +/- 1 year</td></tr>
<tr><td colspan="3">General behavioural change projects (e.g., modal shift): > 4 years</td></tr>
<tr><td rowspan="2">Budget</td><td colspan="3">Individual contracts with municipalities: approximately € 100k+ annually</td></tr>
<tr><td colspan="3">Lower cost per user when centrally procured (see joint tender Overijssel use case)</td></tr>
<tr><td rowspan="4">Strategic offering</td><td colspan="3">Insight into mobility behaviour and transportation movements based on granular (FBD) data</td></tr>
<tr><td colspan="3">Optimisation of policy decisions (e.g., infrastructure)</td></tr>
<tr><td colspan="3">Promotion of sustainable mobility via behavioural incentives (gamification)</td></tr>
<tr><td colspan="3">Possible use cases: real-time traffic management, traffic model validation, optimisation of routes or infrastructure usage...</td></tr>
<tr><td rowspan="14">Data offering</td><td rowspan="2">Data sources</td><td colspan="2">Primary: app data (GPS, cell tower, Wi-Fi)</td></tr>
<tr><td colspan="2">Secondary: online behavioural surveys, for local experience sampling or socio-demographic data</td></tr>
<tr><td rowspan="2">Data types</td><td colspan="2">Most types of FBD are available</td></tr>
<tr><td colspan="2">Braking: available but with lower accuracy to conserve battery life.</td></tr>
<tr><td rowspan="3">Data format</td><td colspan="2">Aggregated data</td></tr>
<tr><td colspan="2">Raw data only possible under strict conditions</td></tr>
<tr><td colspan="2">Real-time possible upon request (e.g., for traffic light optimisation)</td></tr>
<tr><td rowspan="2">Personal data are collected, based on consent</td><td colspan="2">Sharing of privacy-sensitive data with client is possible upon request and subject to DPIAs and data processing agreements</td></tr>
<tr><td colspan="2">Automatic tracking or start/stop tracking possible</td></tr>
<tr><td rowspan="5">Metadata</td><td rowspan="3">Mode of transport</td><td>Near-certainty: cycling, walking, running, public transport (train, metro, bus), airplane</td></tr>
<tr><td>High probability: motor, moped, scooter</td></tr>
<tr><td>Low probability: type of bike</td></tr>
<tr><td colspan="2">Success indicators of types of challenges and rewards</td></tr>
<tr><td colspan="2">Many other types possible upon request</td></tr>
</table>

3. How to Use Floating Bike Data

This chapter helps you understand how and when to set up a mobility project driven by FBD. It highlights best practices, clarifies when to use FBD and when not, outlines key considerations regarding data sources, types and formats, and describes the skills and expertise needed to run a successful FBD project.

3.1 Best practices for running a mobility project based on Floating Bike Data

These best practices were distilled from the interviews and highlight insights that applied across multiple projects. Considering them in advance will help you assess the effort and expertise required to successfully implement your own FBD project.

Be clear about the goal and scope of the project

Avoid running a FBD project for the sake of it. Ensure that it is relevant by clearly aligning your research objectives with official policy goals. Otherwise, you risk producing a polished dataset without a mandate, direction, or pathway to translate insights into meaningful action.

One size does not fit all. Cities vary in their cycling maturity, micromobility context, and data availability, and may therefore require different approaches.

- Start by identifying what you want to understand or accomplish.
- Match your needs with the available budget and data.
- Choose the research design and data collection methods that best fit your use case.
- Converge on a use case that is cost-effective in achieving its goals.
- A practical approach is to pilot first and scale later.
- For inspiration on how to start small, see the use cases from Sarajevo or Stockholm.

Many cycling apps designed to promote biking attract people who already love cycling. If the aim is to support a broader modal shift, relying solely on these apps will have limited impact, since their users are already biking and the conversion potential is low.

Thoughtfully consider the runtime of the project

Balance the need for sufficient data with the timeline by weighing both operational and practical factors.

Very short runtimes (<6 months) may not allow enough time for meaningful data collection, while long runtimes (>6 months) risk a declining participant engagement and may require renewed recruitment.

The cutoff for "short/long" is approximately half a year of data collection. Projects using start/stop tracking often notice a significant drop-off in users after the first 6 months. This effect tends to be less pronounced in projects that use automatic tracking.

Another consideration is that longer runtimes can capture seasonal variation, e.g., higher cycling volumes (and more data) in the summer and increased risks in winter. The latter may offer valuable insights for safety-related studies.

The Dublin use case indicated an increase of approximately 30% in the amount of collected FBD during the summer versus winter. This insight was confirmed by Strava data. On the other hand, for some FBD providers, winter may have a practical advantage. An example is See.Sense, which relies on smart bike lights to harvest data: darker conditions increase the likelihood that cyclists use their lights, resulting in more consistent data collection.

Set up a strong project management and user support

FBD projects often underestimate the effort required for participant outreach and ongoing support, especially when hardware distribution is involved. Ensure that the project is properly resourced for coordination, communication, and follow-up. Ideally, treat the initiative as a standalone project with a dedicated project manager and clearly defined roles and responsibilities.

Prepare to answer questions and provide support, particularly in projects involving hardware distribution (e.g., sensors). When providing support, it is essential to provide a single point of contact (a helpdesk) for user questions, handled either by the public authority or the providers, and to ensure that all support is available in the local language(s).

Keep in mind that international providers may not be able to provide support in your local language. If so, you as a public actor may want to take on this role. Plan and budget accordingly.

Sound communication, recruitment and user engagement is key

Recruiting enough participants to form a representative, evenly distributed sample, is often more challenging than anticipated (see also 4.1 Key considerations for selecting a data provider).

Therefore, use existing communication channels to reach your target audience. Go find them where they already are: employers, cycling organisations, advocacy groups, and signage along popular routes (e.g., QR codes) can all support targeted recruitment.

At the same time, be mindful of the risk of bias: Recruiting participants through a partner may overrepresent certain groups of people or types of trips. Employer-based recruitment, for example, may lead to an overrepresentation of the number of employed people or people over 21 years old, or of certain types of trips (i.e., commutes).

Outsourcing recruitment to the data provider is another common way to reduce the workload of participant recruitment and helps reduce uncertainty around project management. However, relying on a third party means having less control over the sample and user base, which may be detrimental in the long term (see user ownership).

Keep your participants engaged

Drop-out is a major risk in longer-running data collection projects. Users may lose motivation over time, especially when the data collection requires manual effort (e.g., start-stop tracking).

- Send periodic reminders. Regular updates help users stay informed, feel involved, and remain motivated.
- Provide continuous incentives to help maintain day-to-day engagement, e.g., a points system that rewards active participation.
- Use one-time incentives to create a strong motivational boost (e.g., a physical reward). These are most effective when provided at the end of the project.
- Leverage intrinsic motivation: Beyond tangible rewards, consider which immaterial benefits the participants gain. Motivators, such as contributing to improved safety, better infrastructure, or stronger cycling visibility, can help sustain their engagement even without direct incentives.

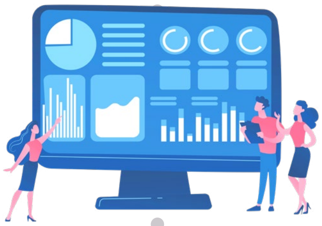
Tip: If your goal is to encourage a modal shift, focus on the number of rides rather than the distance covered to promote everyday cycling.

Tip: Several use cases show that donations to a charity or good cause are a popular incentive. When participants can choose between a personal reward and donating their reward, many opt for the charitable contribution.

Know who owns the user data

When selecting a recruitment partner, pay close attention to who controls the user database. To avoid long-term dependency or vendor lock-in, ensure your organisation retains ownership of the user accounts. Otherwise, switching apps or providers may mean losing access to your users and having to rebuild the database and your community from scratch, an effort that is both costly and time-consuming.

Public sector organisations often operate under strict requirements for privacy, data governance, and GDPR. Taking on data ownership in an FBD use case may therefore require substantial coordination with internal legal teams, which can slow down the project. If timelines are tight and owning the data is not critical, consider models where the ownership of the (processed) data remains external, e.g., with the FBD provider.



Technical glitches may undermine the trust of users

Technical issues during the implementation may quickly erode the user trust and reduce both the quality and quantity of the collected data. If the solution does not function as expected, users may become frustrated and drop out, whether the project relies on an app-based system or dedicated hardware.

This risk can be reduced by offering a local-language helpdesk, partnering with providers that have a proven solution and by formulating clear expectations concerning the provider's technical mobility roadmap.

3.2 When to use Floating Bike Data and when not

The use cases described in this Playbook have often relied on trial and error to learn and understand where FBD can add value and where they fall short. Drawing on the interviews, this section lists the insights on when (and when not) to use FBD.

In summary, FBD are especially valuable when localized information is needed to explore or validate assumptions about cyclist behaviour, such as infrastructure use or route choices. However, when the goal is to describe broad trends or to produce statistically robust insights, FBD should best be paired with other data sources.

On their own, FBD are useful but often insufficient for confident decision-making. Issues of representativeness and other limitations make it essential to pair them with additional datasets or research methods before informing major policy choices. Their greatest strength lies in exploration and identifying areas that merit deeper investigation, rather than serving as a standalone basis for action.

Advantages of FBD

FBD are particularly valuable at two key moments in the lifecycle of a data-driven project: at the outset, when problems and priorities are being identified, and at the end, when proposed measures need to be validated or evaluated. In both phases, FBD help ground decisions in observed behaviour rather than assumptions.

One of the main strengths of FBD lies in hypothesis testing. By comparing baseline measurements with follow-up data, cities can assess scenarios and better validate whether an intervention can deliver the expected benefits, for example when evaluating new cycling infrastructure or major traffic measures. In this way, FBD can help reduce uncertainty and support more informed investment decisions.

In some cases, for example in the context of infrastructure interventions that require substantial investment, FBD can be combined with tactical urbanism approaches as an additional risk-mitigation strategy. Temporary, low-cost interventions such as pop-up bike lanes or interim intersection redesigns can be implemented to test ideas in real-world conditions, with FBD providing quantitative insights into their effects. Experiences such as those suggested by Stockholm illustrate how this combination could help test the effect and potential of an infrastructure change before committing to permanent investments.

FBD also excel in exploration and discovery. They can reveal how cyclists *actually move* through the network, including alternative routes that differ from official or expected paths. This makes it possible to identify bottlenecks, unsafe locations, or missing links, and to highlight areas where more detailed investigation or complementary data collection is needed. In this way, FBD often serve as a starting point for deeper analysis rather than a final answer in themselves.

Because FBD are context-specific, they are particularly well-suited to tackle local questions and use cases. Their flexibility makes them useful for analysing behaviour at specific locations, along individual corridors, or within defined user groups.

Finally, FBD can unlock insights that are difficult or costly to obtain through traditional methods, providing access to real-world cycling behaviour at scale and supporting more evidence-based, responsive planning and decision-making.

The limitations of Floating Bike Data

Limited coverage and representativeness

FBD are often highly localized and specialised, which has advantages but also results in relatively small datasets covering only limited user groups. Take recreational cyclists tracked through Strava or participants in short, project-specific tracking campaigns. As an example, one day 1.000 cyclists may pass a point, of which 20 have the project app installed;

next day 300 can pass, of which 25 have the app installed. Situations like these may rightfully raise concerns about the representativeness of the data for the whole population of cyclists. Therefore, FBD are generally less suited for monitoring high-level trends that require statistically significant results.

However, representativeness is not equally important for all use cases. The interviewees for the projects listed in this Playbook pointed to three examples: Representativeness matters less when the focus is on safety, as even a small number of observations can reveal critical risks. It also matters less when cycling maturity is low and bikes make up only a small share of trips, or when the goal is exploratory rather than obtaining a statistically robust analysis.

Collecting FBD can be expensive

For individual cities or municipalities, the cost per user of collecting FBD can be relatively high. Actual costs depend on many factors, but as a rough indication consider that smaller or self-managed projects can often be delivered for under €50,000; small-to-medium projects typically range between €50,000 and €100,000; and more ambitious initiatives, such as those covering larger cities or requiring higher levels of detail, may exceed €100,000.

Several strategies, however, may help reduce that cost: joint procurement with other public actors (as in Overijssel), partnering with civil society to support data collection (as in Sarajevo), relying on existing FBD sources such as Strava or Komoot (while accounting for sample bias), or embedding FBD within a broader policy initiative such as promoting a modal shift. Additionally, and for specific cases, more traditional data-collection methods such as surveys may nevertheless be cheaper, faster, and equally effective (see Province of Antwerp case).

Lack of information on users

For privacy reasons, many apps record rides but not the identity of the users, making it impossible to link trips to individual users. This results in a limited insight into how rides are distributed across participants. One of the consequences is the difficulty to detect whether a small group of power users is disproportionately shaping the dataset.

This was a bias observed in the Province of Antwerp case where user-level data was available. Just 10 users, representing 4% of the total, generated 50% of all recorded rides!

Lack of information on the user's intent

FBD, like other objective data sources, cannot reveal the motivation or intent behind a ride. This would require manual input from users, which is often considered too intrusive and demanding. Consequently, distinguishing between recreational and commute trips is difficult. Inferences can be made using timestamps, speed or other proxies, but these remain mostly estimates rather than certainties.

Lack of accurate information on mode of transport

While some theoretical FBD use cases may rely on the identification of the mode of transport to reach their goals, many FBD sources in practice do not yet reliably capture the type of bike (regular, cargo, e-bike, e-scooter) or even the base mode of transport. App-based data often rely on algorithmic inference, which is never fully accurate despite best efforts. Sensor-based solutions may be more accurate, especially when they are linked to a specific means of transport. Take this into account and find the right supplier when implementing a use case that requires multi-modal insights.

FBD variability limits their use for modelling

FBD are not well-suited for building transport models or simulations. The main reason is that they are not always representative. In addition, cycling behaviour is highly variable and influenced by numerous external factors such as weather conditions and the availability of public transport. Combined with the inherently flexible nature of cycling which allows for improvisation and alternative route choices far more than car travel, this variability makes it difficult to develop accurate predictive models based solely on FBD. Instead, FBD might be considered as a resource for validating or challenging existing transport models, as demonstrated in the Copenhagen use case.

A few more considerations

FBD cross administrative boundaries, as cyclists often travel through multiple cities, municipalities, or regions. For maximum benefits – lower costs for public authorities, improved infrastructure for cyclists, and societal gains such as a modal shift – FBD procurement and management are best handled at a national, regional, or provincial level. Where such a central management is not feasible, larger cities should preferably share their data with the surrounding municipalities to improve coordination and impact.

Improving awareness and ease of use is essential for a wider adoption of FBD, which remains a relatively new and unfamiliar data source for many stakeholders. To support meaningful integration into policymaking, FBD must become more accessible and appealing to non-experts. This requires two parallel efforts:

- A stronger standardisation to improve the data quality (see 1.2 Current challenges in working with Floating Bike Data).
- A greater focus by both data providers and users on smart, visual storytelling. Creative representations such as Stockholm's "cycling tube map" show how intuitive visual design can make insights more engaging and actionable, reaching policymakers and cyclists in ways that raw data alone cannot.

FBD are but one tool among many. Before investing in a pilot using FBD, therefore, assess whether it genuinely adds value to your use case or whether more traditional methods, such as surveys, might be faster, more cost-effective, and equally suitable.

Whatever data source you choose it is essential to understand its limitations, as recognising constraints is key to sound decision-making. The next section will examine in detail how specific FBD sources, data types, and formats can or cannot meet particular use case needs.

3.3 Data sources, types and formats

This section describes the FBD approaches that were used most frequently across the use cases examined in our research. By exploring their strengths, limitations, and typical applications, this section aims to help readers navigate the landscape of FBD options and identify what may work best for their own context.

For a better understanding of the tables and the options they list, here is a short definition of the key concepts that are used:

Data sources refer to where and how data is collected – for example, through apps, sensors, devices, or third-party providers. Knowing the origin of the data is essential for assessing its reliability, coverage, and suitability for different use cases.

Data types describe the specific information that is captured, such as GPS points, speed, braking events, or user characteristics. The value of each data type depends on the questions you want to answer, and the level of detail required.

Data formats and access methods relate to how the data is delivered and visualised, including file structures, dashboards, and APIs. These choices influence how easily the data can be analysed, combined with other datasets, or integrated into existing tools and workflows.

Data sources

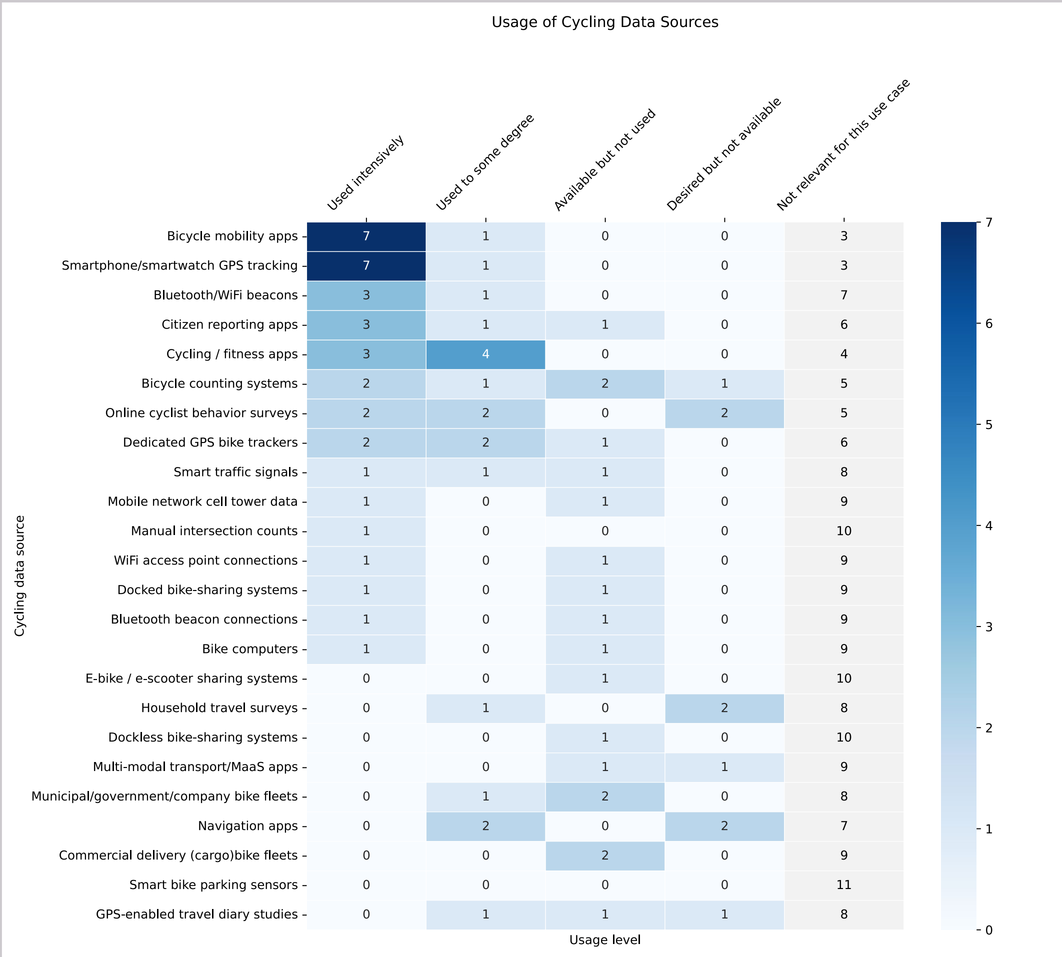


Figure 1: Popularity of various cycling data sources for FBD use cases

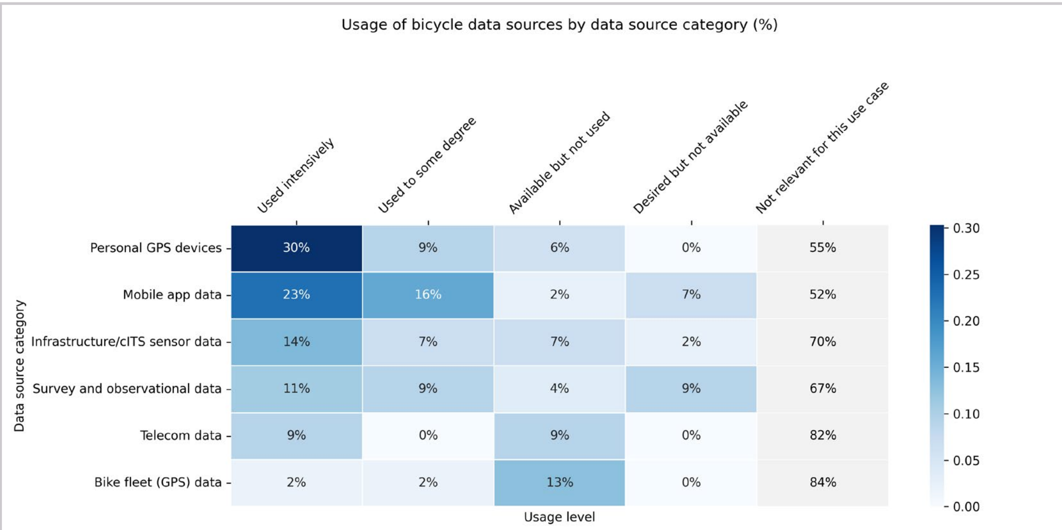


Figure 2: Popularity of various categories of cycling data sources for FBD use cases

Mobile app data and personal GPS devices are the most intensively used data sources in our FBD use cases. They reflect the broader shift toward user-generated and sensor-based data in mobility analysis. Infrastructure and ITS sensor data, as well as survey or observational data are also used but play a more complementary role. Telecom data and bike-fleet GPS data were rarely used in the surveyed use cases and are often considered irrelevant by the interviewees. This is likely due to limited accessibility, privacy constraints, or their weak integration into existing analytical workflows.

Other projects and reports confirm the shift towards using more mobile and GPS-based data, which offer a high spatial and temporal resolution and are relatively easy to collect at scale. Crowdsourced sources, such as fitness apps like Strava or platforms like the Bike Data Project, are increasingly used to fill gaps left by traditional monitoring methods, providing richer insights into cycling patterns and behaviours.

Consider, however, that mobile and GPS data can be biased toward specific user groups (e.g., recreational cyclists). In addition, privacy regulations such as GDPR continue to constrain the sharing and usability of telecom and fleet data.

Although infrastructure sensors and manual surveys remain valuable for validation and calibration, their spatial coverage is limited. Therefore, the integration of multiple data sources – combining traditional, sensor-based, and digital streams – is increasingly recommended to enhance the accuracy and representativeness and to support more robust policy and planning decisions.

Zooming in on the two most popular data sources – apps and sensors – here are the strengths and weaknesses of both. Next are some strengths and weaknesses of adapting an existing solution or implementing a custom one.

Comparison: the pros and cons of apps and sensor data

Data source	Pros	Cons
App-based	Easy to install and distribute	"Yet another app"; users need a strong reason to install new apps
		Lower accuracy in identifying mode of transport (e.g., bike vs. scooter)
	Suitable for tracking multimodal movements (unlike hardware tied to one mode)	Spatial resolution for GPS signals may be insufficient for (real-time) georeferencing (e.g., for traffic light optimization)
Hardware-based (on-bike sensor)	High confidence in detection of mode of transport	More initial effort for users (installation)
	Integrated solutions may offer additional incentives (e.g., sensor in bike light or anti-theft device offer increased safety)	More pathways for technical issues, so may require extra technical support
		Often a higher cost per user due to cost of the hardware

Comparison: the pros and cons of an existing solution vs. a custom solution

Data source solution	Pros	Cons
Off-the-shelf solution (data source)	Faster implementation and rollout	Limited flexibility and customization
	Proven software/hardware stack ensuring stability	
	Access to additional external technical expertise	Dependency on vendor's technical roadmap (may not align with your timeline)
	Avoids fragmentation of user base (see: "yet another app")	Potential constraints on feature development
Custom solution (data source)	Fully tailored to specific project needs	Longer development time
	Greater flexibility and customization	
	Full control over technical roadmap and timelines	Higher initial cost

Data types

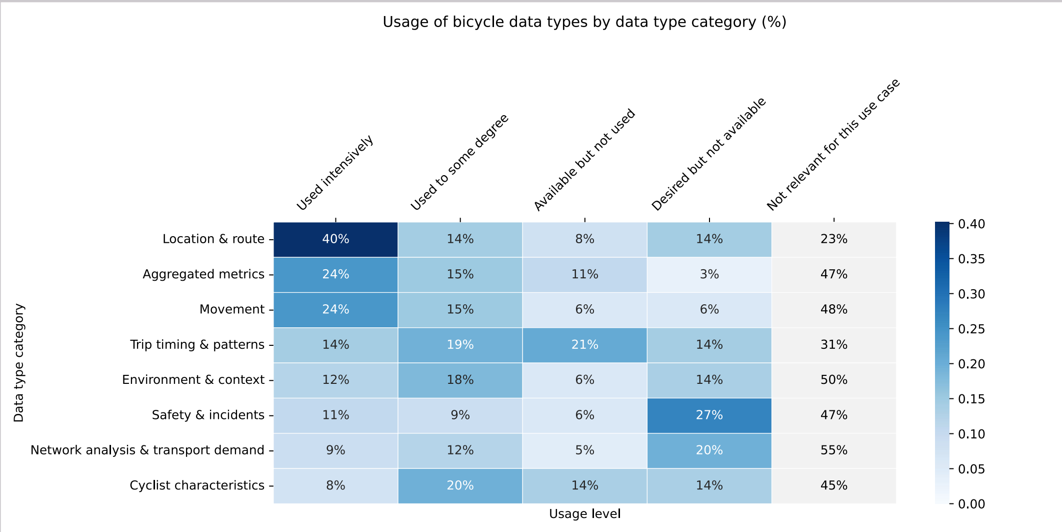


Figure 3: Use of various data types for the FBD use cases, in percentages

The value of any dataset depends on the specific goals and needs of the use case; what is helpful in one project may not be relevant in another. Still, our review of FBD projects shows clear patterns in which data types are most commonly used.

Location and route data, together with aggregated metrics and general movement data, are used most often. This indicates a strong need to understand where people cycle, how they move through the network, and how these patterns can be summarised for reporting and planning.

More specialised data types – such as network analysis results, safety or incident data, and information about cyclist characteristics – are used much less frequently or are often considered to be not so relevant. This suggests that while most projects rely on basic movement data, deeper analytical or demographic insights are either harder to obtain or simply not prioritised.

Overall, the current practice focuses on broad, practical data rather than on niche or highly detailed information.

Data formats

The way FBD are processed and presented strongly influences their usefulness for policymaking, research, and operational planning. Raw data offer the greatest level of detail, but require significant technical skills and resources to clean, validate, and interpret. Aggregated data, by contrast, are far easier to use and provide built-in privacy protection, though this comes at the cost of detail. Cleaned or validated datasets sit in between: they improve accuracy and reduce noise but still require additional effort before they can produce actionable insights.

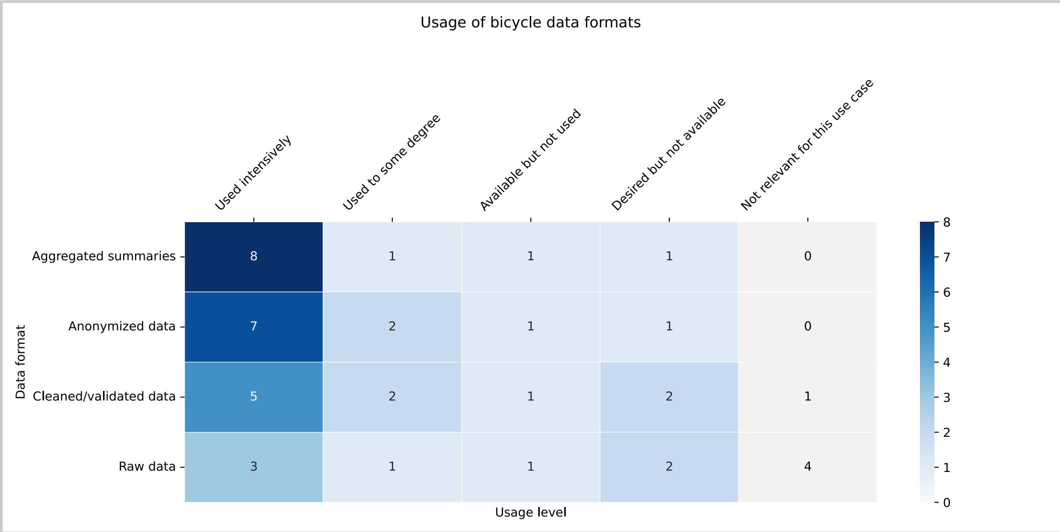


Figure 4: Data formats used in the FBD use cases

As our table shows, public authorities overwhelmingly prefer aggregated data over raw or even cleaned datasets. Interviewees pointed to limited staff capacity and lacking in-house expertise as the main reasons for avoiding unprocessed data (see Required data skills and expertise). Some indicated they would like access to raw or cleaned data but were restricted by data-sharing agreements with providers. This highlights an important consideration for future projects: authorities that need more granular insights should evaluate not only whether raw data are available but also whether they have the capacity and expertise to process them effectively.

Comparison: the pros and cons of raw data vs. (pre-)processed data

Data format	Pros	Cons
Raw data	Highest granularity and detail, essential for projects or models requiring precision	Require additional transformations to be ready-to-use
	Enable (longitudinal) comparisons	
	Reduced risk of long-term vendor lock-in	Often contain identifiable personal data, making it subject to strict regulations (e.g., GDPR)
Aggregated (processed) data	Easier to use	Lower granularity; not tailored to specific needs
	Less sensitive to privacy issues	
	Suited for high-level views and policymaking	Requires open discussion with data provider about quality, assumptions, and limitations

Data access

The survey shows a preference for traditional data-access methods, such as customised reports and scheduled data downloads. Live data feeds and API integrations are rarely used and are frequently considered irrelevant for most FBD applications, indicating that continuous or dynamic data integration is not yet a strategic priority. Web-based dashboards show moderate adoption, reflecting at least some interest in interactive and visual data exploration, but they still lag conventional reporting practices.

Admittedly, the preference for traditional data access is often shaped by practical considerations. Integrating live data streams requires advanced IT systems and interoperability that many municipalities do not yet have in place. Maintaining continuous data flows can also place demands on budgets, staff capacity, and processing resources. In addition, stakeholders may be cautious about relying on raw, real-time information, preferring validated and quality-checked datasets for decision-making. Finally, in many contexts the need for instantaneous insights is limited, as mobility decisions are often based on broader, aggregated trends rather than second-by-second conditions.

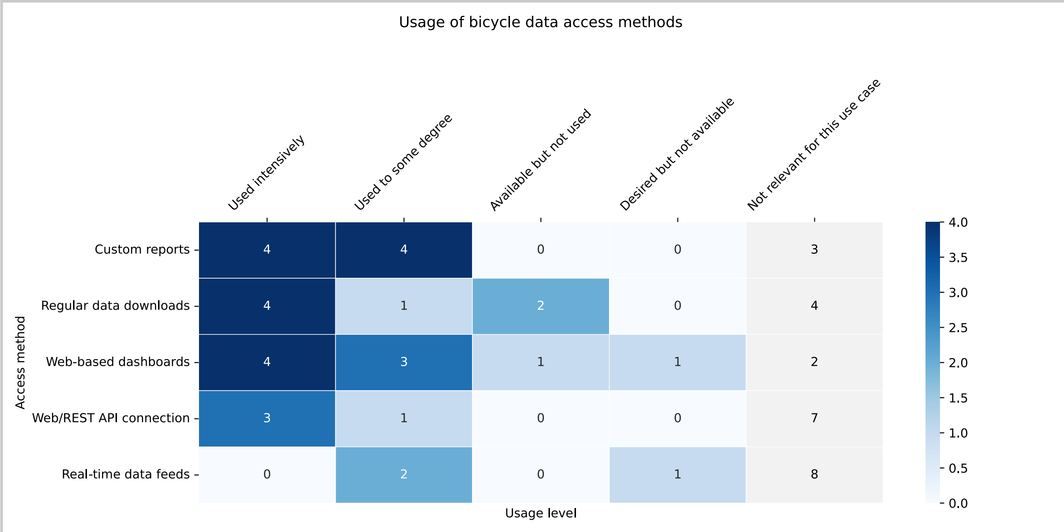


Figure 5 - Data access methods for the FBD use cases

Comparison: the pros and cons of dashboards vs. direct access via API

Data access	Pros	Cons
Dashboard	Ease of use for quick insights without technical setup.	Increased risk of vendor lock-in when the data provider restricts integration with other external data sources.
	Visual representation (charts, summaries) that are easy to interpret.	Standard dashboards often lack deep customization options and may not meet specific requirements.
Direct via API	Flexible integration: can feed data into internal systems	Requires technical and security expertise for integration and maintenance.
	Allows for automation via real-time data flows and integration in your own environment.	Higher resource investment (development, support).

Output formats

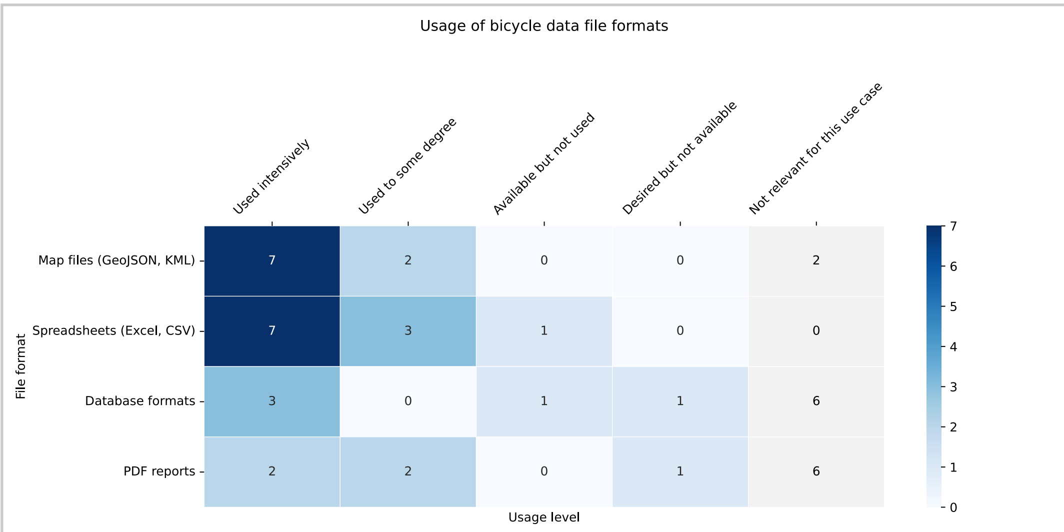


Figure 6: File formats used for bicycle data in our FBD use cases

This use of file formats suggests that users of FBD applications primarily prefer outputs such as GIS map layers and Excel files, which allow them to easily perform further analysis.

In contrast, there is much less demand for fixed formats such as PDF reports or rigid database structures, as these are less flexible and do not support the need to quickly adapt, combine, and explore data for policymaking.

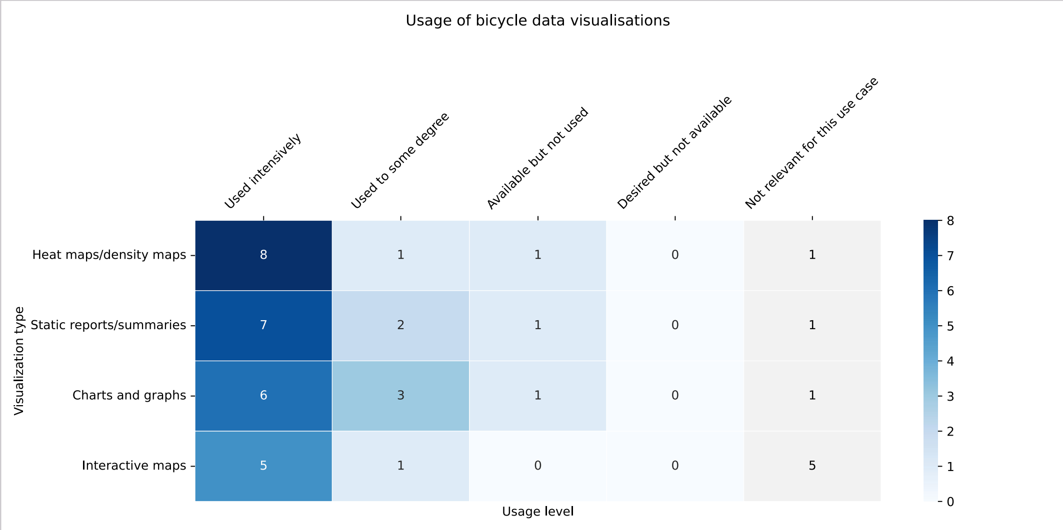


Figure 7: Visualisation techniques used in the FBD use cases

This table shows the adoption of different visualization techniques for FBD datasets. Heat maps and density maps emerge as the most intensively used method, followed by static reports and summaries, and then charts and graphs. It therefore seems like the interviewees prioritise visualisations that provide aggregated spatial insights and straightforward reporting formats, likely because they are effective for identifying usage patterns and supporting decision-making. Interactive maps stand out, with five respondents marking them as “not relevant for this use case.” This may indicate that a large share of use cases has no need for user-driven exploration.

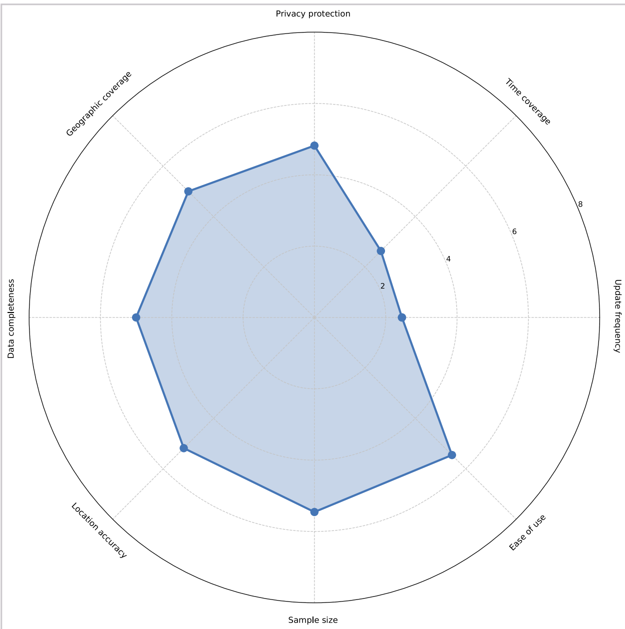


Figure 8 - Importance of eight dimensions of data quality for the FBD use cases

Data quality

The respondents were asked to rank eight data quality dimensions by importance. Privacy protection, data completeness, geographic coverage, location accuracy, ease of use, and sample size were rated as almost equally important, while time coverage and update frequency were consistently ranked as less important.

This pattern reflects a clear preference for data that are trustworthy, representative, easy to work with, and compliant with legal and ethical requirements. In contrast, how far back in time the data go and how often they are sampled is less critical for most FBD use cases, where stable, high-quality datasets are considered more valuable than continuous data streams.

3.4 Required data skills and expertise

Implementing a FBD use case requires a mix of technical, analytical, and organisational skills. This section outlines which tasks may be handled in-house, which can be outsourced, and how to strike an effective balance between the two. Consider that this balance also depends on organisational parameters, including the size of the city, its in-house IT expertise and availability, or its experience with innovative projects.

Data integration and data fusion

Combining multiple datasets is often essential for generating meaningful insights. While basic integration – such as comparing historical datasets – can often be managed in-house, advanced data fusion between different sources is far more challenging. These processes are complex, costly, and highly sensitive to the quality of the data. Low-quality inputs demand extensive cleaning and modelling, for which most municipalities lack the expertise or infrastructure. As a result, public authorities typically outsource these tasks to specialised providers or consultancy agencies.

Data analytics and modelling

Data analytics and modelling are essential for turning (raw) mobility data into actionable insights. Larger public sector organisations often have some in-house capacity through data teams or domain experts such as traffic engineers and GIS specialists. Smaller municipalities, however, typically lack these skills and must rely on external partners.

Both approaches have distinctive advantages. Outsourcing, either to data providers or consultancy agencies, ensures access to advanced expertise, which is particularly valuable when timelines are tight or modelling tasks exceed local capabilities. Building internal expertise, on the other hand, requires significant upfront investments but offers greater control over data handling, interpretation, and categorisation. It becomes more cost-effective over time as the number of use cases grows.

> Local teams are typically more familiar with informal travel patterns, recent infrastructure changes, political sensitivities, and site-specific constraints that strongly influence how results should be read.

One disadvantage of outsourcing is that external parties often lack detailed, on-the-ground knowledge of a city or municipality. This can limit their ability to interpret data with the same nuance and contextual understanding as a public authority.

Alternatively, a hybrid model is also possible: providers supply pre-processed datasets and initial insights, while internal teams perform additional analysis to refine the results and integrate them into policymaking. This approach combines external technical expertise with in-house knowledge of the local context, ensuring both accuracy and relevance.

> Regardless of the model, strengthening the internal data literacy is crucial. Policymakers need to understand how to work with mobility data, interpret outcomes, and make transparent, evidence-based decisions. Training, shared resources, and clear best practices can help bridge the existing capacity gaps and support a more data-driven public sector.

Data visualisation

The need for data visualisation varies significantly with the scale of the organisations and projects. Smaller municipalities often prefer provider-supplied dashboards, which offer dynamic and user-friendly interfaces without requiring technical expertise. These tools are more flexible than static reports but still limited compared to direct access to raw data. Larger entities, by contrast, often seek full access to the underlying datasets, enabling them to create custom visualisations and derive deeper insights tailored to their policy needs (see also Output formats).

Other relevant skills

Beyond the technical capacity to fuse, analyse, and visualise data, the success of any data-driven initiative ultimately depends on formulating the right question – a two-stage process that combines strategic insight with technical precision.

1. Define the research question. Formulating a meaningful research question requires deep domain knowledge and a tight alignment with policy and strategic objectives. Therefore, this responsibility lies primarily with the public-sector authority. When the necessary expertise is not available internally, involving a third-party policy advisory agency may help ensure that the question reflects both the strategic priorities and operational realities.

2. Translate the question into a data query. Once defined, the research question must be translated into a precise query that informs the data selection and analysis. This step demands technical expertise and a thorough understanding of the dataset structure, limitations, and coverage. Data providers are often best positioned to perform this translation due to their familiarity with the data. Alternatively, an in-house analytics team or an external specialist can undertake this role, provided they have sufficient technical competence and access to the data catalogue.

Engage internal domain experts – such as traffic engineers, mobility planners, and policy advisors – to define robust research questions. Collaborate with internal analysts or external specialists to translate these into precise, technically feasible data queries, ensuring that the resulting analyses remain both relevant and actionable.

4. How to collect and acquire Floating Bike Data

Reliable FBD are the foundation of any data-driven cycling initiative. Public authorities can obtain these data through various channels, but in most cases, they must either be purchased as an existing dataset or commissioned as a data-collection effort. In both scenarios, selecting the right provider is essential to ensure the data quality, relevance, and compliance.

This section outlines key criteria for choosing an appropriate provider and provides a concise overview of FBD providers across Europe. It also presents best practices for tendering, offering guidance on how public authorities may design efficient and effective procurement processes.

4.1 Key considerations for selecting a data provider

Scope and budget

First, determine the scope of the project. Decide whether a complete, customised solution is needed, or rather a one-time dataset, as this choice has major budget implications. If a long-term partnership with frequent transactions is expected, higher upfront investments may be worthwhile, e.g., in user recruitment or in a tailored configuration. For short-term pilots or proof-of-concept projects, a leaner approach is usually sufficient.

Next, assess the user requirements as the number of participants directly affects both the data quality and its costs. More users generally provide a better coverage and representativeness, but many providers use pricing models that scale with the number of users. In addition, the recruitment and incentivisation of users can be resource intensive (See Best practices for running a mobility project based on Floating Bike Data). Consider, therefore, whether full representativeness is truly necessary for the use case. In many situations, a smaller but strategically selected user group can provide useful insights without inflating costs.

Finally, evaluate the ease of data collection. Off-the-shelf datasets from platforms such as Strava or Komoot are often readily accessible and sometimes free for public authorities. However, they largely capture recreational cyclists and therefore may not always match the research needs, e.g., for commuting-focused policy needs. While they can support initial exploration or proof-of-concept work (as in the Stockholm case study), many projects will require a more localised, purpose-built data collection. As one interviewee aptly commented:

"Strava is for data on Lycra-dressed men with shaven legs"

Ideally, the data solution will cover all key user segments consistently so that the dataset can reasonably reflect the wider target population. While needs vary by context, the interviewees suggested that a penetration rate above 2% can provide a meaningful basis for analysis. In cities with a large cycling population, rates closer to 5% are often considered ideal for producing robust, representative insights.

Representativeness of the data

Obtaining FBD that are representative for a given population is often a challenge. Still, it is essential if the data are to be used as a basis for policy decisions. Without adequate coverage of all target user segments, the insights derived from the data risk being incomplete or biased, and therefore of limited value for decision-making. It is thus essential to understand how a solution covers the target population, and how that may influence or limit your analysis.

Required resolution of the data

FBD are characterised by their spatial and temporal resolution. The spatial resolution refers to the precision of location data (e.g., GPS accuracy), while the temporal resolution concerns the frequency with which data points are recorded.

Sourcing data with the right resolution is crucial for the success of a FBD project. Projects focused on operational control may require (near) real-time GPS data with high temporal and spatial accuracy. An example is optimising the operation of traffic lights as in Helmond. In contrast, use cases focused on long-term planning or strategic analysis can often rely on lower-resolution data without compromising the overall outcome.

Not all providers can deliver high-resolution data, and when they do, it often comes at a significant cost. Collecting precise data is technically demanding and may require extensive post-processing, further driving up expenses. It is therefore essential to balance the technical requirements of the project with the budget constraints and added complexity of handling high-resolution data.

Data governance: ownership and access

Public authorities must often comply with strict requirements on data ownership, privacy, and regulations such as GDPR. Before looking to collect or purchase FBD, therefore, consult your legal, IT, and data protection teams to clarify your obligations and to ensure compliance between those and your data provider's terms and conditions.

Data ownership preferences vary considerably. Some authorities want full ownership to maintain control and avoid vendor lock-in, while others prefer data providers to retain ownership to reduce liability and to simplify privacy management.

Closely linked to ownership is data access. Authorities should determine whether they prefer the granular insights made possible through direct access over the ease-of-use provided by a dashboard-based solution. Each approach has its advantages and limitations (see also: Data access), with different implications for project execution and long-term data reuse.

Ultimately, choosing a provider whose contractual terms and data policies meet your data governance strategy is essential. Strong data processing agreements, and where necessary, a Data Protection Impact Assessment, help define retention periods, access rights, and the handling of personal data. These measures mitigate risk, support compliance, and enable public authorities to maximise the value of their data investments.

Data collection method

Critically assess both the purpose and the technical design of the data collection method, as it may shape the quality and usability of the data. A technically convenient method may still fail if it cannot meet the privacy requirements or if its level of detail does not match the analytical needs. Making informed choices will ultimately determine whether the investment produces actionable insights or becomes an expensive missed opportunity.

One technical choice to consider is the tracking approach. Automatic tracking, where the user doesn't have to initiate the tracking, captures more data and requires little user effort, but it may raise privacy concerns. On the other hand, tracking that is started and stopped explicitly by the user ensures consent and is less privacy-sensitive, but it depends on manual interventions and is therefore more prone to user error and drop-out.

Alignment of solution goals and use case goals

When selecting a solution to collect cycling data, look beyond the claims of the provider and assess whether the data collection method truly supports your objectives.

Many cycling apps, for instance, are designed to promote cycling rather than to evaluate the quality of the infrastructure or to inform a safety analysis. Relying on such data for infrastructure or safety-related use cases may lead to biased insights and suboptimal decisions.

4.2 Potential Floating Bike Data providers

Once it is clear what to require and expect from providers, the next step is to reach out to a selection of potential providers to explore the opportunity for collaboration. Doing this early on will help validate assumptions, clarify technical capabilities, and determine whether a provider's approach aligns with the project goals.

Here is an overview of potential FBD providers. It builds on the comprehensive market study conducted by the Copenhagen Solutions Lab (see the Copenhagen case) and is further refined with insights from the research for this Playbook. Unlike Copenhagen's broader inventory that also included data processors and consultancy firms, this overview focuses exclusively on solutions that generate and collect FBD, whether through hardware, app-based systems, or a combination of both.

This list is intended for inspiration rather than as an exhaustive catalogue. The FBD market is young and rapidly evolving, with both supply and demand developing quickly. As a best practice, it is therefore strongly recommended to conduct a scan of the local market and identify emerging or local providers.

Name	Type	Comment
Geo Velo	App	Automatic or manual tracking of rides and route planner
Pin Bike	Combination	Hardware on-bike sensor kit and app for tracking and gamification
See.Sense	Combination	Smart bike lights with embedded sensors and companion app
Love to Ride	App	Automatic ride logging with comfort and safety rating options to improve infrastructure
POSMO	App	Automatic tracking of single and multimode mobility activities
Strava	App	GPS-tracking of ride information; integration possible with many consumer wearables. Data available for public sector actors via Strava Metro
Google (Environmental Insights Explorer)	App	Aggregated from Google Maps Location History
FINDRS	Combination	Hardware sensors (bike light, anti-theft "cork") and companion app
Tracefy	Combination	Hardware (sensor) for e-bikes and companion app for real-time location and ride data
Swapfiets	Hardware	Hardware-based IoT solution for e-bikes (and internal fleet performance)
Social Tech Projects	Hardware	RoadSystem 365 offers a modular hardware kit and connected cloud platform to track environmental bike data for infrastructure purposes
Snuffelfiets (Province of Utrecht)	Hardware	Sensors mounted on bikes to measure air quality, speed...
Donkey Republic	App	Bike-sharing platform with IoT locks for fleet tracking
Canyon	Combination	On-bike sensors (for eligible bikes) and Canyon app data for location, movements, odometer readings
Bike Citizens	App	Bike Citizens app for data collection and incentivization of desired behaviour
Umotional	App	Apps for cycling (Cyclers) and mixed mobility tracking (AnyRoute)
TomTom	Combination	Aggregated GPS data (not cycling-specific) from navigation devices and apps
Schwung (Vialis) (website in Dutch)	App	Application that allows for traffic light optimization for cyclists in select locations in the Netherlands
MotionTAG	App	White label or proprietary app for multimodal or cycling tracking
Mobidot	App	White label or proprietary app for multimodal or cycling tracking and incentivization of desired behaviour
InfraSense (website in German)	Hardware	Sensor box aimed at mapping cycling infrastructure quality parameters and providing insights (BIQE monitor platform)
Toogethr Cycles	App	App for collecting bike miles and translating them into points and rewards that can be converted in the in-app web shop

4.3 Tendering, a deep dive

This final subchapter takes a closer look at tendering for FBD. More specifically, it outlines the main components of a FBD tender, identifies the actors involved in drafting and evaluating tenders, lists best practices for designing strong tender procedures, and finally offers examples of criteria for evaluating and selecting bidders.

Tendering is only one of several possible approaches to procuring data. Many of the use cases described earlier did not follow a formal tendering process, either because the budget fell below the threshold or because the solution was considered too innovative for standard procedures. Next to conventional tendering, other common approaches include directly awarding a project after a market consultation or the use of innovation tenders. Annex F details how the Playbook use cases procured their solutions.

Several interviewees noted that tendering can be valuable even when it is not strictly required. This is especially true when the solution is not yet fully defined and needs further shaping, or when multiple market options could address the problem. In such cases, a tender may help clarify expectations and articulate desired outcomes, or it may enable cost comparisons through competitive bids.

Tender components, roles and responsibilities

While formal processes vary across countries and jurisdictions, most tenders share the following core building blocks:

- Instructions to tenderers (submission process, format, deadlines...)
- Procurement conditions (legal terms, liability, intellectual property...)
- Specifications (functional and technical requirements, service levels, deliverables...)
- Selection criteria (eligibility requirements)
- Award criteria (criteria and scoring system used to identify the winning bid)

Each of these components should ideally be developed and reviewed with input from relevant experts. In practice, a good tender is therefore multidisciplinary, drawing on contributions from several departments. While specific roles and responsibilities may vary depending on the tender's size, type, internal procedures, and number of co-authors, the following roles are typically involved:

Domain expert (project lead)	Initiator and owner
	Defines goals and desired results
	(Co)-defines functional and technical requirements
	(Co)-defines selection and award criteria
IT and/or data department	(Co)-defines technical requirements (data standards, data formats, data types, data quality...).
Procurement department	Responsible for the tender framework and instructions
	(Co)-defines selection and award criteria
Legal department	Responsible for the procurement conditions
	(Co)-defines data sharing agreements and policies regarding data access, data ownership, user ownership, compliance...

Best practices for tendering FBD

Drafting a clear and well-structured tender document is a key responsibility of the issuing tender. It leads to higher quality bids, reduces potential misunderstandings later in the process, and signals professionalism and respect towards providers, who often invest significant resources in preparing their proposals. For this reason, it is important to allocate adequate capacity to the drafting of the tender.

An effective tender clearly articulates the desired outcomes of the project, along with the functional and technical requirements needed to achieve them. When these elements are well-defined, providers are better able to understand the problem at hand and propose solutions that truly fit the authority's needs.

The following best practices are intended to support this process and help ensure that tenders are both effective and fair.

Focus on outcomes, not specific solutions

Focus on the desired outcomes rather than overly specific descriptions of a specific technical solution, as tenders that are too specific can discourage providers. They can also create long-term vendor lock-in because only one vendor is able to offer or maintain the rigidly specified solution that is asked.

Where specific solutions are needed, balance thoroughness with flexibility. A best practice could be to list all relevant functional and technical requirements yet use a cascade system to prioritize them into, for example, mandatory, desired, or optional requirements. For more details on technical and data requirements, see chapter 3: How to Use Floating Bike Data of this playbook.

Balance obligation of result with commitment to intent

When defining requirements, it is important to strike the right balance between an obligation of result and a commitment to intent.

An obligation of result, which requires guaranteed outcomes, can drive higher quality but may also create unrealistic expectations, particularly for elements beyond the provider's control, such as recruitment, which often depends on collaboration with the public authority or external partners. This risk can discourage potential bidders. A commitment to intent, based on a "best effort" approach, reduces the risk for providers but may be too lenient and compromise quality.

In practice, an optimal combination of both obligation of result and a commitment to intent may be negotiated during the tender process and tailored to the specific use case and the provider's capabilities.

Define clear and measurable criteria

The main goal of a tender is to identify the best solution for your use case. To ensure comparability between providers and deliver a transparent basis for decision-making, the tender must include clear, measurable criteria.

They should be unambiguous, with precise definitions and metrics that specify, for instance, exactly what counts as a "ride" or a "user." A best practice is applying the SMART principles (Specific, Measurable, Achievable, Relevant, Time-bound) when defining indicators (see, for inspiration, the regional joint tender in the Netherlands).

For innovation challenges, when the exact solution is not yet known, prescribing specific technical criteria may be impossible. In such cases, focus on specifying measurable and comparable service levels rather than technical approaches.

Allow room for negotiation

Foster dialogue at various stages of the process, such as during market consultations or selection rounds, and be prepared to adjust your tender's criteria or metrics based on the feedback from the providers.

Involve key departments early

Legal, business, and IT teams should be involved as early as possible in the tender drafting process, possibly earlier than internal procedures may require. Their input often brings to light additional requirements, for example around data ownership, access, retention, security, or system integration, that directly shape the scope and feasibility of the tender. Engaging these teams from the outset ensures that these additional requirements are incorporated from the beginning, rather than having to revise or renegotiate the tender at a later stage.

Consider joint tenders

Collaborating with other authorities or stakeholders may yield significant benefits. Although joint tenders introduce additional procedural complexity, they enable knowledge sharing when defining outcomes and metrics. Additionally,they strengthen the tenderers' negotiating power through an increased purchasing volume.

Seek external expertise for complex tenders

For large or technically complex tenders (e.g., the Overijssel case), hiring a procurement advisor can help manage the formal procedures while allowing internal teams to focus on the contents and alignment. Early engagement is recommended, as procurement specialists often have long lead times.

Avoid imbalanced risk

Tenders should not place excessive operational or financial risk on the provider. Aim for a balanced partnership with clearly shared responsibilities to foster successful collaboration and delivery.

> Watch out: When drafting the tender, avoid creating conditions that discourage participation or lead to vendor lock-in. Flexibility, clarity, and fairness are key to attracting quality bids.

Selection and award criteria for FBD tenders

Award criteria for modern tenders typically aim to balance cost and quality. Traditionally, cost used to account for as much as 40–50% of the total evaluation score. Recent practices, however, increasingly prioritize quality, often reducing the cost weighting to 20–30%. This evolution reflects a growing recognition that lower prices often correlate with lower data quality or reduced service reliability.

While cost often translates into a relatively straightforward award criterion, quality is inherently more complex. It should be defined in relation to the specific use case or solution and can therefore include a wide range of dimensions.

Below is a set of possible quality dimensions or sub-criteria drawn from the FBD implementations reviewed for this playbook. Rather than an exhaustive checklist, this overview is intended as inspiration for defining those aspects of quality that may be most relevant to the tender's evaluation, selection, or awarding:

User-friendliness

Both end users (participants) and data users benefit from intuitive, easy-to-use solutions. Poor usability, whether in mobile apps or data platforms, can reduce engagement, limit data completeness, and hinder long-term adoption.

Additional services and support

Many providers supply services beyond data collection and visualization, such as user recruitment, challenge design, or technical and helpdesk support. Authorities should clearly specify which services are required and translate these into optional requirements and service-level agreements (SLAs). Doing so helps distribute responsibilities effectively and reduces the operational burden for the public authority.

Cooperation and coordination

Some projects require coordination between multiple stakeholders. Clearly define expectations for cooperation to ensure a smooth delivery and to avoid misunderstandings during the implementation.

Project plan

Request a detailed project or action plan and include it in the quality evaluation. This helps assess a provider's planning capabilities and ensures proactive project management.

Transparency in data collection and handling

Require providers to explain how data is collected, processed, and managed before, during, and after the project. Comprehensive metadata strengthens understanding of data origins, improves comparability, and enhances long-term usability. Requesting qualitative metadata is therefore considered a best practice in any data-driven tender.

Proximity and local presence

Foreign providers may face challenges providing local support in the native language. Time zones, distance, and language barriers can complicate communication. Consider whether local presence and language support should form part of the selection criteria.

Local user base

If recruiting participants is not possible due to cost, complexity or time constraints, requesting an existing user base from the data provider as a selection criterion may be advisable. Be mindful, however, of the implications for user ownership and the risk of a vendor lock-in (see Best practices for running a mobility project based on Floating Bike Data).

Demo or test dataset

Testing a potential solution is often the most reliable way to assess its suitability. Requiring a demo or a sample dataset can therefore be an optional criterion, especially when rapid implementation is important. This will demonstrate that the solution is already operational.

Speed of delivery

Depending on the project scope and timelines, define clear expectations for the speed of delivery. Consider the trade-offs between short and long runtimes and between off-the-shelf and custom solutions.

Track record and referrals

Successful implementations in other cities or municipalities help verify a provider's reliability. Adding a request for referrals to similar projects in the evaluation criteria may therefore help differentiate between bidders.

Service bundling

Depending on one's internal expertise and skill levels (see also Required data skills and expertise), it may be advisable to restrict unnecessary service bundling - or even flag it as an exclusion ground - to avoid paying for services that are not required. Note, however, that this may discourage some providers and reduce the pool of bidders.

Data access and usage

To minimise long-term costs and ensure data reuse, consider the post-project data access rights. Request flexibility in access policies and prioritise open formats and clear data schemas to support future use and integration (see Section Data access for more detail on data access methods).

Risk assessment

As support in comparing bids and to identify potential vulnerabilities, consider asking providers to offer a risk assessment of their solution. Relevant criteria may include:

- Data security and privacy
- Technical risks
- User engagement
- Data quality
- Public perception (PR)

Including these quality criteria, or a subset of them, in tenders will go a long way to ensure that the resulting bids from the providers align with the project's goals and expectations.

Building the future of cycling, together

As this playbook concludes, Floating Bike Data have emerged as a promising tool for informing the future of urban mobility and cycling policies.

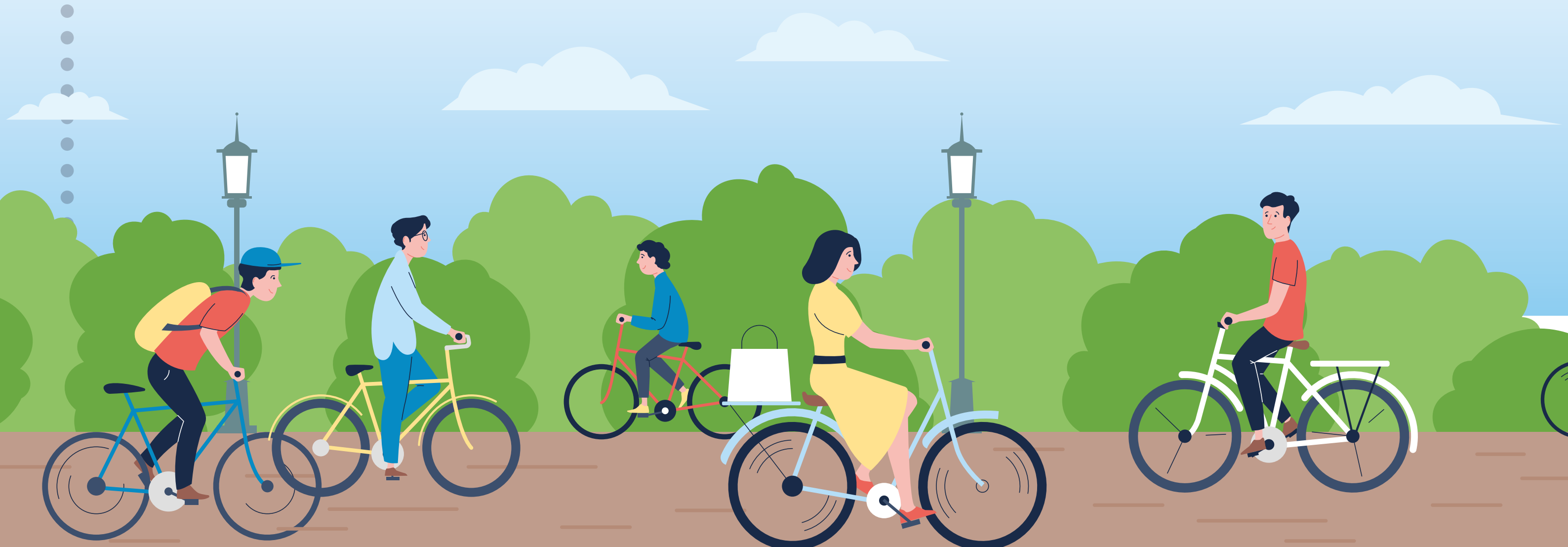
Throughout this guide, we have explored both the opportunities and the challenges that come with leveraging FBD, emphasizing that their true value emerges when projects are grounded in clear objectives, robust data quality, and a thoughtful understanding of the local context.

One of the most important takeaways is that there is no universal blueprint for success. Each city, region, or organization must tailor its approach to fit its unique circumstances, resources, and policy ambitions. Combining FBD with other data sources, investing in user-friendly solutions, and maintaining a critical eye on the data quality and privacy are all essential ingredients for impactful projects. Moreover, compliance and risk management - whether technical, legal, or reputational - should be woven into every stage of the process, ensuring that projects remain resilient and trustworthy.

Looking ahead, the path to smarter, more sustainable cycling ecosystems will require close collaboration between public authorities, private providers, researchers, and civil society. No single actor can address the complexities of FBD alone. By working together, they can ensure that cycling data serve the needs of all stakeholders and contribute to healthier, more inclusive cities.

This playbook is the result of the dedication and expertise of many individuals and organizations. We extend our sincere gratitude to the MegaBITS project team for their commitment and perseverance, and to all the interviewees (public officials, providers commercial stakeholders and civil society advocates) who generously shared their time, experiences and insights. Your contributions have shaped this resource and will continue to inspire progress in the years to come.

Thank you for joining us on this journey. We hope this guide empowers you to navigate the complexities of FBD with confidence and curiosity, and that it encourages ongoing collaboration across sectors. Together, we can move cycling policy forward, one data point, one partnership, and one innovative project at a time.



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THE FLOATING BIKE DATA PLAYBOOK

Annexes

Annex A: Glossary

Some of these definitions are taken from the Data Spaces Blueprint v2.0 with approval of the author(s).

Acronym	Meaning
AI	Artificial Intelligence
API	Application Programming Interface
Data product	Data sharing units, packaging data and metadata, and any associated license terms.
Data (product) owner	A party that develops, manages and maintains a data product.
Data (product) provider	A party that acts on behalf of a data product owner in providing, managing and maintaining a data product.
Data (product) consumer	A party that commits to a data product contract concerning one or more data products.
Data source	Where and how the data is collected (devices, systems, organizations).
Data type	What information is captured (raw data elements and measurements)
Data format	How the data is delivered and presented (file types, access methods, visualizations).
Data fusion	The process of integrating multiple data sources to produce more consistent, accurate, and useful information than that provided by any individual data source.
EU	European Union
FBD	Floating Bicycle (Bike) Data
FCD	Floating Car Data
GPS	Global Positioning System
ITS	Intelligent Traffic Systems
MegaBITS	Mobilizing Europe's Green Ambition for Bicycles through Intelligent Traffic Systems
NDW	Nationaal Dataportaal Wegverkeer (Nl.) National Road Traffic Data Portal (En.)

Annex B: Methodology

Use cases definition

- Creation of a longlist with 15 theoretical use cases for FBD based on input from the MegaBITS consortium.
- Prioritization of the use cases via a Qualtrics survey sent to the MegaBITS consortium members, resulting in 18 responses.
- Manual validation of this automatic use case prioritization during an online session (16/06/2025) .
- Creation of a final shortlist of 14 theoretical use cases for FBD. Two use cases were merged due to their being similar.

Selection of the interviewees

- Creation of a longlist of FBD use case implementations (i.e., real-life implementations of solutions involving FBD).
    - Desk research based on the theoretical longlist of FBD use cases.
    - Referrals by consortium partners and other relevant actors such as POLIS.
    - Selection criteria:
        - Use of FBD as (part of) the solution.
        - Public sector actor (city, municipality or adjacent actors) in the lead.
        - Scope: focus on Europe but openness to other international public actor initiatives.
    - To ensure a comprehensive and balanced view on the requirements for implementing a FBD use case, two providers specialized in public sector clients were also interviewed.
    - Strava was also invited to an interview in light of the availability of its data to public sector actors. Unfortunately, their reply was received too late for inclusion in this playbook.
- Contacted 22 parties with a request for interview:
    - 19 public sector actors
    - 3 data providers

- The parties received an email from an imec MegaBITS team member. This email contained:
    - A brief description of the MegaBITS project.
    - A description of the playbook and its goals.
    - A benefit in the form of the finished playbook itself (upon completion).
    - A link to a booking agent to schedule an interview.
- 12 parties eventually scheduled one or more interviews with the research team

Pre-survey data requirements

- Each organisation agreeing to the interview received an email invitation to a Qualtrics survey about data requirements, to be filled in before the interview.
    - 1 week in advance of the interview
- 10 out of 12 respondents filled in the pre-survey.
- The survey covered the following topics:
    - Identifying information
    - Brief description of use case
    - Definition of FBD:
        - Single choice
        - 7 options (including “do not know”)
    - Use of data sources:
        - Matrix
        - Y-axis: possible sources
        - X-axis: usage levels (used intensively – used to some degree – desired but not available – available but not used – not relevant to this use case)
        - Option: other
        - Procurement (how were data acquired e.g. purchased, collected, ...)
    - Use of data types
        - Matrix

        - Y-axis: possible types
        - X-axis: usage levels (used intensively – used to some degree – desired but not available – available but not used – not relevant to this use case)
        - Option: other
    - Use of data formats
        - Matrix
        - Y-axis: possible types
        - X-axis: usage levels (used intensively – used to some degree – desired but not available – available but not used – not relevant to this use case)
        - Option: other
    - Data quality:
        - Prioritization (drag & drop)
        - 8 dimensions that might define "data quality" (geographic coverage, time coverage, update frequency, sample size, location accuracy, data completeness, privacy protection (anonymization, pseudonymization, ease of use/interpretation)
- The results of the survey were processed and visualised via Matplotlib (Python) and form the basis of the data requirement matrices included in this document's Data sources, types and formats.

Interviews

- 12 organisations were interviewed between August and October 2025, for a total of 16 interviewees.
- Each interview:
    - Took place online (Teams meeting).
    - Was in either English or Dutch.
    - Was recorded for research purposes (after consent was obtained).
    - Was conducted by an interviewer and a note-taking researcher, based on the pre-survey and a topic guide.
- A standard interview consisted of 2 parts:
    - Part 1: Use Case (est. 1.5 hour)
        - Introduction of the interviewee, the organisation and the link with FBD.
        - Description of the use case.
        - Discussion of the data needs & data requirements, based on the pre-survey.
        - Discussion of the skills & expertise required.
        - Discussion of the usability and potential of FBD for data-driven decision-making.
        - Success stories & challenges related to the use case.
        - Resources spent on implementing the use case.
    - Part 2: Tendering (est. 30 min)
        - Discussion of the responsibilities & involvement of different actors in the tendering process.
        - Specifications & requirements included in the tender.
        - Evaluation criteria & selection criteria.
        - Risk mitigation
- Note: In some cases, part 2 of the interview was skipped or modified to accommodate the fact that the use case in question did not require a prior tendering procedure.
- Note 2: full topic guide available upon request.

Processing & Analysis

- Notes were taken during the interview by the note-taking researcher.
- The recordings of the interviews were used to refine the notes.
    - The interviews were not labelled or indexed.
    - Focus was on qualitative input
- Based on a qualitative analysis of the notes, insights were obtained by the researcher and with assistance from a custom-made CoPilot agent.

Annex C: Contacts and interviews

Contacted	Replied	Interviewed	Reason
Münster	Y	N	Not interested
Copenhagen	Y	Y	
Province of Antwerp	Y	Y	
Province of Overijssel	Y	Y	
Zwolle	Y	N	Overrepresentation of MegaBITS consortium
Antwerp	Y	Y	
Helmond	Y	Y	
Sarajevo	Y	Y	
Manchester	N	N	
Amsterdam	Y	N	Did not identify right person internally
Dublin	Y	Y	
München	Y	N	Not interested
Stockholm	Y	Y	
New York City	N	N	
Montreal	Y	N	No follow-up
Bogota	N	N	
Turku	N	N	
Utrecht	Y	N	Did not identify right person internally
Groningen	Y	Y	
InfraSense	Y	Y	
Mobidot	Y	Y	
Enschede	Y	Y	
Strava	Y	N	Reply received too late

Annex D: MegaBITS theoretical use cases

The following use cases were identified by the MegaBITS consortium in April-May 2025. The consortium was then invited to rank the use cases from least important to most important in a survey (May-June 2025).

18 members representing 7 different organisations casted their vote. Next, the prioritisation from the survey was manually validated during a consortium meeting workshop (June 16, 2025). No further changes were made to the prioritisation.

The following list represents the final prioritisation as agreed upon by the consortium members:

Route choice & path analysis

- **Description**: Understanding which routes cyclists actually take versus planned or expected routes. Includes analysing route preferences, identifying shortcuts, comparing alternative paths between the same origin-destination pairs, and understanding how cyclists navigate through the network.
- **Applications**: Route optimization, infrastructure prioritization, understanding cyclist preferences, identifying unofficial cycling routes

Speed & travel time analysis

- **Description**: Measuring cycling speeds, travel times on corridors and routes, identifying delays and congestion, analysing speed variations by time of day, weather, or cyclist type.
- **Applications**: Performance monitoring, corridor optimization, identifying bottlenecks, setting service level targets

Origin-destination (OD) pattern analysis

- **Description**: Mapping where cycling trips start and end, creating origin-destination matrices, identifying major trip generators and attractors, and understanding travel patterns across different areas and time periods.
- **Applications**: Network planning, identifying high-demand corridors, understanding commuting patterns, planning new connections

Traffic volume & flow measurement

- **Description**: Quantifying bicycle traffic volumes across the network, comparing flows over time (hourly, daily, seasonal), measuring traffic intensities on different route segments.
- **Applications**: Infrastructure capacity planning, trend analysis, resource allocation, policy impact assessment

Safety & black spots analysis

- **Description**: Identifying locations with safety concerns ("black spots"), analysing speed variations that might indicate safety issues, understanding where cyclists experience difficulties or hazards.
- **Applications**: Safety improvement programs, accident prevention, targeted safety interventions

Corridor & route performance analysis

- **Description**: Focused analysis on specific high-priority cycling corridors, measuring performance metrics like average travel times, reliability, and service quality on key routes.
- **Applications**: Corridor improvement programs, service level monitoring, targeted investments

Performance monitoring & quality control

- **Description**: Monitoring the performance of data collection systems, detecting anomalies in cycling patterns, validating data quality, establishing baseline measurements for ongoing monitoring.

- **Applications**: System maintenance, data reliability, performance benchmarking, continuous improvement

Network coverage & missing links analysis

- **Description**: Identifying gaps in the cycling network, understanding connectivity issues, finding missing links that would improve network coherence, analysing network completeness.
- **Applications**: Strategic network planning, prioritizing new infrastructure, improving cycling network connectivity

Intermodal & multi-modal integration

- **Description**: Understanding how cycling connects with public transport, analysing bike-and-ride patterns, identifying optimal locations for bike parking near transit stations, studying multi-modal trip chains.
- **Applications**: Transit integration planning, parking facility placement, promoting sustainable transport combinations

Cyclist segmentation & behaviour analysis

- **Description**: Understanding different types of cyclists (commuters, recreational, delivery, etc.), analysing behaviour patterns by cyclist type, examining how different groups use the network differently.
- **Applications**: Targeted infrastructure design, policy development, service differentiation, user-specific improvements

Network capacity & congestion analysis

- **Description**: Identifying bottlenecks and capacity constraints in the cycling network, analysing where and when congestion occurs, understanding flow limitations, and measuring network utilization efficiency.
- **Applications**: Capacity planning, congestion reduction, infrastructure sizing, flow optimization

Traffic signal & intersection optimization

- **Description**: Analysing cyclist behaviour at intersections, optimizing green wave timing for cyclists, measuring stop frequencies and delay times at traffic lights, reducing wait times.
- **Applications**: Signal timing optimization, intersection design, reducing cyclist delays, improving traffic flow

Parking & end-of-trip facility analysis

- **Description**: Identifying optimal locations for bicycle parking facilities, analysing parking demand patterns, understanding where cycling trips typically end, and planning end-of-trip facilities like bike storage and services.
- **Applications**: Parking facility placement, capacity planning, supporting cycling uptake, urban planning integration

Virtual infrastructure & synthetic data generation

- **Description**: Creating virtual counting points to supplement physical infrastructure, generating synthetic traffic data for locations without sensors, filling data gaps in the monitoring network.
- **Applications**: Cost-effective monitoring, comprehensive network coverage, reducing physical infrastructure needs.

Annex E: Use case implementations: data needs and requirements

This table shows which organisations completed the data needs and requirements survey, covering the data sources, data types, data formats and data quality dimensions of their use case.

Organisation	Data Needs and Requirements Survey
Province of Antwerp	Completed
Copenhagen	Completed
Antwerp	Completed
Sarajevo	Completed
Dublin	Completed
Helmond	Completed
Stockholm	Completed
Enschede	Completed
Mobidot	Completed
InfraSense	Completed
Groningen	No survey data
Province of Overijssel	N/A (joint tender)

Annex F: Use case implementations: overview of the FBD procurement methods

Organisation	Type of Procurement Procedure	Comments
Copenhagen	Direct	Below threshold for tender Extensive market study by Copenhagen Solution Lab
Province of Antwerp	Tender	Innovation tender
Province of Overijssel	Tender	Joint tender (European) with 5 provinces 3 tenderers National procurement of FBD for all participating public authorities
Antwerp	Tender	Part of wider Synchronicity tender, specifications were written on European, not local, level 3 tenderers, test project with 2
Helmond	Direct	No tender for Schwung app Da's Zo Gefietst app as part of joint tender (see Province Overijssel)
Sarajevo	Direct	Below tender threshold
Dublin	Direct	No tender for Sandyford Pedal Pulse case (2024-2025): below threshold Based on previous tender (2016), procurement by challenge
Stockholm	Direct	Strava data
Groningen	Direct	No formal tender but market consultation with 3 potential providers
Enschede	Tender / Direct	Innovation tender (2011) to build app and user base: 10 tenderers (1st phase), 3 negotiations, no submissions for 2nd phase Eventually directly awarded to Mobidot
Mobidot	N/A	
InfraSense	N/A	