Evaluation report

Baseline implementations and overall impact

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1. Introduction

This evaluation report is the first report in a series of three. This report gives a current view on the ITS implementations and is a baseline report at the end of month 12 in the BITS reports. The second report will be an interim report at month 24 and the third report will be the final report at month 36.

For each implementing partner and each ITS implementation, it is described what the **intervention** will be, what **data** will be collected (amongst others for the evaluation of the intervention), what **effects** are expected and what the **expected impact on the overall project objectives** is. Afterwards, some more information on the general survey and how the survey contributes to the overall project objectives is given.

The ITS implementations and the general survey contribute to the following overall project objectives. Firstly, one of the main objectives is an increase in the take-up of cycling with 10% and a reduction of CO2 emission with 9% within target groups due to the implementation of ITS solutions. In this report, it is described how the specific interventions and the survey contribute to this objective. Moreover, the bicycle pyramid gives an overview of factors influencing the modal shift from car to bike. Three categories can be distinguished: safety and reliability; speed and convenience; comfort and experience. Each ITS intervention is situated on the Bicycle Pyramid.
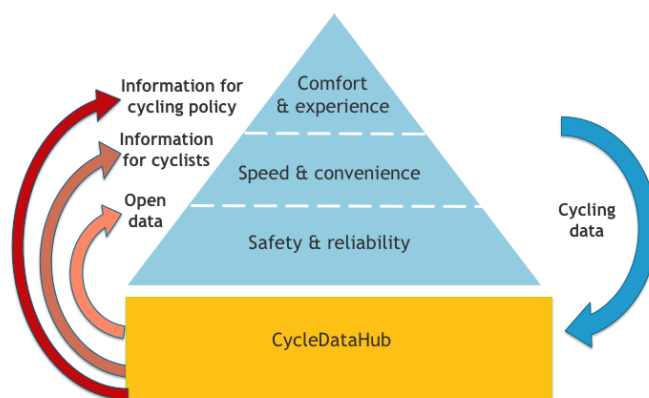

Figure 1: Bicycle pyramid and CycleDataHub

This version of the first evaluation report is written in December 2019 and contains all the latest information on the pilots. When new information on the interventions or on the evaluation of the interventions is available, it will be added to the report.

2. Aarhus

2.1. Dynamic safety time by radar

Intervention

This ITS intervention is a sensor put at traffic lights on a cross road where cyclists come downhill and thus have a certain speed. The sensor detects the cyclists coming and can influence the traffic lights. The sensor can extend the green for the cyclists or can extend the inter-green-time so the cyclist can still reach the other side of the crossing without vehicles coming from other directions. With this sensor, the city of Aarhus wants to increase safety, avoid conflicting traffic and avoid that cyclists need to brake rapidly for the red light. This intervention is planned in Summer 2020.

Data

Before the implementation, the cyclists using the intersection will be **interviewed**. Their opinions about the intersection and the safety will be asked. Possibly, a **camera** will be put on the intersection and the behaviour of cyclists and (near) accidents will be filmed.

During the pilot, the speed and position of cyclists will be **detected** using a radar and the number of incidents where the traffic regulations has been changed will be **counted**.

After the implementation, the users of the intersection will be **interviewed** again about their experiences on the intersection, e.g. do they feel more safe now. A **camera** will be used again to film the behaviour of the cyclists and the (near) accidents.

Expected effects

With this intervention, the colleagues in Aarhus expect to have more safety at that downhill intersection and less (near) accidents.

Impact on project objectives

This intervention will contribute to the objective of an increase of cyclists and a decrease of CO_2 emission thanks to the counting of the cyclists. Due to the cycle counters, information on the amount of cyclists will be available. However, no pre and post counting information will be available.

This intervention can be situated on the first and second level of the Bicycle Pyramid, i.e. safety and reliability and speed and convenience. It will increase the safety on the intersection since cyclists won't need to brake on short notice or won't cross the crossing through red lights anymore. Cyclists will also have the possibility to maintain their speed when cycling downhill.

2.2. Smart lightning

Intervention

In and around the city of Aarhus bicycle paths and highways often go through ecological zones. In these parts, it is not allowed to install regular lightning along the road for environmental reasons. Therefore, LED lights in the pavements not disturbing nature but giving light to cyclists can be a solution. The city of Aarhus would like to test these LED lightnings in different parts of the cycle highways. Moreover, they

would like to add different colours to the LED lights giving information to the cyclists. The lights can for instance give information about the temperature of the road surface, a dangerous crossing or a turn in the road ahead. The installation of this intervention is planned in 2021.

Data

Before installing the LED lights, the inhabitants of Aarhus will be **involved** in the project. They will be asked which kind of information they would like to receive from the lightning. Also the number of cyclists using the highways at certain locations will be measured using **counting systems**.

After installing the LED lights, the users will be **interviewed** about their experiences. They will be asked how they perceive the LED lightning and whether it is an added value for them. The number of cyclists will again be **counted** to see whether there is an increase in cyclists, (possibly) due to the lightning system.

Expected effects

On the one hand, an expected effect is to give more safety for cyclists. Due to the lights, they see more in the dark. On the other hand, they want to increase citizen participation via the input they can give on the colours and the meaning of the colours.

Impact on project objectives

This ITS implementation will contribute to the objective on the increase of cyclists since via the counting systems information will be available on the amount of cyclists before and after the implementation of the smart lightning system.

The intervention can be situated on level 1, safety and reliability, and level 3, comfort and experience, of the Bicycle Pyramid. It contains to safety and reliability since cyclists will have safer cycle paths and highways and will have orientation in the dark. Moreover, it contributes to comfort and experience since cyclists will receive information about the road.

2.3. Travel time

Intervention

The city of Aarhus wants to collect information about the travel time on certain bicycle routes in and around the city, e.g. from a neighbourhood to the city centre. They will distribute Bluetooth tags to cyclists using the cycle routes and the tags will collect the data needed. When they have the information, they will put information signs on different locations in the city indicating the time needed to cycle to place X or Y. They would like to put these signs amongst others on places in the city where people using different transport modes meet, since they have noticed that people do not always have the correct information about travel time with different modes of transport. With these signs they hope to convince car users to take the bicycle instead of the car, when they notice that cycling to their destination only takes 10 minutes more compared to driving the car. Due to a lot of up and downhill roads in the city and the choice for the most optimal cycle routes, the real cycle time is not yet available for cyclists or the cycle time given in for instance Google Maps is not accurate. This ITS intervention is planned in 2021. The Bluetooth tags still need to be developed.

Data

Via the Bluetooth tags, **information on travel time** for cyclists will be collected in a large data set. When passing a certain sensor with the Bluetooth tag, data is collected. Before, during and after the pilot, **cycle counters** will be put on cycling paths counting the numbers of people passing by. After the intervention (i.e. collecting data on travel time and putting up the signs with the travel time), users and other inhabitants will be **interviewed** about the pilot: do they think it is useful, would they change from car to bike etc.

Expected effects

The city of Aarhus hopes that more people will cycle due to the travel time information they have after the pilot. Also, via collecting the travel time data, they hope to receive information on potential difficulties cyclists and commuters have.

Impact on project objectives

The increased information given to inhabitants of Aarhus about the travel time to the city will presumably lead to an increase in cyclists. The counters will partly give a proof of this assumption, however possibly the effects of this intervention will only be visible after some years.

This intervention contributes to the second level of the Bicycle Pyramid, i.e. cyclists will get information on travel time thanks to this intervention.

3. Bruges

3.1. Parking Referral System for Bikes

Intervention

The city of Bruges will install a parking referral system for bikes in two underground parking in the city centre. This system has three goals: (1) make it for the users easier to find an empty parking spot; (2) make it for the city easier to detect orphan bikes so they can remove them faster; (3) the system will give the city permanent information about the occupancy rate of the parking. This system will be implemented during Spring 2020.

Data

Before the implementation of the camera system, the city will **count** the amount of people using the underground parking. Also, users of the parking will be **questioned** about their level of satisfaction of the parking using a survey. After installation of the camera system, the occupancy rate will be **counted** again and the users of the parking will be **questioned** again. Through the camera system, the city will also have **data** about the amount of orphan bikes and about the amount of time a bike is parked in the underground parking.

Expected effects

With the implementation of the camera system, the city of Bruges expects an increase in the usage of the parking and an increase of people coming by bicycle. Moreover, they expect an increased level of satisfaction of the users, since they can more easily find a parking spot and since there are more spots available.

Impact on project objectives

Using the counting of people putting their bicycle in the underground parking before and after the intervention, it will be possible to make statements on the overall objective of the project, i.e. the increase in cyclists and the decrease in CO2 emission.

The intervention can be situated on level 2, speed and convenience, of the Bicycle Pyramid. Since cyclists will have more available spots in the underground parking and will receive more information on these parking spots, it will be more convenient for cyclists to use the parking.

4. East Riding of Yorkshire

4.1. Counting cyclists

Intervention

Since cycling is not very popular in Withernsea and by extension in East Riding of Yorkshire, they would like to promote cycling in the region. The East Riding of Yorkshire Council will install temporary static counters to count cyclists for four times during the project: in December 2019, December 2020, August 2021 and March 2022. They will gather information on the number of cyclists, their direction of travel, their speed of travel and the date time and location. During the years of the BITS project they will collect a lot of data and they will follow the evolution in cycling.

Data

During the pilot, **data** on the number of cyclists will be collected. With the general **survey** in the BITS project, they will collect information on cycle motivations and barriers to cycle. In **informal conversations**, people from Active Withernsea collected information on cycle motivations and the health and wellbeing of people.

Expected effects

This intervention will give the council a lot of information on the cyclists and the evolution in cyclists, amongst others due to the other intervention they plan (see 4.2).

Impact on project objectives

After collecting data for a longer time, information on the increase of cyclists will be available.

This ITS implementation has no immediate impact on the Bicycle Pyramid.

4.2 Bicycle library

Intervention

With the bicycle library pilot, the East Riding of Yorkshire council wants to promote cycling. They will lease approximately 50 bicycles to inhabitants of Withernsea for a year. Using a box on the bicycle, they will be able to collect a lot of information on the usage of the bike (e.g. usage, speed, distance) and on cycling infrastructure (e.g. road condition). The subject of this project is not only the renting of bicycles, but social workers will also play a role. They will function as cycling buddies and will follow the bicycle users. They will get in touch with the users during the project with different purposes: to follow up the cycling, to give the users trainings concerning e.g. bicycle safety, to follow up their wellbeing, to support them when their motivation is decreasing etc. This intervention is planned to be rolled out in Spring 2020.

Data

Different sources of data will be collected. Firstly, **statistics** on the usage of the bicycles and the cycling infrastructure will be collected during the intervention. Active Withernsea, a social organisation in Withernsea, will conduct **interviews** of the users to get more information on their perceptions of the bicycles and the pilot. Thirdly, the social value engine will be used to calculate the **social return on**

investment on this intervention. The partners in East Riding do not only want to know how many people are how often cycling, but they also want to measure the social impact of this intervention on the users: what about their wellbeing, the potential to get out of isolation, the effects on their health etc.

Expected effects

The partners in East Riding not only expect to motivate more people to cycle in Withernsea with this pilot, they also want to invest in the community of Withernsea. They hope to get more people out of social isolation and want to improve the health and wellbeing of participants with this intervention.

Impact on project objectives

It is hoped that the indirect impact of this intervention will be that more people will cycle in Withernsea. However, the direct impact on the increase of cyclists will be measured via the counters, described in 4.1.

The intervention can be situated on level 3, comfort and experience, of the Bicycle Pyramid since this pilot is focused on increasing the user comfort and experiences.

5. Baron Mobility Oldenburg

5.1. Interactive mobile application for cyclists

Intervention

Baron Mobility will develop an interactive mobile application to motivate employees of companies to cycle more. They've noticed that the interest of companies in (electrical) bicycle leasing is growing because of requests of their employees or because of a need to improve their ecological footprint. Baron Mobility will develop an app with gamification features, routing and tracking options and other features. Using the app, they will collect data on cycling and commuting behaviour. The app will be introduced in the companies in 2020 and will run for around 14 months.

Data

Baron Mobility has already **statistics** available on their number of clients, the number of employees in the companies and the number of leased bikes. During the pilot, they will collect information through the app on the usage of the leased bikes, on the number of bike commuters, on the number of app-users, on the frequency of biking and the frequency of using the app. Via a GPS in the app, they can also collect data on the locations, driven kilometres, speed etc. of the app-users. Possibly, the city of Oldenburg will also collect counting data and data on infrastructure. From the German weather service, they will receive data on the weather conditions.

Users of the app will receive a pop-up from time to time with **questions** concerning their satisfaction about the app. They will be questioned how often they are cycling now and whether they are cycling more at the moment compared to when they started using the app.

Expected effects

Baron Mobility will have a lot of data available on cycling behaviour and bicycle use through the implementation and the use of the app. They expect also to encourage more people to cycle and cyclists to cycle more due to the gamification element. Through the pop-up questions for the cyclists, they will receive information on the user satisfaction.

Impact on project objectives

Baron Mobility will have a lot of data available with which they can contribute to the first overall objective, i.e. the increase of cyclists. It will be possible to make conclusions concerning the increase using their data sets on the number of cyclists.

The cycle app can be situated on level 3, comfort and experience, of the Bicycle Pyramid due to the gamification feature it contains.

6. Province of Antwerp

6.1. Traffic measurements with 3D cameras

Intervention

A dangerous intersection in Bornem with a lot of (serious) accidents in the past is the subject of this intervention. At the intersection a railway crossing, industrial zone, primary road and a cycle highway come together. Using 3D cameras, the Province of Antwerp wants to get insight in the behaviour of participants and in near accidents at the junction. With the results of the cameras they will be able to make documented recommendations to make the junction safer. The cameras were put in place for three full days and two half days in September 2019. Afterwards the results were analysed in different ways.

Data

Before the pilot **information** was available on the number of accidents at the intersection, via the Flemish government. The 3D cameras will collect **statistics** on the number and location of near accidents, on the number of cyclists and other road users and on the traffic flows. Through the Large Scale Survey the Province of Antwerp has data available on the amount of non-cyclists willing to choose for the bicycle in case of safer infrastructure. They also have data available on cycle infrastructure. Via the survey distributed in the BITS project information about the perception of safety at the intersection will be collected.

During the process of the pilot, several other data was also collected. In a **group discussion**, the mobility team of the Province of Antwerp thought about the main traffic flows, conflict areas and possible solutions. After the release of the camera results, in a commission of mobility several professionals and involved citizens **discussed** the results, problems and possible solutions. In **meetings** internally small infrastructural changes were discussed. Within the scope of the project, it is the intention to make small infrastructural changes improving the safety of the junction. Possibly, users of the intersection will be **interviewed** afterwards about their perception of the changes.

Expected effects

With the camera measurements, the Province of Antwerp will gain a lot of insight in the intersection and the traffic flows on the intersection. With this information, they will be able to do small interventions and increase the safety on the junction.

Impact on project objectives

It can be assumed that due to the camera recordings and the changes made to the intersection, the intersection will become safer and people will cycle more. However, at this moment, it will be difficult to prove the increase in cyclists due to this intervention using data collected within the scope of this ITS implementation.

This ITS implementation can be situated on the first level of the Bicycle Pyramid, the safety and reliability level since due to the camera recording, the safety will be increased on the intersection.

7. Zwolle

7.1. Sniffer bike

Intervention

The first intervention of the city of Zwolle is the sniffer bike. A small box collecting environmental data on air quality is put on the bicycles. Using these data, the city will have information on the 'cleanest cycle routes'. They will promote the cleanest route to cyclists and they will invest more in maintenance of the infrastructure on these routes. Their hypothesis is that investing in the cleanest route will motivate people to cycle more on this route. In December 2019, the first 10 people started using the Sniffer bike for three months. In 2020 more people will follow.

Data

Several data will be collected in the light of this pilot. The city will **count** the number of cyclists on the different cycle routes before promoting the cleanest routes. Before implementing the pilot, they will **interview** the users of the sniffer bikes and ask them their motivation to participate in the project. During and/or after the project, the participants will be **interviewed** again. They will be questioned about the impact of the sniffer bikes on them, conditions and barriers when using the boxes etc. The boxes on the bikes will collect a lot of **quantitative data** about air quality, routes used, speed, cycled kilometres, etc. When the cleanest route is known and promoted, non-cyclists will be questioned via a **survey** about their willingness to cycle.

Expected effects

The city will receive information about the cleanliness of different trajectories in the city of Zwolle. Via promotion, they hope to count more cyclists on these clean routes. The city will have information on which routes they need to prioritize for infrastructure maintenance. This should also lead to more cyclists.

Impact on project objectives

This ITS intervention will contribute to the overall project objectives since it hopes to motivate people to cycle more due to the promotion of the clean routes. However, as foreseen at the moment, it won't be possible to make conclusions concerning the increase of cyclists based on the data collections currently planned.

This implementation can be situated on the third level of the Bicycle Pyramid. Since inhabitants of Zwolle will receive information on clean cycle routes, their comfort and user experience when cycling is increased.

7.2. Smart lightning

Intervention

In an area under development the city of Zwolle wants to install smart lightning in the cycle paths. This area is an industrial area, but located in an ecological zone. Therefore, the cycle path and the lightning

cannot disturb nature. Both the cycle path and the smart lightning still needs to be installed. At this moment, it is unclear when the cycle path will be constructed.

Data
The city will collect **data** about the number of cyclists in the area after the implementation of the pilot. Moreover, using a **survey** they will ask people about their use of the illuminated vs unlit cycle routes.

Expected effects
With this intervention, the city of Zwolle wants cyclists to give more comfort in cycling, using good, illuminated infrastructure. They also expect more cyclists in this area due to the new cycle path.

Impact on project objectives
The assumption of the city of Zwolle is that more cyclists will be attracted to the new, well equipped cycle path. However, as foreseen at the moment, no data collection to prove this assumption and to be able to make conclusions concerning the objective on increase in cyclists and decrease in CO_2 emission is planned. Since there is no bicycle path at the moment, a pre-measurement of the number of cyclists before the implementation is not possible.

This intervention can be situated on the first and third level of the Bicycle Pyramid, i.e. safety and reliability and comfort and experience. The cycle path will be safe due to the lightning and the new infrastructure and the comfort of cyclists will be increased since it is a new, beautiful cycle trajectory in an ecological zone.

7.3. Priority for freight bicycles

Intervention
As in other cities, the amount of cargo traffic is increasing in Zwolle. Therefore, the city wants to encourage green mobility with this pilot and wants to reduce freight trucks in the inner city. Freight bicycles will be given priority at the traffic lights. The cyclists will use an app which will track them during their route and which can send signals to traffic lights being able to give priority to these cyclists. This pilot is still in the starting phase and will be rolled out in 2020 or 2021.

Data
The app will collect **data** about how often the cyclist is giving priority at traffic lights (*more info still missing)*. A **survey** will be rolled out to collect information about the time gained and the amount of money saved by the app (*more info still missing*).

Expected effects
The city expects more traffic on bicycles instead of with cargo trucks, which results in more green mobility.

Impact on project objectives

The city of Zwolle aims to attract more cyclists due to the app, and thus reduce cargo traffic by car. However, since no pre-measurement is foreseen at the moment, it will not be simple to make conclusions concerning the increase in cyclists and the reduction of CO_2 emission.

This ITS implementation can be situated on the second level, i.e. speed and convenience, of the Bicycle Pyramid. The cyclists will reach their destination faster due to the priority they receive at traffic lights.

8. General survey

Besides the specific evaluations of the ITS implementations, a general survey across all implementing partners will be distributed. This survey has different goals it aims to reach. Firstly, with statements on motivations to cycle, it wants to distinguish different types of cyclists (e.g. people cycling as an exercise, for health, for environmental reasons, for financial or social reasons). Secondly, it will be investigated which ITS interventions are preferred by which type of cyclists. Thirdly, the perception of the respondents (cyclists and non-cyclists) against ITS in cycling will be investigated. And finally, the current cycle use and their willingness to cycle in the future is also questioned in the survey.

With this survey, we wanted to bring coherence in the evaluation part of the project. We will be able to make statements over and between participating cities and regions with regard to cycle use, cycle motivations, perceptions against ITS etc. In the last part of the survey, the six implementing partners were given the opportunity to add questions which would only be added to the survey in their city or region.

The survey will be rolled out in Spring 2020 and its goal is to reach as many inhabitants (cyclists and non-cyclists) in the implementing cities and regions (Bruges, Zwolle, Aarhus, Oldenburg, East Riding of Yorkshire and Province of Antwerp) as possible. The survey is a one-time web survey.

With this survey, we will also be able to make some statements with regard to the overall project goals. Firstly, two of the most important goals of the BITS project are a 10% increase in cyclists and a 9% reduction in CO_2 emission due to ITS, within target groups. With the question 'to what extent would these technologies convince you to cycle (more often)?', we will be able to make statements on the increase of cyclists and reduction of CO_2 emission due to ITS. We investigate the willingness to cycle with this question. Using statistical analyses, it will be possible to deduct the responses on this question to a percentage in cycle uptake. Secondly, different questions in the survey will give information on the importance for respondents of speed, safety, comfort and other elements of the bicycle pyramid. To give some examples: the question regarding the satisfaction with the cycle infrastructure, the question about the barriers for cycling (more), the question about the ITS interventions, the questions about the motivation for cycling.

Depending on the questions added in the case-specific part of the survey, they contribute to one or more overall goals of the project.