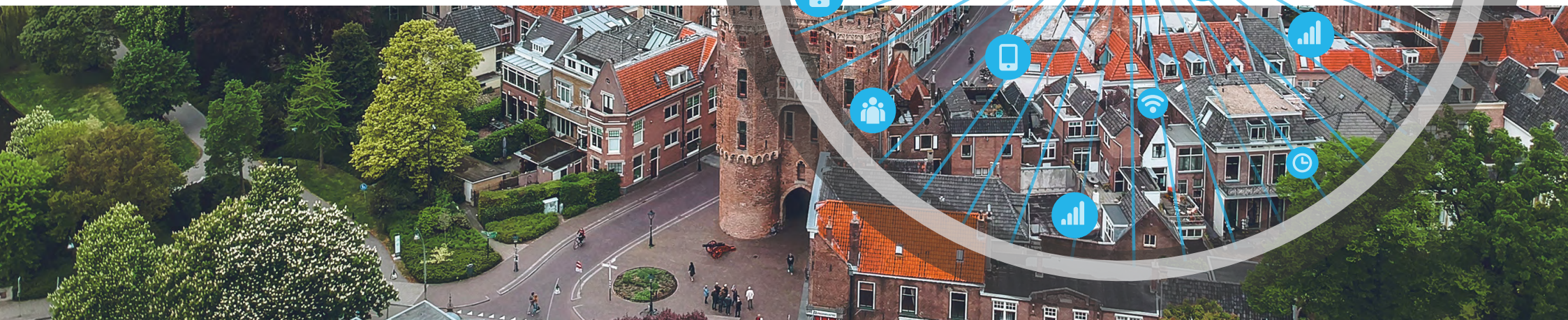
BITS

Bicycles and Intelligent Transport Systems



Interreg North Sea Region BITS
European Regional Development Fund
EUROPEAN UNION

Colophon
This booklet, a concise review of the BITS project, is written by Robin Kleine, Ronald Jorna and Veronique Rietman. Giorgia Berrevoets, Stephen Kurz and Annelot van Mourik supported us in the design of the booklet and final editing.

Our warm thanks go to the Province of Overijssel, the lead partner in this project, who entrusted us with the project management. Their guidance was essential in the project's success. We also gratefully acknowledge Interreg North Sea Region for their vital financial backing, without which the BITS project would not have been possible.

We also thank the BITS project partners for their collaborative efforts: City of Zwolle, University of Oldenburg, Baron Mobility Service GmbH, City of Aarhus, City of East-Riding, VIVES University of Applied Sciences, City of Bruges, Province of Antwerp, Cycing Industries Europe, Deelfiets Nederland, and Cycle Data.

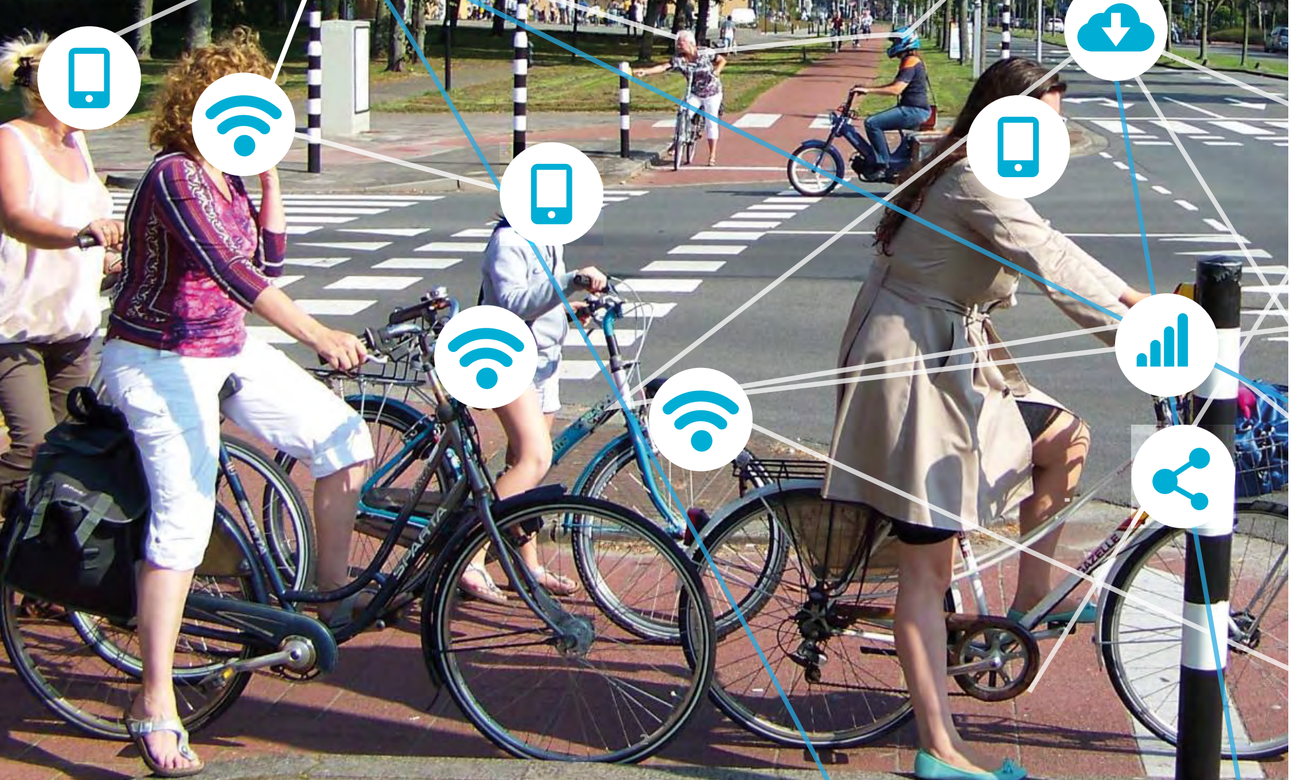
Since the project timeline didn't allow us to compile this reflection, we took it upon ourselves to create it post-project as a valuable resource. This booklet showcases our actions within BITS and our key learnings, aiming to inspire future sustainable transport initiatives.

BITS
Bicycles and Intelligent Transport Systems

MOBYCON

provincie Overijssel

TABLE OF CONTENTS



FOREWORD

Cycling is known for being a healthy and sustainable way of getting around. Cycling policy therefore occupies an important place in mobility policy, also in the province of Overijssel. More people on bicycles also means fewer people in cars and public transport, which not only helps prevent traffic jams on the road, but also reduces pressure on short-distance public transport services. That benefits us financially as a government body. For this reason, we are fully committed to the use of bicycles, not only for short distances within urban areas, but also for slightly longer distances around the city.

The development of e-bikes and speedpedelecs helps make this transition a success. Building fast and comfortable cycling infrastructure has also been an important theme in provincial and municipal budgets of the past years. That is all well and good, but it is not enough. We therefore invest in various campaigns to realize a shift in travel behavior. Equally important is the development of smart mobility and related ITS measures, which also offer great opportunities for making cycling safer and more attractive. However, this is neither well-known amongst the general public nor commonplace in cycling and ITS policies.

To get the topic of smart and connected cycling more on the European, national and regional cycling agenda, we have therefore decided to become the lead partner of both the Interreg NSR BITS project, as well as the MegaBITS follow-up project. We have noticed a growing interest in the topic, which motivates us to continue and remain at the forefront of smart cycling. Mobycon, which we hired to manage the project, also sees the importance of this topic and is publishing this booklet. We hope this booklet can inspire other parties to move towards smart cycling policies.

Wim Dijkstra

Strategic Advisor Mobility

Province of Overijssel

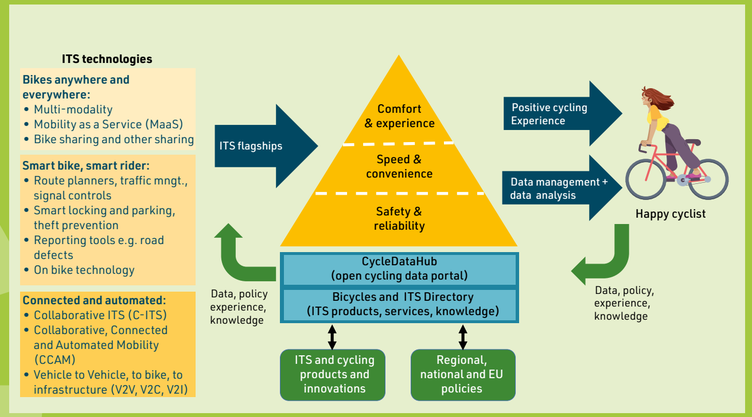


Figure 1.1: Bicycle Pyramid

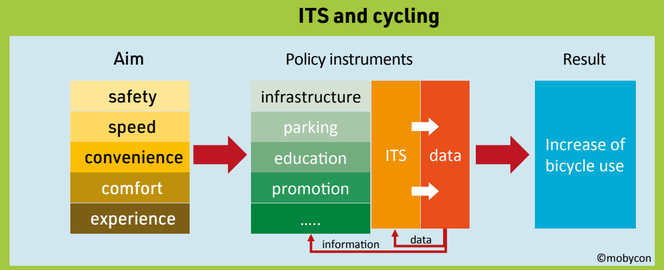


Figure 1.2: ITS as a digital layer for cycling policy

1. INTRODUCTION

The mobility sector is full of ICT-developments that have a major impact on how we travel and how we use our public space. While these developments, often referred to as 'Intelligent Transport Systems' (ITS), receive a lot of attention when it comes to motorized transport, this is certainly not the case for ITS applications for cycling. Given the fact that cycling, as a healthy and sustainable mode of transport, is increasingly being promoted, we should ask ourselves what role ITS could play in promoting cycling. The **Bicycles and ITS Project (BITS)**[1] has done exactly that: from 2019-2022 the project has demonstrated over 30 ITS applications for cycling.

Bicycle Pyramid

Figure 1.1 shows the Bicycle Pyramid, which forms the foundation of the Bicycles and ITS project. Derived from Maslow's Hierarchy of Needs (Maslow Pyramid) and Herzberg's Two-Factor Theory, the Province of Overijssel has developed a similar hierarchy of ITS needs for cyclists, showing the factors influencing modal shift from car to bike using ITS (see figure 1.1). Firstly, cycling has to be safe and reliable, secondly it should be (relatively) fast and convenient (clear routes, easy bicycle parking, etc). Once these basic-level needs have been matched, comfort and user experience become important. The Bicycle Pyramid is the foundation of the Bicycles and ITS project.

A digital layer for cycling

Overall, we have found that ITS can have a remarkably positive effect on cycling, and that ITS certainly deserves a place in the cycling toolkit. On top of the 'traditional' measures (cycle infrastructure, parking facilities, education and promotion), it is often a cost-effective solution in different circumstances (see figure 1.2).
An additional benefit of using ITS applications in cycling is that they often generate valuable data (counts, speed, crashes, etc.), that can be used in at least two of the following ways:

- As direct feedback to the cyclist (speed advice, nearest available bike parking, priority at traffic light, etc.)
- To gain new insights and improve cycling policies.

Cycling data is underrepresented in the overall traffic and transport data, with most data collected focused on motorized traffic. ITS for cycling offers the possibility to generate more cycling related data. Thus, ITS can become the digital layer for cycling and bring cycling data to an equal status with motorized traffic data.

In this book

This book gives an overview of a selection of those ITS applications and the lessons learned. We follow the structure of the bicycle pyramid, starting with ITS focussed on safety and availability of cycling, and then moving on to convenience, speed and experience/ comfort. We then proceed with collecting and using data and conclude with an Outlook and additional information on the BITS project.

[1] *See chapter 11 and https://northsearegion.eu/bits/ for more information about the BITS project.*

Figure 2.1: Warning sign for car drivers in Zwolle

Figure 2.3: Dynamic lighting in Zwolle

Figure 2.2: Rope light in Aarhus

2. MAKING CYCLING SAFER

Introduction

Safe cycling infrastructure is a prerequisite for a large-scale take-up of cycling. Safety forms the base layer of the bicycle pyramid (see figure 1.1) and can be divided in two types of safety:

- Traffic safety - This has to do with crashes, e.g. car-bike crashes, crowded bike lanes, single-sided bike crashes, etc. Traffic safety has two aspects:
  - Objective traffic safety: are you actually safe (based on statistics)?
  - Subjective traffic safety: do you feel safe?
- Social safety - Covers mainly topics like tunnels, illuminated bike routes, populated routes, litter free routes, etc.

Traditional means of increasing the various types of safety for cyclists are building separate bike lanes, installing good lighting, installing traffic lights, lowering speeds of motorized traffic, etc.

Implementations in BITS

Within the BITS project we have had two projects focused on traffic safety:

- In Zwolle (NL) the Burgemeester van Roijensingel, a main road in the city, intersects with the Emmawijk, a smaller street giving access to a residential area (figure 2.1). Two types of signs were installed here. A classic sign that warns the cyclists of motorized through-traffic and a digital speed display to encourage car drivers to lower their speed if a cyclist is detected.
- In Utrecht (NL), the Biltstraat has a busy cycle path with a dangerous intersection. Sightlines are hindered by a curve, and in rush hours there is a high intensity of bicycle traffic. By means of installing measuring equipment and different types of dynamic signs with motivational feedback for cyclists, the pilot aimed to reduce cycling speed and thus to improve safety feelings among cyclists.

With respect to social safety two projects were carried out:

- In Aarhus (DK) a rope light was demonstrated, which can give different colours of light (figure 2.2).
- In Zwolle (NL) dynamic lighting was implemented, which only lights up when cyclists are detected (figure 2.3).

Lessons learned

- Regarding the traffic safety implementations, we saw that the pilots led to safer traffic situations, less risk conflict situations and speed reductions.
- The installation of a road safety system can require more physical work on the street than previously expected (digging cable ducts, connection to electricity cabinet etc.). The installation of such a system also needs to be checked with external parties such as a power supplier.
- A busy and complex traffic situation might be an overstimulating environment for cyclists and therefore not suitable to add dynamic signs in order to improve the traffic safety. It is better to choose a less complex traffic situation.
- It is too early to recommend the social safety implementations to others, as there is not yet enough experience and knowledge concerning the systems and their limitations. The lighting systems have no obvious disadvantages regarding safety and comfort.

Figure 3.1: Bicycle library in Withernsea

Figure 3.2: Bike sharing Steenwijkerland

Figure 3.3: Bike sharing Deltion College (Zwolle)

Figure 3.4: Bike sharing Oldenburg

3. MAKING CYCLING AN OPTION/AVAILABLE

Introduction

Not everybody has a bike. Especially in countries with limited cycling infrastructure, having a bike is not common. But also in typical cycling countries, such as The Netherlands and Denmark, not all citizens have the (financial) possibility to own a (good) bike. And even if you have a bike, you might not have access to a bike at the right place, such as for the final part of multimodal trip. ITS can make cycling an option for everybody everywhere.

Implementations in BITS

- The county of Yorkshire (UK) launched the bicycle library in Withernsea, together with local partner SHoRes (figure 3.1). The bicycle library allows people to borrow bikes while being supported by a 'cycle buddy'. The aim is to get people cycling with enthusiasm and confidence, while also contributing to greater community participation by the target group, and to a healthier lifestyle. The bicycles are equipped with sensors (see. sense) that collect data, such as the routes taken, speed, road quality, and braking. This data is used by the 'cycle buddies' to encourage cycling and provide support to the user where necessary. At the same time this is valuable information for the region to improve their cycling policy (safety, quality, etc.).
- In the province of Overijssel (NL) the company Deelfiets Nederland has set up two bike sharing schemes for two different target groups:
  - Bike sharing for citizens and tourists in Steenwijkerland (figure 3.2), a touristic wetland region in the province of Overijssel. An environmental sensor is mounted to the bikes measuring (among other information) particulate matter (see chapter 8 for more information).
  - Bike sharing implemented exclusively for students of the Deltion College in the city of Zwolle (figure 3.3), in order to reduce the pressure on the public transport system. The pilot was limited in scope with 25 shared bikes connected to a closed user group of 100 students.
  - In Oldenburg (DE) a shared biking system has been launched (see figure 3.4). The bikes, named OLi-bikes, can be used for a reduced rate by holders of certain bus tickets. This allows people to reach their destination by bus and bike.

Lessons learned:

- The data collected by the trackers is very valuable information for Yorkshire council cycling policies. Even though results apply to a particular selection of cyclists (users of the bike library), the results point to priorities for creating or improving cycling paths (popular routes), to potentially unsafe situations for cyclists (info on speed, braking, road surface) and to the need for storing facilities at certain locations (dwell time).
- Consistency in the cycle buddies is essential for this specific target group, in order to keep them motivated to cycle.
- Since the project in East Riding of Yorkshire Council was their first ITS project, there was a steep learning curve, e.g. on tendering ITS, using the data, (technical) support to the users, poor mobile phone connection, charging the sensors, etc. More technical experience would have been helpful to avoid/overcome technical challenges.
- Bike sharing starts with clear objectives shared amongst all stakeholders. The right bike share concept at the right locations combined with a good marketing campaign are key elements.
- Pilots can serve as a tool to create awareness and interest from stakeholders. Both bike sharing pilots are seen as great initiatives and have generated interest from various new parties, which will result in expansion of both bike sharing projects.

Category	Process	Possible Automation
The facility/ garage	Accommodating stairs and inclines	A conveyor belt to make it easier for people (especially with heavy bikes) to get in and out of the garage.
	Regulating access and payment	Access by smartcard, chip or barcode (instead of a receipt)
	Bike parking	Fully automated parking at ground level where the system parks the bicycle itself.
Management	Supervision	Remote camera surveillance.
	Duration of storage	Length of storage time can be determined by e.g. check-in and check-out sensors in the racks and cameras that register parked bicycles.
	Enforcement	On the basis of the same systems and, for example stickers with barcodes, it is possible to efficiently enforce orphan bicycles and error parkers.
Monitoring and information	Real-time individual storage occupancy	Based on the current occupancy, cyclists (especially in large parking spaces) can be guided to the free spaces within the parking facility.
	Real-time total storage occupancy	Via apps and digital signs cyclists can see which parking facilities still have space available.
	Monitoring and policy information	Data on the use of parking facilities (and predictions thereof) can easily be made available to managers and policymakers via dashboards and reports.

Figure 4.1: Automation possibilities

Figure 4.2: Dynamic signs in Zwolle

Figure 4.3: Parking referral system in Bruges

4. MAKING PARKING MORE CONVENIENT

Introduction

Automation plays an increasingly important role in bicycle parking. In addition to real-time availability of parking spaces, cyclists can increasingly benefit from automated conveyor belts and easy check-in and check-out. A better flow of information helps managers to enforce incorrectly parked bicycles and orphaned bicycles. Policy makers also benefit from an increasingly better picture of how bicycle parking facilities are used.

Implementations in BITS

- The city of Zwolle (NL) placed dynamic signs on three of its city entrances (figure 4.2). With these signs, cyclists will be able to read which parking facilities have sufficient capacity and are available for use. With this, the government offers a service that stimulates people to park their bikes in the designated facilities without having to look for one with capacity, improving both the experience for cyclists as well as the use of public space (less wandering cyclists in the already crowded center).
- The city of Bruges (BE) installed a parking referral system for bikes in two of their underground parking facilities in the city center (see figure 4.3). In the parking, the number of parked bikes is monitored continuously by optical sensors. LED screens inform cyclists on the availability of parking spots within the facilities. With this implementation, the city managed to:
  - Make it easier for cyclists to find a safe, convenient parking spot.
  - Get information on occupancy rates in the facilities.
  - Monitor orphaned bikes.

Lessons learned:

- Visibility of the information provision is key. People need to be able to consume the information. The signs must therefore be visible and placed at logical, strategic locations:
  - When approaching the facilities: In Zwolle there were only a few signs relatively far away from the facilities. As a consequence, many people didn't notice the signs.
  - At the facilities: In Bruges people did notice them, as they were located at the entrance of the parking facilities, where people are already thinking about parking their bikes.
  - Apps can be used to inform people about parking locations before they start their trip.
- The scale of the implementation must also be sufficient for people to be able to notice and therefore use the system.
- As a relatively new product (parking referral for cyclists), the number of suppliers is limited. It turned out to be challenging to find good suppliers.
- Such a system (parking refferal for cyclists) involved various technologies. For example, one for registering the bicycles in the parking facilities and one for cyclists entering the facility or passing by specific roads. When developing such a service, it is recommended to pay close attention to ensure the technology fits the needs and context. There are various ways to detect bikes and cyclists, varying in price, quality and application possibilities in different contexts.
- Automation can be of added value in various stages of the parking process. The main question is what should be automated to improve service quality or efficiency. See table 4.1 for an overview of possibilities.

Figure 5.1: Bike couriers in Zwolle

Figure 5.2: Extended green for cyclists cycling downhill in Aarhus

Figure 5.3: Bike chain in Hengelo

5. MAKING TRAFFIC LIGHTS SMARTER

Introduction

Traffic lights play a crucial role in regulating traffic flow. However, traditional traffic lights systems often lack flexibility and fail to adapt to changing traffic patterns and user needs. In this chapter, we will explore how the BITS project has implemented smarter traffic lights systems to improve traffic flow and safety for cyclists and other road users.

Implementations in BITS

- The city of Zwolle (NL) implemented an app that tracks cyclists and gives them priority at traffic lights (see figure 5.1). The app connects to traffic lights from a distance, making it able to apply for green lights quicker than with traditional sensors/buttons. Within this app, the city of Zwolle added an extra functionality for bike couriers (logistics). They were given extra priority at a given set of intersections, enabling them to minimize delays and gain a competitive advantage over motorized logistics.
- The city of Aarhus (DK) implemented a system that detects approaching cyclists on a downhill slope (see figure 5.2). If the traffic light is green, and a downhill cyclist is approaching, the green phase is extended so that the cyclist can safely cross the intersection.
- The city of Aarhus (DK) has also implemented a system that uses machine learning algorithms to predict traffic patterns and optimize traffic light timings, especially for cyclists.
- In Hengelo (NL), the province of Overijssel implemented a "bike chain" system that allows groups of cyclists to get priority at a traffic light (figure 5.3). By rewarding cyclists with priority at the traffic light, they are stimulated to cycle together and reduce speed differences, leading to safer behavior at the intersection. The implementation was accompanied by an extensive communications campaign.

Lessons learned

- We see three main functions of smart traffic lights in the interaction with cyclists: data collection (registering cyclists), processing data (influencing sequence) and providing feedback (to the cyclist).
- The emergence of smart traffic light applications brings the need to be able to connect other systems to the traffic lights (e.g. weather sensors, priority apps) and intervene in and experiment with different phasing settings. This means traffic lights need to be made 'smart' (be connected to the cloud) to be able to use these kinds of applications.
- The experience of getting an advantage is a large part of the success; make sure to communicate this. In Hengelo, this was done by an extensive campaign and clear signs on the road. In Zwolle, the app was used to inform people about this.
- The reliability of a system is key. If a system fails, people get demotivated. If a system works from day one (and keeps working) this drastically improves trust and promotes follow-up behavior.
- An important aspect of these implementations is the phasing of traffic lights. To offer an advantage, the phasing needs to be adjusted. This may impact other traffic (flow). The phasing is also something that can be experimented with. For example, it may be possible to give some extra priorities to cyclists in the quieter hours.
- Traffic lights are often part of long lasting and rigid contracts. A few years ago, the municipality of Aarhus chose to renew the way they contract traffic lights. Although this was costly, both in time and investments, it gave the municipality more flexibility and the possibility to intervene quickly and experiment when and how they want, making it a good investment on the long run.

Figure 6.1: Baron Mobility (Source: Ciclogreen)

Figure 6.2: Baron Mobility (Source: Ciclogreen)

Figure 6.3: Fietsmaatjes (Province of Overijssel)

6. MAKING CYCLING MORE ATTRACTIVE THROUGH NUDGING

Introduction

Nudging is a behavioral change approach to encourage people to make specific choices or behave in a certain way without restricting their freedom of choice. Various nudging techniques have been developed to make cycling more attractive, increasing the use of bicycles in daily transportation. The European project BITS (Bicycles and ITS) featured several examples, including apps and infrastructure based nudging applications.

Implementations in BITS

- Baron Mobility implemented three apps that encourage people to cycle more (see figures 6.1 & 6.2):
  - One for citizens of the city of Oldenburg (DE), including rewards and information on people's bike use.
  - One for businesses, including a six-week challenge, competitions and prices.
  - A second one for businesses, with more health and sustainability related feedback to the cyclist.
- The province of Overijssel (NL) implemented an app that stimulated people to cycle to work and to bring others with them. The implementations were aimed at people that (used to) go to work by car.
- CycleData implemented a system in the province of Utrecht (NL) that rewarded people for cycling by planting a tree for every 100 cyclists passing by. The cyclists were informed by the progress (number of trees) by a digital sign.
- The city of Aarhus implemented a system that measures travel times by bike to certain destination and informing both cyclists and motorists about these travel times. Motorists are therefore also stimulated to choose the bike as a convenient and quick alternative.

Lessons learned

- When it comes to apps, there are various ways to engage people. From rewards and competitions to networking functionalities, routes and other personal statistics. It turns out the latter is often the most effective. Some of the statistics people were the most enthusiastic about were:
  - CO_2 reduction;
  - Routes;
  - Calories burnt;
  - Health tracker data (heartrate etc).
- Networking functionalities, team challenges and other internal collective functionalities can be big motivators. People are generally more motivated if they network and compete with people they know.
- It is challenging to motivate people over longer periods of time. With some of the apps we saw declining user numbers and after the rewarding initiative in Utrecht stopped, cycle use quickly dropped to the old level. Intrinsic motivation is key to keeping them active. Continue offering incentives to keep people motivated.
- Effective cycling apps must be easy to use and reliable, with tracking that starts automatically and accurately.
- Data protection is also a crucial topic to coordinate. If an app is not good from the start, people might stop using it and never return.
- Communication is key to success: Promotion in local and online newspapers, as well as internal communication within organizations, can generate interest and participation.

Figure 7.1: More cyclists, more trees

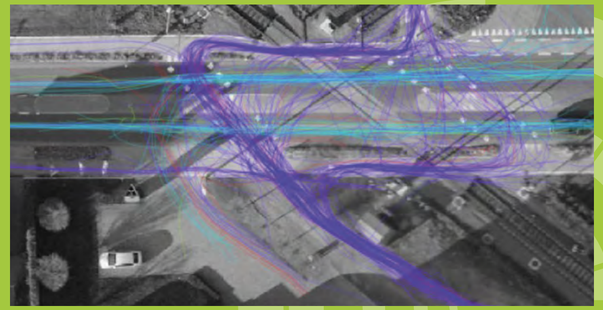


Figure 7.2: Antwerp 3D cameras

Figure 7.3: MicroTraffic

Figure 7.4: See.Sense

7. COLLECTING CYCLING DATA

Introduction

Traffic safety is a topic of great importance to governments, from national to local levels. Collecting (cycling) data is a useful means to gain insight into important cycling routes, unsafe locations, and measures to improve the safety.

Cycling data can be collected to get insight into the number of cyclists that pass a certain location or the trend in the number of cyclists on a longer term. Furthermore, cycling data collection can be an important step in the process of defining the problem at an unsafe location and developing measures that need to be taken in order to improve the traffic safety in that location. Cycling data collection can be done in several ways, for example infrastructure based (with cameras) or GPS-based.

Implementations in BITS

- The East Riding of Yorkshire Council (UK) installed temporary static counters at five locations to count cyclists during five weeks through the project, in order to address the cycling data gap. This has enabled the council to identify and analyze local cycling trends.
- In the province of Utrecht (NL), a rewarding system has been installed to encourage people to use their bike (see figure 7.1). A digital counting system was installed near a cycle path, and this system communicated the message that for every 100 cyclists, one tree would be planted. The system led to an increase of cyclists with 34%.
- In the Province of Antwerp (BE) and the city of Zwolle (NL) similar projects were conducted (see figures 7.2 & 7.3). However, in both cities/regions a different technology was used. The design of an intersection (both in Antwerp and in Zwolle) was considered as unsafe for cyclists. In both cases the traffic behavior and near-accidents were recorded throughout several days in order to make recommendations on how to make the intersection safer. With that information, some adjustments to the design of the intersection were made.
- At an unsafe intersection in the city of Utrecht (NL), Cycledata installed measuring equipment and different types of dynamic signs with motivational feedback for cyclists, with the aim of reducing speed.
- Various implementations also collect GPS data (Baron app, See.sense sensors (see figure 7.4). Although collecting this data is not the main goal of these implementations, this data can be very valuable, especially if combined with data on intensities (counting). BITS was involved in a national working group in the Netherlands on further developing this types of data.

Lessons learned

- Counting cyclists can offer new insights for local policymaking and it can be useful in evaluating the effect of measures. The amount of counting locations and the counting period are important for the reliability of the results. It is important to put the results into perspective: the counted number of cyclists is determined by circumstances such as weather or events that take place.
- Collecting cycling data through cameras gives useful insights regarding (near) accidents and their severity. Conflict analysis systems such as MicroTraffic indicate exactly where the problem is so that targeted measures can be taken to improve the traffic safety.
- It is crucial that these relatively 'new' data sources are analyzed and interpreted correctly. This expertise is not always present within city administrations. Raw data are meaningless without that expertise.
- We see growing opportunities and interest for using and combining new data sources (e.g. GPS combined with counting to get a detailed insight in cycling behaviour).

Figure 8.1: Measuring bike Bruges

Figure 8.2: Sniffer bike Zwolle (photo Eric van Dijk)

8. COLLECTING DATA WITH CYCLING

Introduction

A different type of data collection is the collection of all kinds of data with cycling. This concept combines cycling, data collection, citizen science and participation. With the use of low-cost, small sensors, citizens are being involved in the data collection process. It is an accessible form of data collection, as it enables citizens to collect data while they do their regular bike trips to work, school or anywhere else. This data can then be used to inform policy decisions.

Implementations in BITS

- In Bruges (BE), a measuring bike ('meetfiets'; see figure 8.1) cycled on the bicycle network in 2020 and 2021 while measuring the quality and comfort of the infrastructure. This led to a clear overview of the status of bike paths and measures that need to be taken to improve the quality at certain locations.
- The Province of Antwerp (BE) has conducted a similar project with measuring bikes (see figure 8.2). The goal of this project was to evaluate three types of measuring bike systems. The preferred type of measuring bike systems depends on the goals to be achieved.
- The municipality of Zwolle (NL) has collected data on air quality on and along bike routes in Zwolle. Inhabitants conducted the data collection by installing sensors on their bikes. Similarly, Deelfiets Nederland installed sensors on their shared biking system. The sensors collected environmental data when inhabitants were cycling. All collected data together give insights in the air quality along the cycle routes in the city.
- As mentioned in chapter 3, the county of Yorkshire (UK) launched a bicycle library where inhabitants could borrow bikes. Those bikes are equipped with sensors (see.sense) that collect data such as braking location, speed, and road quality.

Lessons learned

- In general, the sensor technologies were well received by participants. The technology of sniffer/measuring bikes was seen by participants as easy and convenient to use.
- Each measuring system generates the GPS coordinates in its own way, which influences the comparability of different measurements since the location definition is not necessarily the same. Further research should point out to what extent different cycling speeds affect the precision of the results.
- Patents and economic interest of the data providers should be taken into account. In Antwerp, the raw data of all three technologies could not be released because of this. When the data are processed (aggregated or summarized for instance), some details will get lost that may have helped in defining a better comparability between the three technologies.
- Projects where citizens are responsible for data collection, the possibility for citizens to see the data they collected, the convenience of the sensor and the involvement of the government are seen as positive aspects that make citizens want to contribute to data collection.
- As a consequence, these types of implementations do not only serve a purpose in terms of collecting data, but also in getting people more involved in both data collection and understanding, as well as in the decision-making process that follows.

1

Available
- Make information available to all parners

2

Understand
- Understand the information and format of all datasets

3

Process
- GDPR
- Data standards
- Open Data

4

Process
- Share
- Discover
- Innovate
- Developе ITS

Figure 9.1: data reflex

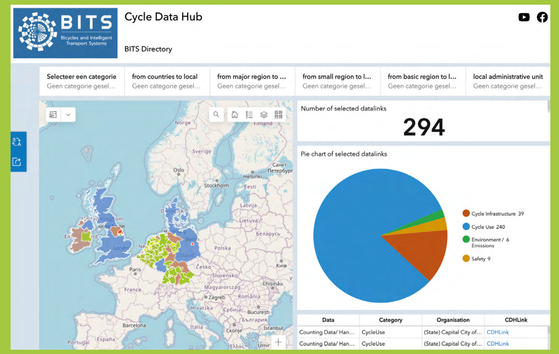


Figure 9.2: CycleDataHub

Figure 9.3: Bicycle-data.de

Figure 9.4: Fietsbarometer Antwerp

9. USING AND SHARING DATA

Introduction

Cycling data is gaining importance. Integrating ITS with cycling creates a lot of new data-opportunities, that can be used to improve bicycle policies or justify new cycling investments. Being able to spot and capitalize on data opportunities is what we have called the 'data reflex'. This data reflex consists of 4 steps (see figure 9.1):

1. Seeing the opportunities of data and making sure data will be available.
2. Having an understanding of the collected data (what value does the data have and what does the data look like?).
3. Processing data in a correct manner (taking into account privacy standards etc.).
4. Sharing the data with others.

Implementations in BITS

- The CycleDataHub (CDH) is an international platform developed and launched by the Province of Antwerp (BE), see figure 9.2. The goal of the platform is to collect, share and compare cycle data sets. The CDH contains data on bicycle use, infrastructure, health, safety, climate impact and bicycle business performance. These data are essential to give the cyclist more visibility in statistics, analyses, and policy, with the ultimate goal to increase the take-up of cycling and reduce CO2 emissions.

- The university of Oldenburg (DE) developed the platform bicycle-data.de (see figure 9.3). The platform is meant to display analyses and visualizations, and to compile and process raw data.
- The cycle barometer dashboard is developed by the Province of Antwerp (BE) and is meant to improve bicycle policies with objective numbers and scientific research. Some of the data have been collected with the sniffer bike (see chapter 8). The platform shows, amongst others, the number of cyclists using several roads, the bottlenecks in the network and collision locations.

Lessons learned

- Sharing data creates more value because more people using the data leads to new insights. In order to make the data accessible, the user friendliness of a platform is crucial.
- When developing a data platform, be sure about what data can and cannot be collected without consent of cyclists (according to the General Data Protection Regulation (GDPR)). We found out that thorough debate on GDPR guidelines is still very much desired.
- In the process of collecting and sharing data, it is important to consider what and how much data will be collected, in what format, and how the data will be analyzed afterwards. For example, is the data openly available or is it owned by the client? Was the tender by the client clear on data ownership? These questions have an indirect impact on the availability of datalinks,

CycleDataHub

Bicycle-data.de

10. OUTLOOK

Future developments

Several developments are expected for ITS for cycling:

- Increased interaction between the cyclist and other vehicles and between the cyclists and the infrastructure. This interaction will probably focus on improving road safety of the cyclist and improving traffic flow. A development we already see is that of intelligent traffic lights: traffic lights will be influenced when cyclists are approaching (e.g. through GLOSA (Green Light Optimal Speed Advice) messages).
- Increased integration of cycling in the multimodal transport chain: combining cycling with public transport, parking at public transport stations, shared mobility options, MaaS. Standardisation of data will be key to success, for example GBFS, the open standard for shared mobility.
- Information provision to cyclists about routing, parking, traffic and weather conditions. This will be mainly focused on improving convenience and comfort for the cyclists. The main technology will be smart phone apps.
- Data management and usage: collection, processing, storage, interactions, standards, regulations, privacy. Data collection will move from inductive loops to radar, LiDAR and (infrared cameras), as well as floating bike data. The data will become available through open data platforms such as National Access Points (NAP). In the NAPCORE[2] project standardisation and coordination activities operate to facilitate the exchange and search of cycling and cycling infrastructure data through the NAPs.

Besides the developments we foresee, we may ask ourselves what kind of developments we want. Technologies will keep evolving and we can influence these developments with policies, rules, and investments. How do we want technologies to evolve further? What kind of (urban) environment do we want to live in and what does that mean for the things we should do right now? Cycling ITS has shown to efficiently bring more safety, sustainability, inclusion, health, and fun to our mobility system. As such it is a valuable tool in cycling policies in addition to cycling infrastructure, bicycle parking, education, and promotion.

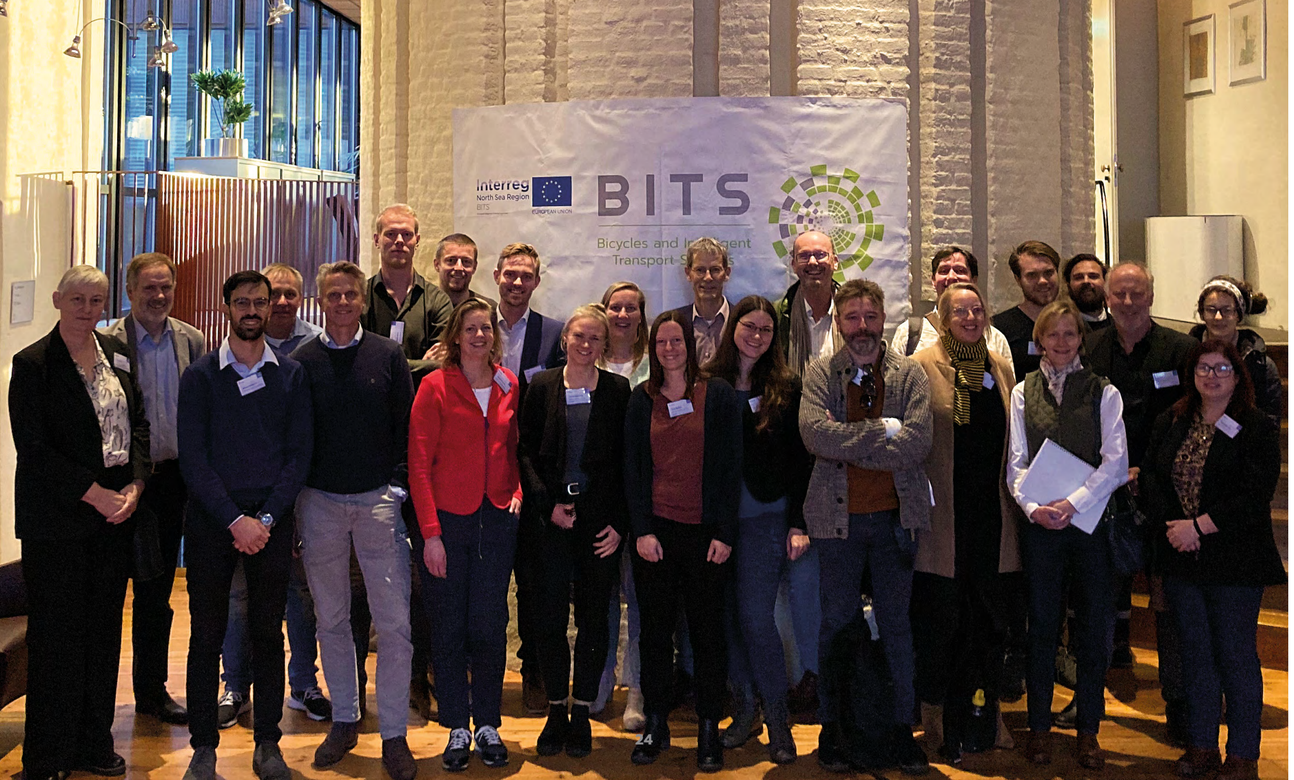
MegaBITS

In April 2023 the Interreg North Sea program approved the MegaBITS project (Mobilizing Europe's Green Ambition through Bicycles and ITS). MegaBITS will focus on five flagships across seven cities/regions, each with its own theme:

- Province of Overijssel, City of Zwolle, City of Enschede
- City of Copenhagen
- City of Hamburg
- Province of Antwerp
- Le Havre Seine Métropole.

Apart from the five flagships, the project will further develop the CyclingDataHub (CDH) and the BITS Directory (BID). These tools will facilitate the development of a fuller ecosystem for connected cycling technologies and streamline the procurement process for these technologies.

[2] *See https://napcore.eu for more information about the NAPCORE project.*



11. ABOUT BITS

What is BITS about?

The BITS project was a large-scale Interreg North Sea Region initiative focused on the deployment of advanced technologies in the bicycle and intelligent transport systems sectors. Over the course of four years (2019-2022), we have made significant progress towards promoting cycling as a clean and sustainable mode of transport in the region through the deployment of new ITS technologies and solutions, establishment of partnerships and collaborations, engagement of a wide range of stakeholders, and organization of numerous events.

Some of the achievements we are proud of are:

- Over 30 implementations in Belgium, Denmark, Germany, the Netherlands and the UK
- A thorough and standardized evaluation of those implementations
- The creation of the CycleDataHub, BicycleData.de and the BITS directory
- The creation of a cycling and ITS community with over a 1.000 businesses, governments and academic institutions
- Participation in over 20 conferences and exhibitions (see European Tour)

The partnership

BITS is a collaboration of public, academic and private institutions, consisting of:

- Province of Overijssel (lead, NL)
- City of Zwolle (NL)
- Deelfiets Nederland (NL)
- Cycledata (NL)
- Province of Antwerp (BE)
- City of Bruges (BE)
- VIVES (BE)
- CIE (BE)
- Baron Mobility (DE)
- University of Oldenburg (DE)
- City of Aarhus (DK)
- East Riding of Yorkshire Council (UK)

The BITS project was co-funded by Interreg NSR and had a total budget of €5,6 million. For more information on the BITS project and our achievements, please see our website through the following QR code:

Closing words from the project managers

As Mobycon, we're really thankful for the chance to be part of this project, since the Province of Overijssel gave us this opportunity. We want to say a big thank you to all the partners, stakeholders, supporters, and of course, the Interreg NSR program, who all helped make the BITS project successful. Your dedication and excitement pushed the project ahead and helped us reach our goals. Even though the project has finished, we're excited about the face the project will be continued through 'MegaBITS'. As we look forward to the future with MegaBITS, we hope you'll stay involved with us and keep being a key part of this adventure!

BITS
Bicycles and Intelligent Transport Systems

EUROPEAN TOUR

7-8 March 2019 – Zwolle
3-6 June 2019 – Eindhoven
11-13 June 2019 – Bruges
25-28 June 2019 – Dublin
4-7 September 2019 – Friedrichshafen
24-26 September 2019 – East Riding of Yorkshire
2-4 October 2019 – Graz
3 October 2019 – Brussels
7-9 October 2019 – Helsinki
2 December 2019 – Antwerp
18-20 February 2020 – Antwerp
10 March 2020 – Turnhout
6-9 September 2021 – Lisbon
10 September 2021 – Brescia
6 October 2021 – Copenhagen
11-15 October 2021 – Hamburg
1-2 December 2021 – Gothenburg
30 March 2022 – Antwerp
23-25 May 2022 – Bruges
30 May - 1 June 2022 – Toulouse
31 May 2022 – Deinze
1-2 June 2022 – Enschede
14-17 June 2022 – Ljubljana
22-24 June 2022 – Aarhus
13-15 July 2022 – Frankfurt
27 September 2022 – Hamburg.
6 October 2022 – Brussels
15-17 November 2022 – Zwolle