DIRECTORATE-GENERAL FOR MOBILITY AND TRANSPORT

Directorate-General for Mobility and Transport

EUROPEAN COMMISSION

D3: Projects relating to the impact of new technologies on vehicle safety and passenger safety

SAFECYCLE

The Intelligent Bicycle Initiative for safe cycling in Europe

Project Acronym: **SAFECYCLE**

Project Coordinator: **Mobycon (Netherlands)**

Proposal full title: **ICT applications for safe cycling**

Grant Agreement No: MOVE/D3/SUBV/2010-125/SI2.593924/SAFECYCLE

Document Title: **SWOT analysis results and best potential ICT applications**

Authors: **Antonino Tripodi, Luca Persia: CTL (Italy) - Marjolein de Jong: Hasselt University, IMOB (Belgium) - Ronald Jorna, Angela van der Kloof, Henk Jan Zoer: Mobycon (The Netherlands) - Radomira Jordova, Zbynek Sperat: CDV (Czech Republic)**

Summary: **Overview of activities realised for SWOT analysis of ICT applications and selection of most promising applications to be assessed**

Status: **Rev.1**

Distribution: **All Partners**

Date: **May 2012**

Project start: 1 June 2011 **Duration: 18 Months**

Table of Contents

List of Figures

List of Tables

List of Terms

Abbreviation	Definition
SWOT	Strengths, Weaknesses, Opportunities, Threats

1. Introduction

ICT can be used in cycling to provide intelligent systems that assist the cyclist to avoid, prevent, or mitigate accidents. This can be done for example by providing correct information on the safest route, avoiding red light offences, bicycle detection by vehicles, blind-spot signalling for trucks, or by using intelligent bicycles, thus reducing the risk of getting injured or the seriousness of the injury. Although isolated ICT applications and services have been developed for cycling, there is no integrated approach to research activities in this domain at a national or international level. To fill in this gap, the SAFECYCLE project was proposed in 2010 and accepted in 2011. The main objectives of SAFECYCLE are:

- to identify e-safety applications that have the potential to enhance the safety of cyclists in Europe;
- to create knowledge and raise awareness about e-safety applications applied to cycling (policy, industry, users);
- to speed up the adoption of (new) e-safety applications in cycling.

E-safety applications for cycling are a “greenfield” domain. Therefore we started the SAFECYCLE project with a worldwide survey of potential e-safety applications for cycling. The survey consisted of an Internet search; mobilizing our network in the fields of cycling, ICT and safety; and reviewing completed and ongoing EC projects and initiatives. The survey was qualitative in nature. Next we focused on the e-safety applications with the highest potential, based on SWOT analysis, followed by impact assessment for those e-safety applications with the best SWOT score. This showed which e-safety applications/services contribute most to safe cycling. Then recommendations are made concerning further development, standardisation and deployment. Dissemination activities will be carried out aimed at establishing a platform for e-safety applications/services for cycling. A research and demonstration agenda will be formulated and the need for standards in e-safety assessed. Last but not least, a platform will be established for match-making between relevant parties (ICT and cycling industries, the Intelligent Car Initiative, (local) authorities, service providers) and for communicating the results.

1.1 Work Package 3

The aim of Work Package 3 is to select the most promising ICT applications among those identified in Work Package 2, and to assess their impact on cyclist safety. To identify the most promising solutions, a SWOT analysis of the applications was carried out by European cycling and road safety experts. The analysis identified the strengths, weaknesses, opportunities and threats of 30 cycling-related ICT applications.

Strengths and weaknesses refer to the internal environment of an application or service, and give an overview of what the application or service can or cannot provide to the users, the community, etc.

Opportunities and threats refer to the external environment of an application or service, and give an overview of the potential improvements or risks associated with using an application or service. They relate to demographic, economic, political, social and technical factors.

For each application and service, the results of the SWOT analysis were set out using a template indicating their strengths, weaknesses, opportunities and threats.

A meeting with a group of European cyclists enabled us to collect opinions from a sample of the potential end users of the applications. The two sets of information were merged and the 11 most promising applications were selected for impact assessment.

2. Methodology for analysis of the applications

The objective of this phase of SafeCycle was to review the possible ICT applications for cyclists (or from which cyclists could benefit) and to select the most promising ones for further analysis.

To do this, opinions about a set of applications were collected from road safety and transport experts and from bicycle users.

The methodology consisted of the following steps:

1. selection of applications to be assessed;
2. SWOT analysis of selected applications by experts;
3. opinions on applications from bicycle users (i.e. workshop);
4. brainstorming session among SafeCycle partners to identify the most promising applications, based on the experts' analysis and the cyclists' opinions.

The first step was carried out by SafeCycle partners, who, through consultation, selected the 30 most reliable applications among the 121 found (see D2.1 for more details). These apps covered all of the 'clusters' of application types: cyclist, bicycle, other vehicle, infrastructure, internet and nomadic (i.e. portable devices such as mobile phones).

The members of the consortium selected the 30 applications on the basis of the following criteria:

- a good spread over the various dimensions and subcategories;
- enough information available for the SWOT analysis and the impact analysis;
- innovative aspects of the application (where there was a choice between different applications within one subcategory).

A sheet has been compiled containing information about each application. These sheets were used for the SWOT analyses.

Table 1 shows the applications to which the analysis methodology was applied.

Table 1 Short list of 30 applications

Subcategory	No	Name of application	Idea in short
Cyclist			
Visibility	C03	Speed vest	The speed vest shows the speed of the cyclist.
Bicycle			
Direction indicator	B04	Direction indicator on handlebars	A direction indicator on the handlebars informs other road users that the cyclist is about to change direction.
e-Bike	B05	Copenhagen Wheel	Developed by MIT SENSEable City Lab for the City of Copenhagen, with support from the Italian Ministry of the Environment and Ducati Energia s.p.a. It should provide a solution for the clunky and unwieldy battery packs (internal or added) connected to the motor.
Physical problems	B09	HindSight35	A rear camera records the movements around the bicycle and the images are shown on a display on the handlebars. The cyclist knows what is going on behind the bicycle without having to make extra manoeuvres. This allows the cyclist to focus on the road ahead and to avoid instability.
Handlebars	B14	Foldable Cycle Handlebars	A lot of the abdominal injuries suffered during cycle incidents are caused by the handlebars. If the handlebars were to move away, injuries might be less severe.
Street projection	B17	Light Lane Bike	A green laser projects a cycle lane behind the bicycle, which increases the visibility of the cyclist and makes it easier for other road users (car drivers) to react appropriately to the cyclist's presence.
	B19	Self-Powered Laser	The laser light (that surrounds the bicycle) is green when there is a correct action. The distance sensor is activated when there is a wrong action. Automatically, the laser light becomes red and the twelve horns start to sound.
Visibility	B20	Bicycle braking light	The rear light of the bicycle becomes brighter when the cyclist starts to brake.
	B24	Hokey spokes	Hokey Spokes are bicycle safety lights that allow riders to display computer-generated images and text inside the spoke cages while riding at night, making the bicycle more visible (e.g. lights with different colours can be displayed).
Warning system	B27	Safety Personal Area Network System	It connects an attachment to a mobile phone and communicates the bicycle position. The exchange of information between pedestrians and vehicles can be enabled. When the attachment receives a data packet from a vehicle, it transmits the information to the mobile phone.
Other vehicles			
Airbag	O01	Car airbag for cyclists	Decrease of severity of injuries of cyclists in case of an collision with a car bonnet.

Subcategory	No	Name of application	Idea in short
Speed	O04	ISA – Intelligent Speed Adaptation	By adapting the speed of individual cars, based on their position on the road network and specific characteristics of the vehicle, safety of specific road user groups can be increased.
Visibility	O07	Frontzicht	Blind spot detection by a camera monitor system to avoid blind spot accidents by trucks.
	O08	Night view	Detection of objects and pedestrians during the night-time so the driver can take account of them.
Warning system	O11	Approaching Vehicle Audible System	Electric/hybrid vehicles are very quiet. The system makes a noise so that cyclists and pedestrians are not surprised by a car.
	O18	ISI - Intelligent Speed Information	Intelligent Speed Information encourages car drivers to adapt their speed and to pay extra attention in specific situation, e.g. in the vicinity of schools.
	O20	LEXGUARD	Detection strips on the truck detect objects around the truck and trigger warning signs inside the truck.
Infrastructure			
Traffic light	I09	Countdown traffic lights	Traffic light gives information about the expected waiting time during red light.
	I10	Cyclist traffic light for rain	The traffic light has a shortened cycle for cyclists when it is raining.
	I13	Traffic Eye Zürich	To prevent conflicts between trams, buses and other traffic at intersections, bicycles get green before the public transport to increase the safety and comfort of the cyclist. Extra green is only given when cyclists are detected to ensure optimal use of the intersection.
Visibility	I16	LED-Mark	Increased visibility of cycle infrastructure by LEDs integrated in the cycle lane.
	I18	Photovoltaic panels to illuminate cycle lanes	Better visibility of cycle infrastructure by illuminating cycle lanes
Warning system	I21	See-mi	Application aimed at prevention of left-turn accidents.
Internet (web)			
Communication	W03	Street view for cycle infrastructure	To provide more detailed information about cycle infrastructure that can be viewed on the internet, like the current Street View for car infrastructure.
Route planner	W05	ArriveAlive	To provide extensive safety information for residents and visitors of South Africa about safety when using different transport modes.
	W12	Opwegnaarschool.nl	Educational application focusing on safety around the school and on the route to school.
	W13	Routeplanner Gent	Route planner enabling cyclists to plan a safe route, avoiding (perceived) dangerous situations for cyclists.
Nomadic			
Educational	N06	Bike Wise	Application for nomadic devices to contribute to safer cycling by reporting hazards and planning safe routes.
Monitoring & action	N09	Citizens connect	App for nomadic devices aimed at involving citizens in keeping the public environment liveable and safe.

Subcategory	No	Name of application	Idea in short
Physical problems	N11	Bikestability	App helping people with stability problems to improve their cycle capacities.

2.1 SWOT methodology

To identify the most promising solutions, a SWOT analysis of the 30 applications selected was carried out by SafeCycle partners and by road safety / transport experts. The analysis identified the main strengths and weaknesses, and examined the opportunities and threats of each of the 30 applications.

In SafeCycle, the strengths and weaknesses refer to the *internal environment* of an applicationor service, providing an overview of what the application or service can or cannot provide to the users, the community, etc.

The opportunities and threats refer to the *external environment* of an application, providing an overview of the potential improvements or risks associated with using the application or service. They relate to demographic, economic, political, social and technical factors.

For each application and service, the results of the SWOT analysis were set out using a template indicating their strengths, weaknesses, opportunities and threats.

This involved the following steps:

1. writing the questions to be answered in order to identify the strengths, weaknesses, opportunities and threats;
2. identifying the main experts to answer the questions;
3. asking the experts to provide their opinions about some of the applications;
4. collecting the opinions of the SafeCycle partners about all the applications selected;
5. merging all the opinions (in a worksheet for each application) and analysing them.

SWOT questions

A template was drawn up for the SWOT analysis. It was composed of four quadrants (for strengths, weaknesses, opportunities and threats) and provided a set of possible questions for each quadrant, allowing people filling in the SWOT to consider possible positive and negative aspects.

The questions related to:

- Strengths: advantages of the application, innovative aspects, etc.
- Weaknesses: disadvantages, gaps in capabilities, financial aspects, etc.
- Opportunities: impacts on mobility and the environment, customer satisfaction, quality of life, etc.
- Threats: economic impacts, awareness of benefits, political impacts, etc.

Figure 1 shows the SWOT sheet prepared for the applications analysis, including questions for each quadrant.

SWOT Analysis	< name of the application >		
Brief description:		Type of application:	
		Status:	

Strengths			Weaknesses	
Possible criteria	Assessment		Assessment	Possible criteria
Safety advantages		Internal environment		Safety disadvantages
Innovative aspects				Negative impacts on safety of cyclists
High ratio between safety and price				Costs for development
Directly developed for cyclists safety				Gaps in capabilities
Positive impacts on cyclists safety				Unusability for cyclist
Userfriendly application				Not common type of use
Immediate market availability				Completely new application
Similar application available				Prototype application
Main focus on safety				Impacting cyclist safety only indirectly
Increase of cyclist visibility				No information on safety impacts
Reduces interaction with other modes				No impact on cyclist visibility
Supports safer path choice				Low accident prevention
Trendy				Extra items to wear
Comfort				Structural weakness (e.g. can be easily broken)
				Works only if majority of users uses it
				Dependence on interaction with other actors on the road
Market developments		External environment		Legislative effects
Technology development and innovation				IT developments
Business and product development				Seasonality, weather effects
Useful in all geographical area				Useless in some geographical area
Potentially high market demand				High costs for use
Already existing				High costs for development
Previous experiences existing				Low market demand
Suitable for several target groups				Developed in different geographical/cultural context
Suitable for several motives				Useless for some user categories
Easiness in estimating safety impacts				Difficulties in estimating safety impacts
Low development costs				High technical skills for development
Low technical skills for development				Buyer of the application not directly benefiting of its use
Integation with other applications (e.g. phone)				Complexity of the application
				Can produce increase of external costs
				Subject to vandalism
Possible criteria	Assessment		Assessment	Possible criteria
Opportunities			Threats	

Figure 1 SWOT sheet and questions

Experts contacted for SWOT analysis

Each partner identified key European experts on cycling or road safety issues (e.g. researchers, cyclists' associations, public administrations, etc.), to be contacted for providing opinions on applications.

Each partner provided a list of 15 experts (mainly road safety and cycling experts and decision-makers in public administrations), each of whom was asked to provide opinions on 5 applications of a different category (i.e. cyclist, bicycle, other vehicle, infrastructure, internet and nomadic). 33 out of the 60 experts contacted provided their opinion about the ICT applications (see in Annex III the list of experts that provided their opinion).

The experts were then provided with:

- an introduction to SafeCycle, the SWOT and how to fill in the sheets;
- for each application, a sheet describing it and providing basic information to judge it;
- for each application, a SWOT sheet to be filled in.

Analysis of SWOT opinions

As well as preparing a single worksheet summarising the opinions of the experts and SafeCycle partners, a preliminary quantitative analysis of the answers was made. The aim was to create a first ranking of the applications to be used during the brainstorming session as a reference for selecting the most promising applications.

The formula used for ranking the 30 applications was:

$$SC_i = \sum w_j \cdot S_j + \sum w_k \cdot O_k - \sum w_h \cdot W_h - \sum w_l \cdot T_l$$

where:

- SC_i is the score of the application *i*.
- S_j is the opinion *j* on the application strengths.
- O_k is the opinion *k* on the application opportunities.
- W_h is the opinion *h* on the application weaknesses.
- T_l is the opinion *l* on the application threats.
- *w* is the weight assigned to the opinion, being equal to:
    - 1 if the opinion is not "safety related".
    - 2 if the opinion is "safety related".

The "safety related" opinions were considered those having a direct correlation with potential safety benefits or issues (e.g. "increase cyclist visibility", "directly developed for cyclist safety", "difficulties in estimating safety impacts", etc.).

When the same (or similar) opinion was given by more than one expert, this was considered in the formula by multiplying the opinion score by the number of experts giving it.

2.2 EUCG workshop with cyclists

It was important for the SWOT analyses to include the opinions of cyclists, to see where their opinion, based on practical experience, matches the opinion of experts and the project team.

In cooperation with members of the Brussels-based EUCG (European Union Cyclists' Group), a workshop was arranged in Brussels. Sixteen members (all active cyclists) from six different EU countries attended this meeting. The aim of the workshop was to collect as many opinions as possible about the various e-safety applications. General comments and recommendations were also welcome.

The participants

Figures 2 to 4 show the background and some characteristics of the cyclists.

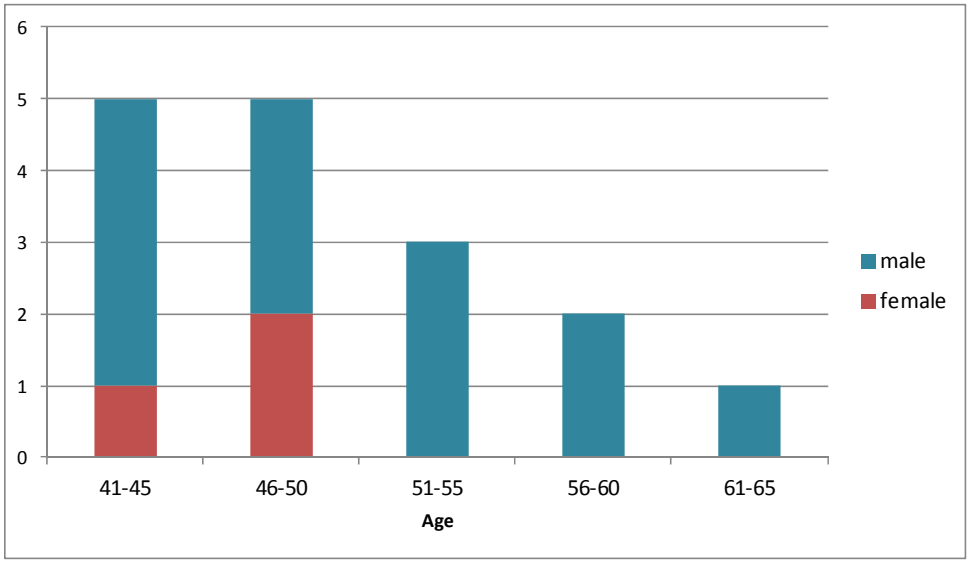


Figure 2 Age and gender of the participants

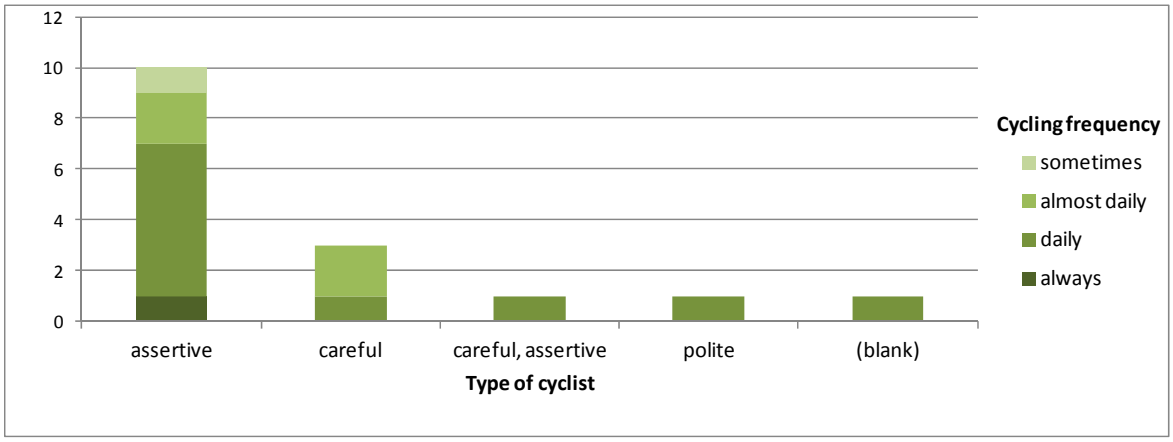


Figure 3 Frequency of cycling and style

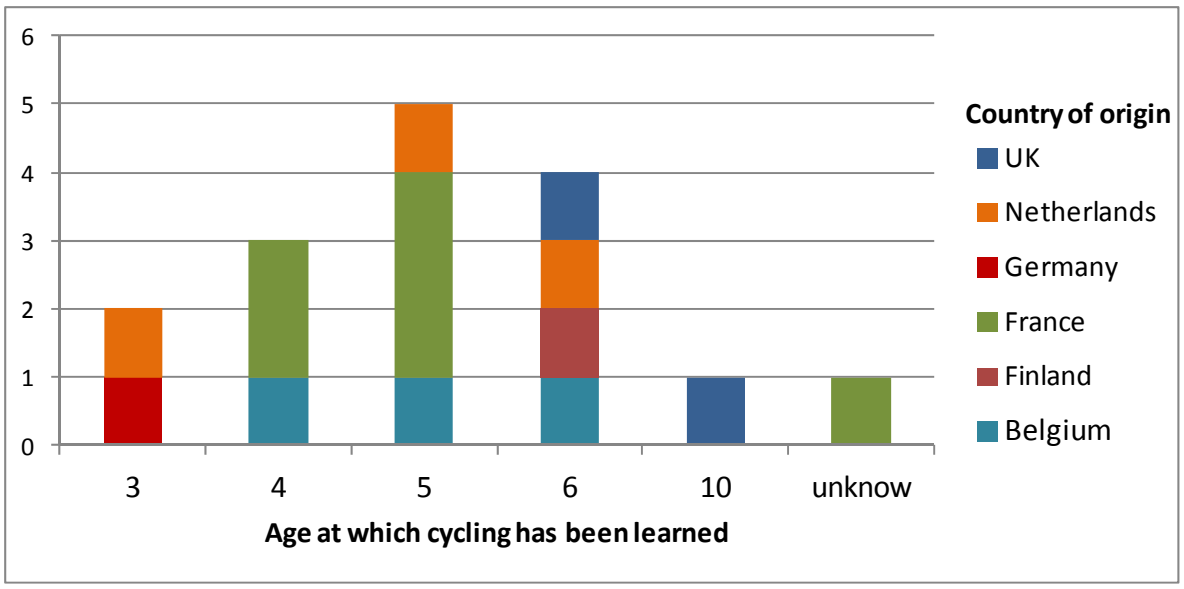


Figure 4 Nationality and age at which cycling has been learned

We need to keep in mind that only people aged 40 and over attended the meeting. Also, women were under-represented. The majority of the participants cycle daily and have an assertive style. All participants learned to cycle at a young age. Membership of the EUCG is linked with working for the European Union and all participants have a higher education and they work in different sectors, ranging from IT, finances and environment to translation and employment.

Method

The time for the workshop was limited to one hour, so we had to work very efficiently. The workshop started with a short overview of the 30 selected applications. The participants were then asked to fill in a short questionnaire about their background, and finally to assess a part of the applications in small groups, to report on them by answering a questionnaire (Annex II), and to indicate which applications they considered to be potentially successful and which ones they considered unusable. The session resulted in very useful information for the SWOT.

At the end of the meeting all the forms were collected and the participants were given the full list of applications for their information.

2.3 Brainstorming session

The project partners held a brainstorming session to select the applications with the greatest potential, based on the results of the SWOT analysis and the discussion with cyclists (EUCG workshop), for assessment of their impact on safety.

This task consisted in discussing the opinions provided by experts and bicycle users about possible positive and negative aspects of each application. The output was a list of applications that could be more beneficial from a road safety point of view.

The brainstorming session (held in Rome at the end of March 2012) started from the SWOT results (especially the ranking of the applications) and reviewed the 30 applications, starting with the lowest score and ending with the highest one.

The ranking was only used as a starting point for the discussion. As the opinions provided by the experts and bicycle users were of a qualitative nature, it appeared more appropriate to select the most promising ones by comparing them based on judgements than by referring only to the ranking.

3. Results of SWOT analysis

First a quantitative analysis of the SWOT opinions was made, using the formula described previously. The scores obtained for each application are shown in Table 2. Only the overall score (i.e. the difference between positive and negative scores) is given; as the number of opinions provided for each application varied, only the overall score can be used for a comparison.

For most of the applications, the general opinion of the experts is positive (i.e. the positive judgements outweighed the negative ones). Only 6 applications received a negative overall score (highlighted red in Table 2), meaning that the experts found more negative aspects than positive ones.

Table 2 Quantitative analysis of SWOT opinions on 30 applications

Nr	Name of application	Score (SC)
W13	Routeplanner Gent	37
I18	Photovoltaic panels to illuminate cycle lanes	31
W03	Street view for cycle infrastructure	21
W12	Opwegnaarschool.nl	21
O07	Frontzicht	20
B20	Bicycle braking light	19
B17	Light Lane Bike	17
B27	Safety Personal Area Network System	16
I13	Traffic Eye Zürich	14
O20	LEXGUARD	14
I21	See-mi	13
I10	Cyclist traffic light for rain	11
B09	HindSight35	10
B04	Direction indicator on handlebars	10
B19	Self-Powered Laser	9
I09	Countdown traffic lights	9
O04	ISA – Intelligent Speed Adaptation	9
N06	Bike Wise	7
I16	LED-Mark	7
O01	Car airbag for cyclists	6
O18	ISI - Intelligent Speed Information	6
O08	Night view	5
O11	Approaching Vehicle Audible System	4
B24	Hokey spokes	3
N09	Citizens connect	-1
W05	Arrive Alive	-4
N11	Bike stability	-4
B05	Copenhagen Wheel	-7
C03	Speed vest	-14
B14	Foldable Cycle Handlebars	-15

The experts' opinions of each application are summarised below. The application sheets prepared by merging all the SWOT opinions are attached as Annex I.

Routeplanner Gent

The experts considered Routeplanner Gent to have more advantages than negative aspects.

Main positive opinions:

- The app has clear safety advantages, with positive impacts on cyclists' safety, mainly due to reduction of interactions with other transport modes and to the support of safer route choice.
- There are several similar applications available and it can be combined with other safety information tools. It can be accessed via mobile devices.
- The app has a high ratio between safety impacts and cost. In particular, it is free of charge for users.
- It can be used by several target groups and can be suitable for several purposes.
- It can be used in all geographical areas and can contribute to increasing awareness of and interest in cycling.
- The market demand is potentially high.

Main negative opinions:

- Cyclists need knowledge about how to interpret the views provided by the app (what is safe and what not).
- The system is not very useful for preventing accidents.
- Mostly useful for inexperienced cyclists or for those not knowing the area.
- More suitable for countries where e-infrastructures are widely developed.
- It needs to be supported continuously by local authorities and managed as a dynamic tools.
- It requires continuous data input.

Photovoltaic panels to illuminate cycle lanes

The experts considered the use of photovoltaic panels to illuminate cycle lanes to be a potentially very effective application.

Main positive opinions:

- The application has several innovative aspects and has been developed specifically to improve cyclist safety (by increasing the cyclist's visibility).
- The app can help cyclists to choose safer routes.
- It is user-friendly, relatively simple, and trendy.
- The app can be used in all geographical areas and can also be useful for other vulnerable road users (e.g. pedestrians).

- There is a potentially high market demand, related to technology development and innovation.
- In addition to objective safety advantages, the app can also enhance the feeling of security of cyclists and pedestrians.

Main negative opinions:

- The development costs — , to be supported mainly by public administrations — may be rather high, so the overall cost to the community may be high.
- It requires very accurate technology: for example, the lights should not be triggered unnecessarily by the many animals moving around in rural areas.
- The app can be vulnerable from a structural point of view (i.e. possible vandalism).
- There may also be legislative hurdles to overcome before the app can be implemented.

Street view for cycle infrastructure

Street view for cycle infrastructure was in general highly rated by the experts filling in the SWOT.

Main positive opinions:

- The application is very attractive as it combines several positive aspects: possibility to choose safer routes; positive impact on cyclist safety due to reduced interactions with other transport modes; user-friendliness; comfort; trendy.
- It is especially attractive if used in combination with other information providers (i.e. possibility to integrate the app with other ones).
- There are already some previous experiences.
- The app is free of charge for users.
- It is suitable for several purposes and target groups and can be used in several geographical areas.
- It has the potential to increase awareness about cycling.

Main negative opinions:

- The app has no direct impact on cyclists' safety.
- It can entail high costs for its implementation.
- Cyclists need a minimum knowledge about how to interpret the views provided by the app (i.e. what is safe and what not).
- The app is more suitable in countries where e-infrastructures are widely developed.
- Market demand for this app may be low and the costs for its development may be high (high technical skills required).
- The complexity of the app is also based on the need for GIS maps.

Opwegnaarschool.nl

The experts had a very positive opinion of Opwegnaarschool.

Main positive opinions:

- The app is immediately available (already on the market).
- It can increase knowledge about road safety aspects of cycling (higher awareness can lead to lower accidents).
- The app is especially important for a specific (and very vulnerable) target group: young people. Including them in the identification of safe / unsafe situations provides the children's perspective on mobility and infrastructure.
- The app is suitable for several target groups, other than young people.
- It can be integrated with other applications.

Main negative opinions:

- The website is part of school programmes, thus it is not accessible for everybody.
- There is a lack of evidence about its effectiveness (evaluation study not completed).
- The app focuses on school routes, but other routes should be safe as well.
- It might be difficult to estimate its safety impacts.
- In some cases, the ICT requirement could be a practical problem in a school class.

Frontzicht

In general, the experts considered this application positively.

Main positive opinions:

- The app helps increase the visibility of cyclists, thereby reducing risks of collision with other vehicles.
- It is immediately available on the market (already existing).
- Road users other than cyclists can also benefit from its use (e.g. truck).
- The app can be suitable for several target groups and for several purposes. It can be used in all geographical areas.
- It can be part of a safety package installed inside the vehicle and can be easily integrated with other applications.

Main negative opinions:

- The app only has an indirect impact on cyclist safety, as its usefulness depends on its use by other road users (drivers of vehicles in which the system is installed).
- The truck driver needs to pay attention to yet another monitor in the cab. This could lead to sensory overload in busy, bustling, urban centres where there is so much activity.
- The app could be complex to use.
- Car drivers (non professionals) might find it difficult to navigate using a mirror.

Bicycle braking light

Main positive opinions:

- The app has been developed specifically for cyclist safety (rear-end collisions).
- It is user-friendly, trendy and immediately available on the market.
- The safety advantages are related to the increased visibility of the cyclist and to the reduction of interactions with other transport modes.
- A strong advantage is the low cost of development and purchase by cyclists.
- It is especially useful on busy bike paths or in mixed traffic situations (car/bicycle).

Main negative opinions:

- This app entails an extra item to be fitted to the bicycle.
- There is a problem of structural weaknesses.
- It might increase the risk of accidents due to faulty decisions by drivers, where only certain cyclists in a group use the device.
- It may be difficult to distinguish this device from similar devices used for higher visibility (and not for braking).
- There could be legislative barriers to its use in some countries.

Light Lane Bike

Main positive opinions:

- The app is considered innovative, trendy and user-friendly.
- It has the advantage of having a high ratio between safety improvements and purchase cost.
- By creating a safety zone behind the bicycle, it increases safety conditions and cyclist visibility.
- It can be a soft approach to enforcing distance-keeping regulations, without distracting other road users.
- Market demand for the app is potentially high.
- It should go hand in hand with legislation on distance-keeping and information to car drivers.
- A condition for success is its integration with the standard lighting fitted to the bike in the factory or ease of installation after buying the bike.

Main negative opinions:

- This app entails an extra item to be fitted to the bicycle.
- It does not support safest route choice and can create a false perception of safety, confusing other road users.
- This device somehow seems a nice “Father’s Day” gadget: usable at first sight, but unlikely to be used widely.

- There could be legislative barriers to its use in some countries.

Safety Personal Area Network System

Main positive opinions:

- The app is considered innovative and trendy.
- By supporting safer route choices, it reduces interaction with other transport modes. It also increases cyclists' visibility.
- If the app is attractive enough for target groups, a lot of use should be possible.
- Market demand is potentially high and the development costs lows.
- It might have a benefit for car / truck drivers as it could draw their attention to traffic in the blind spot.

Main negative opinions:

- This app is complex: its safety effect depends on a long chain of links.
- It can distract the user, reducing attention to the traffic environment.
- It can trigger false alarms and its signals can be misinterpreted.
- It could be difficult to evaluate its safety impacts.
- The greatest danger is that it creates a false sense of safety and lowers attention levels rather than alerting road users to potentially dangerous interactions.

Traffic Eye Zürich

Main positive opinions:

- The app is developed specifically for improving the safety of cyclists. It increases their visibility and reduces interactions with other transport modes.
- It allows safe shared use of scarce space in cities and efficient use of traffic lights for cyclists.
- The app already exists and has low costs (easy to implement).
- The app can be useful in many cities.

Main negative opinions:

- The shared use of tram tracks might cause a safety disadvantage for cyclist infrastructure.
- If the system does not work reliably and fails to detect the cyclist, the risk of confusion and safety risks might be even higher because everyone expects it to give priority to the cyclists.
- The absence of advantages for other road users could lead them to neglect this system.
- If cyclist numbers are low, the app prioritizes a few cyclists over many tram riders.

LEXGUARD

Main positive opinions:

- The app increases awareness of obstacles, cyclists and pedestrians around the truck.
- The solution fills the gap in cyclists' safety (increasing their visibility) in relation to heavy vehicles.
- Similar apps already exist.
- It can be retrofitted to existing vehicles and can be adapted easily for use on several kinds of trucks, public transport vehicles, etc.

Main negative opinions:

- There is no direct impact on cyclists' safety (depends on driver behaviour) and it can distract the driver.
- Its acceptance by drivers needs to be assessed.
- To be reliable (and to generate measurable impacts) it needs to be widely installed.

See-mi

Main positive opinions:

- The app is user-friendly and developed specifically for improving cyclists' safety (it reduces interactions with other transport modes and increases the cyclists' visibility).
- The app has potential for market development and could be integrated with other systems.
- It can be useful for several target groups.
- Its safety impact can be assessed easily.

Main negative opinions:

- The cost of developing the app can be high and it could also produce external costs.
- The app could be complex. There are many different elements in the chain: bicycle needs to have a reflector, infrastructure at intersection has to detect reflector, truck driver has to look at the indication light at the intersection and take action.
- If the app does not work, there is a risk that the truck driver will think there are no cyclists around.
- There could be legislative barriers to its use.

Cyclist traffic light for rain

Main positive opinions:

- The app has several innovative aspects and positive impacts on cyclists' safety.
- It reduces interactions between bicycle and other transport modes and it allows the cyclists to wait less at crossings equipped with traffic lights.
- The app is especially suitable for rainy countries.
- The immediate consequence of the system is a fall in the nuber of red light offences.

Main negative opinions:

- The cost of developing the app can be high.
- Using this system is different for cyclists and for road users in general.
- If the sequence of traffic lights at a junction is varied, the risk of a fatal collision between a cyclist and a vehicle might be increased.
- Its usefulness depends on the weather.
- It might be not suitable in coordinated traffic light systems.

HindSight35

Main positive opinions:

- The app has several safety advantages: it reduces interactions with other transport modes, decreases the cyclist's blind spots, and increases the cyclists' visibility.
- It provides better control of the traffic situation in all geographical areas.
- The app is interesting from the point of view of technology development and innovation.
- it can be quite easily integrated with other applications.

Main negative opinions:

- This app is an extra item to be fitted to the bicycle.
- It can distract the cyclist and entail an extra task load while cycling (this depends on how the screen is designed and attached to the handlebars).
- It will probably be too expensive, with a high risk of theft and difficult to carry (two items to install / take off the bicycle at each stop, etc.).

Direction indicator on handlebars

Main positive opinions:

- This app already exists and can easily be adapted to bicycles.
- It increases cyclists' visibility and makes their direction more predictable.
- It is an important feature, especially when the speed difference between bicycles and other vehicles is high.
- The costs of its development are low and there could be a good market demand.

Main negative opinions:

- Its impact on accident prevention might be low.
- The type of use is different and there is an extra item to be fitted to the bicycle.
- The app could be subject to vandalism and there could also be legislative barriers.

Self-Powered Laser

Main positive opinions:

- The app is innovative and developed specifically with the aim of improving cyclists' safety.

- It is a strong way to protect the cyclist from encroachment into their cycling space which seems to use components that would be easy to fit on a bicycle.
- Expected low costs, very easy deployment, control and maintenance - value for money rated as highest. Direct value for buyers.
- It is a good base for ITS on bicycles, which might encourage other apps.
- It would be highly advisable for the device to be integrated in the lighting system of new cycles.

Main negative opinions:

- The app is actually an idea and there is no information on its safety impact.
- It is an extra item to be fitted to the bicycle.
- Other road users might not understand the idea of a safety zone.
- The use of coloured lights and horns could be very distracting to cyclists and might cause accidents.
- User's risk can potentially increase because of over-reliance on the application.
- The app might not be allowed in some countries (legislative barriers).
- It might not be very attractive in areas with a lot of cyclists.

Countdown traffic lights

Main positive opinions:

- The app has several safety advantages for cyclists: it reduces interactions with other transport modes, reduces red-light offences, helps with the "dilemma zone" issue and can contribute to reducing the rate of traffic accidents.
- The app is based on existing experiences and has a potentially high market demand.
- It is suitable for several purposes and several target groups.

Main negative opinions:

- The app can have high costs for large-scale use across a city.
- Information about the time left has to be highly accurate, otherwise people will not wait. Furthermore, knowing that waiting time is long might lead to red light offences.
- The app can produce an increase in external costs.
- Generalising this app in countries where cyclists and motorised traffic are not segregated may encourage cyclists to ride on the sidewalk.

ISA – Intelligent Speed Adaptation

Main positive opinions:

- The app can reduce the severity of injuries in the event of an accident.
- It increases the visibility of cyclists and already exists.
- If the system works reliably, speed limit signs would no longer be needed.

Main negative opinions:

- The costs for its development could be high.
- The safety impacts on cyclists are not clear.
- Acceptance by car drivers could be an issue. It is expected that car drivers will resist the restriction of their free choice of speed. If not compulsory (by legislation), low acceptance is expected.

Bike Wise

Main positive opinions:

- The app is developed specifically for improving cyclists' safety (it supports choice of safer routes).
- It helps to categorize the exact type of problem and assists with accurate geo-location.
- It already exists and is suitable for several target groups.
- Besides the use of the tool by cyclists, the highest potential is for its use by municipalities. It helps to analyse weaknesses in the network and to consequently do something to improve the situation.

Main negative opinions:

- The app focuses on negative messages/information regarding cycling only, which might have a negative effect on cyclists' safety (if the user knows before setting out that many hazards are to be expected, he might not make the journey at all).
- Most people ride bicycles for convenience, thus low participation is expected.
- It might be unsuccessful, if the information is not forwarded to the municipality. Users who take the time to report a problem expect a reaction. Good marketing and dissemination is essential to promote use of the tool.

LED-Mark

Main positive opinions:

- The app has positive impacts on cyclists' safety (it increases their visibility and supports safer route choice).
- The costs are borne by the infrastructure owner/manager (not by cyclists).
- It is expected to be highly reliable, being suitable for several target groups and in all geographical areas.
- The operation and maintenance costs are low compared to the high value for users.

Main negative opinions:

- The app works only if a majority of cyclists use it.
- The safety impact depends on the actions of other road users.

- The system presumably requires thousands of lights to cover a cycle path network and, if each light has its own battery, the maintenance task of changing the batteries is huge, even if it is only once every 5 years.

Car airbag for cyclists

Main positive opinions:

- The app is innovative and user-friendly.
- It reduces the severity of cyclists' injuries after a collision with a car (it can be part of the car equipment).
- The app could also help raise awareness among car drivers about the presence of other people (cyclists) around them.
- The app is suitable for the protection of other vulnerable road users (pedestrians, powered two-wheelers).

Main negative opinions:

- The app has no impact on accident prevention. It only acts on severity of injuries.
- There is a risk of pushing the cyclist in other (unexpected) directions upon impact.
- It transfers the costs to the car driver and thus may require legislative developments for introduction.
- It could convey the message that a collision is "less" dangerous.

ISI - Intelligent Speed Information

Main positive opinions:

- The app is user-friendly and similar systems already exist.
- The main safety advantage is related to reduction of interaction with other transport modes.
- Cars drive more slowly and more safely in school environments because of warning systems.
- It is easy to adapt. GPS combines the information it has on the vehicle's speed and position with a database of the road / street.

Main negative opinions:

- The development costs may be high.
- There is no direct impact on cyclists' safety (it depends on increased awareness of car drivers).
- The driver needs to have a positive attitude towards the application (has to be willing to adapt speed when the application suggests it).
- The app does not guarantee slower speeds and would work better for drivers who are already law-abiding than for problem speeders.

Night view

Main positive opinions:

- The app increases cyclists' visibility. It is innovative, trendy, user-friendly and improves cyclists' comfort.
- The potential positive impact is not limited to cyclists (other road users can also benefit from its use – it could also be an added value for the driver).
- The safety impacts can be assessed easily.
- Giving drivers more information about things that are in the same road space (or may come into the same road space) is a trend that will continue.

Main negative opinions:

- The task load during driving may increase, with a negative impact on driver safety.
- The app seems to have a greater impact on the safety of the driver whose car is equipped with it than on the safety of other road users.
- The overall safety impact, for bicyclists, depends on penetration among vehicles/demand from car drivers. Penetration is expected to be low, at least initially and for typically city-oriented vehicles (small cars).

Approaching Vehicle Audible System

Main positive opinions:

- The app has a positive impact on cyclists' safety (it reduces interactions with other transport modes).
- The ratio between safety advantages and price is high.
- The app already exists and is potentially highly reliable for technology development and innovation.
- With some modifications (i.e. possibility to activate it for a given period of some minutes), it can have some usefulness in pedestrian areas and shared spaces.

Main negative opinions:

- The app is not used by cyclists.
- It is developed only for electric vehicles, not yet on the market.
- How will the system work when there are a lot of cyclists around? Lots of noise?
- It can increase the car driver's confidence and lower his perceived responsibility and need to pay attention.

Hokey spokes

Main positive opinions:

- Similar applications already exist, having positive impacts on cyclists' safety.
- It can be installed and customized easily. It can also be installed directly on new bicycles.

- The development costs are low.

Main negative opinions:

- There is little information available about its impact on safety.
- It may make cycling weird and fringe and less attractive to mainstream audiences.
- It is visible only from the side, not when you are driving behind or in front of the bicycle.
- Bicycles with a lot of lights, together with bikes which are less well lit, might cause dangerous situations (“dark” bicycles are less visible).
- Other road users (car drivers) might be distracted by attempting to read the message, which might decrease safety.

Citizens connect

Citizens connect was not considered very useful by the experts. The opinions were mainly negative.

Main positive opinions were:

- The app makes good use of existing IT communication systems and encourages people to take an interest in the state of local infrastructure.
- It stimulates citizen's involvement and contributes to the improvement of comfort in public space, to maintenance and to fewer single-vehicle accidents.
- This system is of much broader value than just cycling and encourages local residents to take an active interest in their environment.

Main negative opinions:

- The accident prevention is low. The impact on cyclists’ safety is indirect.
- Its functioning depends on (very fast) follow-up by the responsible authority (this requires organisation).
- It is difficult to keep the reports up to date and to prevent the system getting clogged with reports about very minor things, or nuisance reports.
- The development costs are high and it is not easy to assess its safety impact.
- The system will soon become discredited if the authorities do not act quickly in response to reports that are lodged by the public.

Arrive Alive

Arrive Alive was judged negatively by the experts.

Main positive opinions were:

- The app is considered a very complete and informative website, including safety aspects.
- It is suitable for several target groups and for several purposes. It can be used in all geographical areas.

- It may be useful for research purposes.

Main negative opinions:

- The app has no direct impact on cyclists' safety (it has no impact on cyclist visibility and has a low impact on accident prevention).
- There is too much information on the website.
- The emphasis appears to be more on wearing helmets and reflective vests than on sensible road positioning, etc.
- The possible market demand is low.
- It would be difficult to assess its safety impact.

Bike stability

Bike stability was considered not very useful by the experts.

Main positive opinions were:

- The app is innovative and can have positive safety impacts.
- It increases the cycling skills of specific target groups (e.g. elderly).
- The app seems to respond to a need and could help people to ride again.
- It could be easily integrated with other apps.

Main negative opinions:

- The costs for developing this app can be high.
- Effectiveness of the app depends on the usage (e.g. only effective with help of professionals or when very direct instructions are provided about the interpretation of the results).
- The cyclist should monitor the results after cycling since doing so while cycling could provide an extra distraction.
- A high level of skills is need to develop the app.
- For optimal/correct use, knowledge is required about the app and about using its outcomes.

Copenhagen Wheel

Copenhagen Wheel was considered not very useful by the experts.

Main positive opinions:

- The app is innovative, trendy and user-friendly, and increases cyclists' comfort.
- The power supply makes it possible to use all kinds of apps (including safety-related apps).
- Safety could be enhanced by reducing cyclists' reluctance to stop (restoring the kinetic energy lost when you stop is hard work).
- It is interesting for groups that need extra help when cycling (e.g. the elderly), or for cycling long distances.

Main negative opinions:

- The accident prevention provided by the app is low and the development costs are high.
- The methodology is not really validated.
- Costs will be a challenge. Such a feature cannot be expected to command a premium of more than 200 euros.
- Currently a scientific toy, with no real plans to make it publicly available (or for sale).

Speed vest

Speed vest was considered not very useful by the experts.

Main positive opinions:

- The app is trendy and user-friendly and has several innovative aspects.
- It can be very useful for electric bicycles (the speed of which is often underestimated by car drivers, resulting in dangerous attempts to overtake).
- It could also be suitable for pedestrians in rural areas.

Main negative opinions:

- The app has no direct impact on cyclists' safety and entails an extra item to be worn.
- The effectiveness depends on whether drivers understand that it is a cyclist who is wearing the vest.
- It might not be useful in some geographical areas and for some road users.
- There could be legislative barriers to its use.
- Market demand might be low (with high development costs).
- It can also cause general confusion due to multiple lights in cities.

Foldable Cycle Handlebars

The Foldable Cycle Handlebars were considered not useful by the experts.

Main positive opinions:

- The app has some safety advantages and is user-friendly.
- The direct benefit for the user does not depend on market penetration.
- It could be integrated on the bicycle.

Main negative opinions:

- The app is costly to develop and accident prevention is low.
- The technical solution has no impact on accident prevention. It only acts on severity of injuries.
- If there is a construction defect, it could lead to dangerous situations (folding too early or too late).
- Its safety impact would be difficult to assess.

- Expected use: for new or more expensive bikes; maybe for professional bikers; no investments by users of "veteran" models.
- It might even increase injuries of other body parts.

4. Results of EUCG meeting

Opinions about the applications

The participants pointed out those applications they considered usable/successful and those considered unusable/unsuccessful. Figure 5 shows the 30 applications from the short list, sorted from most to least popular. The three applications considered most promising were Routeplanner Gent, Bicycle braking light, and Hindsight (a rear-view camera system).

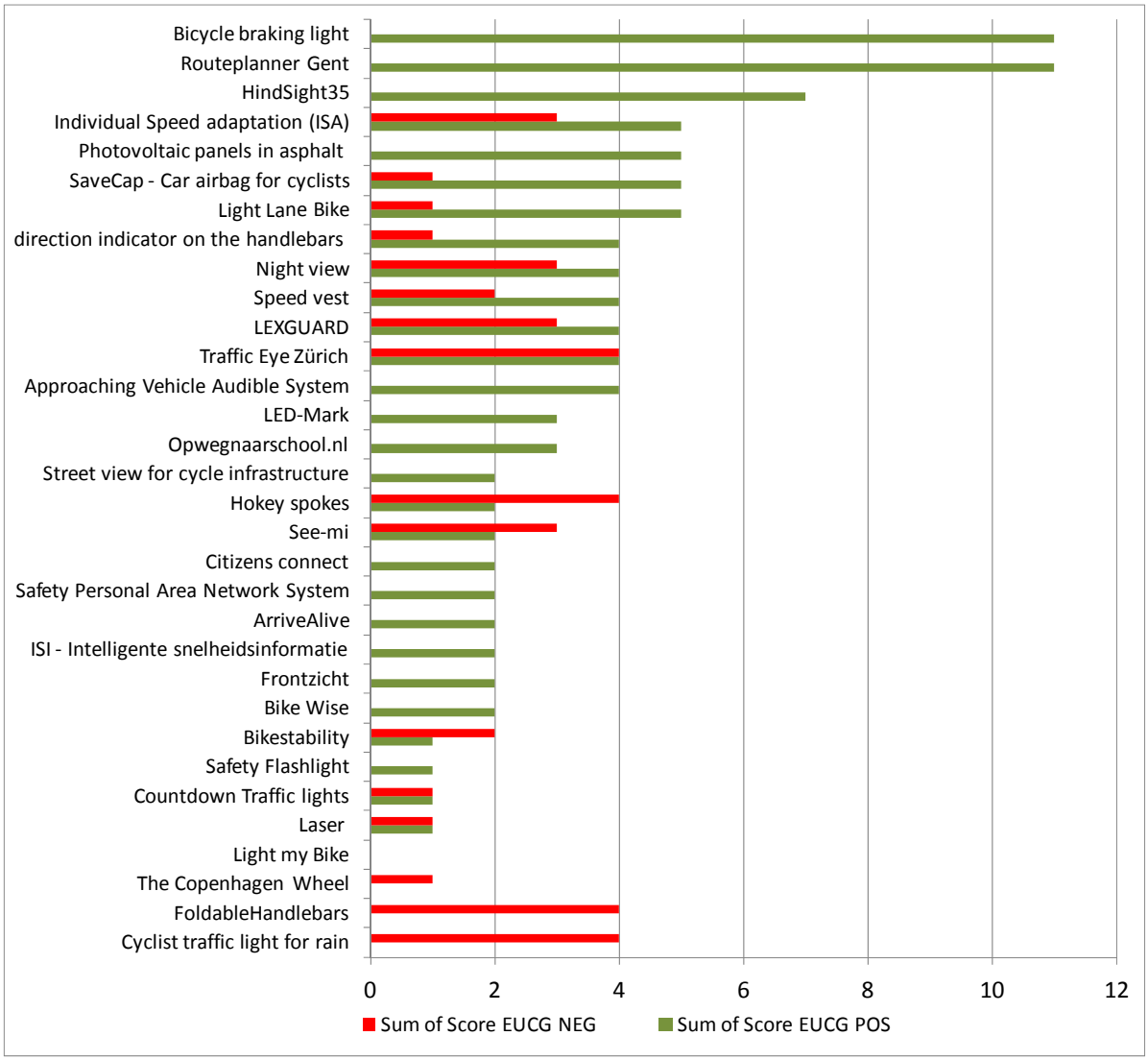


Figure 5 Overview of opinions about the 30 e-safety applications

Some comments about the Routeplanner Gent are: “interesting for all cities in Europe”, “even for intercity traffic” and “in combination with identification of dangerous spots”. A comment about the Bicycle braking light was “great safety improvement by single device”. Hindsight was also considered “nice” and one of the remarks was “nice to see one’s baby in the trailer”.

The e-safety applications that were considered least promising were: Cyclist traffic light for rain, Foldable Handlebars, and Copenhagen wheel. The Copenhagen wheel was considered expensive and “Apps could be integrated in any e-bike”. A comment about the Foldable Handlebars was “Is it really safe; could it fold by accident and cause injuries?” The Cyclist traffic light for rain was considered a nice application, “… but a bit of a luxury. Other safety measures [have] higher priority”.

General comments

The organization of the meeting was a good way to start up the discussion about ITS applications for safer cycling with the target group themselves. Some members were very critical about the subject and communicated that through email or during the meeting itself. Others were more open and positive about the potential of ITS for safer cycling.

“To enhance the safety of cyclists, local and national governments should invest in structural measures like infrastructure” was an important comment, supported by other participants as well. It was also stated that cyclists themselves play an important role in the safety issue as they neglect rules and often cycle around in ‘stealth mode’ when they are not properly visible because of limited conspicuousness. One member noted that “Improvements in LED lights make it now possible to have cheap bright lights that didn’t exist 15 years ago. …… this gives room to find out how to reduce SMIDSY (sorry mate, I didn’t see you) accidents”.

Also the behaviour of other road users was a point of criticism. Car drivers often do not respect the rules and the position of cyclists on the road and thus are a very important cause of dangerous situations. Attention should therefore also go to this group of road users. It was considered positive that the project acknowledges the fact that motor vehicles and cyclists need to communicate and that ICT could play a role in improving mutual communication.

It is important to start a discussion with cyclists themselves about safety and the role ITS could play, as they are the target group and they would need to play an active role in the implementation and use of many of the selected applications.

5. Most promising applications

On the basis of the results of the SWOT analysis and of the meeting with cyclists (EUCG group), the eleven most promising applications were identified and selected for the impact assessment on safety of cyclists.

The selection was made during a brainstorming session among the project partners, in which the opinions provided by experts and cyclists were compared and discussed. Thus the final decision about the apps is the best compromise between the opinions provided and the type of application to be assessed (as far as possible the selection included at least one application per type – only the subcategory “Cyclist” was excluded).

Table 3 shows the 11 applications selected for the impact assessment, together with the scores obtained from the SWOT analysis and from the cyclists group.

For some categories two very similar applications have been included (i.e. Frontzicht and Lexguard for “other vehicles / visibility” and Led-Mark and Photovoltaic panels for “infrastructure / visibility”).

The scores obtained from the analysis were purely indicative: the final decision on the applications to be selected was based on an in-depth analysis of the opinions provided. Thus some applications having low scores were nevertheless considered promising due to their specificities.

Table 3 List of 11 most promising applications

Subcategory	No	Name of application	Score for experts	Score for cyclists
Bicycle				
Physical problems	B09	HindSight35	10	7
Street projection	B17	Light Lane Bike	17	5
Visibility	B20	Bicycle braking light	19	11
Other vehicles				
Airbag	O01	Car airbag for cyclists	6	5
Speed	O04	ISA – Intelligent Speed Adaptation	9	5
Visibility	O07 O20	Frontzicht LEXGUARD	20 14	2 4
Infrastructure				
Traffic light	I09	Countdown traffic lights	9	1
	I13	Traffic Eye Zürich	14	4
Visibility	I16 I18	LED-Mark Photovoltaic panels	7 31	3 5
Internet (web)				
Route planner	W13	Routeplanner Gent	37	11
Nomadic				
Educational	N06	Bike Wise	7	2
Monitoring & action	N09	Citizens connect	-1	2

Most of the 30 applications analysed were considered useful or having a potential for improving cyclists' safety. Opinions differed when looking at the context where the applications could be used (e.g. countries where cycling is highly developed and countries or cities where bicycle commuting is not frequent).

Table 4 shows the main opinions provided by the experts (in terms of strengths, weaknesses, opportunities and threats) for the 30 ICT applications analysed.

Table 4 Synthesis of main SWOT opinions

Strengths	Improved safety conditions thanks to (depending on the app): • Higher cyclist visibility. • Reduction of interactions with other transport modes. • Support of safer route choice. Innovation. User-friendliness. Trendy.	New or prototype app (thus little information on safety impacts). Impacting user behaviour (can cause an excess of confidence leading to higher risks). Extra item to fit to the bicycle or wear (depending on the app). No direct impact on cyclists' safety (depending on the app).	**Weaknesses**
Opportunities	Increased awareness about cycling safety. Possible integration with other existing applications. Potential market demand. Possible use by several target groups and for several purposes. Possible use in all geographical areas.	High costs of development and / or use. Not suitable in all seasons or under all weather conditions. Buyer of the app doesn't benefit directly from its use (depending on the app). Complexity of the app (e.g. due to not common type of use). Doubts about possibility of use in some countries, due to legislation.	**Threats**

While in most north European countries ICT applications are considered to have a high potential for improving the safety of cyclists, in other countries (e.g. Italy) they are considered more useful as ways of increasing awareness about cycling. The impact assessment and the recommendations for standardization/harmonization will take these aspects into consideration.

Annex I – SWOT sheets

SWOT Analysis — Self Powered Laser - CTL_01

Brief description:	The laser light (that surrounds the bicycle) is green when there is a correct action. The distance sensor is activated when there is a wrong action. Automatically, the laser light becomes red and the twelve horns start to sound.
Type of application:	Bicycle
Status:	Idea

Strengths

Innovative (2)
Directly developed for cyclists safety (4)
Positive impacts on cyclists safety (4)
Userfriendly application (3)
Main focus on safety (2)
Increase of cyclist visibility (5)
Reduce interactions with other modes (2)
Trendy (2)
A strong way to protect the cyclist from encroachement into their cycling space which seems to use components that would be easy to fit on a bicycle
Excellent also for rare users (does not depend on penetration)
Independent on geographical areas - useful everywhere
Expect low costs, a very easy deployment, control and maintenance - value for money rated as highest. Direct value for buyers.

Weaknesses

Completely new application (4)
Prototype application (2)
No information on safety impacts
Dependence on interaction with other actors on the road (2)
extra item to wear (3)
Other road user has to understand the idea of the safety zone
The use of coloured lights and horns could be very distracting to cyclists and might cause accidents (2)
Also the system will only be effective in slow moving traffic as a car travelling at speed could be on top of a cyclist before the system triggered a warning (2)
sound warning is more efficient in the case of a really high risk
user´s risk can potentionaly grow because of overestimation and relying on application functionalities
not sure how it works when passing static obstacles in the closeness - false alarms can be problematic.
sudden sounds could frighten cyclists or pedestrians in surrounding and be a reason for unexpected and unsafe reactions
Might be misunderstood by car drivers and other road users
The higher the speed, the greater the "laser circle" should be to avoid a crash
quality of input can vary, how will it work in the long term

This could have a negative environmental effect (noise) and causes possible difficulties in determining which car or bike is entering the "laser circle". What to do in the situation of traffic lights? Car has stopped and the cyclist(s) choose to stand just next to the car(s). Will the alarm go off? The device will have the optimum effect at poor illuminated tracks and where cyclists are not expected generally. In these situations the other road users will be warned effectively the the laser and the horns. But still the factor speed interferes. At well illuminated tracks and with the presence of many cyclists, probably other road users already are more alert related to cyclists.

Internal environment

Opportunities

Technology development and innovation
Useful in all geographical area (4)
Potentially high market demand (2)
Suitable for several target groups (2)
Suitable for several motives
A good base for ITS applications on bicycles which might encourage other applications
Can be spread also into pedestrians community where are no dedicated safe footpaths

Capability for other drivers possible: in-vehicle warning in cars could be linked with impuls from the red laser light (based on V2V communication)
Could be used as element within broad promotion campaign

It would be highly advisable, if the device could be intregated in the lighting system of newly bought cycles
Special target could be children (8-14); interesting "safety gadget" and it develops a safety culture

Threats

Legislative effects in some geographical area - may not be allowed in all countries (2)
IT developments
Seasonality, weather effects (2)
difficulties in estimating safety impacts (3)
High costs of use (2)
increase value of bicyle and potentially its robbery
Low demand market (2)
Not very attractive in areas with a lot of cyclist (useless in some situations)

Can produce increase of external costs
Power consumption could be a problem -

Not convinced that the system will be able to distinguish between vehicles that are a potential threat to the cyclist and those that are not might not work with lorries (2)
Application in particular in areas/countries where already exists a kind of cycling culture
Different expectations if a government or a company starts up this application

External environment

SWOT Analysis	Speedvest - CTL_04		
Brief description:	Illuminated vest for cyclists, increasing visibility of driver and providing information about the bicycle speed to other road users	**Type of application:**	Cyclist
		Status:	Existing

Strengths

Userfriendly application
Immediate market availability
Increase of cyclist visibility (6)
innovative aspects (4)
trendy (3)
awareness of cyclists speed (4)

very usefull for electrical bikes (the speed of which is often underestimated by car drivers which results in dangerous overtaking attemps)

Weaknesses

Impacting cyclist safety only indirectly (4)
No information on safety impacts (4)
Extra items to wear (5)
not common type of use (2)
new app: use limited
structural strenght ? Energy supply ?
effectiveness depends on whether the drivers understand a cyclist is wearing the vest
May encourage dangerous cycling in young people

Could provide false safety for ciclysts
not trendy enough - because of a low acceptancy rate by (Dutch) cyclists (comparable to helmet)
very few impact on cyclist safety

Internal environment

Opportunities

Potentially high market demand
Already existing (2)
Suitable for several target groups (2)
Integation with other applications (e.g. phone)
useful in all geographical area (2)
technology development and innovation (2)
suitable for several motives (2)

In combination with pedelecs interesting: difficult for other road users to estimate how fast they go without extra notice
Especially in rural areas also suitable for pedestrians

Could perhaps be combined with tracking systems for children
could be used in combination with other information: visual / auditive impairments

Threats

Seasonality, weather effects (4)
Useless in some geographical area (2)
Useless for some user categories
Difficulties in estimating safety impacts (2)
legislative effects in some geographical areas
low demand market (3)
high costs for use (3)

same indirect safety effects can be achieved through a simple reflective vest (2)
might not be usable in the rai because of the electical equipment in the vest

it can also serve the general confusion caused by multiple light/s in cities
It also adds to the cyclist's responsibility to radiate his/her presence instead of educating car drivers

External environment

SWOT Analysis	Light Lane Bicycle Lane - iMOB_01		
Brief description:	A green laser projects a cycle lane behind the bicycle	**Type of application:**	Infrastructure
		Status:	Development

Strengths	Weaknesses
Innovative aspects (3)	Prototype (5)
High ratio between safety and price	No info on safety impacts (5)
Positive impacts on cyclists safety	Extra item to wear (2)
userfriendly app (4)	Structural weakness (can be easily broken) (3)
Similar app available (2)	Completely new app (3)
Main focus on safety (2)	needs batteries (3)
Increase of cyclist visibility (8)	does not support safest route choice and can create false perception of safety, confuses other road users
Trendy (6)	May be to "soft" to convince cardrivers to increase lateral distance
Directly developed for cyclists (4)	could lead to distraction or confusion for other road users (2)
creation of a safety zone behind the bike (3)	safety disadvantages
increases awareness of other road users (2)	negative impacts on cyclists safety
Soft approach to enforcing distance keeping regulations without the possible distraction of CTL_01	Works only if majority of users uses it
reduce interactions with other modes	Dependence on interaction with other actors on the road
	This device somehow seems a nice 'Fathers day' gadget: usable at first sight, but not very likely widely to be used

Internal environment

External environment

Opportunities	Threats
Business and product development (2)	Seasonlity and weather effects (3)
Suitable for several motives (2)	Useless in some geographical area (2)
Low technical skills for development (3)	Legislative effects in some countries (2)
Low development costs (3)	Difficulties in estimating safety impacts (4)
Potential market development	Possible vandalism / robbery (5)
Possible integration with other apps	Effect might depend on spread of the application and how other road users react on it
useful in all geographical area (3)	can be used only on night
technology develpment and innovation (3)	Should not cost more than 15 Euro's per unit
potentially high market demand (3)	low market demand
Interesting for areas with lack of seperate cycle infrastructure	useless for some user categories
Should go hand in hand with legislation on distance keeping and information to car drivers	Buyer of the application not directly benefiting of its use
A condtion for success is integration with standard lighting that is put on the bike in the factory or easily installed after buying the bike	
suitable for several target groups	
integration with other apps (phone)	
Prevents fights over 'where to cycle / drive'	
Might even lead to cost saving, especially in rural areas, of infrastructural 'building' for cyclists	

SWOT Analysis	CopenhagenWheel - iMOB_06		
Brief description:	Solution for the clunky and unwieldy battery packs (internal or added) connected to the motor	**Type of application:**	Bicycle
		Status:	Idea

Strengths

Innovative aspects (5)
Support safer path choice (3)
Trendy (7)
Comfort (3)
Power supply offers possibility for use of all kind of apps - also safety related
Userfriendly
Option to use different types of sensors, also to add them later on
Grab attention
low bateries maintenance
can be used everywhere by all electrical bicyle users

Safety could be enhanced by reducing the cyclists reluctance to stop- since the kinetic energy is lost on a stop & must be re-gained with difficulty
no need to re-charge
take a route with many stops

Weaknesses

Not common type of use
Impacting cyclist safety only indirectly (3)
No info on safety impacts (2)
Low accident prevention (2)+
Extra item to wear
Structural weakness (2)
Costs for development (2)
Prototype (3)
works only if majority of users uses it (2)
No impact on cyclist visibility

Not really validated methodology. Tried to get a personal demonstration in Boston last year, but I still haven't seen the real thing myself
Hilly cities
Bateries
safety disadvantages
phone has to be close to the bike to unlock; bluetooth is necessary
Electrical bicycle users only
Costs will be a challenge- expect such a feature could command only a 200 Euro premium

Internal environment

External environment

Opportunities

Market development
Technology development and innovation (5)
Business and product development (4)
Potentially high market development
Suitable for several motives (2)
Integration with other apps (5)
Suitable for several target groups (2)
useful in all geographical area
Interesting for groups that need a extra help when cycling (e.g. elderly, or for cycling over long distances)
Should be integrated with sensors (e.g. air quality and noise) that uplink information on cycling conditions to online geo-apps
As Floating Car Data provide a lot for traffic mamangement then Floating Bike Data should have the same potential
final prototype

Threats

Seasonality, weather effects (3)
High costs for use
Difficulties in estimating safety impacts (5)
Complexity of app (3)
Subject to vandalism (3)
High costs for development
Low market demand (2)
high technical skills for development
Cost for use
As far as I'm away, presently a scientific toy but no real plans to make it publicly available (or for sale)
useless for some user categories

SWOT Analysis	ArriveAlive - iMOB_07		
Brief description:	Website with a lot of road safety information	**Type of application:**	Internet
		Status:	Existing for cars

Strengths

safety advantages
similar app available (5)
main focus on safety
supports safer path choice (5)
trendy
very complete and informative website
TomTom route planner
inclusive of safety stats very interesting
Potentially such a (government run) website could provide lots of useful information

Weaknesses

gaps in capabilities
unusability for cyclist
impacting cyclist safety only indirectly (3)
no info on safety impacts (2)
no impact on cyclist visibility (2)
prototype
works only if majority of users use it
low accident prevention (2)
too much info on website (2)
Structural weakness
those who need to read, do they read and act? Is it really targetting active trip makers?
Its benefits are only as good as the quality of the information there
emphasis appears to be on wearing helmets and reflective vests with much less stress on sensible road positioning etc.

Internal environment

Opportunities

useful in all geographical area (1)
suitable for several motives (4)
low technical skills for development (2)
integration with other apps (4)
suitable for several target groups (3)
technology development and innovation
also use for research purposes
database development
connection with social media

Cycling maps showing the cycle friendliness of all roads in South African towns and cities (similar to the cycle maps produced for Cheltenham in the UK) might be a useful tool to include

Threats

low market demand (2)
developed in different geographical / cultural contexts
useless for some user categories (2)
difficulties in estimating safety impacts (4)
increase of task load during driving
Risk is always present, also when the app doesn't warn
Can produce increase of external costs
Subject to vandalism and thefts
quickly obsolete information

who controls that all data are updated frequently

External environment

SWOT Analysis	HindSight - iMOB_11		
Brief description:	A rear camera records the movements around the bicycle and the images are shown on a display on the steer.	**Type of application:**	Bicycle
		Status:	In development

Strengths

safety advantages (5)
directly devoted for cyclists safety (4)
positive impacts on cyclists safety (5)
main focus on safety
innovative aspects (2)
reduces interactions with other modes
decrease of blind spot of bicycle (2)
trendy (3)
increase of cyclist visibility
mainly for novel cyclists or cyclists with difficulties to look back (neck stiffness, etc.)
Better visibility of otherwise difficult to see (but dangerous) overtaking traffic
Better control (improved traffic safety)

comfort
not relateed to weather

Weaknesses

Gaps in capabilities
Completely new application
No information on safety impacts (4)
No impact on cyclist visibility (2)
Extra items to wear (3)
Structural weakness (e.g. can be easily broken) (2)
costs for development
not common type of use
prototype
can distract cyclist
app under development (3)
Extra task load while cycling (depends on how the screen on the steer is designed and attached)

Limited use: probably too expensive, with high theft risk and difficult to keep (two items to mount / take off the bicycle at each stop, etc.)
Much more expensive and fragile than a rearview mirror. May easily be blocked by bagage.
Needs to be combined with transporting luggage
Mirror can be used alternatively without the threats of vandalism
low accident prevention

Internal environment

Opportunities

Technology development and innovation (4)
Business and product development
Useful in all geographical area (5)
Suitable for several target groups (3)
Integation with other applications (e.g. phone) (5)
potential market developments (3)
suitable for several motives (2)
User has direct safety impacts
previous experiences exist
can be used on all type of bikes

Threats

Seasonality, weather effects (4)
Useless in some geographical area
Difficulties in estimating safety impacts
Subject to vandalism (6)
legislative effects (2)
high costs for use (6)
useless for some user categories (2)
weather might be a problem
distraction
not covered angles
High technical skills for development
Complexity of the application
Can produce increase of external costs

External environment

SWOT Analysis — Countdown Traffic Light - iMOB_15

Brief description:	LED Countdown Meter reminds drivers and pedestrians of the waiting time through counting down numbers to effectively reduce the rate of traffic accidents
Type of application:	Infrastructure
Status:	Existing

Strengths

safety advantages (2)
Positive impacts on cyclists safety (5)
userfriendly (4)
immediate market availability (4)
reduces interactions with other modes (3)
comfort (5)
directly developed for cyclists safety
reduce red offences (4)
innovative aspects (2)
helps with "dilema zone" issue
better control
give info about expected waiting time during red light
reduce rate of traffic accidents
provides feedback to let you know you were detected by sensors

Weaknesses

impact cyclist safety only indirectly (2)
no info on safety impacts (4)
no impact on cycists visibility (2)
low accident prevention
structural weakness
dependence on interaction with other road users
costs for large scale use inside a city (5)
Information about the time left has to be very correct otherwise people won't wait (2)
Knowing that waiting time is long might lead to red light offences
a similar measure aimed at pedestrians is increasing the risk for them
most traffic controllers can't send 'time to green' information to the proposed display- often it's not a fixed time

Internal environment

Opportunities

business and product development
already existing (6)
previous experiences existing
easiness in estimating safety impacts
potentially high market demand (4)
suitable for several target groups
suitable for several motives
can be retrofitted to existing intersections

Threats

useful in some geographical area (3)
difficulties in estimating safety impacts (2)
can produce increase of external costs
vandalism (2)
high technical skills for development (2)
Cultural context (only works if cyclists are willing to wait for red light)
high costs for use
The generalization of this gadget outside the segregationist countries risks to foster / naturalize sidewak riding
distraction
low market demand
high cost for development
standardization in state/provincial norms suggested

External environment

SWOT Analysis	Bikewise - iMOB_23		
Brief description:	Bikewise has been started in the belief that they can contribute to making cycling safer and more fun by gathering good data on the things that sometimes go wrong	**Type of application:**	Website / nomadic
		Status:	Existing

Strengths

Safety advantages (2)
directly developed for cyclists safety (3)
similar app available
main focus on safety
supports safer path choice (3)
positive impacts on cyclist safety (3)
immediate market availability (3)

combination of nomadic, internet and educational activities possible
great tool for communication between users
userfriendly
cheap app
users reporting to the administration
if data are evaluated by admin, safety can be improved
get more data than reported in official stats
well designed
it helps catagorize the exact problem type and assists with accurate geo-location

Weaknesses

impacting cyclists safety only indirectly (5)
no info on safety impacts (2)
extra item to wear
structural weakness
works only if majority of users uses it (2)
not common type of use
low accident prevention (2)

Focuses on negative messages/information regarding cycling only, which might have an negative effect on the use of cyclists (if the user knows before starting atour, that many hazards are to be expected only, he might not go on the tour at all)
the outside world / opinion could use it against cycling
However most people ride bikes for convenience and I do not expect high participation

Internal environment

Opportunities

business and product development
useful in all geographical area (4)
already existing (2)
integration with other apps (4)
suitable for several target groups (3)
low development costs

Besides the use of the tool for users, the highest potential is the use for municipalities - It helps to analyse weakness of the network and to consequently do sth. to imporve the situatio (2)
easy adaptable for other cities
could be a survey tool

Threats

useful for some user categories (2)
difficulties in estimating safety impacts (4)
complexity of the app
low market demand (2)
especially interesting for novice cyclists
only for smatphone owners (4)

it is not expected to be sucessful, if the information is not sent forward to the municipality users expect a reaction to their effort of reporting good
marketing and dissemination is essential to promote the use of the tool
weather depending
random data, not statistical relevant
Presentation of crashes, hazards and thefts could have contra-productive effects on bike-promotion (2)

External environment

SWOT Analysis — Traffic Eye Zürich - iMOB_27

Brief description:	To prevent conflicts between trams, busses and other traffic on intersections, bicycles get green before the public transport to increase the safety and comfort of the cyclist. Extra green is only given when cyclists are detected to ensure optimal use of the intersection.
Type of application:	Infrastructure
Status:	Existing

Internal environment

Strengths

safety advantages (3)
directly developed for cyclists safety (2)
positive impacts on cyclists safety
userfriendly
similar app available
main focus on safety
increase of cyclist visibility

reduces interaction with other modes (5)
comfort
immediate market availability
co-use of scarse space in cities
efficient use of intersections (3)
suitable for all cyclists
efficient use of traffic lights for cyclists

Weaknesses

cost for development
not common type of use
no info on safety impacts
dependence on interaction with other actors on the road (2)
cost for large scale use
structural weakness (2)
co-use of tram tracks might cause safety disadvantage for cyclist infrastructure (3)
if the system does not work reliable and does not detect the cyclist, the risk of confusion and safety risks might be even higher because everyone expects/is used to priorisation of cyclist
not many advantages for other taffic it could irritate them to neglect this system

External environment

Opportunities

technologiy development and innovation
already existing (2)
easiness in estimating safety impacts
useful for many cities (2)
low development costs (2)
road owners implements safety app - benefit for all cyclists
Techological it is not difficult ans easy to implement

Threats

IT developments
high costs for use (2)
low market demand
difficulties in estimating safety impacts
high technical skills for development
complexity of app
useful in some geographical area (outside city)
seasonality, weather effect (2)
vandalism (2)
if bike volumes are not very high, this prioritize a few cyclists over many tram riders

SWOT Analysis	Individual Speed Adaptation - NextGenITS - iMOB_31		
Brief description:	V2V en V2I communication allows detection of bicycles and other vehicles to anticipate on them by adapting speed or braking	**Type of application:**	Vehicle
		Status:	Existing

Strengths

safety advantages (3)
innovative aspects
positive impacts on cyclists safety (2)
userfriendly
in case of accident lead to lower severity of injuries
main focus on safety
increase of cyclist visibility (2)

Weaknesses

cost for development
not common type of use (2)
no info on safety impacts
extra item to wear
works only if majority of users use it
structural weakness
dependence on interaction with other road users (2)

high risk that people get used to the system and trust it; in case the system does not work reliable the risk of high speed is given and the question of responsibility is to be answered

Internal environment

Opportunities

technology development and innovation (2)
already existing (2)
easiness in estimating safety impacts
useful in all geographical area (2)
integration with other apps (2)
If the system works reliable, now speed limit signs would be necessary anymore

Threats

IT developments
high costs for development
buyer of app not directly benefiting of its use (2)
difficulties in estimating safety impacts
low market demand
complexity of app (2)

Acceptance of car drivers; it is expected that car drivers hesitate to accept restriction of their free choice of speed;
if not compulsory/obligatory (by legislation) low acceptance is expected

External environment

SWOT Analysis — Citizens Connect - iMOB_32

Brief description:	To act as fast as possible on reports of citizens and to encourage them to take actively part in keeping the public environment livable
Type of application:	Nomadic
Status:	Existing

Strengths

supports safer path choice (2)
innovative aspects (2)
comfort (2)
userfriendly (4)
better state of the roads so less one sided accidents (2)
crowd sourcing option (2)
free of use

makes good use of existing IT comms systems and encourages people to take an interest in the state of local infrastructure
Strong tool to show comittment of city towards cycling
trendy
already existing

It stimulates citizen's involvement and contributes to the improvement of comfort in public space, to maintenance and to less one sided accidents related with promotion

Weaknesses

low accident prevention (2)
not common type of use
no info on safety impacts (2)
impacting cyclist safety only indirectly (4)
works only if majority of users use it (2)
Functioning depends on (very fast) follow by government or reposnisble body (this needs organisation)
no impact on cyclist visibility (2)

Difficult to keep the reports up to date and prevent the system getting clogged with reports about very minor things, or nuisance reports
No immediate action or improvement
no impact on road users behaviour
if there follows no visible action in case of an announcement, the system won't work

quality of input can vary, how will it work in the long term

Internal environment

External environment

Opportunities

suitable for several motives (5)
already existing (5)
low development costs
integration with other apps (3)
useful in all geographical area (3)

This system is of much broader value than just cycling and is an encouragement to local residents to take charge of their environment
Potential tool for citizen involvement
can be upgraded and other reports introduced
free of charge for users
business model without government money

Threats

can produce increase of external costs
high costs for development
low market demand (4)
difficulties in estimating safety impacts (3)
complexity of app

The system will soon get discredited if the authrrities don’t act quickly in response to reports that are lodged by the public
Citizen expect changes and city looses credibility in case nothing changes
Different expectations if a government or a company starts up this application
How active is follow up? Motivation of users depend on it.

SWOT Analysis	Street View Cycle infra - iMOB_37		
Brief description:	Street view also for cycle lanes	**Type of application:**	Internet
		Status:	Existing (not for bicycle infrastructure)

Strengths

safety advantages (3)
positive impacts on cyclists safety (3)
similar app available (3)
reduces interaction with other modes (2)
supports safer path choice (8)
userfriendly (7)
nice way to explore unknown situations

In combination with other (safety) information attractive
comfort (3)
good potential for new bicycle users
Very useful information for the cyclist

high ratio between safety and price

immediate market availability (5)
free of charge (2)
trendy (3)
not only for safety but also for cycling facilities information and the promotion of cycling in general

Weaknesses

impacting cyclist safety only indirectly (6)
no info on safety impacts (2)
high costs for implementation (4)
Cyclist needs knowledge about how to interpret the views: what is safe and what not?
no impacts on cyclist visibility
low accident prevention (3)
Limited use for seasoned cyclists with well stablished habits / routes
Should be integrated with much more info (e.g. noise, cycling speed, air quality, user feed-back) to avoid unpleasant/dangerous trajectories being proposes by the software (e.g. this was a sign problem in Vancouver)
Most useful for the unexperienced but perhaps not really know except to cycling enthousiasts?
Not enough data about e.g. safety roads for cyclist. Then it could be perceived later as regular pedestrian navigation
Very complex system - requires administration (evaluate relevance, updating, etc) of all information

potential users of application will probably prefer proven paths
more suitable for countries where e-infrastructure is widely developed - It is useless for countries without Intelligent Transport Systems infrastructure
high cost of taking pictures of all the locations

Internal environment

External environment

Opportunities

technology development and innovation (4)
business and product development (3)
useful in all geographical area (6)
already existing

suitable for several motives (6)
integration with other apps (4)
Increased knowledge about cycle infrastructure (2)

suitable for several target groups (5)
good opportunity to expand / morph into something more substantial than “cycle lanes maps”, namely global maps assessing the quality of normal streets and whole areas for users, as well as mapping other services for them

any POI could be interested to pay some fee to be in this map. Eg. If restaurnat will advertise then notice "dont drink and bike".
May contribute to increased interest for cycling
low development costs
potentially high market demand
it can be accessible through mobile devices

Threats

high costs for development (3)
difficulties in estimating safety impacts (4)
low market demand (2)
Buyer of the application not directly benefiting of its use
Needs to be supported continously by the local authorities and managed as a dynamic tool. 1 person need to be in charge of keeping the app up and running
What will be the impact for operator of website. Advertisment?
It could be based on activity of cyclists, there is then the threat of less activity of users.
need for continuous data input - It means that high technical skills required in order to provide sufficient and reliable information for not familiarized users with the internet technology

increase of external costs

complexity
who would finance this measure to google? Only advertising on the web would do?
It is more likely to be implemented by a public administrations rather than through a private company expecting to get profits

SWOT Analysis — BikeStability - iMOB_40

Brief description:	App used to measure the cycle behaviour of someone, for example to get an idea about the critical stability problems, important because of chance on falling

Type of application:	Nomadic
Status:	Idea

Strengths

safety advantages
innovative aspects (4)
main focus on safety
positive impacts on cyclists safety
Increase of cycling skills of specific groups (e.g. elderly)

comfort
userfriendly
supports safer path choice
Directly developed for cyclists safety
App seems to respond to a need, and could help people to ride again

Weaknesses

costs for development (2)
Completely new application (2)
No information on safety impacts (3)
Structural weakness (2)
not common (2)
Effectivity of the app depends on the usage (e.g. only effecitve with help of professionals or when very direct instructions are provided about the interpretation of the results)
Impact on safety indirectly
not every cyclist has an smartphone, especially elderly
Dependence on interaction with other actors on the road
Those who have stable cycling behaviour problems may not be smart phone users
I am presuming that the cyclist would monitor the results AFTER cycling since doing so while cycling could provide an extra distraction. Are we attempting to replace human observation and advice to a learning cyclist with an app?!

Internal environment

Opportunities

Technology development and innovation
Useful in all geographical area (5)
Suitable for several target groups (2)
Integation with other applications (4)
market development
Easy availibilty on smartphone possible
May encourage certain groups to cycle longer
pin-off app-based applications for kids to learn cycling, for insurance company issues

Threats

IT developments
Useless for some user categories (2)
Difficulties in estimating safety impacts (2)
seasonality
high technical skills for development (2)
low market demand (3)
For optimal/correct use, knowledge is required about the app and about using the outcomes of the app
high costs for use
positioning not accurate enough to measure fine details of stable riding
App use while cycling not recommended

External environment

SWOT Analysis — Direction Indicator - int_01

Brief description:	A direction indicator on the steering wheel

Type of application:	Bicycle
Status:	Idea

Strengths

safety advantages
innovative aspects (2)
directly developed for cyclists safety (3)
positive impacts on cyclicts safety (3)
main focus on safety
reduces interaction with other modes (2)
increase of cyclist visibility / direction (3)
supports safer path choice (2)
can be provided as extra on bike

Road users are better aware of what others do.
Important feature especially now speed-differences between bikes (e-bikes) increase

Weaknesses

new app (4)
no info on safety impacts (2)
no impact on cyclist visibility
low accident prevention
dependence on interaction with other road users (2)
not common use (3)
extra item to wear (3)
structural weakness
Visibility less than manual indication. When is a turn a turn, and use while overtaking?

Are we seeking a technological solution when the more traditional hand-signals and eye-contact are what really matters - and are affordable to everyone!? It is yet another item for which batteries (or a working dynamo) will be required?

Internal environment

Opportunities

technology development and innovation
useful in all geographical area (2)
market development
low technical skills for development (3)
Partly already existing on other vehicles (2)
Low development costs (2)
potentially high market demand
suitable for several target groups
High-tech sells, and catalyses spin-off developments

Threats

IT developments
seasonality, weather effects
difficulties in estimating safety impacts
low market demand (3)
vandalism (4)
legislative effects
useless for some user categories
battery problems like with lights on the bike

External environment

SWOT Analysis — FoldableCycleSteer - int_06

Brief description:	Cycle steer folding in case of an accident, so that abdominal injuries can be prevented

Type of application:	Bicycle
Status:	Idea

Strengths

safety advantages (6)
innovative aspects (5)
directly developed for cyclists safety (4)
userfriendly (3)
main focus on safety (3)
Direct benefit for user/buyer in saving his health
Immediate availability in case of need
Penetration of this measure is not impacting the direct benefit for individual user
Useful everywhere, everywhen - no certain external conditions necessary
addresses an important but often ignored aspect of bicycle design - ie avoiding fixtures and fittings that can caused nasty injuries

Weaknesses

new app (4)
costs for development (2)
impacting cyclist safety only indirectly (2)
no info on safety impacts (3)
low accident prevention (5)
structural weakness (3)
not common
Safety disadvantages, when the steers folds during cycling (2)
This technical solution is not preventive, but supportive in case only after an incident
Costs for prototype development, but mainly testing, are expected on a medium level
No nomadic device for more goals
This is just a theoretical idea at present and the engineering challenges may be too hard
Take-up difficult for cyclists; higher costs of bicylces
What if there is a construction defect, it could lead to dangerous situations (folding too early or too late)

Internal environment

Opportunities

technology development and innovation
useful in all geographical area (3)
suitable for several target groups (3)
suitable for several motives (2)
integration in bicycle (add-on or included)
Could be interesting for insurance companies
Possible integration with e-Call in the case of detected crash
The principle of design that avoids injury has wide application
If it works for cyclists, it should be examined if the idea also could be used for mopeds and motorcycles
Develop an airbag for steer injuries
usefull and easy to understand

Threats

high costs for development (4)
high technical skills for development (4)
difficulties in estimating safety impacts (4)
legilslative effects
seasonality (2)
low market demand (4)
vandalism
Buyer of the application not directly benefiting of its use (2)
false alarms are a potential problem
Expected use: for new or more expensive bikes; maybe for professional bikers; no investments by users of "veteran pieces"
Without extensive trials in use it is difficult to judge whether this is a good or a bad idea
Might even increase injuries of other body parts

External environment

SWOT Analysis	Photovoltaic panels to illuminate cycle lanes - int_19		
Brief description:	Photovoltaic panels illuminate the cycle path	**Type of application:**	Infrastructure
		Status:	Existing

Strengths

safety advantages (6)
innovative aspects (4)
directly developed for cyclists safety (3)
userfriendly
main focus on safety
comfort (3)
increase cyclist visibility (6)
support safer path choice (4)
simple technology
trendy
energy autonomy

Cyclists don't need to do anything.

Weaknesses

new app
no impact on cyclist visibility
impacting cyclist safety only indirectly (4)
costs for development (6)
not common (2)
structural weakness (2)
cost of technology
more suitable for the sunshine countries
vulnerability in any intentional or unintenional damages such as hits, accidents,or strong hail fall
Only justified for frequented bike paths
Solar pannels can be stolen, specially if they are installed in non-watched out areas

Very accurate technology is need since in rural areas many animals are moving around and the lights shouldn't get on at any time
Only technological and price aspects could be really seen as negative aspects

Internal environment

Opportunities

technology development and innovation (4)
usefil in all geographical area (2)
easiness in estimating safety impacts (2)
suitable for several motives (3)
potentially high market demand (2)
Fits in energy-responsible developments (energy saving aims of governments)
To be implemented by government, but advantage for all cyclists using the cycle lanes
Advantage on locations without energy supply
Can be programmed to only work when cyclists pass
sustainable energy market development (can energy produced be used for other purposes?)
innovation
Specific for rural areas (2)

Low technical skills for development because of the existence of previous experience in the field of ICT applications in road infrastructure
interesting solution in less developped countries e.g. southamerica, china

Could also enhance the feeling of security of cyclists and pedestrians
high market demand (3)

Threats

high costs for use (3)
useless in some geographical area (2)
useless for some user categories
legislative effects
seasonality
high technical skills for development (2)
vandalism (2)
Buyer of the application not directly benefiting of its use
can produce external costs
Acceptance might differ depending on geographical/cultural context
Developed in different geographical/cultural context
weather dependence? (2)

buyer(e.g. a local municipality) may have indirect benefits
will increase the predictability of an approaching cyclist (eg towards an blind spot, or during the night)

Are there many high frequented bike paths in rural areas without electricity supply?
And if so, do they have the finances to set up such a system?
There are some studies stating that dark streets are safer than illuminated situations

External environment

SWOT Analysis — Street View Cycle infra - int_34

Brief description:	Street view, also for cycle lanes
Type of application:	Internet
Status:	Existing

Strengths

directly developed for cyclists safety
Possibility to choose a safe route (2)
nice ay to explore unknown situations
userfriendly (7)
main focus on safety
comfort (2)
in combination with other (safety) information, attractive
support safer path choice (6)
similar app available (3)
no costs
trendy (3)
immediate market availability (2)

positive impacts on safety
free of charge
reduce interaction with other modes
afety advantages because of a better information of the cyclist on the route to cycle
innovative to use it for the bikes but the technology already exists

Weaknesses

gaps in capabilities
unsability for cyclist
impacting cyclist safety only indirectly (5)
completely new
no info on safety impacts
high costs for implementation (2)
cyclist needs knowledge about how to interpret the views: what is safe and what not?
not common type of use
no use on travel
low safety impacts
potential users of application will probably prefer proven paths
more suitable for countries where e-infrastructure is widely developed

It can easily developed in various "smart" cities like Amsterdam, Copenhagen etc but not to the majority of cities on Eastern or South Europe
low accident prevention
extra item to wear

Internal environment

Opportunities

previous experience existing (2)
usefil in all geographical area (7)
integration with other apps (5)
market development (2)
Increased knowledge about cycle infrastructure (2)
Suitable for several target groups (5)
Suitable for several motives (5)
already existing
expected technology development in this segment
high technology development and innovation

quite easy for someone to see detailed information about the cycle infrastructure or for the possible blind spots and dangerous intersections
Potentially high market demand (2)

Threats

difficulties in estimating safety impacts (5)
high costs for development (4)
more an enforcement tool than a safety one
legislative effects (2)
depends on knowledge of the people using it and additional information provided
high technical skills for development
low market demand
buyer of app not directly benefiting of its use
useless for the majority of users
doubts on safety impacts

need for continuous data input
high technical skills required
compexity of the application is based on the mandatory GIS maps existence
IT developments
not clear the income for implementing this technology
more likely to be implemented by a public administrations rather than through a private company expecting to get profits

External environment

SWOT Analysis — Cyclist Traffic Light for Rain - MOB_01

Brief description:	Traffic light for cyclists has a rain sensor. If it is raining, the cycle of the traffic lights is shortened, which means that cyclist will get a green light faster when it is raining. This will prevent them from driving through red ligh.

Type of application:	Infrastructure
Status:	Existing

Internal environment

Strengths

innovative aspects (7)
positive impacts on cyclists safety (5)
reduces interaction with other modes (4)
userfriendly (3)
safety advantages (2)
comfort (5)
developed for cyclists safety
immediate market availability
Supports cyclists during rain, less waiting (2)
shorter stay of cyclists on crossings equiped by traffic lights
safer path choice
low costs (2)

directly developed for cyclists safety

Weaknesses

gaps in capabilities
no info on safety impacts (2)
impacting cyclist safety only indirectly (5)
no impacts on cyclist visibility (3)
dependence on interaction with other road users
costs for development (2)
liability of sensors
not common type of use
high demands on change of traffic lights settings
red light running of cyclists is marginal safety problem
very specific focus of measure
dependence from the uniterrupted function of the traffic lights

If the traffic lights into a juntion be set out of order, the possibilities for a fatal collision between a cyclist and a vehicle will be increased
Conscious red light offenses are usually not a relevant cause for crashes. Do cyclists realize that red phase is shortened?
low accident prevention

External environment

Opportunities

business and product development
already existing (5)
easiness in estimating safety impacts
less red light offences (2)
potentially high market demand (4)
technology development and innovation (5)
Especially suitable for countries who have a high rain factor (2)
Road owner installs extra device, all cyclists who pass take the benefits
increase traffic fluidity
suitable for several user groups (2)
potential use of measure for pedestrian traffic lights
potential for combination with other measures related to traffic lights
useful in all geographical area (2)
low technical skills for development
Nice to communicate within bicycle promotion (low costs, high public awareness)
integration with other apps

Threats

seasonality, weather effects (6)
useless in some geographical area (4)
can produce external costs (2)
difficulties in estimating safety impacts (2)
extra costs for sensor and programming traffic lights
Might be complicated on locations with dynamic traffic lights
compexity of the application
high costs for use (2)
low impacts on safety (2)
expected very low demand of cyclists community for measure of this kind
low number of dedicated traffic lights for cyclists in some countries
vandalism
Not usable in coordinated traffic light systems
low market demand
develop in different geographical / cultural contexts

SWOT Analysis	Car airbag for cyclists (SaveCap) - MOB_03		
Brief description:	Airbag on car inflates when a bicycle is detected by camera under the rear view mirror and the car is hit. It is an ad-on for cars that could be made obligatory	**Type of application:**	Vehicle
		Status:	In development

Internal environment

Strengths

innovative aspects (4)
positive impacts on cyclists safety (3)
main focus on safety (5)
userfriendly (3)
safety advantages (3)
developed for cyclists safety (2)
high ratio safety / price
innovative aspects
Reduced severity of injuries of cyclist after collision with car
Can be part of safety equipment/package of car
Mitigating injuries in case of a collision
prevention of severe injuries
could raise awareness in car drivers that there are other people around at all

Weaknesses

completely new app (3)
no info on safety impacts
impacting cyclist safety only indirectly (4)
not common
dependence on interaction with other road users (3)
costs for development (4)
low accident prevention (3)
Not impacting on change of collision, only on severity of injuries
unusability for cyclists
full advantages can be reaped at relatively high market penetration
no impact on visibility
can reduce other users' attention to cyclist interaction
prototype
risk of pushing the cyclist in other (unexpected) directions upon impact

External environment

Opportunities

business and product development (3)
potentially high market demand (5)
business development
easiness in estimating safety impacts (4)
legislation could speed up introduction
technology development and innovation (3)
suitable for PTW riders protection
useful in all geographical area (3)
At least on a symbolic level, the devices signals 'we care for your safety'

Threats

legislative effects
IT development
high costs for development (5)
seasonality
buyer not directly benefiting of its use (4)
high technical skills for development (3)
compexity of the application (2)
Impact on safety depends on availability on cars
relatively high costs for use (3)
transfers costs to the car driver and thus may require legislative developments for introduction
If it scores extra points on EURONCAP tests it will be implemented by the car industry (2)
low market demand
conveys the message that collision is 'less dangerous
enhances the risk of unsafe driving

SWOT Analysis	LED-mark - MOB_07		
Brief description:	Energy efficient lightning that can be applied on infrastructure surfaces.	**Type of application:**	Infrastructure
		Status:	Existing

Strengths

main focus on safety
positive impacts on cyclists safety
similar app available (3)
userfriendly
safety advantages (6)
comfort
directly developed for cyclists safety (3)
immediate market availability (2)
increase cyclists visibility (2)
support safer path choice (4)

no external energy supply
innovative aspects
Costs on the side of the infrastructure owner/manager, no costs for cyclists
Expected as highly reliable
increases road orientation

Weaknesses

structural weakness
no info on safety impacts (4)
works only if majority of users uses it
costs for development
No impact on cyclist visibility
Safety impact depends on action of other road users
Safety disadvantages, when the steers folds during cycling
low accident prevention
impacting cyclist safety only indirectly
The use of battery powered LEDS may not provide enough light to be effective
the system presumably requires thousands of lights to cover a cycle path network and if each light has its own battery the mainteneance task of changing the batteries is huge, even if it is only once per 5 years
High infrastructure and maintenance costs (2)
final effect is depending the behaviour of other road users mainly

Internal environment

External environment

Opportunities

business and product development
already existing (4)
market developments
potentially high market demand (2)
suitable for several target groups (3)
technology development and innovation (2)
Road owner decides on implementation of LEDs (safety as part of public task)
suitable for several motives
useful in all geographical area (2)
Capability mainly in interaction with other modes
Could be also used as a virtual kerb between road and cycle path, or pedestrain path
low operation and maintenance costs versus high value for users (2)
Low technical skills for maintenance
Used in combination with reflecting paint and reflective garments it greatky increases safety

Threats

seasonality, weather effects (3)
useless in some geographical area
difficulties in estimating safety impacts (5)
buyer of app not directly benefiting of its use (3)
can produce increase of external costs (2)
vandalism (2)
legislative effects
high costs for use (3)
Not for all geographical area suitable
In case of non-functioning of lights, cyclists might not be expected
low market demand
high skills for development
Slithery should be tested for cyclists safety and developed for optimising the LED mark surface
suspect there are more effective ways to light cycle paths than this proposed system
Interruption of road flow during installation and maintenance
Effects are in mobility policies mainly
runs on batteries, which is not in line with cradle to cradle
also works when there are no cyclists on the cycle lane
reflecting lights can be annoying

SWOT Analysis	Opwegnaarschool.nl - MOB_10		
Brief description:	The application allows students to define the safest route to their school, often part as an educational program. Students draw their school routes on online maps and mark unsafe locations	**Type of application:**	Internet
		Status:	Existing

Strengths

main focus on safety
positive impacts on cyclists safety
userfriendly (4)
immediate market availability
safety advantages
increase knowledge about road safety (2)
increase awareness - smaller chance for involvement in accidents (2)
similar apps available
For important targetgroup (young cyclists)
support safer path choice (4)
Directly developed for mostly the cyclists safety
Adaptive, adresses road user experiences, harvests those for policy development
seems to have the option of adapting the difficulty to children's age

including children in the establisment of safe and unsafe situations / crossings / etc. provides a children's perspective on mobility and infrastructure

Weaknesses

gaps in capabilities (2) - not every web browser is supported
works only if majority of users use it
Website is part of a programm at school, so not accessible for everybody
Consultant who is 'owner' of the app has to be hired / involved
Application focuses on school routes, but other routes should be safe as well: depends on government
Estimating risky situations is not part of the training as well as bicycle training
Lack of evidence about its effectiveness. Evaluation study never completed
I wonder how many educational topics can / shall be included in computerized learning methods
impacting cyclist safety only indirectly (3)
children can 'forget' that there is a real world of traffic 'out there'
As with all digitalized learning, in its parallel to gaming, it might prevent a real-life feeling and estimation of traffic situations

Internal environment

Opportunities

business and product development (2)
already existing (4)
low development costs
potentially high market demand
suitable for several target groups
integration with other apps (3)
useful in all geographical area (2)
suitable for several motives (4)
Possibility to involve all kind of stakeholders in educational program (2)
Easy to use in school environments. Students can work on their own
Children are computer litterate anyway - so the educational element should come natural
A nice option is to make the programme interactive with local communities' policy makers (infrastructure) or with the police

Threats

complexity of the app
useless in some users categories
difficulties in estimating safety impacts (4)
IT developments
only beneficial if it is part of an intensive educational programme
ICT demands could be a practical problem in a school class
not innovative
Only uses cleverly available information and connects them for education purposes

External environment

SWOT Analysis	Night View - MOB_11
Brief description:	Detects objects and pedestrians during the nighttime

Type of application:	Vehicle
Status:	In development / Existing

Strengths

main focus on safety
positive impacts on cyclists safety
innovative aspects (4)
increase cyclist visibility (6)
safety advantages (3)
reduces interaction with other modes
directly developed for safety of cyclists (2)
Direct positive impact on the road safety generally, what includes cyclists, too
comfort
trendy
Possible effects are not confined to cyclists
userfriendly
improving attention

Weaknesses

costs for development (2)
unusability for cyclist
completely new app (4)
no info on safety impacts (4)
extra item to wear
works only if majority of users use it
dependence on interaction with other road users (2)
impacting cyclists safety only indirecly
task load during driving may increase (3)
No impact of bicyclists on penetration of this application
The way information is conveyed to the driver needs more thought
low accident prevention
It seems that that the device has more effects on safety of the driver with the equipped car than on the safety of others

What if the technique fails

Internal environment

Opportunities

technology development and innovation (5)
already existing (3)
easiness in estimating safety impacts (2)
business development
useful in all geographical area (5)
as extra on vehicle, could be part of "safety package"
market development (2)
Sound in-vehicle warning added could be of a value for a driver, too
Safety impacts easily to be detected at driving simulators

Total safety impacts for the car driver and passenger are very high - positive motivation for buyers
Giving a driver more information about things that are in the same road space (or may come into the same road space) is a trend that will continue
can be integrated with other in-car devices
many sensors can be used for automatic driving (cars) and will have a huge impact (active safety).

Threats

IT developments
useless in some users categories
high technical skills for development (4)
IT developments
seasonality (3)
high costs for development (4)
buyer of app not benefitinh directly of its use (4)
high costs for use (5)
complexity to use for drivers

Total safety impact, for bicyclists, simply depends on penetration among vehicles/car drivers demand. Penetration percentage expected as low, at least at the beginning and for typically city oriented vehicles (small cars)

market to be created
this system could make drivers over dependent on IT and loose the ability to judge situations with common sense.
Driver depends too much on system
Extra weight of device can lead to extra fuel consumption
Moral hazard effect. Car driver is reading faster and is less carefull
Developed for in-car, not for cyclists.

External environment

SWOT Analysis	Approaching Vehicle Audible System - MOB_12		
Brief description:	By means of a speaker the electric/hybrid car makes a noise every time the vehicle is driven at 25km/h or reversing the system can notify pedestrians with an automated alert sound	**Type of application:**	Vehicle
		Status:	Existing

Strengths

similar app available
positive impacts on cyclists safety (4)
innovative aspects
main focus on safety (4)
safety advantages (5)
reduces interaction with other modes (3)
Extra on vehicle - so choice for app has to be made only once
High ratio between safety and price
immediate market availability

Less chance to be hit by an electric/hybrid car

userfriendly (3)

Weaknesses

no info on safety impacts (4)
unusability for cyclist
not common type of use (3)
No impact of bicyclists visibility (3)
Dependence on interaction with other actors on the road (3)
costs for development
developed only for electric vehicles, not yet on the market
How will the system work when there are a lot of cyclists around? Lot of noise? (4)
increment of the car driver's sense of confidence and a lowering of his perceived responsability and needs for attention

doubt that the final net outcome would bepositive, and can't see how this is any better than a redesigned (for lower volumes) horn activated by the driver as needed

Internal environment

technology development and innovation (3)
already existing (3)
Potentially high market demand (when more e-cars are used) (2)
business development
useful in all geographical area (3)

With some modifications (i.e., possibility to activate it for a given period of some minutes) can have some usefulness in pedestrian and shared spaces areas
not automatical trigered systems (without sensors) are well known from electrical scooters
Previous experiences existing
low development costs

Opportunities

External environment

IT developments
difficulties in estimating safety impacts (4)
legislative effects (2)
low market demand (2)
Countereffective perhaps (if there is no noise, it doesn't mean there are no vehicles around)

high costs for use
buyer of app not benefitinh directly of its use (5)

complexity of the app

Threats

SWOT Analysis	Bicycle Braking Light - MOB_13		
Brief description:	Back light connected to a sensor registering decellaration	**Type of application:**	Bicycle
		Status:	Existing

Strengths

directly developed for cyclists safety (6)
positive impacts on cyclists safety
innovative aspects (3)
main focus on safety
safety advantages (4)
reduces interaction with other modes (4)
increase of cyclist visibility (8)
userfriendly (5)
immediate market availability (2)
better possibility of movement prediction for drivers
high ratio between safety and price
trendy

Weaknesses

no info on safety impacts (2)
no impact on cyclist visibility
not common type of use (2)
extra item to wear (2)
Dependence on interaction with other actors on the road (4)
costs for development (3)
structural weakness (3)
low accident prevention (4)
higher risk of accidents due faulty decisions of drivers in case of group of cyclists with and without this device
additional costs for cyclists (2)
problem with distinguishing from similar devices used for higher visibility and not used for braking
poor quality of product with high risk of damage
short interval of braking (2)
completely new app
Needs a dynamo (battery light should be possible as well)
Usually expensive to be upgraded

Internal environment

External environment

Opportunities

market developmens (3)
already existing (5)
Potentially high market demand
business development
useful in all geographical area (5)
suitable for several target groups
low development costs (6)
low technical skills for development (4)
high potential of product producers
Usefull on high frequented bike paths or in mixed traffic situation (car/bicycle)

Threats

high technical skills for development
difficulties in estimating safety impacts (4)
legislative effects (4)
vandalism (2)
Powersupply of lights is regulated in some countries
low market demand (4)
lower proportion of cyclists on traffic in some regions
complexity of the app
increase of external costs
the competitive market have been developed more efficient ways of increasing cyclists' visibility
Needs support of manufacturers and dealers.
seasonality, weather effects
useless for some user categories

SWOT Analysis — HokeySpokes - MOB_18

Brief description:	Hokey Spokes are bicycle safety lights that allow riders to display computer-generated images and text inside the spoke cages while riding at night

Type of application:	Bicycle
Status:	Existing

Strengths

directly developed for cyclists safety (2)
positive impacts on cyclists safety
similar app existing
main focus on safety
trendy (2)
easili to mount (3)
increase of cyclist visibility (5)
userfriendly
possible to customize (2)
fun
can be build directly on bicycles
safety advantages

Weaknesses

no info on safety impacts (4)
not common use
extra item to wear (2)
uses batteries (2)
relatively expensive (2)
majority won't use it because of costs
no possibility to turn them off, only by removing them
It is only visible from the side not when you ride behind or in front of the bicycle (2)
uniformity of the product
These may make cycling weird and fringe and less attractive to mainstream audiences
full safety benefits would come from widespread adoption
don't solve the problem of people not using required light systems

Internal environment

Opportunities

market developments (3)
already existing (2)
Potentially high market demand
easiness in estimating safety impacts
useful in all geographical area (2)
low development costs (3)
suitable for several target groups (2)
easy-to-use tool
highest acception is expected for kids because of the colourful look

Threats

legislative effects (4)
difficulties in estimating safety impacts (2)
Bicycles with a lot of light together with modest lighted bikes might cause dangerous situations ('dark' bicycles are less visible)
vandalism (3)
majority won't use it because of it's 'too much' visibility, it's too trendy
colours might be mistaken with colours of emergency vehicles (police, firecars)
other people (car drivers) might get distracted by the attempt to read the message which might decrease safety
seasonality, weather effects (2)
Flashing lights shifts the safety responsibility to the most vulnerable users rather than the cause of the threats, cars going too fast

External environment

SWOT Analysis — Frontzicht - MOB_21

Brief description:	Blind spot detection by a camera monitor system which makes every corner of the truck visible on a screen inside the truck	**Type of application:**	Vehicle
		Status:	Existing

Strengths

userfriendly (2)
positive impacts on cyclists safety (5)
similar app existing
main focus on safety (2)
immediate market availability (4)
less material damage (2)

increase of cyclist visibility (3)
high ratio between safety and price
safety advantages
Other road users could benefit (motor cyclists, pedestrians) not just cyclists
responds to a need

Weaknesses

unusability for cyclist
structural weakness
works only if majority of users use it (4)
dependence on interaction with other road users (3)
not common type of use
impacting cyclist safety only indirectly (2)

The truck driver needs to pay attention to one further monitor in the cab. Does this / can this lead to sensory overload in a busy, bustling, urban centres when there is so much activity? (2)
capital intensive

Internal environment

Opportunities

technology development and innovation (2)
already existing (3)
Potentially high market demand
easiness in estimating safety impacts
useful in all geographical area (2)
market development
suitable for several target groups (3)
suitable for several motives (3)
part of the safety package of a car
business and product development
integration with other apps
Possible spin-off in person transport

Threats

useless in some geographical area
high costs for development
useless for some user categories
buyer of the app not directly benefiting of its use (5)
complexity of app
low market demand
difficulties in estimating safety impacts
high costs for use (2)
Not common yet to use screens for navigation, but this is becomming more common (2)
Car drivers (non professionals) might find it difficult to navigate on a mirror

External environment

SWOT Analysis	LEXGUARD - MOB_22		
Brief description:	Detection strips on the truck to warn for objects around the truck combined with warning signs inside the truck	**Type of application:**	Vehicle
		Status:	Existing

Strengths

userfriendly (5)
positive impacts on cyclists safety (2)
similar app existing
main focus on safety (3)
immediate market availability (2)
safety advantages (5)
increase of cyclist visibility (3)
Increased awareness of obstacles and cyclists and pedestrians around the truck
good ratio cost/benefit
solution filling gap within safety of cyclists in relation to heavy vehicles
positive effects also on pedestrians
directly developed for cyclists safety

Weaknesses

unusability for cyclist
not common type of use
works only if majority of users use it
dependence on interaction with other road users (2)
gaps in capabilities - there is no real vison for the driver, can he truely trust this blindy? (2)
Impacting cyclist safety only indirectly (2)
What if there are a lot of cyclists around?
safety impacts doubtful
fake positives/fake negatives;
timely warning not proven sensors distance range to be defined
additional costs for transport companies
missing analysis or study about effects of system in all potential circumstances (how system respond in various traffic conditions)
close dependence with the driver's awareness
cannot prevent the collision unless the driver is careful and full concentrated in his driving
needs the existence of side truck mirrors
no info on safety impacts
need maintenance
may be damaged

Internal environment

Opportunities

market development (4)
already existing (4)
Legislation could speed up use of this kind of applications (also provided as part of new vehicles)
easiness in estimating safety impacts (2)
useful in all geographical area (5)
Can be added on vehicles afterwards
suitable for several target groups
easy app
can be easily developed in several kinds of trucks, vehicles of public transport etc.
business and product development (2)
potentially high market demand

Threats

useless in some geographical area
IT development
useless for some user categories
buyer of the app not directly benefiting of its use (6)
high technical skills for development
low market demand
difficulties in estimating safety impacts
technological failure
high costs for use (2)
acceptance by drivers to be assessed;
resilience to external conditions to be proven
easy installation can be a sitting target for vandalism (2)
high costs for development
it needs to be widely spread and installed to generate measurable impacts

External environment

SWOT Analysis — See-mi - MOB_24

Brief description:	To inform waiting trucks at an intersection about cyclists in their blind spot, the bicycle sends a signal with a special reflector to a receiver at the intersection showing their presence

Type of application:	Infrastructure
Status:	Existing

Strengths

userfriendly (2)
positive impacts on cyclists safety (4)
directly developed for cyclists safety (4)
main focus on safety
reduces interaction with other modes
safety advantages (2)
increase of cyclist visibility (5)
system responds to a need

Weaknesses

costs for development (5)
no info on safety impacts
no impacts on cyclist visibility
dependence on interaction with other road users (2)
structural weakness
works only if majority of users use it (2)
not common type of use
prototype (2)
extra item to wear (2)
Works only if majority of cyclists has a special reflector and if detecting infrastructure is available (3)

Too many different elements in the chain (bicycle needs to have a reflector, infrastructure at intersection has to detect reflector, truck driver has to look at the indication light at the intersection and take action)

Internal environment

Opportunities

technology development and innovation (4)
already existing (2)
easiness in estimating safety impacts
integration with other apps (2)
market development
useful in all geographical area (4)
suitable for several target groups (2)
potentially high market demand

Threats

useless in some geographical area
IT development
low market demand (2)
complexity of the app (2)
can produce external costs
vandalism
high costs for use (3)
difficulties in estimating safety impacts
buyer not benefiting directly of its use
Risk of not functioning which might let the truck driver think that there are no cyclists
legislative effects
Reliance on system may make drivers 'lazy' hence safety hazard
it may make cyclists assume the system is operational in a truck, while it isn't.

External environment

SWOT Analysis	Safety Personal Area Network System - MOB_28
Brief description:	"Safety Mobile Phone Attachment" was developed based on the Safety Mobile Phone system can send positioning data via DSRC.

Type of application:	Bicycle
Status:	In development

Strengths

innovative aspects (5)
positive impacts on cyclists safety (4)
reduces interaction with other modes
trendy (2)
reduces interaction with other modes (2)
safety advantages (3)
increase of cyclist visibility (2)
system responds to a need
main focus on safety (3)
support safer path choice
If the app is attractive enough for the target group a lot of use should be possible
directly developed for cyclists safety
immediate market availability
similar app available

Weaknesses

costs for development (3)
completely new app (4)
no info on safety impacts (2)
dependence on interaction with other road users (2)
extra item to wear
works only if majority of users use it (4)
Complexity of the system: a lot of links in the chain define if the application has a safety effect
not common type of use
can reduce attention to traffic environment
some cyclists may find it hard to use
prototype application
Pedestrians' own perception of risky situations. Looking on a PDA is too much distraction
False alarms, and misinterpretation of signals
Prevents people from using their senses altogether

Internal environment

Opportunities

technology development and innovation (4)
suitable for several target groups (4)
potentially high market demand
integration with other apps (5)
already existing
useful in all geographical area (2)
suitable for several motives
low costs for development
Might have a benefit for car / truck drivers in that it could signal traffic from the 'dead man's angle'

Threats

high technical skills for the development
low market demand (3)
difficulties in estimating safety impacts
complexity of the app
vandalism
IT development (3)
high costs for development (3)
difficulties in estimating safety impacts
useless for some user categories
not effective in areas without fast mobile internet coverage
developed in different cultural setting
only works if the application is free and easy to find and install
The largest danger is that it creates a false sense of safety and loweres attentions levels rather than alerting road users for potentially dangerous interactions

seems an absolute distraction for road users. Takes away individual and collective responsibility for improvising and behaving in traffic.

External environment

SWOT Analysis — Intelligent Speed Information - MOB_34

Brief description:	Warning in the navigation system when driver is close to a school, which has to encourage the driver to drive slow and to pay extra attention
Type of application:	Vehicle
Status:	Existing

Strengths

userfriendly (2)
positive impacts on cyclists safety (2)
similar app available
main focus on safety (2)
reduces interactio with other modes
safety advantages (5)
Cars drive slower and safer in school environments because of warning systems
Also in other parts of the city cars are encouraged to drive slower
Makes school environments safer for other road users
safer routes for cyclists
reduction of potential collisions

Weaknesses

costs for development (2)
no impact on cyclists safety
no info on safety impacts (2)
dependence on interaction with other road users (3)
Impacting cyclist safety indirectly (depends on increased awareness of car driver)
extra app in car
Application needs to be switched on
Driver needs to have a positive attitude towards the application (has to be willing to adapt speed when application 'askes' for it)
If other road user don't use GPS then you have a 'blind spot', so you can't trust it completly (2)
not directly for cyclists alone
in case the system does not work reliable the risk of high speed is given and the question of responsibility is to be answered
political willing to implement
technique should be of high quality
there are lots of people and industy involved to make it succesfull
The device does not guarantee slower speeds and would work better for drivers who are already law abiding than problem speeders.

Internal environment

Opportunities

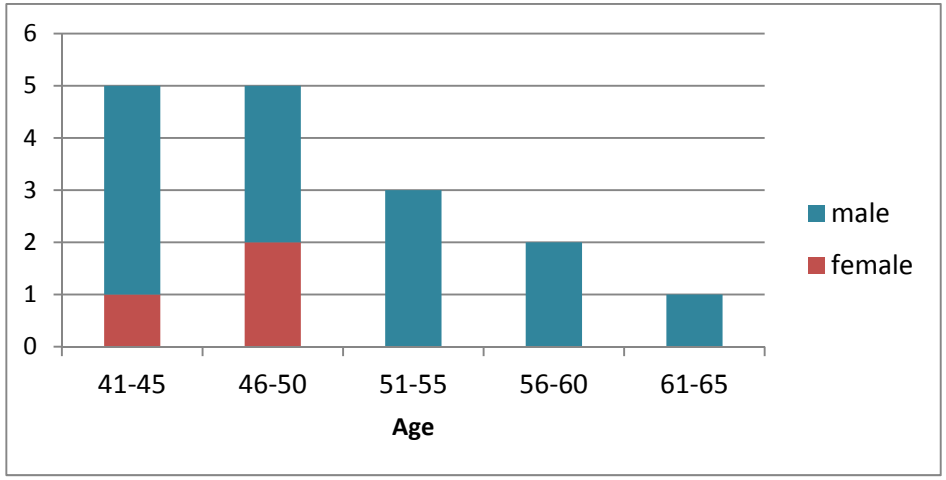
technology development and innovation
suitable for several target groups
business and product development (2)
integration with other apps (3)
already existing (2)
useful in all geographical area
suitable for several motives (2)
easy to adapt / GPS knows your speed and position combine it with a database of the road / street
insurance or auto registration discounts for drivers that install such a device.

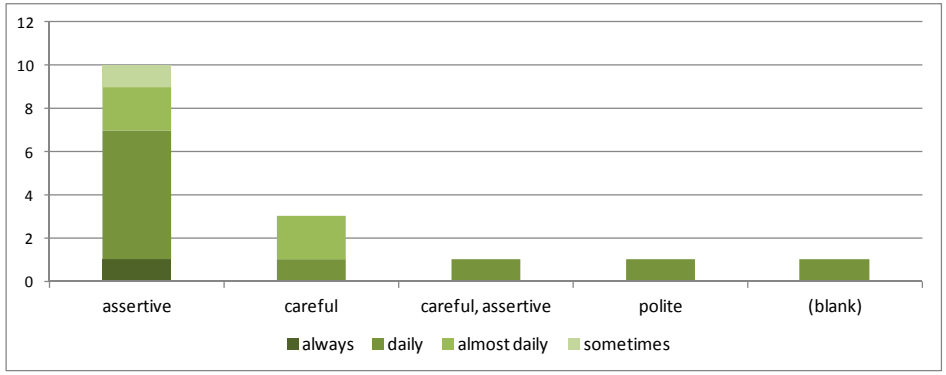
Threats

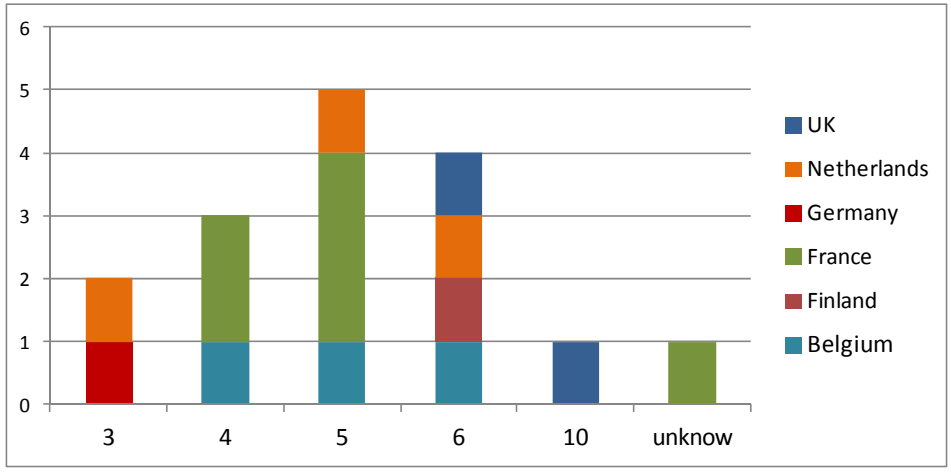
useless in some geographical area (2)
useless for some user categories (2)
buyer of the app not directly benefiting of its use (3)
low market demand
High costs for added value (if you keep your speed in 30 km zones, the app is not necessary)
IT development (2)
partly depending on navigation unit suppliers
impact on the so called freedom of motorized traffic
The entire system may reinforce the notion that the driver is separate not a part of the traffic environment around them

External environment

Annex II – EUCG workshop questionnaire answers

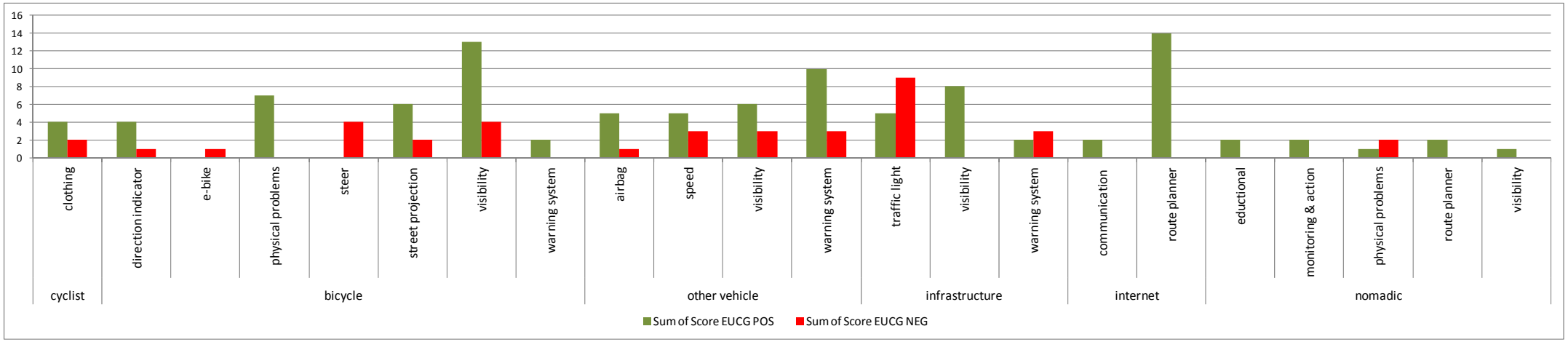


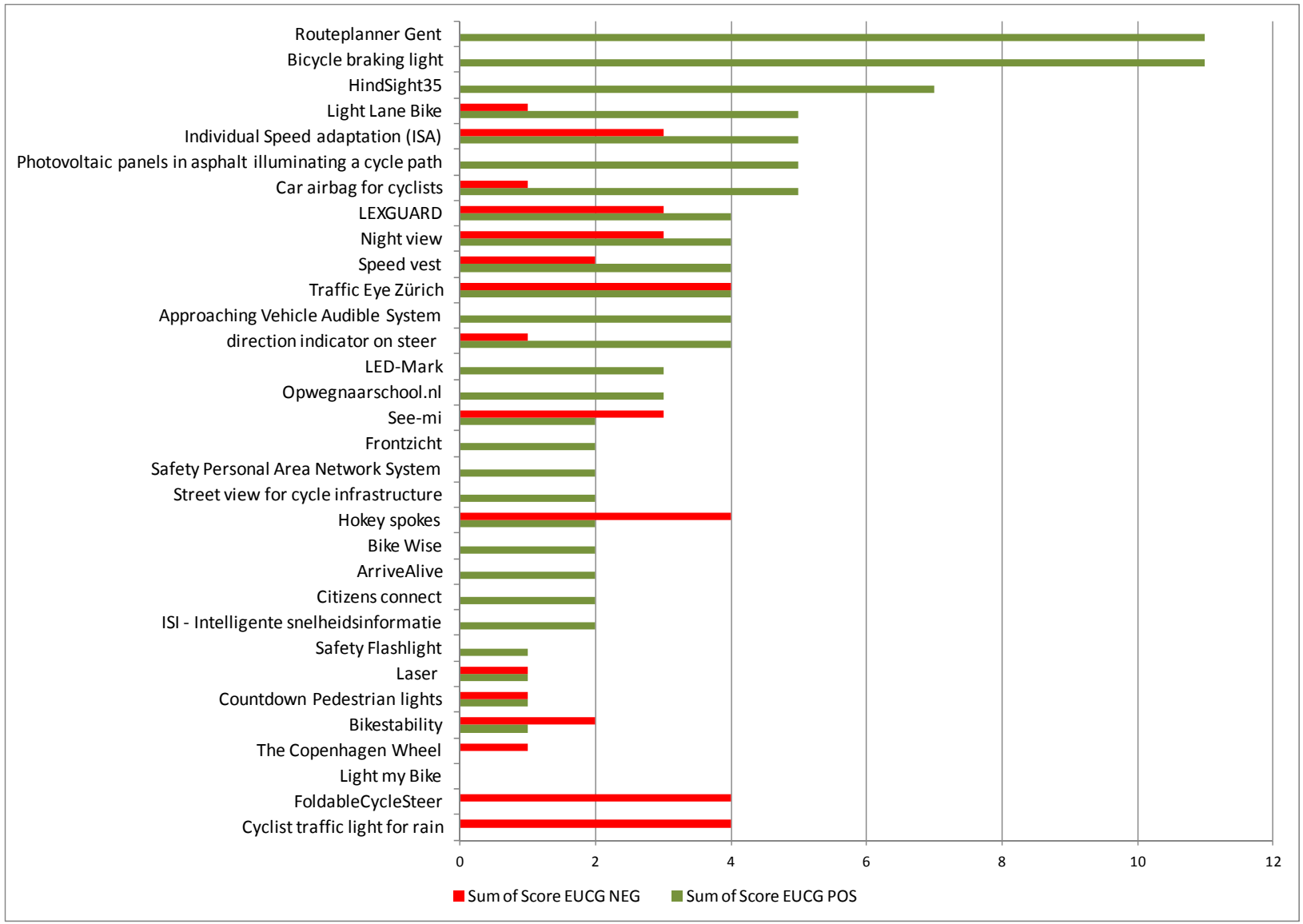




Row Labels	Count of Name
Belgium	3
financial	1
ITS/administration	1
non-bike-related	1
Finland	1
translator	1
France	6
employment	1
environment	1
finance audit	1
IT	1
IT, governance for Fremework PGM	1
(blank)	1
Germany	1
Energy efficient cities	1
Netherlands	3
IT	1
languages	1
product normalisation	1
UK	2
Disaster management	1
Translation, terminology	1
Grand Total	**16**

Which applications would you consider **successful** (green) and unusable / unsuccessful (red)




Routeplanner Gent
Bicycle braking light
HindSight35
Light Lane Bike
Individual Speed adaptation (ISA)
Photovoltaic panels in asphalt illuminating a cycle path
Car airbag for cyclists
LEXGUARD
Night view
Speed vest
Traffic Eye Zürich
Approaching Vehicle Audible System
direction indicator on steer
LED-Mark
Opwegnaarschool.nl
See-mi
Frontzicht
Safety Personal Area Network System
Street view for cycle infrastructure
Hokey spokes
Bike Wise
ArriveAlive
Citizens connect
ISI - Intelligente snelheidsinformatie
Safety Flashlight
Laser
Countdown Pedestrian lights
Bikestability
The Copenhagen Wheel
Light my Bike
FoldableCycleSteer
Cyclist traffic light for rain
0
2
4
6
8
10
12
Sum of Score EUCG NEG
Sum of Score EUCG POS


nomadic
ArriveAlive
Bike Wise
Citizens connect
Safety Flashlight
Bikestability
Light my Bike
internet
Routeplanner Gent
Opwegnaarschool.nl
Street view for cycle infrastructure
infrastructure
Photovoltaic panels in asphalt illuminating a cycle path
Traffic Eye Zürich
LED-Mark
See-mi
Countdown Pedestrian lights
Cyclist traffic light for rain
other vehicle
Car airbag for cyclists
Individual Speed adaptation (ISA)
LEXGUARD
Night view
Approaching Vehicle Audible System
Frontzicht
ISI - Intelligente snelheidsinformatie
bicycle
Bicycle braking light
HindSight35
Light Lane Bike
direction indicator on steer
Safety Personal Area Network System
Hokey spokes
Laser
The Copenhagen Wheel
FoldableCycleSteer
cyclist
Speed vest
0
2
4
6
8
10
12
Sum of Score EUCG NEG
Sum of Score EUCG POS

Comments about the project

“This looks like one of the most absurd, irrelevant and out-of-touch project I've seen in the last couple of years! Increasing safety for cyclists is an important part of making cities more bicycle friendly and ultimately increasing quality of life. There are tons of straight forward solutions which are still not put in place in most cities. Focusing on some fancy ICT before local and national governments have done their homework completely misses the point. Please use the money for something better.”

“I have been living in Brussels (Oudergem) for more than 16 years and I use my bike to go to work, to do my shoppings and so on. Although your project might be interesting I think it still is the wrong approach to the issue of using a bicycle as a means of transport in this city (or country in general). The problem is not the cyclist but the car drivers who do not know the rules or deliberately do not respect them. Every day, I can observe them not stopping at a red light, not to mention the pedastrian crossings. They drive in darkness without their lights on, do not use the direction indicator etc. I always use a helmet, a bright yellow vest and have clearly visible lights on my bike, but still they keep saying "oh, I haven't seen you". In the 30km/h-zones, they drive 54, in 50km/h-zones they drive 80...

If you really want to change something and persuate more people to use public transport (+ walk, which is as dangerous as cycling!) or bicycles then you should persuate local and regional governments to finally start with law inforcement: control cars' speed and make sure that drivers stop at red lights, stop using their cell phones while driving! I am sure that this would make trafic safer for everybody.”

“It isn't clear how much ICT has to offer cyclist safety, the proposal itself clearly sets out the dominant linkage: more cyclists = safer cyclists. However it seems useful to do what this proposal sets out and investigate to see if there is a possible application of ICT that could help cyclists. Some of my most dangerous moments are when I am in an unknown town and trying to navigate a route as well as work out traffic patterns at the same time - my attention is divided between my route map, trying to see street names or road signs and actually paying attention. Not sure that ICT has so much to offer commuter cyclists, but maybe this sort of investigation will turn up something useful. And I very much like the starting point that they take, that the issue is about motor vehicles and cyclists needing to interact better. So my initial reaction is that I am in favour.

There could be a secondary benefit, even if all ICT does is make people _feel_ a bit safer. If this makes them cycle a bit more, then there are more cyclists on the street so they are actually safer from the: more cyclists = safer cyclists.

And visibility is an issue, "stealth cyclists" really annoy me and are also a significant cause of injury and even death to other cyclists. ICT may be able to offer something here, in the same way that LED lights now make it possible to have cheap, bright lights that really did not exist even 15 years ago. I think there is room for finding out more about how to reduce the SMIDSY accidents ("Sorry mate, I didn't see you") where a driver totally fails to see a cyclist either in daylight or at night when cyclist has good lights. There are quite a lot of accidents and near misses by drivers who are either careless or who are good drivers but just have a momentary lapse (and although I haven't had a near miss

with a cyclist, I know that having a momentary lapse of concentration and doing something stupid includes me, too).”

“IT and Cycling:
- I'm not sure it's worth the time trying to articulate why this project is ridiculous - it is a logical conclusion of the technologists frame of thinking which will sooner or later collapse against the greater weight of the laws of (geo)physics. But until energy descent gets further along the line I think our time is better spent elsewhere. Besides, all the money COM/EU/MS throw at e.g. the car industry is far worse…. “

Annex III – Experts that participated to the SWOT analysis

Name	Company
Paul Potters	Connekt
Marco Wigbers	ROVO
Artur Alves	Marlo
Uli Wessling Tolon	AIMSL
Joop Goos	LAPRI
Ida Sabelis	VU University of Amsterdam
Zlatko Krstulich	City of Otawa
Esther Anava	Bicycle Mobility consultant
Randy Neufeld	SRAM
Damien O' Tuama	Independent Transport consultant
Peter van Bekkum	LALINEA
Divera Twisk	SWOV
Koen van waes	City of Den Bosch
Tasos Skordaris	Civil & Environmental Engineer
Frans van Schoot	ECF
Mark Zuidgeest	University of Twente
Nicole Rongen	City of Eindhoven
Maria Cristina Marolda	European Commission
John Mumford	International Road Assessment Programme
Kerstin Robertson	Swedish National Road and Transport Research Institute
Antonio Avenoso	ETSC
Hans van Vliet	Shimano
Rafael Urbanczyk	PRESTO
Luc Int Panis	VITO
Esteban Garcìa	Attiza
Urs Walter	City of Zurich
Jan Pelckmans	Flemish Government
Katerina Budinova	BESIP
Pavel Mindl	CVUT
Sona Sestakova	VUD
Ute Kabitzke	TUD
Martin Pipa	CDV
Eva Gelova	CDV