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EVALUATING IMPACTS OF NEW MOBILITY IN URBAN AND PERI-URBAN AREAS

A PIARC COLLECTION OF CASE STUDIES

TECHNICAL COMMITTEE 2.1 *MOBILITY IN URBAN AREAS*

STATEMENTS

The World Road Association (PIARC) is a nonprofit organisation established in 1909 to improve international co-operation and to foster progress in the field of roads and road transport.

The study that is the subject of this report was defined in the PIARC Strategic Plan 2020– 2023 and approved by the Council of the World Road Association, whose members are representatives of the member national governments. The members of the Technical Committee responsible for this report were nominated by the member national governments for their special competences.

Any opinions, findings, conclusions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of their parent organisations or agencies.

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AUTHORS/ ACKNOWLEDGEMENTS

This literature review has been prepared by the Technical Committee 2.1 “Mobility in urban areas” of the World Road Association (PIARC).

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EXECUTIVE SUMMARY

2023R15EN

EVALUATING IMPACTS OF NEW MOBILITY IN URBAN AND PERI-URBAN AREAS

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In urban areas, accessing services, education, workplaces and/or goods requires efficient mobility systems. In recent years, various transport technology developments have started to enable more efficient mobility across the world. Innovative transport solutions and sharing contracts, including new technologies, new business models, new types of infrastructure and sharing systems are being developed to maximize the effectiveness of transport systems in urban regions. Through the integration of multiple transport modes and intelligent systems, there is a significant opportunity to deliver better access and mobility for all transport users. **The management of new urban mobility will be one of the main future tasks of public governance,** to help ensure these developments provide more efficient and effective access and mobility in a way that also meets the wider needs of citizens' and city-users.

During the Covid-19 pandemic there were travel restrictions across the world. The pandemic strongly influenced people's travel patterns and their frequency of travel, especially in relation to the proximity between people using public transport systems. **The new mobility concept is a dynamic task that has also been influenced in recent years due to the Covid-19 pandemic**.

Since the transport systems have to address many future challenges in terms of sustainable ways of travelling, **sustainable mobility still is the goal for public administrations**.

The goal of the Technical Committee 2.1 is to establish a shared knowledge base to help guide policy development and decision-making on urban mobility, and to raise awareness of best practice. Considering the purpose, this work seeks to reflect the efforts the different uses of a wide variety of new mobility initiatives around the world.

The aim of this project is to collect case studies relating to new mobility in urban and peri-urban areas from all over the world, and to use these case studies to identify good practices for achieving success.

The work has been organized as follows.

- **Chapter 1** provides an overview about the consolidated context and the main challenges faced in recent years, to help clarify the mobility challenges faced in urban and per-urban areas. In
- **Chapter 2** outlines the methodology followed/applied for the survey, as well as discussing the future prospects of emerging mobility options.
- **Chapter 3** explains the key findings and the results of the survey. The first part of this chapter outlines key trends and patterns from the survey sheets, while the second part of the chapter evaluates the impact of the new mobility initiatives on sustainability goals and looks at how these initiatives were funded.
- **Chapter 4** summarises the key aspects of the work and makes recommendations for the final report.
- The **Annex** describes specifics fromthe 27 fact-sheets collected on new mobility measures applied in the global context.

CONTENTS

1 INTRODUCTION

1.1 NEW MOBILITY

This report is part of a set of deliverables of the "TECHNICAL COMMITTEE 2.1 – MOBILITY IN URBAN AREAS" expected for the 2020-2023 cycle. The TC 2.1 is inside the Strategic Theme 2 –"Mobility" together with the following TCs:

- T.C. 2.2. – Accessibility and mobility in urban areas;
- T.C. 2.3. – Freight;
- T.C. 2.4. – Road Network Operations/ITS.

Furthermore the TC 2.1 has divided its works in three main topic areas that has been developed by 3 Working Groups. The first analyzes the "Accessibility and mobility facing land use in urban and peri-urban development" and the second studies the "Integrated transportation systems, multimodality".

The Working Group n. 3 "Evaluating impacts of new mobility in urban and peri-urban areas" has 4 objectives:

- evaluating impacts and challenges of new mobility on urban environments;
- identifying good practices of smart cities using ICT technologies;
- paying special attention to vulnerable users;
- analyzing the ITS contribution to urban mobility.

Starting from these objectives we've started to collect case studies and "good practices" from the beginning of summer of 2021. We've obtained 27 fact-sheets from the "northern hemisphere" and in particular 12 case studies from Europe (7 countries: Netherlands, Spain, France, Italy UK, Belgium, Czech Republic), 10 good practices from North America (Canada and USA) e finally 5 answers from Asia (China and Japan).

Having conducted this collection in a pandemic era obviously did not help: contact between people, especially in academia and conferences, is vital for the exchange of information; the confrontation mediated by a computer screen unfortunately focuses attention on the object of the meeting and impoverishes the possibility that it is extended and enriched with other components.

For this reason we encourage a future coordination of this deliverable with other TCs and TFs as described in the Strategic Plan 2020-2023. As we describe in the conclusion "… is important, and could constitute a future activity of our association, to build a set of indicators to be shared among the subjects involved in the conduction of innovative projects so that it was possible to make effective comparisons and draw elements as objective as possible from the analysis of the projects themselves".

Innovation in the field of urban mobility has always been of great interest, and has attracted significant investment. Often urban mobility innovations have paved the way for change in other sectors.

Realsing the benefits of innovation for urban mobility requires collaborative efforts and careful decision-making by public administrations to help ensure they contribute positively towards desired goals and outcomes, and to help their implemention into collective transport. This because mobility is a city's essential tool in accessing services, education, employment and goods.

Indeed, urban environments created the need for collective transport, one of the earliest and most important transport innovations.

Before the MTA and the automobile, philosopher Blaise Pascal created the concept … of the bus. […]. Most people don't associate Pascal with buses, but urban planning is a math problem too, and his bus system is considered his greatest, and final, achievement.

(https://www.ozy.com/true-and-stories/the-first-buses-in-the-world-were-in-paris-and-they-ate-hay/90088/)

In other words, innovation has been a constant in the history of transport. Recent innovations do not have to mean we change our direction or give ourselves new priorities. Instead, new mobility can be seen as additional 'tools' to help achieve these priorities and better made progress towards our desired direction.

Therefore, "new mobility" does not mean only "new" (new technologies, new business models, new infrastructures or new sharing platforms) it also – and above all – means a new ability to create more effective regulations, improve capability to manage the costs of infrastructure and services, and to find better ways to maximize the effectiveness of initiatives in progressing the interests of citizens and city-users (Figure 1.1).

In Europe, we estimate that more than 85 percent of today's emissions can be abated with already-demonstrated technologies, though the pathway to deploying these technologies remains uncertain.

(https://www.mckinsey.com/business-functions/sustainability/our-insights/solving-the-net-zero-equation-nine-requirements-for-a-more-orderly-transition)

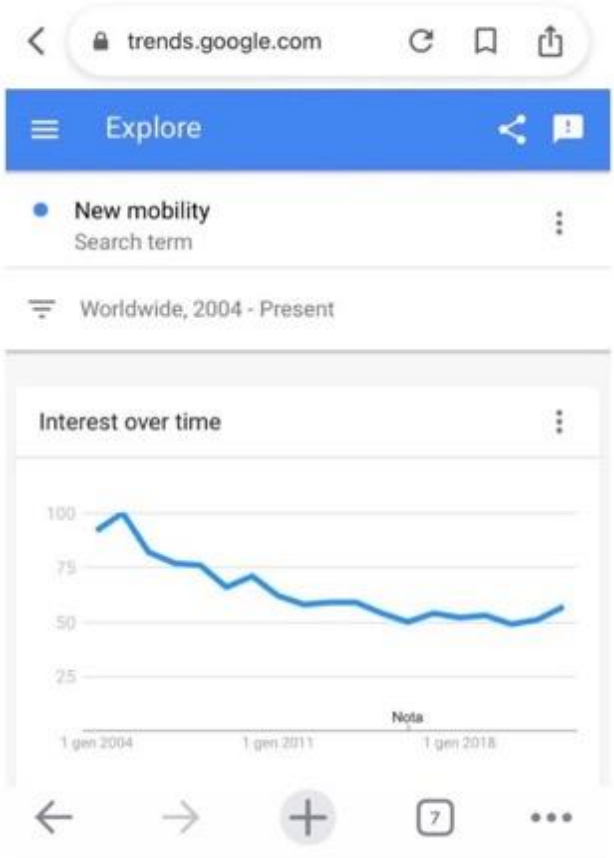

Figure 1.1: New mobility, Interest over time

1.2 CONSOLIDATED CONTEXT

The context for our work is twofold:

1. on the one hand, urban areas and regions (depending on the degree of administrative complexity to be considered), are growing and becoming more dynamic. The population settled in urban areas is growing on the basis of a Compounded Annual Rate of Growth (CARG) equal to 1.4%, while the extra-urban population decreases by 0.2% (Figure 1.2). Consequently, demographic changes affect mobility needs and habits and thus urban mobility demand is growing by 50% on a 10-year basis;
2. on the other hand, every single city is now in competition with its peers to achieve higher levels of urban liveability and quality of life. This competition between cities is played locally (for example between cities that belong to the same region), as well as nationally and internationally, right up to competition between world capitals on different continents to compete with each other to attract citizens and investments. The quality of local mobility and relations with the rest of the world play a critical role in this competition.

In this context, the degree of innovation in helping to improve urban mobility outcomes has significant potential to influence the future success of urban areas around the world.

In the face of cities that are becoming larger and denser, therefore, effort needs to focus on two fronts:

3. research that provides us with new ways of addressingour transport challengesthrough technological developments (an example: autonomous driving);
4. finding ways to implement proven actions and measures, including how to build public support where there is a perception that these actions are not in line with their interests (two examples: speed limitations and pedestrianizations).

Therefore, we are moving between technological innovation and forward-looking administrations; the “smart city” is not the one that only addresses smart technologies, it is the one that does it with smartness.

This wider approach to realising the benefits of innovation and ”new mobility” is necessary because of the complexity of urban environments. This approach is also necessary because “sustainability” is not only an environmental consideration, but is also characterized by equally significant social and economic components. Actions feasible from an environmental point of view may not be for social reasons (is it bearable?) or for economic reasons (is it viable?). Similarly, actions that could be equitable (doable from a social and an economic point of view) might be not suitable for the community's environmental needs.

As a result, cities are confronted with new challenges (Figure 1.2).

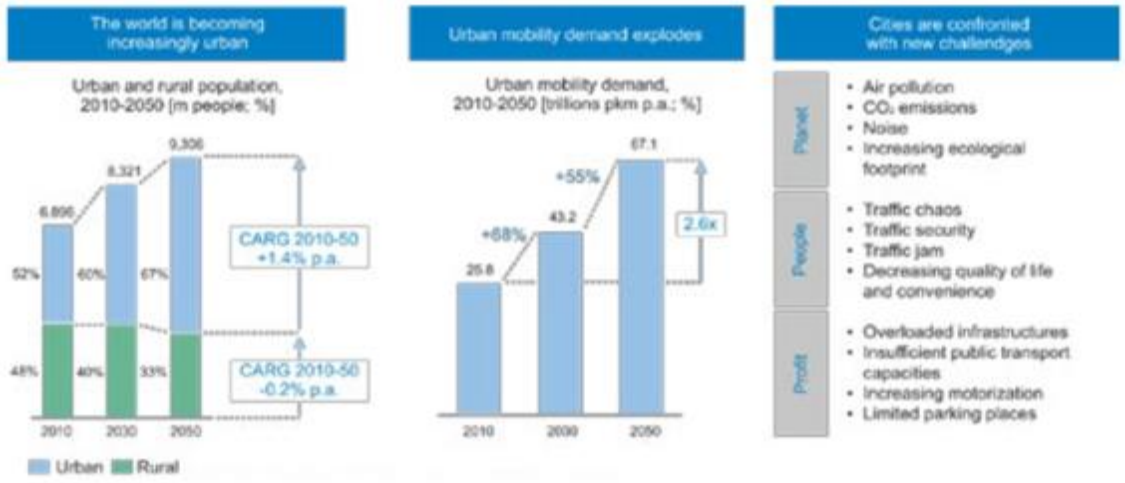

Figure 1.2: Our common urban future

(https://unece.org/DAM/trans/main/wp5/publications/1922152E_WEB_light.pdf)

1.3 COVID-19, "NEW NORMAL"

Since March 2020 the Covid-19 pandemic has had significant impacts on urban mobility. These impacts have varied across different types of transport, with individual forms (e.g. private vehicles, walking and cycling) returning to pre-pandemic rhythms faster than more collective forms like public transport. Even within public transport, some services have been enhanced to offer the same capacity offered before the pandemic, in particular to reach key destinations like hospitals, while trips to some destinations like schools have recovered faster than others like offices.

In the meantime, there has been increased attention paid to mobility data, with movement data often being used as a key indicator of the pandemic and its impact on people's lives. For example, data from mobile telephone operators provided media with key measures the slowdown in urban mobility.

Every citizen was aware, in real time and with great information detail, of what was happening around them. Not only were the movements measured and their reduction compared to a month or a year earlier was quantified, but this figure was also related to the reason for the movement. Concepts like the "15-minute-city" gained increased attention, especially as longer journeys across and between cities were reduced and increasingly replace by shorter, local movements. Use of modes well-suited to these shorter journeys, like the bicycle, was particularly noteworthy.

One impact of the pandemic that is likely to be particularly enduring is chages to the organization of work. Many of us have been able to experience remote working, triggered by an emergency, but it's been appreciated and now assumed as an available variable. With long, peak-time, work-focused journeys one of the most fundamental historic urban mobility challenges, changing work patterns could have a significant impact in the future.

While remote work is not possible for every worker, as our society is increasingly oriented towards the provision of services, it affects a growing portion of the population, even if this can change on a geographic or seasonal basis, as well as over the working week. With remote work our mobility changes, but it does not necessarily mean that it will be reduced.

So, after the pandemic, the shape of the cities is going back to its dynamic: in the 60s it was car-oriented, the focus was on building roads and carparking, on urbanisation, decentralisation and car

ownership. Then the focus shifted to sustainability, provided by public transport, cycle networks and public space re-allocation. Lately, as resulting in many countries and environments, in the 10s/20s, the city is becoming citizen-oriented, the focus is on public space re-gaining and on traffic restraint and calming.

In absolute terms, in all probability, the number of trips we make and will make in the future will remain relatively constant. But we will make shorter journeys, less demanding, more oriented to satisfy personal needs than others. We will be less willing to spend a large portion of our earnings on owning and operating one or more cars.

City administrations will be more careful about dedicating urban space to the circulation and parking of private vehicles, having conducted the experience of public spaces occupied by economic activities that could not conduct their business within closed premises.

“Think about car-pooling”, “take public transport”: new mandatory messages on car advertisements. On television and on the Internet, any promotion of a motor vehicle must be accompanied by a message encouraging less polluting mobility from March 1, 2022.

(https://www.lemonde.fr/economie/article/2021/12/29/pensez-a-covoiturer-prenez-les-transports-en-commun-de-nouveaux-messages-obligatoires-sur-les-publicites-automobiles_6107611_3234.html)

Even the cycle paths that were created as emergency response to the pandemic (the “pop-up” ones) in all likelihood will be confirmed and made permanent. Nobody knows if we will have a “new normal” or if the situation will return to being similar to the pre-existing one. In all likelihood – in the opinion of the writers – urban mobility will return to what it was previously, therefore a phenomenon that is always evolving towards more sustainable standards and greater satisfaction for the citizen.

What may characterize the future is the widespread awareness of what is happening, the availability of data, the involvement of new economic operators, historically not involved in the management of mobility, the desire of citizens to freely organize their mobility – even at the last minute. These are phenomena that are not entirely new, but that experienced a fast and great growth with the pandemic parenthesis, coming to consolidate as phenomena known and accepted by the vast majority of the population.

1.4 WORK GOALS

Because sustainable urban mobility is not a recent goal for public administrations and new technologies have continued to emerge over its history, our work has taken a broad approach to ensure we considered issues like innovative governance models and ways building public support, not just transport technologies themselves. This approach recognises that sustainable mobility is a subject that continues to constantly evolve, while also reflecting how Covid-19 has changed the awareness, expertise and involvement of mobility managers, citizens and city-users in relation to urban mobility.

The goal of the committee, entrusted to the working group, is to create a shared, up-to-date knowledge base, which can be offered to the interested public – made up of specialists, but also of ordinary people, passionate about the subject – as a starting point for discussion and decision-making.

With this in mind, the work that has focused on the variety a wide variety of different 'new mobility' initiatives, rather than their detail.

Each case study has been described and reported as consistently as possible. However, the the main objective of the work is to share information in a way that can easily be updated and deepened on the basis of the very different needs of each of us who will read these pages.

2 METHODOLOGY

The committee wanted to discuss and examine developments in ”new” urban mobility through a consistent method for a subject that is, on the contrary, innovative. We wanted to investigate “new mobility” in a way that properly considered impacts from the Covid-19 pandemic on people’s travel habits and choices.

Every time you think about the concept of novelty, by definition, you have to tackle the subject knowing that in all likelihood the point of arrival will not be what you may have imagined. A survey conducted on a planetary level sees this condition multiplied up to its largest possible dimension.

We therefore conducted the work by adopting the following method, which sought to be consistent and repeatable, while also being open to highlighting unexpected trends or findings.

The work we did, as a result, was the following:

1. We decided not to formalize a definition of “new mobility”. While this was considered, such an approach would have limited the collection of measures adopted in the world and applying this limitation would have induly risked influencing the result of our survey;
2. We therefore only indicated several ‘macro-categories’ within which to frame the measure proposed to us as innovative. Six ‘macro-categories’ were identified, to balance a manageable number while also offering a sufficiently wide range of options;
3. We very strongly specified that the framework to be formalized was not unique, each measure could be indicated to refer to several macro-categories, up to three;
4. We then asked for the prevailing sustainability component to be specified because the concept of sustainability must be understood in a broad sense, not just environmental impact but also social and economic considerations;
5. We then investigated the funding of various measures represented, to help understand their implementation and make comparisons between them. Partnerships between public and private are increasingly leading innovation processes for urban mobility. Mobility operators are also increasingly linked to administrations that entrust them with the delivery of works and/or the management of services through contracts that have return on invested capital (ROI) as a fundamental driver, alongside managing the effectiveness of the services for users.

We started a collection of “good practices” from the beginning of summer of 2021, inviting members of the committee to give a feedback, but also to broaden the collection phase as much as possible, referring to their own experiences but also to those with which they came into contact on the most diverse occasions. Having conducted this collection in a pandemic era obviously did not help: contact between people, especially in academia and conferences, is vital for the exchange of information; the confrontation mediated by a computer screen unfortunately focuses attention on the object of the meeting and impoverishes the possibility that it is extended and enriched with other components.

The phase of collecting the “good practices” was originally intended to help guide a subsequent phase of selecting the “case studies” of measures considered most interesting and worthy of sharing. However, collection difficulties and the wealth and interest we found in the 27 fact-sheets relating to various measures meant a change in approach where we decided together with the committee to bring further “case study” details on all the “good practices”.

Following collection of the 27 fact-sheets (included in the Annex) we focused on better understand the measures of greatest interest. The fact-sheets are about four pages each and have been organised tobest highlight each of the specificities that characterize them.

In the following chapter, some of the information collected will be elaborated upon, with the aim of identifying possible common findings relating to urban mobility of the future. These findings helped to demonstrate that the choice we have made of the macro-categories was helpful and appropriate.

A key overall finding from the different measures examined is how transport ownership appears to be evolving over time from most people being owners of a means of transport, mainly a private car, towards more people being users of a related family of services (Figure 2.1).

Today, most of us own a car and use it on a daily basis, some do the same with bicycles or motorcycles. Others have a public transport pass and use it every day. New services are beginning to appear on the scene which are available to us for limited periods of time ("sharing services"). We rely on these in special occasions: when our car needs to be repaired, when we are in a city different than ours, when the climate is different from what it was when we left home.

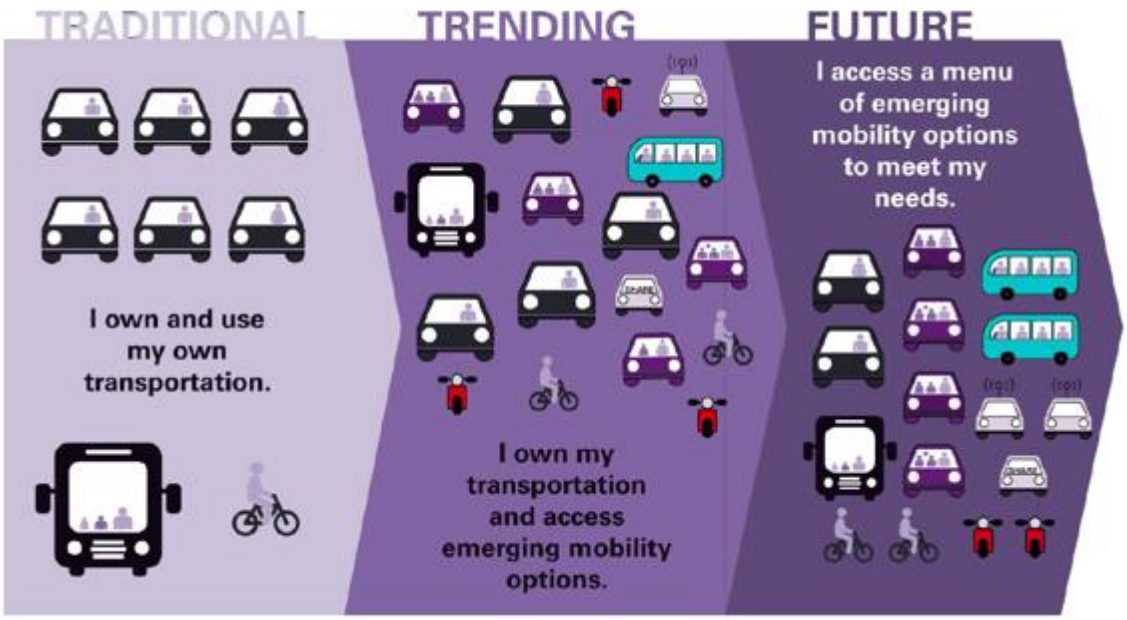

Figure 2.1: Shift in transportation norms

(https://nacto.org/wp-content/uploads/2017/12/SFMTA_Danielle_Harris.pdf)

In the future, in all likelihood, we will not need to own and drive a vehicle. Instead, we will have a portfolio of options, which we will see as one single service provided to us by several operators who collaborate, from which we will choose based on our specific needs. In this way, we will access services designed in real time especially for us (if the destination of our trip is peculiar, or at times of low demand), or which will be shared (if our need will be overlapping with that of other users, at the same time moment). In the same way, deliveries will reach us rather than needing to go and grab them at different shops.

Potentially, we will travel every day in different ways at different times, using different means and service-platforms. We will be able to share parts of the journey with different people, making our

choices based on the fare we will be asked to pay; especially with reference to first- and last-mile trips. These shifts will significantly reduce the need for carparking at our destination. Since cars are parked for more than 90% of the time, this represents a huge amount of space made available for other purposes.

Amsterdam plans to systematically strip its center of parking spaces in the coming years, making way for bike lanes, sidewalks, and more trees. The city plans to reduce the number of people permitted to park in the city core by around 1.500 per year. These people already require a permit to access a specific space and so by reducing these permits steadily in number, the city will also remove up to 11.200 parking spaces from its streets by the end of 2025.

(https://www.bloomberg.com/news/articles/2019-03-29/amsterdam-s-plan-to-eliminate-11-000-parking-spots)

In recent months, numerous initiatives have sought to develop a definition and trace the path for the evolution of urban mobility over the coming months and years, reflecting changes caused by the pandemic and seeking to map a pathway to sustainability. One initiative deserving to be highlighted is the Urban Mobility innovation index (UMii) platform and forum. It was initiated by its main sponsor, the Roads & Transport Authority of Dubai (RTA), and is implemented by UITP (International Association of Public Transport) in collaboration with Future Cities Catapult.

UMii aims to provide insights into urban mobility and innovation in cities across the world, and to deliver a guide for cities to foster innovation in their urban mobility services and systems. Data is collected globally from cities invited to participate to the index and they work as a guide for cities to foster innovation.

Having a collectively agreed future vision for a city takes time, but it allows to justify the deep changes that will result and to lower innovation adoption barriers down the line.

(https://cms.uitp.org/wp/wp-content/uploads/2022/06/UMii-report-2021_NEW.pdf)

3 KEY FINDINGS

We have collected case studies designed and implemented from all parts of the world, even if not all countries are represented in the same way due to our difficulty in reaching some remote representatives and also because innovation in the mobility sector is not occurring in a homogeneous way.

The 27 fact-sheets constitutes a starting point – although it is already an interesting number – providing a cross-section of different types of activities and locations. We collected 12 measures for Europe, 10 for the Americas, 5 for Asia, unfortunately none were collected for Africa and for Oceania. Among the Americas, a certain difference has emerged between North and South, even Europe sees the Northern part of the continent more dynamic than the Southern one; as far as Asia is concerned, the East seems to be more attentive and committed than the West.

3.1 MACRO-CATEGORIES

We identified the following six macro-categories:

- autonomous driving;
- innovative contracts and sharing systems;
- MaaS platforms;
- smart-cities, using ICT and/or ITS;
- active users (eg. pedestrians, cyclists, ...);
- persons with disabilities.

There was lively discussion among the members of the working group on these groupings: on the one hand, six categories seemed too numerous, they could have led to a dispersion of the classification. On the other hand, certain innovation initiatives could be misrepresented compared to a too limited series of cases proposed to professionals who intended to suggest a project they had undertaken.

After considering different options, we confirmed the six macro-categories while also adopting a criterion that would allow the editor of each project-sheet to indicate more than one reference macro-category, up to a maximum of three.

This assumption demonstrates, first of all, how innovation in the field of urban mobility is a matter that requires complex consideration because there is no single or majority trend. To manage the evolution of mobility it is necessary for different skills to be available, as many of the projects cover multiple investment areas, as well as complex and varied regulation systems.

More than 60% of the forms compiled indicated more than one macro-category, including a variety of different combinations. Because of this, the classification of the measures collected was very complex. To bring the combinations of macro-categories that have been indicated back to the original ones, the second and third choices have been weighted equal to two and one thirds compared to the first. In this way, the level of relevance of each macro-category originally indicated to the compilers of the forms was measured.

The breakdown by relevance among the six macro-categories is shown in the Figure 3.1.

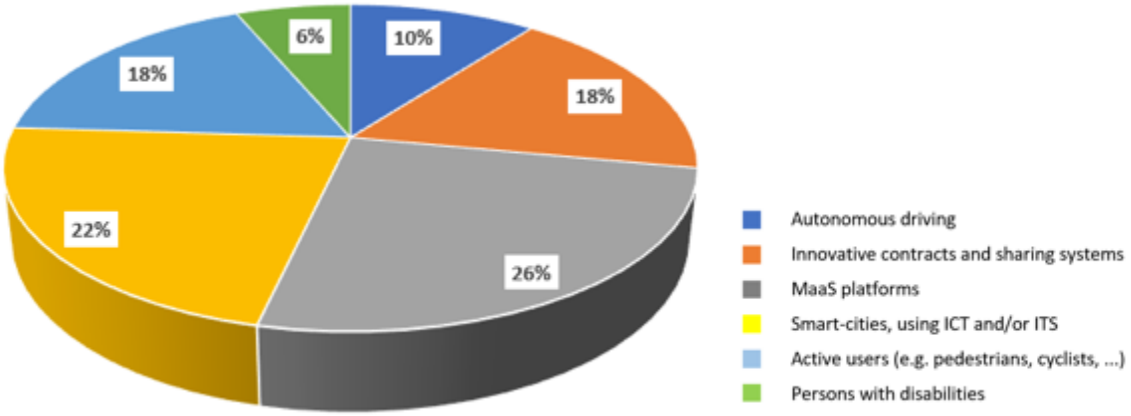

Figure 3.1: Macro-categories object of study

As shown in Figure 3.1 above, the most common macro-category was that of the **MaaS**, indicated by numerous projects, scattered throughout the world (Canada, USA, numerous in Europe, more than one in China), with a share of 26%.

Until a few years ago this acronym did not exist: according to Wikipedia it was born in Europe and turned ten years old in June 2022. A concept of such recent development garnering so much attention and success (among our fact-sheets about it, 50% is not European), can only coincide with the right name given to the right thing.

In fact, while still representing something that cannot be said to be fully operational, MaaS meets the interest of all those involved in the process of organizing/delivering/using city mobility services.

One point to note about MaaS: mobility “is” a service, you don’t need to see it “as a service”. Mobility is a service that the individual renders to themselves, in their own interest, through self-production, or that the user purchases from someone else, an operator, who offers them – as a matter of fact – a service. It has always been a service, not just for the last ten years.

The acronym MaaS is written in English and the article "a" is used with the meaning of "one". When you use “a” in English, you simply mean a single thing, one single thing. When you use “one”, you mean a single thing, but you are implying that there is more of the same thing. So, MaaS should be understood not as mobility becoming a service, but meaning that mobility is perceived by those who have to perform it as a single service. As this document is written in English by non-native speakers, and will be read by people in the same condition, it was felt that this specification deserves to be made. It was also reviewed by a member of the working group – mother-tongue.

It is not yet known if MaaS will focus onserving everyday journeys tor on occasional users, for tourism or for work. It is also still unclear if it will be be largely provided by local operators, who tailor their products to meet local needs, or if it will be largely provided by a few large providers who will serve every user, in every place. We also do not know if MaaS will develop by integrating competing services (eg. the city bus and free-floating bike-sharing schemes) or if it will focus more on complementing existing services through a focus onlast-mile trips. Finally, it is unknown how MaaS may integrate with other services, perhaps yet to be invented, such as accessing events, making use of co-working spaces or renting an apartment.

Case Study 9292 (fact-sheet n. 01) is a Dutch national scheme based on an app.

E-tickets for train, bus, tram and subway in the 9292 app. Explore The Netherlands by public transport? That can be done easily, by using the train, bus, metro or subway. Purchase your e-ticket for train, bus, tram or subway in the Netherlands. We're pleased to explain how to do this and tell you which public transport companies are included.

(https://9292.nl/en)

Another case study from Beijing (fact-sheet n. 05) looked at a situation where the MaaS has been launched to promote climate-friendly transport and mobility, in a city where fundamental change is required to achieve the targets carbon emissions reducing after 2030 to reach carbon neutrality by2060 across China.

For the first time in China, the "MaaS – Mobility for Green City" initiative has achieved a carbon credit model covering all green travel modes, including bus, metro, bicycle, and walking. […]. The carbon trading measure establishes an effective transmission mechanism for the social benefits of green travel and the willingness of the public to participate".

(https://transition-china.org/mobilityposts/beijing-maas-platform-launches-maas-mobility-for-green-city-initiative/)

Last, but not least, a case study in Turin, Italy (fact-sheet n. 06), examined a MaaS initiative fully delivered bya public agency, led by the Region and in collaboration with the local Mobility Agency. It embraces all aspects related to the development of MaaS services, such as user needs, the system of rules and business models, data and standards. This initiative intends to undertake a collaborative path with all stakeholders in the area, including citizens.

MaaS is a new concept of mobility, involving the integration of multiple public and private services (local public transport, ride-sharing, car-sharing, bike-sharing, scooter-sharing, taxi , car-rental, …). It aims to constitute an efficient and advantageous alternative to the use of a private car in a single service accessible via smartphone, on a platform with many functions and a single payment system, able to respond in a personalized way to all specific mobility needs.

(https://www.muoversiatorino.it/it/maastorino/)

The future of MaaS has significant dependencies with the availability of autonomous vehicles. In the future, urban mobility will not be characterized, as it is today, by a large number of private cars, mainly for individual use. This model is unsustainable and forces us to devote more and more space to mobility – and parking.

The MaaS macro-category is followed by the macro-category of **smart-cities, using ICT / ITS**, with a share of 22%.

The smart-city concept is by now well established. It does not relate only to urban mobility andcan be extended to other functions and services in the city.

A case study of the Roger app in Bologna, Italy (fact-sheet n. 22) examines a technological application that sells travel and parking integrated with itinerary creation technologies (travel-planner). It was developed with the aim of collecting and making available the greatest number of mobility services.

It is not yet a MaaS, but that is the goal of the initiative. There is no contribution from the policy maker, and agreement has not been reached yet to offer integrated tickets and trip solutions.

This example clearly highlights that while technology enables results unimaginable a few years ago, it remains necessary for organization the governance systems to be supportive and integrated for progress to really happen.

Two macro-categories then assumed the same importance, equal to 18% of the total: these are **active users** and **innovative contracts and sharing systems**.

The ways in which citizens walk and/or cycle, increasingly assisted by a small electric motor, also plays an increasingly importantrole in moving towards sustainable urban mobility. If we want to reduce the use of private cars, often with only one person on board, to free up space in our cities and stop producing noise and pollution, a lot of attention must be paid to active modes of travel, not only in terms of infrastructures, but also with incentives and support to make mode shift convenient and lasting.

We have always thought that it was convenient to protect pedestrians and cyclists, at least segregating them from vehicular and heavy traffic. But in doing so, we have hierarchized our streets and squares in a way that is too expensive and takes up too much space. We are now in the phase in which we aim at co-existence between different modes, with the aim of achieving a balanced and safe system. as A case study of France (fact-sheet n. 26) examines the work of CEREMA (a public establishment under the supervision of the Ministry of Ecological Transition, which supports the State and local authorities in the development, deployment and evaluation of public planning and transport policies), which has coordinated more than 100 local authorities to implement transitional cycling facilities in response to the Covid-19 pandemic. CEREMA has also focused on actions to reduce the number of heavy vehicles in our cities.

Figure 3.2: Documents produced by Cerema for local authorities (an introductory brochure and two express guides). Some webinars were organized as well and are available on-line.

(https://www.cerema.fr/fr/actualites/villes-territoires-100-marchables-100-cyclables)

”Smart City” approaches have also given impetus to different types of urban mobility services and contracts, particularlyshared mobility services based on the Internet of Things (IoT). These services focus on providing ”last-mile” solutions to complement traditional public transport, but also a possible way to serve areas not efficiently able to be provided with public transport.

They also offer new transport choicesfor the youngest and most dynamic city-users, who often have less predictable in their mobility needs, especially the time and way they wish to travel. While bicycles, mopeds and kick-scooters have existed for decades, the novelty of these new services lies in being able to access micro-mobility only when you need it and as close as possible to where you are. At this point, in some ways, the kind of available vehicle has little relevance, the convenience and the price of the service do count much more.

As discussed previously, shared mobilityis being applied differently from place to place. Some results from shared mobility include fewer vehicles in circulation and parked, which has freed up some urban space (during the pandemic this thing was particularly evident), public transport has grown as the backbone of collective mobility, to anyone was given a way to move, even if they didn't own a car.

A case study in Japan (fact-sheet n. 24), examines the technological and innovation aspects of building a performing monitoring platform for shared motorcycles, to realize a 24/7 effective service quality evaluation. These services are characterized by the availability of a lot of data, leading to the possibility of conducting analysis of customer usage and real-time flow monitoring, thus improving service quality and efficiency.

The project is self-financed and this is one of the most important characteristics of the most recent sharing-mobility models. The public administration often does not have to finance these services, but it must regulate them so that they do not have a negative impact on the city, because the goal of guaranteeing the convenience and availability of vehicles – regardless of whether they are bicycles or kick-scooters – jeopardizes the quality of public spaces. In this context, the greater commitment of public administrations is not necessarily economic, but it is regulatory; the management contract assumes absolute significance.

Main takeaways:

> 1) the highest number of projects (80) focused on management subtheme. Approximately half of European (30 out of 55) and 80% of national projects (19 out of 25) focuses exclusively on management subtheme, while the remaining overlap with another subtheme; 2) the digitalisation and emissions are also in the scope of many projects (52 and 41 projects, respectively); 3) the remaining three subthemes (CAM, safety and infrastructure) have attracted significantly less attention.

“Public transport research and innovation in Europe”, https://publications.jrc.ec.europa.eu/repository/handle/JRC129420

In the future shared mobility fleets will be increasingly integrated with public transport and it will not be easy to see where the first ends to begin the second. Demand Responsive Transports (DRTs) will be more widespread, delivering a significant proportion of services in urban areas. The future of these too, however, is not clear: will they cost less and offer a service that is after all similar to what is offered today? Or perhaps will they cost something more to the community but will feed a quantitative and qualitative step that will definitively convince us to abandon our old habits?

Autonomous driving involved 10% of the initiatives presented to the working group. While this is a lower proportion, autonomous driving is already of great interest, even if much of the discussion has been too anticipatory of future arrangements and scientific research.

Any debate about the future of urban mobility cannot fail to take into account autonomous driving. It is a technology that is in some ways already very advanced – with numerous field trials, including

those already open to the public. Fact-sheets n. 02 and 03, refer to case studies in the city of Madrid (ALSA, at Universidad Autónoma de Madrid) and Montreal (Keolis, at Plaza St-Hubert),complex and very different urban environments. It is relatively easy to build a test site in the courtyard of a university campus and run a prototype vehicle without anyone driving it, but it is absolutely difficult, in many ways still impossible, to see a vehicle without a driver circulating in the traffic of a city, especially during rush hour on a rainy day.

Figure 3.3: Images from Madrid (Spain) and Montreal (Canada). Vehicles in service.

At present we do not know how to predict what will become of numerous structures that we consider consolidated; for example, to date the prevailing cost in many companies providing public transport services is represented by employees driving vehicles.

Equally, we do not know whether the concept of car ownership will survive when autonomous driving becomes widespread, as the owner will no longer have to be the driver and the car can belong to an entire family. Given the vehicle will be able to serve more people, even without a driving license, without any of them being engaged in driving, the car will become sort of publicly available.

At this point, the need to have a car parked at the destination of our travels may disappear, even for many hours when we rest at home or work in the office. The car we will have used, not necessarily ours, will be able to serve another person and be available for us again after several hours. In all likelihood, we will be able to share the same car with people who have similar or even partially overlapping needs.

The most likely scenario will see vehicles with capacities higher than those of current private cars and lower than those of the buses we are used to, which must maximize the users/driver ratio and be constantly on the move to meet the needs of people who are travelling to locations they will not be able to walk or cycle. The temporary use of these vehicles, in all likelihood, will cost more at rush hours and less during the off-peak hours, or in any case it will have different availability. They will cost us more to travel alone, or will impose not-flexible timetables on the service we will access. We will not pay for the parking, probably not even for the fuel; we will pay for the service and spend less if we will be able to plan our mobility, so that it can be organized and managed more easily by urban mobility operators. These last ones will be economic entities that will own or have vehicles and depots at their disposal, but above all they will invest in software and resources for optimizing

the assets available and will manage platforms for the public that are dynamic and customizable for users.

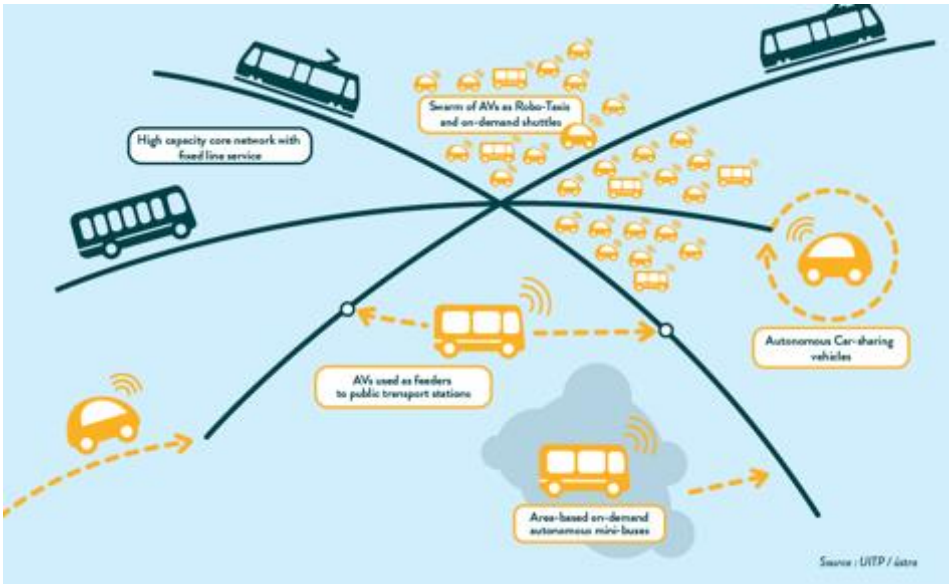

Figure 3.4: Possible applications of autonomous vehicles (AVs) as part ofa diversified public transport system

(https://www.uitp.org/publications/autonomous-vehicles-a-potential-game-changer-for-urban-mobility/)

The last macro-category of initiatives surveyed was dedicated to **people with disabilities**, accounting for 6% of the total. Initially the working group did not know whether to include this macro-category, and planned to revise the matter in the drafting phase of this document. The result, however, told us that this investment item has its own relevance. Although the issue of disability has been at the center of attention for a long time, it has not lost importance, also because the world of disability has expanded, over the years, in the awareness of the population.

Up to now we have essentially worked to improve infrastructure with the aim of allowing people with disabilities to enjoy the city without obstacles and with full dignity and satisfaction. Case study “Complete trip - ITS4US” (fact sheet n. 09), outlines how the United States Department of Transportation has been conducting research to support an increase in independent mobility of all travellers, through the use of ITS and other advanced technologies, regardless of disability, identifying needs and challenges by the population. This initiative is aimed at taking innovating approaches, using technology and shared mobility, to enable all people to be involved in the life of their cities.

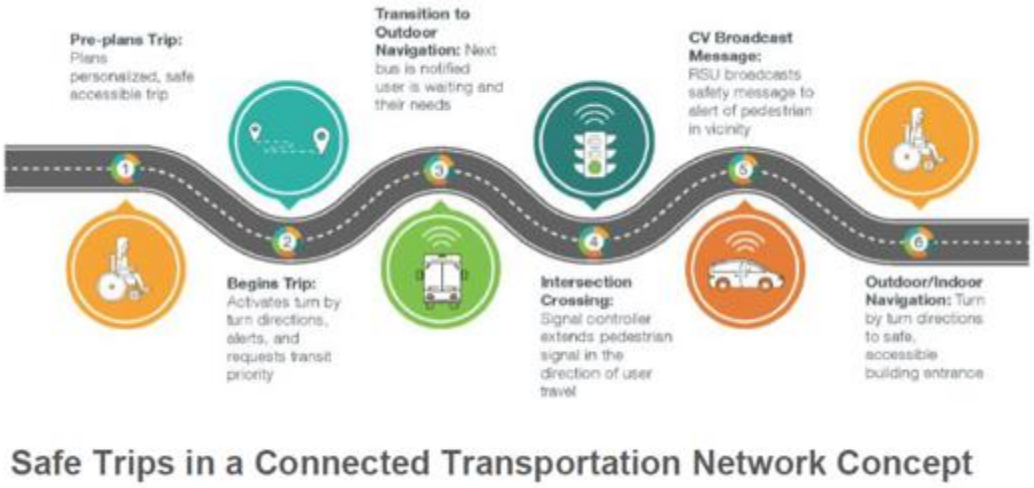

Figure 3.5: Safe Trips in a Connected Transportation Network (ST-CTN), Gwinnett County, GA, USA (https://www.its.dot.gov/its4us/media/ARC-Kickoff.pdf)

3.2 SUSTAINABILITY

Sustainability is a complex goal, it must be seen from at least three points of view: environmental, social and economic. Any policy that is adopted by a public administration – but the same also applies to private companies, especially if they are entrusted with providing services for the community – must be verified for all three components mentioned, not just one being enough to validate the feasibility and the convenience, of an action to be taken.

6. Car use will still need to be curbed even when all vehicles are powered by clean electricity. Electrifying cars will not address traffic jams, urban sprawl and wasted space for parking.

Roger Harrabin, BBC environment analyst (https://www.bbc.com/news/uk-48875361)

Since sustainability is now to be considered as an input constraint, not only as a goal – see the 2030 Agenda for Sustainable Development, adopted by all United Members Nations States in 2015 – any innovative idea must first of all be measured in terms of sustainability, over several time horizons.

It is no longer considered acceptable for any initiative, whether infrastructural or regulatory, even if effective for a single short period, to be undertaken rif it runs the risk of not being sustainable.

For this reason, all the measures we have considered have also been evaluated in terms of sustainability. We requested and obtained that each fact-sheet mentions the specific main contribution to sustainability.

The resultsof this evaluation show somewhat surprising results, with the **environmental** component of sustainability not being the most common identified, covering 39% of recurrences. Instead, the **social** component is the one that most often (41%) indicated as the prevalent reference. Lastly, the **economic** component also plays an important role, with 19% of recurrences.

By intersecting the macro-categories identified as references with the sustainability components that characterize the individual measures, it emerges the macro-categories that appear to have a more marked sustainability component are those of people with disabilities and of the smart-cities using ICT/ITS. The initiatives undertaken for people with disabilities are declared 100% socially relevant and those that have the smart-city as their object are declared relevant from an environmental point of view over 60%.

The case studies involving active users and the innovative contracts and sharing do highlight a majority component to be referred respectively to the social and environmental component.

Autonomous driving and MaaS do not highlight prevailing (> 50%) sustainability components, even though the environmental component is the majority one in relative terms.

3.3 FUNDING OF MEASURES

It seems that a great wave of innovation is needed in the urban mobility sector. Urban mobility – especially collective mobility, organized by the public administrations – has often been the forerunner of experimentation and research of considerable depth, thanks above all to the public funding from which it benefits.

This doesn't mean that innovation necessarily cost that much.

The collection of case studies we have conducted of the most interesting innovation projects in the sector also looked at the way in which these initiatives are financed, especially the mix of public and private funds.

Of the collected 27 case studies, 22 are either self-financed or financed with public administration's resources in excess of 50%. Initiatives relying on private funding made up only 2 out of the 27case studies looked at.

Self-financed initiatives and over 50% public financed projects are instead equally represented, each recording exactly 11 cases out of the 27 collected.

The **self-financed projects focused on the implementation of MaaS platforms** (36%). Following the item "innovative contracts and sharing systems" with 27%. The two items of "autonomous driving" and "active users (eg. pedestrians, cyclists, ...)" record the same share of 18%.

No project involving the item "persons with disabilities" and the item "smart-cities, using ICT and / or ITS" is self-financed.

The **projects financed mainly by public resources focused on "smart-cities, using ICT and / or ITS"** (27%) and the MaaS systems (18%). Following, with a common relevance, the items "persons with disabilities" and "active users (eg. pedestrians, cyclists, ...)". The two items with lesser relevance (9%) are found to be those related to "autonomous driving" and to "innovative contracts and sharing systems".

Looking that this information, it appear that public investment focuses more into traditional sectors, which have been the object of investment for the longest time, with the sole exception of MaaS. Investments made with private fundingfocus more on the most innovative initiatives.

On the sustainability side, the resources that fuel investments appear to be distributed more evenly. Self-financed projects invest in the social side of sustainability to an extent of 46% and, equally, in the environment and the economy of 27%. The projects heavily funded by the public invest in the environment to an extent of 46%, in the social sector of 36% and in the economy to an extent of only 9%, demonstrating that the return on investment is not the first objective of the initiative.

4 CONCLUSIONS. PRE-RECOMMENDATIONS TOWARDS THE FINAL REPORT.

Managing the future of urban mobility – some of us call it the "new normal" – has long been necessary and will continue to be so. We should not think of innovation as completely separate category: each intervention can be characterized by an innovation component, but this should not be confused with the overall objective to work towards sustainable urban mobility. Furthermore, innovation should be thought of as not just the urban mobility solution, but also developing better methods for developing and applying transport solutions. Gathering experiences allows you to build a method, a bit like the European Union did.

7. An example from the European Union: THE NEW EUROPEAN URBAN MOBILITY FRAMEWORK, WITH OUR FRAMEWORK WE PROVIDE GUIDANCE FOR LOCAL ACTION AND OFFER CITIES A TOOLBOX FOR SUSTAINABLE MOBILITY.
8. A stronger public transport network; easier and more attractive options for active mobility such as walking and cycling; efficient zero-emission urban logistics and last-mile deliveries; better management of mobility flows, through multimodal hubs and digital solutions; modern stations that connect rail with public transport, and provide shared mobility services; bigger and better park-and-ride facilities, equipped with recharging points for zero-emission vehicles; more multimodal terminals and freight consolidation centers; more sustainable and well-functioning passenger transport-on-demand services such as taxis and PHVs – private hire vehicles.

(https://ec.europa.eu/commission/presscorner/detail/en/fs_21_6781)

To have a common reference it would be important to have shared macro-indicators.

Ours was a study activity, to go into the details of an effective analysis it is certainly necessary to build uniquely defined and clear reference indicators. On several occasions, projects carried out in different countries, at different times, based on different fundings, have been based on inconsistent performance indicators. This makes them substantially not comparable.

Indicator	Low	Medium	High
Car sharing market potential (% of United States adult population)	3% [a]	10% [b]	26% [c]
% Reduction in private vehicles owned	10% [d]	21% [e]	49% [f]
Private vehicle replacement rate for each car sharing vehicle	1 [g]	15 [h i]	23 [i]
% Reduction in vehicle kilometres travelled	27% [j]	31% [h]	67% [d]
% Fuel efficiency improvement	17% [k]	24% [l]	43% [h]
% Reduction in public parking demand	26% [l]	38% [m]	50% [n]
% Increase in rail transit use	0% [h]	8% [o i]	36% [l]
% Increase in cycling	7% [h]	9% [o i]	14% [l]
% Increase in walking	2% [h]	19% [i]	25% [o]

a Schuster et al., (2005) b Shaheen et al., (2006) c Duncan, (2011) d Cervero et al., (2007) e Zhou and Kockelman, (2011) f Martin and Shaheen, (2011a) g Martin and Shaheen, (2016) h Frost and Sullivan Research Service, (2010) i Lane, (2005) j Martin and Shaheen, (2011b) k Rydén and Morin, (2005) l Meijkamp, (1998) h Martin and Shaheen, (2011c)l Stasko et al., (2013) m Department for Transport, (2004) n Engel-Yan and Passmore, (2013) o Cooper et al., (2000)

Source: adapted from Chen and Kockelman (2016)

Table 4.1: Research and innovation in car sharing in Europe

(https://publications.jrc.ec.europa.eu/repository/handle/JRC127774)

It is important, and could constitute a future activity of our association, to build a set of indicators to be shared among the subjects involved in the conduction of innovative projects so that it was possible to make effective comparisons and draw elements as objective as possible from the analysis of the projects themselves.

4.1 THE ROLE OF ROADS

None of the evolutions we have discussed so far will be able to ignore the road network on which trips will be made within cities, accessing cities and in relationships between cities, today and in the future.

For sure railways and air connections do exist, but every single journey, even the longest or the fastest, cannot do without seeing – at least in part – the roads involved.

This means that the **maintenance of existing roads**, as well as the **construction of new roads**, are operations that in the future must be carried out with full awareness of what could happen upon them.

Autonomous driving, but also MaaS and shared services, are services offered to the community that will need a flexible road network, equipped with technologies and materials that lend themselves to guaranteeing full efficiency and effectiveness to what can give greater satisfaction to the users.

It seems almost obvious, but it deserves to be underlined: the road network – especially in denser cities, where public space is scarcer and therefore more precious – will always remain the field on which we will play our games. **This document is also addressed to road designers**, so that they can become aware of how much the future of urban mobility sees them too involved in every single maintenance and construction operation of the road networks.

4.2 LMICS INVOLVEMENT

Lastly, the issue of cities and towns that with greater difficulty will be able to follow the evolution that we have tried to outline with this document deserves to be addressed.

Since this is essentially an economic question and since on many occasions the poorest countries are also those in which the administration manages to be less attentive to the full pursuit of quality of life in urban areas, low- or middle-income countries necessarily will not be the ones who will lead the evolution in the direction described in this document.

On the one hand, this means that these countries will remain behind on this front, but – on the other – it also means that **they will be able to access certain technologies and certain organizational models of regulation and service delivery when these are tested and fully operational – as well as cheaper**.

It is therefore essential that the LMICs follow this evolution, with the aim of being able to benefit from it as soon as possible, perhaps precisely by **following and optimizing the example of cities that arrived earlier**. It is no coincidence that this document unfortunately does not see the contribution of continents such as Africa or South America, but the revision work that has been done by South Africa deserves to be underlined, in the context of an active collaboration which was also guaranteed, for example, by Argentina.

5 REFERENCES

The main bibliographical references are included in the preceding text. The following is a list of possible texts useful for any further information.

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6 ANNEX.

1	9292 MaaS app	The Netherlands
2	Autonomous bus line	Spain
3	Autonomous shuttle	Canada
4	Awarding innovative services with innovative contracts	Italy
5	Beijing MaaS platform – MaaS service for green city	China
6	BIP for MaaS	Italy
7	Bus rapid transit (BRT) on boulevard Pie-IX	Canada
8	Car-sharing service	Canada
9	Complete trip - ITS4US deployment program	USA
10	C-roads ITALY 2	Italy
11	Express bike network (EBN) project	Canada
12	Fair travel (Ensuring hov users use HOV-only lanes)	USA
13	Future Transport Zone	UK
14	Link multiple payment methods in various travel scenarios	China
15	Navajo autonomous shuttle	Belgium
16	One-stop mobility service platform	China
17	OPUS card	Canada
18	Pedestrian lights with sound signals	Canada
19	Preferences of PT and firefighters using C-ITS	Czech Republic
20	Reduction of the uncontrolled parking (comfort of pedestrians)	Belgium
21	Replicability of the digitalization of public transport	Spain
22	Selling tickets and providing info / travel-planning	Italy
23	Sharing motorcycles and platform project in Huai'an City	China
24	Sustainable business model of bike-sharing using ICT technologies	Japan
25	The chrono mobile application for greater Montreal	Canada
26	Transitional cycling facilities	France
27	Vision zero action plan	Canada

6.1 9292 MaaS App

6.1.1 General information of the area involved in the practice

Country/Region: The Netherlands

City/Metropolitan area: Nation wide

Overview of the area – Name: Netherlands – nation wide

Area dimension: 42 543 km^2

Inhabitants: 17.44 million of people

6.1.2 Overview

The "9292" mobile app is the leading travel planning platform in the Netherlands that has been providing travel information on public transport all over the country. It has more than 2 million individual monthly active users and provides more than 3.5 million daily travel tips. In 9292 app are shown all the timetables, fares and tickets for the train, bus, tram, metro and ferry in the Netherlands. With 9292, it is possible to plan trips by train, bus, metro, tram and ferry entering your trip from origin A to destination B. The application immediately provides up-to-date travel information for all public transport in the Netherlands. In addition to travel information, 9292 expanded in 2020 its offer with the possibility of buying electronic tickets for public transport within its current mobile application. 9292 has integrated e-ticketing and payment environment created by Tranzer for 9292 through combining all the different requirements, ticket options, prices and validation. Therefore, travelers don't have to use another platform or a vending machine to buy a ticket because all tickets can be easily purchased via smartphone.

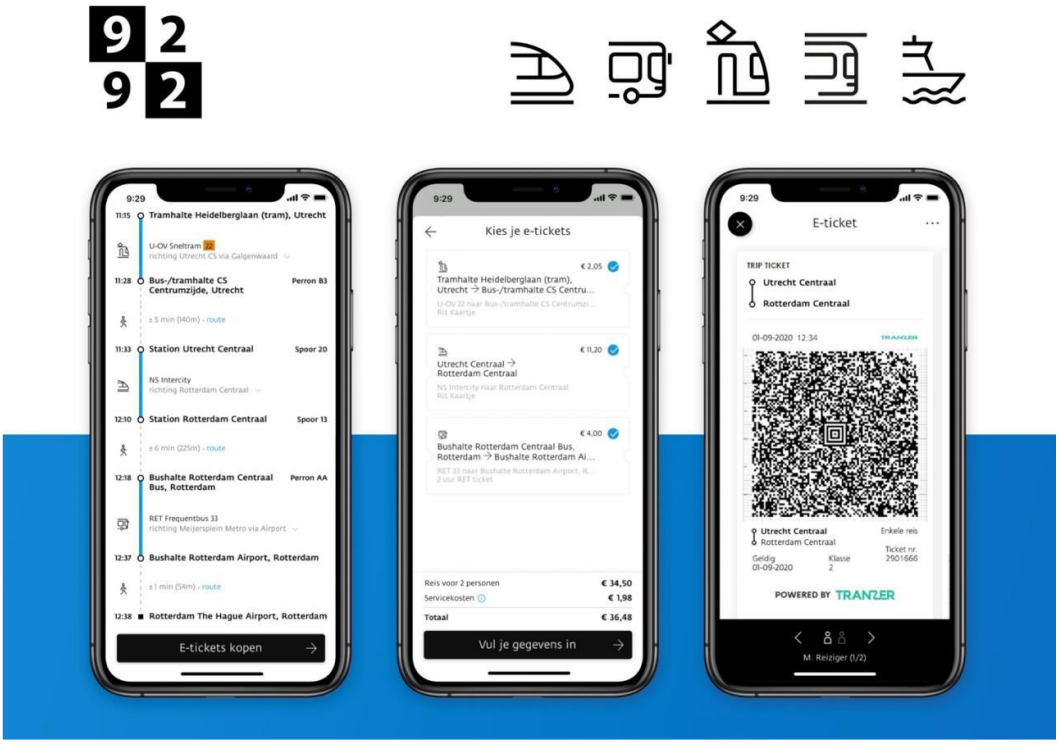

Figure 1: Bike sharing operating area and hubs (https://tranzer.com)

6.1.3 Framework and goals

9292 is a daily source of travel information for public transport for all types of passengers, in which all information of transport companies are gathered in a user-friendly way. In the 4 months from marketing launch, 100 000 monthly tickets were sold. The mobile app provides many important features:

- Crowdedness indicators and real time information on delays, arrival times of public transport;
- Off peak discounts for national railways (NS) tickets;
- Integration with taxi, micro-mobility and shared mobility operators ongoing (bike sharing, car sharing, shared scooters, etc.);
- Integration with international and cross-border public transport operators.

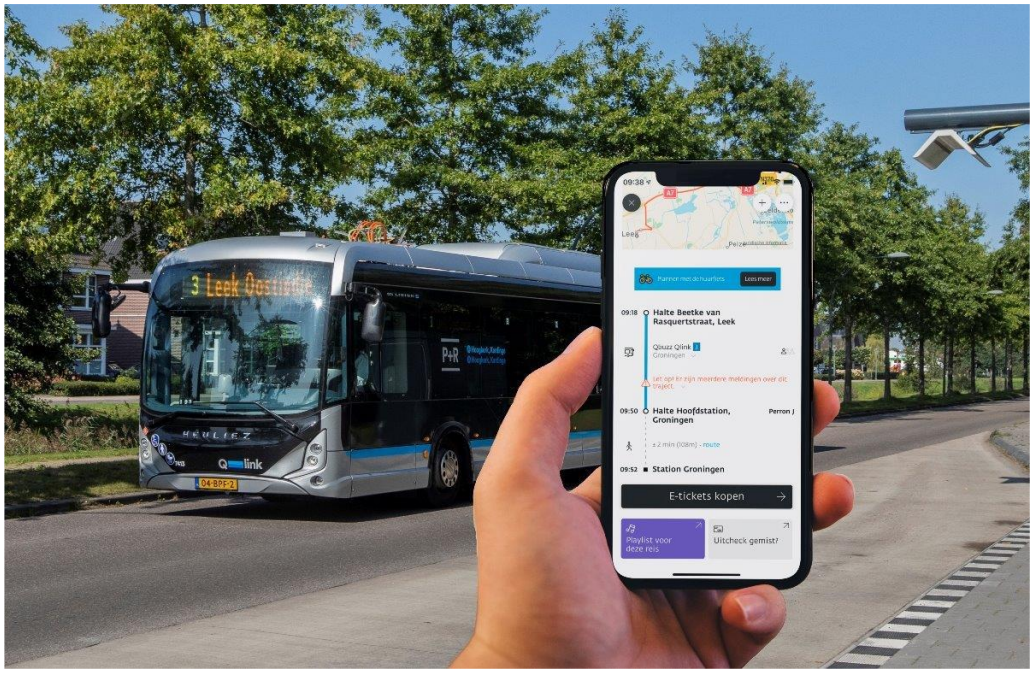

Figure 2: Trip planning and e-ticketing service (https://tranzer.com)

6.1.4 Purpose of the project

The objective of the project is to provide a more convenient and information-rich alternative to ticket vending machines or the public transit card used by Dutch operators (the Ov-chipkaart). This solution allows users to purchase tickets from national railways and all other public transportation operators in the country via smartphone.

6.1.5 Macro-categories included in the assessment

The macro-category involved in the 9292 mobile app project is:

(1) MaaS platform.

6.1.6 Contribution to innovation and sustainability

The main contributions to innovation can be resumed in:

- among first national level MaaS platforms worldwide;
- active pricing policies addressed to users;
- real time crowdedness estimates and real time information.

The main contribution to sustainability is **economical**.

6.1.7 Status and finance

The project is **100% completed** and operating and it has been financed by **private**.

6.1.8 Summary of the survey

Macro-categories dealt with: MaaS platform

Status/Progress: 100% completed. Operating

Finance: By private

Main contribution to sustainability: Economic

6.1.9 Respondent's Information

Federico Bosio

Italy

Tranzer B.V.

https://tranzer.com

6.1.10 References

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[2] https://tranzer.com

6.2 AUTONOMOUS BUS LINE

6.2.1 General information of the area involved in the practice

Country/Region: Spain

City/Metropolitan area: Madrid

Overview of the area – Name: Madrid

Area dimension: 604.5 km^2

Inhabitants: 3 334 730 people

6.2.2 Overview

The Asturian company ASLA of Madrid has introduced autonomous electric minibuses in the city of Madrid, which circulate in open traffic. The line of these vehicles is located within the Universidad Autonóma (UAM) area in Alcobendas in Madrid. In particular, the bus operates on a 4 km circuit connecting the different facilities and centres of the campus where 30,000 people and 6,000 vehicles circulate every day. The line has a total of seven stops and connections with various intercity bus lines. The route of the autonomous buses is marked by a green line on the asphalt. The line is not an optical driving system but rather a reminder to other road users. Thus, road signs warning that these are preferential routes for the autonomous bus have also been installed. This ambitious deployment gives the opportunity to validate easily potential locations and reject the ones not suitable, scaling the project to the final context.

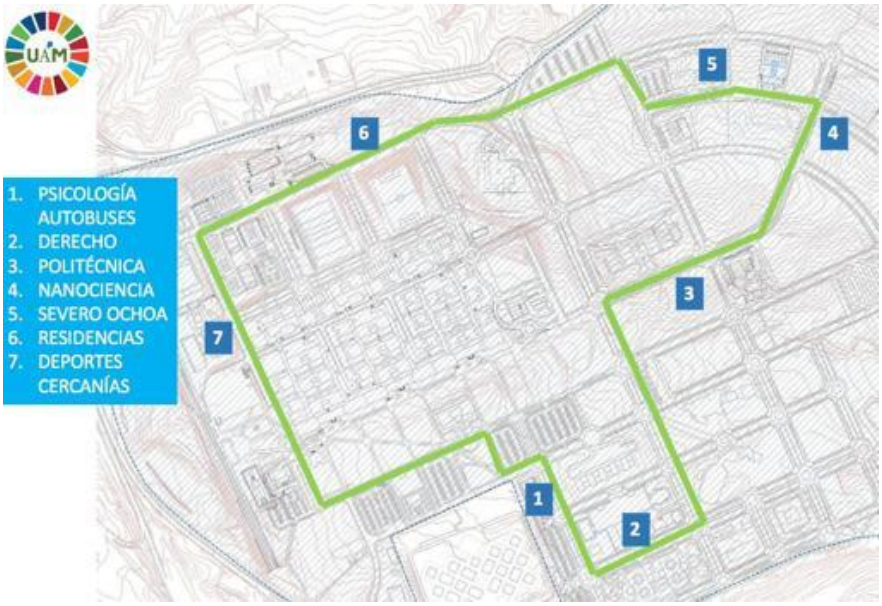


Figure 3: Autonomous buses line in UAM district (https://www.abc.es)

6.2.3 Framework and goals

The vehicle used in the autonomous bus fleet is 100% electric and it is the first autonomous bus to operate in real environments in Madrid. It has a capacity of 12 passengers and it is wheelchair accessible thanks to a removable platform (Figure 4). Its electric propulsion system allows it to reach a maximum speed of 25 km/h, electronically limited to 15 km/h. The vehicle has four batteries, fully chargeable in 6 hours and with a capacity of 30.72 kWh that give to the vehicle a range of 16 hours. The vehicle does a 4 km round trip on the campus with 7 stops, providing a last mile service for

intercity bus and train services using public roads together with normal road traffic. The autonomous vehicle is integrated into the network of the Regional Transport Consortium of Madrid (CTRM), as another regular service of the public transport system of the Community of Madrid.

Currently, the system operates with a level 4 automation in accordance the regulation of Spanish transport, although the technology is able to operate with a level 5 automation. The project involves 4 partners: Universidad Autónoma Madrid, DGT - Spain Transport Authority, CRTM and ALSA. The first three partners are the joint initiators of the project, while the operation of the bus is monitored and carried out by the national bus operator ALSA. In this perspective, the role and the collaboration between the partners is crucial to developing a connected, safer and sustainable mobility.

Figure 4: Wheelchair accessible vehicle (https://www.alsa.com)

Figure 5: Connection with the interurban bus network

(https://www.urban-transport-magazine.com)

6.2.4 Purpose of the project

The goal of the project is to offer to the students a sustainable mobility alternative when traveling on campus. This bus is an alternative to last mile trips, as it connects the campus with the intercity bus and commuter train. The project opens the door to the development of new autonomous mobility projects in Spain, as part of its strategy to offer innovative and increasingly sustainable mobility solutions. The purpose is to drive the transition to zero emission fleets and enhance the new mobility concept based on electric, shared and autonomous vehicle where the principles of environmental sustainability and safety will be a priority.

6.2.5 Macro-categories included in the assessment

Concerning the codification of the "new mobility" practice, the macro-category involved in the autonomous buses project is:

(1) Autonomous driving;

(2) Smart-cities, using ICT and/or ITS;

(3) Persons with disabilities.

6.2.6 Contribution to innovation and sustainability

The implementation of this system represents a step towards alternative and innovative solutions of public transportation in Madrid. The challenging deployment experienced and applied in a complex traffic ecosystem offers the possibility to evaluate future potential locations and projects providing a safe, innovative and accurate value proposal. In particular, the principal aspects developed within the project are:

- Drive automation & Infrastructure Digitalization;
- Vehicle communication;
- New transport regulation.

The main contribution to sustainability is **social**.

6.2.7 Status and finance

The project is **100% completed** and operating.

The project has been **self-financed** by the managing operator.

6.2.8 Summary of the survey

Macro-categories dealt with: Autonomous driving, Smart-cities using ICT and/or ITS, Persons with disabilities.

Status/Progress: 100% Completed - Operating

Finance: Self-financed

Main contribution to sustainability: Social

6.2.9 Respondent's Information

Álvaro Andrade Bonet

Spain

ALSA - National Express Group

alvaro.andrade@alsa.es

6.2.10 References

[1] https://www.alsa.com

[2] https://www.urban-transport-magazine.com

[3] https://www.movilidadsostenible.com

[4] https://www.europapress.es

[5] https://www.eleconomista.es

6.3 AUTONOMOUS SHUTTLE

6.3.1 General information of the area involved in the practice

Country/Region: Canada/Québec

City/Metropolitan area: Montréal

Overview of the area – Name: Ville de Montréal

Area dimension: 432 km^2

Inhabitants: 1 780 000 people

6.3.2 Overview

The city of Montreal has developed an autonomous shuttles project that is the first step toward the integration of innovative transport technologies in the urban city. The implementation is carried out in the area around Plaza Saint-Hubert in the district of Rosemont - Le Petite - Country.

Two Keolis autonomous vehicles were following a 30-minute trip with several stops along the 2 km route (Figure 6). Shuttles are programmed to run along a predefined route and operate at low speeds. The maximum speed is limited to 20 km/h and an operator is on board to act in case of emergency or to troubleshoot difficult situations where control of the vehicle needs to be taken. Each vehicle can carry 15 passengers, but with the current pandemic context, only 5 passengers can board the vehicle at the same time.

The first phase of the project was carried out from October to December 2021 and the second phase will be performed from May to July 2022.

The shuttle routes will be tested during the project in both residential and commercial contexts. The city will survey residents throughout the project with a view to providing mobility solutions that are adapted to the population.

Figure 6: First phase path (Ville de Montreal)

6.3.3 Framework and goals

Facing the crisis caused by COVID-19, the City of Montréal has developed different projects to support commercial streets over the last two years. In fall 2021, a pilot project to implement an autonomous shuttle on Saint-Hubert street, an important commercial street of the Rosemont – La Petite - Patrie borough, has taken place. This project was a follow-up to another autonomous shuttle project carried out in 2019 as an experimental testing of autonomous shuttle on public roads between the Olympic park and the Maisonneuve Market. The aim of this second project is to test the concept and its implementation in a different urban setting. This new mode of transport, comfortable and eco-friendly will serve the neighbourhood by improving the experience of active and public transport users. The shuttles are perfectly suited to the objectives of 2020-2030 Climate Plan of Montreal, which focuses on clean technologies and electrification (Figure 7).

Figure 7: Intern of autonomous shuttle and access platform (https://www.cpacanada.ca/)

6.3.4 Purpose of the project

The project brought together different researchers and professionals to learn from this experiment (Polytechnique Montréal, INRS, MTQ, Ville de Montréal) and better understand how it can be used in an urban context. Inside the urban areas is important to address three main themes that directly concern transport users: safety, progressiveness and acceptability.

The purposes of the project are:

- Integrate the potential of mobility needs in different urban scenario;
- Promote alternative solution of public transport that reduces traffic congestion;
- Support innovative technologies which include electric vehicle to contribute to the reduction of greenhouse gasses;
- Integrate autonomous vehicles in the urban city to improve road safety.

6.3.5 Macro-categories included in the assessment

Focusing on the codification of the "new mobility" practice, the macro-categories involved in the Autonomous Shuttle Plan are:

(1) Autonomous driving;

(2) Smart-cities, using ICT and/or ITS.

Contribution to innovation and sustainability

The main contribution to innovation is related to the potentiality of autonomous shuttles to meet mobility needs in certain urban settings, such as commercial streets. The main contribution to sustainability is **economic**.

6.3.6 Status and finance

The project is **100% completed** and operating.

The project has been **self-financed** by the managing operator.

6.3.7 Summary of the survey

Macro-categories dealt with: Autonomous driving, Smart-cities using ICT and/or ITS

Status/Progress: 100% Completed – Operating

Finance: Self-financed

Main contribution to sustainability: Economic

6.3.8 Respondent's Information

Judith Mageau-Béland

Ville de Montreal

6.3.9 References

[1] https://montreal.ca

6.4 AWARDING INNOVATIVE SERVICES WITH INNOVATIVE CONTRACTS

6.4.1 General information of the area involved in the practice

Country/Region: Emilia-Romagna Region (Italy)

City/Metropolitan area: Municipality of Bologna

Overview of the area – Name: Bologna

Area dimension: 140.9 km^2

Inhabitants: 395 000 people

6.4.2 Overview

Bike-sharing is a urban-transit solution for medium-short routes, which encourages intermobility by providing the public with a convenient and quick service that meets the demands of individuals traveling throughout cities. The RideMovi Bike-sharing service operates in Bologna through a mixed-model service that provides 2200 muscle pedalling bicycles with 3-speed gearboxes and 360 pedal-assisted bicycles (e-bikes) with an 80-kilometer range and a top speed of 25 km/h. To carry out this strategy and decide the partner, a competition between four foreign companies was held. The municipal administration has prepared 180 hubs reserved for the parking in the urban area and the service is provided in the free-floating mode based on the "China model" (Figure 8). The application allows to obtain information about: bicycles and e-bicycles available, reserved hubs and operating area. The price structure is defined into the application for both single-trip and monthly subscriptions. To use the service, it is necessary to scan the QR code on the bicycle through the mobile app in order to start the trip. Bicycles can run freely inside or outside the operating area, consisting of a large central area and various perimeter points spread throughout the city. If the user wants to avoid surcharge, the ride must end within the operating area or within one of the hubs located outside the same. Once completed the trip, the user can give feedback about the service and view a sheet with useful information about the travel such as travelled distance and time or avoided CO_2 emissions.

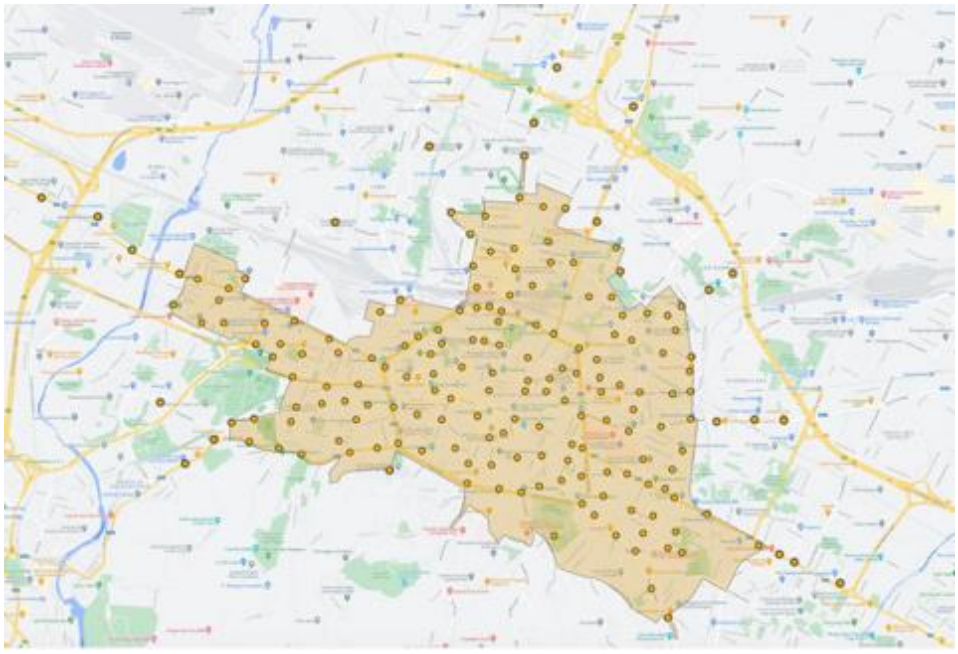


Figure 8: Bike sharing operating area and hubs (https://www.comune.bologna.it)

6.4.3 Framework and goals

In the municipality of Bologna there was already a "first-generation" bike sharing service active since 2005 to 2018. The service presented problems that with the new bike-sharing system were solved:

- Stations – it was not possible to leave the bicycle in different stations because there was only one station;
- Bicycle/users ratio – the number of bicycles provided was 210 compared to 7000 active profiles;
- Data and employment – it was not possible to acquire data and information about the bicycles users. The turn-over of the employees was low;
- Network integration – there was not an effectiveness integration system with the transportation alternative provided in the urban area;
- Low accessibility – the service was not available for tourists and it was not user-friendly for citizens.

As aforementioned, since 2018 the bike-sharing service is provided by RideMovi which offers a fleet of muscle pedaling and electric bicycles. The offered service has increased from 1000 bicycles for 2500 trips/day to 2500 bicycle for 10000 trips/day. In the Figure 9, it is illustrated the monthly distribution of the use of bicycles, which is concentrated in the center of Bologna (red color).

An important task that needs to be addressed is related to the acts of vandalism (Figure 10). In order to make the service more and more reliable and safe, the users' behaviors are tracked and it is encouraged a conscious and responsible use of the service with tariff rewards.

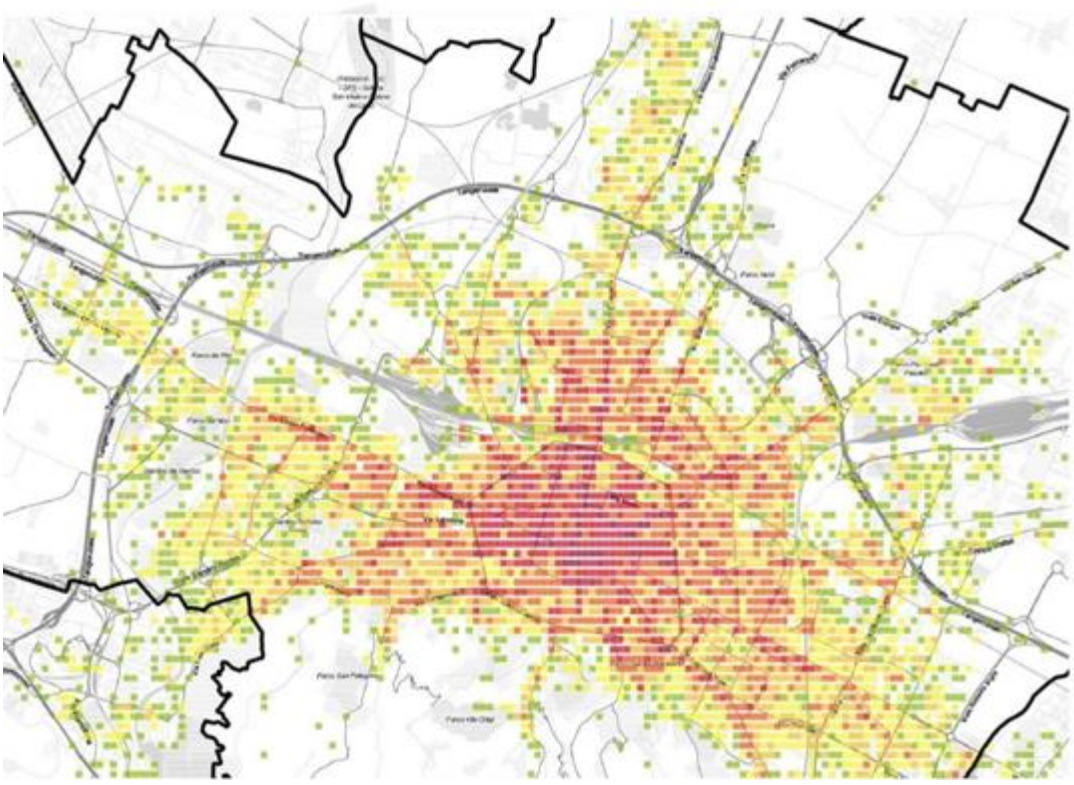


Figure 9: Monthly usage (https://www.srmbologna.it)

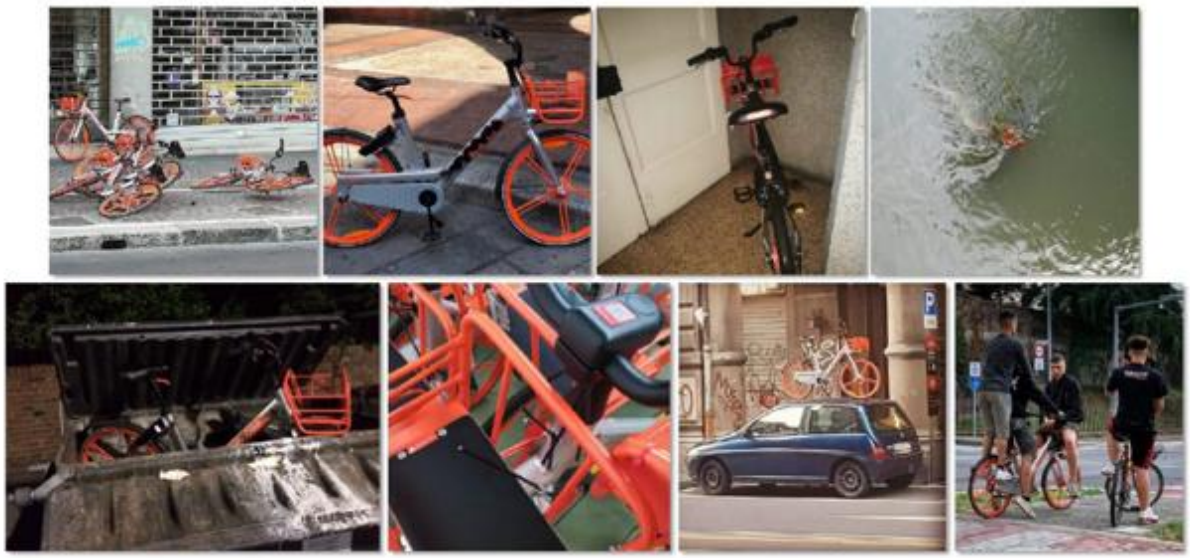


Figure 10: Acts of vandalism and inappropriate usage (https://www.srmbologna.it)

6.4.4 Purpose of the project

The bike sharing in Bologna has all the characteristics of a public service and provides timely commitments from the operator. The goal is to revolutionize the way people connect in the city through a fun, efficient and sustainable sharing service awarding sustainable services with innovative contracts.

The main objectives of the project are:

- to reduce CO2 emissions promoting sustainable and shared systems that decrease the environmental impact;
- to tackle the traffic congestion problem: enlarging urban areas and promoting solutions for smoother travel;
- to increase the opportunity of intermodal transit solutions according to the SUMP (Sustainable Urban Mobility Plan) objective.

6.4.5 Macro-categories included in the assessment

The macro-categories involved in the bike-sharing service provided in the municipality of Bologna are:

(1) Innovative contracts and sharing systems;

(2) **Active users** (e.g. pedestrians, cyclists, ...);

(3) Smart-cities, using ICT and/or ITS.

6.4.6 Contribution to innovation and sustainability

The main contributions to innovation can be resumed in:

- “Competitive dialogue” contracts;
- Exclusive rights in the market;
- Data available from competitors and data shared from the awarded operator.

The main contribution to sustainability is related to the **environmental** impacts, which benefits all citizens and travellers thanks to a reduction of air pollution via sustainable transport solutions.

6.4.7 Status and finance

The project is **100% completed** and operating since 2018.

It has been financed by **public** for **less** than **50%**.

6.4.8 Summary of the survey

Macro-categories dealt with: Innovative contracts and sharing system, Active users, Smart-cities using ICT and/or ITS

Status/Progress: 100% completed. Operating

Finance: By public (<50%)

Main contribution to sustainability: Environmental

6.4.9 Respondent's Information

Tommaso Bonino

Italy

SRM – Reti e Mobilità

www.srmbologna.it

6.4.10 References

[1] https://www.comune.bologna.it

[2] https://www.srmbologna.it

[3] https://www.bolognametropolitana.it

[4] https://www.ridemovi.com

6.5 BEIJING MAAS PLATFORM - MAAS SERVICE FOR GREEN CITY

6.5.1 General information of the area involved in the practice

Country/Region: China

City/Metropolitan area: Beijing

Overview of the area – Name: Beijing

Area dimension: 16 411km^2

Inhabitants: 21 890 000 people

6.5.2 Overview

The promotion of climate-friendly and integrated new mobility services is a key element to achieve China's carbon emissions reduction targets, which seek to peak emissions by 2030 and achieve carbon neutrality by 2060. Beijing inaugurated China's first MaaS platform in November 2019, with the goal of offering citizens a one-stop transport solution that incorporates smart routing, full navigation, and green incentives. Travel data for public transportation modes such as bus, metro, and suburban train, as well as active and shared mobility modes such as walking, cycling, and ride-hailing, has been integrated into the platform. Many features are provided by the application including bus arrival forecasts, carriage crowding information, transfer and disembarkation reminders. Green travel carbon credit incentives and trade mechanisms are an extension of the MaaS platform services, an attempt to encourage the use of green mobility options through incentive-based guidance, to achieve a significant shift in travel behaviour. The figure is related to software homepage of carbon-calculation and carbon-incentive activities.

Figure 11: MaaS mobility for Green City

6.5.3 Framework and goals

The implementation of a carbon credit incentive scheme for green mobility based on Beijing's integrated green mobility service platform (MaaS platform) is the first of its kind in China. Residents who want to take part in this initiative need to first create a personal carbon credit account with Amap or Baidu Maps. Users are encouraged to use green modes of transportation such as bus, metro, cycling, or walking. Using the Amap or Baidu Maps applications for route planning and navigation, they can earn carbon credits that can be redeemed for a range of benefits. For example, collected carbon credit could be used for public welfare, such as donating credits for the planting of trees and supporting philanthropic activities and so on. The figure illustrates on the left side the MaaS participation interface, and on the right one shows coupons that green travel users can redeem with their activity carbon points.

Figure 12: MaaS interface partecipation (left) and carbon-rewards (right)

Regarding the MaaS platform developed for the city of Beijing, the main challenges to address and goals to be achieved, are:

- Low travel satisfaction level while transferring due to low connection, stress and uncertainty;
- Citizens' low willingness to travel with green modes;
- The imbalance between supply and demand;
- Difficulties in integrating transport operators and service providers since different stakeholders hold unique concerns and therefore gather different realities within the platform is complicated;
- Digital technologies (e.g., block chain technology, smart urban transportation brain) need to be enhanced;
- Sustainable and smart travels require a digital platform which can gather all transportation modes and service providers, and then encourage sustainable modal shift through incentive approaches and high travel satisfaction.

6.5.4 Purpose of the project

The main objectives of the Beijing MaaS platform for Green City project are:

(1) To create seamless and door-to-door services through the technological connection of all the transportation modes and smart functions;

(2) To encourage travellers to use public and active transportation through carbon-incentive activities;

(3) To provide information transportation data such as real-time bus congestion and reminding of the time to get off shared by the government and transit operators, and internet enterprises fully used the data to provide public transportation information services;

(4) To explore integrated scenarios such as gathering all the bikes to a platform, increasing the P+R (Park+Ride) facilities and payment integration when using different transportation modes;

(5) To reduce carbon emission by means of citizens' green travel records, which are converted into incentives through carbon market transactions.

Macro-categories included in the assessment

The Beijing MaaS platform for Green City involves the following macro-categories:

(1) MaaS platforms;

(2) Smart-cities, using ICT and/or ITS;

(3) Innovative contracts and sharing system.

6.5.5 Contribution to innovation and sustainability

The development of integrated transport projects required the participation of multiple stakeholders. The main contributions to innovation are represented by:

- Cooperation between public (Beijing Transport Committee, Beijing Transport institute) and private sectors (such as Amap and Baidu Map);
- Carbon emission reduction data is calibrated using third-party verification platforms;
- Stimulate significant and innovative policies, and realize the transformation of traditional traffic governance methods through accurate identification of needs.

The main contribution to sustainability is **environmental**. By strengthening green policies and encouraging the use of sustainable transport systems, the reduction of carbon emission is expected. Moreover, participators of carbon-incentive activities could use their carbon-bonus points to support environment and rare animals' protection programs.

Figure 13: The start of public welfare program based on MaaS carbon-rewards in Beijing

6.5.6 Status and finance

The project is **100% completed** and it has been **less** than **50%** financed by **public**.

6.5.7 Summary of the survey

Macro-categories dealt with: MaaS platform, Smart-cities using ICT and/or ITS, Innovative contracts and sharing systems

Status/Progress: 100% completed. Operating

Finance: <50% by public

Main contribution to sustainability: Environmental

6.5.8 Respondent's Information

Yufang Zhou

China

Beijing Transport Institute

6.5.9 References

[1] https://transition-china.org

6.6 BIP FOR MAAS

6.6.1 General information of the area involved in the practice

Country/Region: Piemonte Region (Italy)

City/Metropolitan area: Metropolitan city of Turin

Overview of the area – Name: Comune di Torino

Area dimension: 130 km^2

Inhabitants: 887 000 people

6.6.2 Overview

Turin is the chief town of Piemonte and the main municipality of the Metropolitan City of Turin. In the last few years, the Piemonte Region has developed a public transport policy aimed at supporting the digital transformation of the local transport system. The implementation of the concept of MaaS redefines the rules of the mobility market in an open eco-system. BIPforMaaS is a strategic project, coordinated by 5T, which is focused on the diffusion of MaaS services in the urban and metropolitan area of Turin and also in the Piemonte Region This is the first local administration in Italy to launch a MaaS project driven by public governance and appropriate public policies. The accessibility is guaranteed by means of the BIP card, an innovative smart ticketing system that enables easy access to the different transport services operating in the regional area: urban and suburban buses, railway service, metro and bike sharing.

Figure 14 : BIP smart card contactless to access bike sharing service (https://bip.piemonte.it/)

6.6.3 Framework and goals

The BIPforMaaS project started in 2019 and involved more than 60 local public transport operators, 18 local authorities and 1 million users in the Piemonte region. The Regional Electronic Ticketing Platform, established at the Regional Mobility Centre, ensures the technical coordination of the BIP regional electronic ticketing system, enhances interoperability, and manages the security of the system. It supplies and distributes smart cards to local public transport companies, centralizing the data recorded by these corporations. BIPforMaaS involves all the relevant stakeholders (public

transport operators, shared mobility services operators, local authorities, users, MaaS Operatorsetc.) in a multi-stakeholder co-creation collaborative project, with permanent working tables and coordination meetings, to identify a common vision. Through the BIPforMaaS path, the projects related to the digitalization of the BIP card on smartphone and the introduction of the Pay-per-use tariff are pursued.

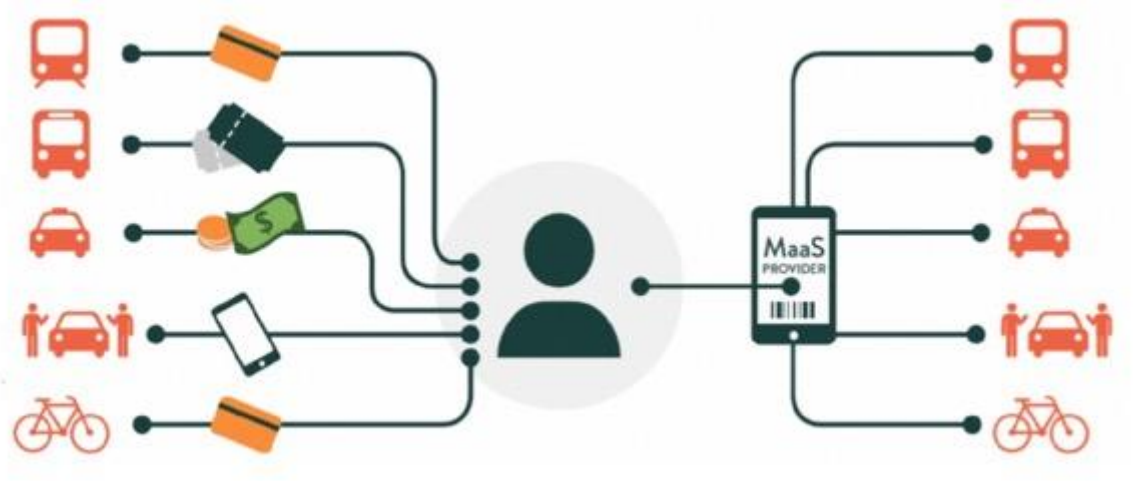


Figure 15: Current situation vs Maas system (M. Kamargianni and M. Matyas, 2016)

Figure 16 : BIP card and SmartBIP mobile app (http://www.bipformaas.it/en/home-en)

6.6.4 Purpose of the project

The aim of the project is to encourage the spread of new MaaS services for the benefit of citizens, travellers and tourists, increasing the number of mobility alternatives in an integrated system and promoting a modal shift of mobility demand towards sustainable solutions.

The main objectives are:

(1) evolve the BIP system on mobile through smartphone apps that allow the purchase and the enabling to use travel tickets for all regional public transport services;

(2) establish and unify a new integrated tariff system, based on pay-per-use and best-do logic, which allows users to freely access all regional services;

(3) establish a "MaaS ecosystem", comprised of the Piemonte Region and other local stakeholders, which is facilitated by technological infrastructure and a set of rules and pricing policies, for a more integrated, accessible, and sustainable local mobility system based on the MaaS model.

6.6.5 Macro-categories included in the assessment

Regarding the codification of the “new mobility” practice, the macro-categories involved in the BIPforMaaS project are:

(1) MaaS platforms;

(2) Innovative contracts and sharing systems;

(3) **Active users** (e.g. pedestrians, cyclists, ...).

6.6.6 Contribution to innovation and sustainability

The contribution to innovation can be summarized in:

- Simplify access to public transport services;
- Promote intermodality of transport;
- Speeding up the mobility digital transformation in Piemonte;
- Support the evolution of the current services of local public transport, improving the quality and ensuring the continuity of the public service;
- Increase the number of transport services involved in the MaaS services;
- Develop a common view among stakeholders for the future of digital mobility;
- Increase the number of transport services involved in the BIPforMaaS;
- Set up of a regulatory framework for MaaS.

The main contribution of the measure to sustainability is related to the **economic** advantage, which benefits users, private and public sectors. The users will take advantages from seamless, high-quality and competitively priced personalised mobility services. The mobility as a service creates new market opportunities for the traditional territorial operators and new start-up oriented towards innovative solutions.

6.6.7 Status and finance

The operating project is currently more than half-completed, with the full operating schedule set for May 2022.

The project has been financed by **public** institutions.

6.6.8 Summary of the survey

Macro-categories dealt with: Maas Platform, Innovative contracts and sharing system, Active users.

Status/Progress: >50% completed

Finance: by public

Main contribution to sustainability: Economic

6.6.9 Respondent’s Information

Matteo Antoniola

5T S.R.L. Via Bertola 34, 10122, Torino (Italy)

www.5t.torino.it

6.6.10 References

[1] http://www.bipformaas.it/en/home-en

[2] https://bit.ly/3EX2wz6

6.7 BUS RAPID TRANSIT (BRT) ON BOULEVARD PIE-IX

6.7.1 General information of the area involved in the practice

Country/Region: Canada/Quebec

City/Metropolitan area: Montréal metropolitan community

Overview of the area – Name: Montréal metropolitan community

Area dimension: 4 259 km^2

Inhabitants: 4 099 000 people

6.7.2 Overview

The Bus Rapid Transit (BRT) Pie IX is a high-performance public transportation project integrated into the work of rebuilding and revitalizing of Boulevard Pie IX. The distribution of public spaces across Boulevard Pie-IX has been redesigned, reworking intersections and widening the existing sidewalks. Improving user comfort and experience is the main goal of this project. Each station will be equipped with secure access and a shelter protected from traffic. The signage will be spacious, comfortable and clear within a green system.

The new public transit infrastructure is approximately 13 km long following a north-south axis that links Saint-Martin Boulevard in Laval and Notre-Dame Street in Montréal (Figure 36). The project will feature 20 stations and will allow bus services to transfer more than 70,000 people each day on this vast north-south axis.

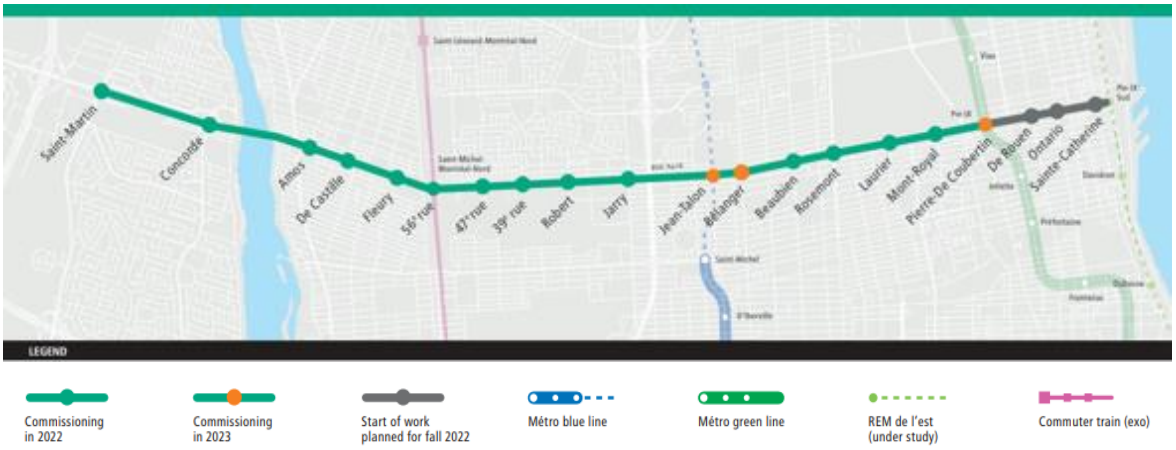


Figure 17: Pie-IX Bus Rapid Transit path (https://www.stm.info/)

6.7.3 Framework and goals

The Pie-IX BRT project is one of the projects developed following the declaration made by the Government of Quebec and the City of Montréal to revitalize the east end of Montréal.

The public transit infrastructure is positioned at the centre of the road. The reserved lanes, operational 24/7, will be exclusively accessible to buses. The lanes will be different coloured and they will have exclusive road signs compared to normal lanes.

Figure 18: Future Pie-IX BRT at the corner of Jean Talon Street and PIE-IX Boulevard

A total of 38 bus shelters, measuring 30 meters, will cross the 13 kilometres of the integrated BRT Pie-IX project (Figure 38). The shelters are equipped with electronic displays indicating the buses passages in real time. In addition, the screens at the bus stations will provide real-time information on bus routes and timetables. At the intersection, the traffic lights will give priority to buses through a real-time system in order to optimize the public transit flow. Moreover, the intersections will include digital and audible counting pedestrian lights and accessible pedestrian-friendly facilities and layout are designed to improve the safety to access and to leave the shelters.

Figure 19 : BRT Bus stop configuration in Saint-Martin (https://www.stm.info)

6.7.4 Purpose of the project

The main purpose of the project is to boost public transit ridership by increasing service frequency and improving the quality and safety of the experience. The Intelligent Transport Systems implemented and integrated in the project will enhance the performance of the bus service, allowing the addition of buses and determining a higher frequency of passage. The implementation of a new transit system required:

Comfortable, accessible and safe configuration and features

- Spacious bus shelters;
- Electronic displays showing bus arrivals/departures in real time;

- Pedestrian access;
- Pedestrian crossing lights with digital and audio countdown;

Rapid and reliable systems through

- Lane reserved for buses;
- Rapid boarding doors.

6.7.5 Macro-categories included in the assessment

The codification of the "new mobility" practice for the Bus Rapid Transit Pie-IX plan includes the macro-category:

(1) Smart-cities, using ICT and/or ITS.

6.7.6 Contribution to innovation and sustainability

To improve the smoothness and speed of buses, the BRT Pie-IX provides dedicated lanes for buses in their own lane (physical separation from lanes for other vehicles), passenger waiting stations, and automatic priority traffic lights. Thus, BRT Pie IX is an example of structuring public transit system run by buses that relies on technological means to provide an attractive and efficient experience which is an important contribution to innovation. Regarding the sustainability, the project is focused on the **environmental** advantages related to the new rapid transit system and the requalification of the area, which will create a multifunctional environment inserted into a green system.

6.7.7 Status and finance

The Pie-IX BRT will be operational in most sectors between Pierre-De Coubertin Avenue in Montréal and Saint-Martin Boulevard in Laval by the end of 2022 and it is more than **50% completed**. The project is planned to be operating by the end of 2023. The budget for the public transport project, **financed by public** (Ministère des Transports, ARTM and the federal government), is 472.5 million dollars.

6.7.8 Summary of the survey

Macro-categories dealt with: Smart-cities using ICT and/or ITS

Status/Progress: >50% Completed

Finance: by public

Main contribution to sustainability: Environmental

6.7.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.7.10 References

[1] https://www.stm.info/en

[2] https://www.artm.quebec/

6.8 CARSHARING SERVICE

6.8.1 General information of the area involved in the practice

Country/Region: Canada/Québec

City/Metropolitan area: Montréal

Overview of the area – Name: Province of Québec

Area dimension: 1 542 056 km^2

Inhabitants: 8 631 147 people

6.8.2 Overview

Carsharing is a cost-effective and environmentally beneficial alternative to owning a car. In the Province of Québec the use of carsharing is strongly encouraged to reduce car ownership. Communauto offers two types of services in Montréal and the city of Québec. One third of its 2000 cars are available in the free-floating service (One Way FLEX), which does not require reservation. More than 20% of this fleet is made up of electric vehicles. The remaining two thirds vehicles are available by reservation in the station-based service (Round-Trip vehicles). Montrealers were the first to benefit from this dual service. Communauto has different subscription packages and plans adapted to all mobility needs. Whether it is for occasional or more regular use, the degressive rates encourage using the service frequently. The partnership developed with public transportation operators (bus, train, bike-sharing) allows customers to access the complete network at competitive rates, therefore promoting the use of the different urban transportation options and reducing the number of cars on the road.

6.8.3 Framework and goals

Communauto was born out of the necessity of using cars differently. It started its operations in the city of Québec (1994), and then in Montréal a year later. It expanded its carsharing service to Sherbrooke in 2002 and to Gatineau in 2003. Today, tens of thousands of Québecers can access more than 1,500 shared cars. Communauto also operates in Halifax (since 2008) and Ottawa (since 2000). In 2012, a survey to understand the factors that affect vehicle usage and availability in Montreal's car sharing has been carried out. Mobizen, a Paris-based company, is acquired by Communauto in 2012. Communauto is the longest running carsharing service in North America and the one serving the largest number of communities in Canada.

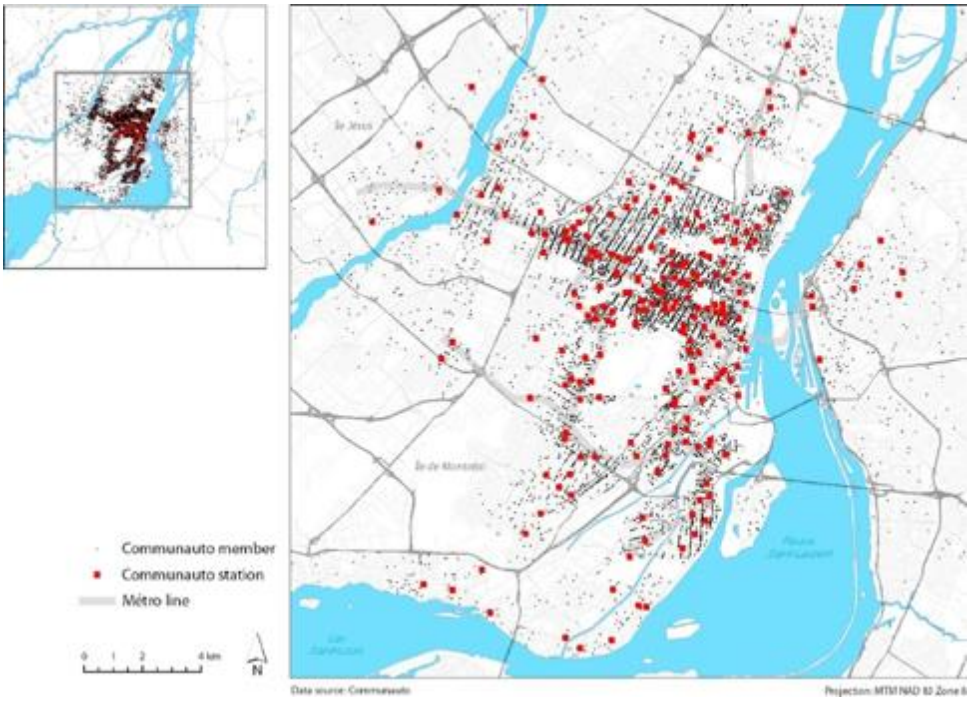


Figure 20: Communauto members and stations distributed in the Greater Montreal area

(Ahmed M. El-Geneidy, 2012)

As aforementioned, in Québec, Communauto offers two distinct services: the one-way FLEX service, available only in Québec City and Montreal, which does not require a reservation, and the round-trip reservation service, available in Québec City, Montreal, Sherbrooke and Gatineau.

Round-trip vehicles available by reservation

Station-based: Bring your Communauto back to its station.

- Retire the car at the station choice and return it to the same station at the agreed time;
- Round-trip vehicles can be reserved up to a month in advance;
- Ideal for planned trips or when you need to make sure you have access to a vehicle at a specified time and location.

All of round-trip vehicles have reserved parking spaces. The vehicle stations are located, for the most part, in private or public lots. At most stations, there is a specific parking spot reserved for car sharing, while in some, it is possible to park anywhere onsite.

One-way FLEX without reservation

Travel from point A to B: Release your FLEX car where you want, when you want.

- The ideal solution for unplanned trips or for multimodal trips;
- Releasing the car at your destination within the FLEX Zone, it is possible to minimize costs and take advantage of parking in resident-only zones.

In Québec City and Montreal, FLEX vehicles can be released within the FLEX Zone where “Excepté véhicules munis d’un permis” signs are displayed, provided there are no additional parking restrictions in place.

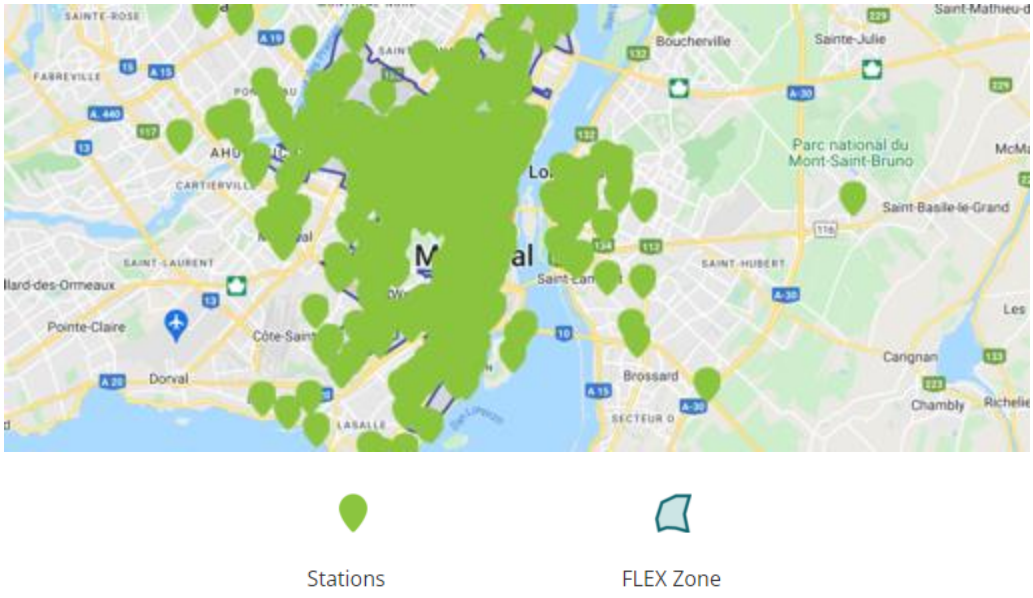


Figure 21: Example of stations distribution and FLEX zone boundaries in Montreal (https://montreal.communauto.com/)

6.8.4 Purpose of the project

The goal of Communauto car sharing system is to provide a convenient and economical alternative to owning a car. The car sharing tends to reduce the need of a private car and it is expected that this system adds benefits in the urban region where it is implemented. Reducing the number of vehicles in circulation, it is possible to calm traffic congestion especially during the peak hours.

6.8.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-category involved in the Communauto Car Sharing system is:

(1) Innovative contracts and sharing systems.

6.8.6 Contribution to innovation and sustainability

The main contribution to innovation is related to provide an economical alternative to owning a car with different subscription packages and plans adapted to mobility needs. The relevant innovative elements are:

- A mixed vehicle fleet to meet the needs of the clientele;
- Two services that work together to provide the best coverage;
- Degressive rates adapted to customer needs;
- Partnerships with public transportation for efficient and integrated mobility;
- Business development true to its social, environmental and urbanistic mission;
- Technology in the service of mobility and unique reservation system.

The main contribution to sustainability can be recapped in terms of car sharing's **environmental** impact on traffic and pollutant emissions.

6.8.7 Status and finance

The project is **100% completed** and operating.

The project has been **self-financed** by the managing operator.

6.8.8 Summary of the survey

Macro-categories dealt with: Innovative contracts and sharing systems

Status/Progress: 100% Completed – Operating

Finance: Self-financed

Main contribution to sustainability: Environmental

6.8.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.8.10 References

[1] https://montreal.communauto.com/

[2] https://communauto.com/

[3] Lorimier, Alexandre & El-Geneidy, Ahmed. (2012). Understanding the Factors Affecting Vehicle Usage and Availability in Carsharing Networks: A Case Study of Communauto Carsharing System From Montréal, Canada. International Journal of Sustainable Transportation - INT J SUSTAIN TRANSP. 7. 10.1080/15568318.2012.660104.

6.9 COMPLETE TRIP - ITS4US DEPLOYMENT PROGRAM

6.9.1 General information of the area involved in the practice

Country/Region: USA nationwide

City/Metropolitan area: Gwinnett County, Georgia; Buffalo, Ney York; Dallas County, Iowa; California; Oregon; Washington; Maryland

6.9.2 Overview

The innovation of business partnerships, technologies, and practices that promote independent mobility for all is strongly encouraged by the US authorities. The Complete Trip - ITS4US Deployment Program is part of a transport strategy that attempts to develop new sustainable solutions of mobility. “Complete Trip” means that a user can travel from origin to destination seamlessly, regardless of the number of modes, transfers, and connections available. Currently, the project is in progress in the planning phase and it is a 40 million dollars multimodal effort, led by the Intelligent Transportations Systems Joint Program Office (ITS JPO) and supported by Office of the Secretary (OST), Federal Highway Administration (FHWA), and Federal Transit Administration (FTA). The aim is to identify more efficient, affordable, and accessible transportation options for underserved communities that often face greater challenges in accessing essential services. The Vision is related to innovative and integrated complete trip deployments to support seamless travel for all users across all modes, regardless of location, income or disability. The Mission is: facilitate the integration and deployment of emerging technologies, along with innovative and replicable, traveller-centric partnerships, business models and practices to foster reliable, spontaneous, independent, safe, affordable, accessible, and efficient mobility options for all travellers.

6.9.3 Framework and goals

The US Department of Transportation (USDOT) is carrying out foundational research to support an increase in independent mobility of all travellers through the use of Intelligent Transport Systems and other advanced technologies. The ITS4US Program focuses on improving traveller's ability to complete a planned trip without interruptions in the travel chain regardless of location, income, or disability. A complete trip includes multiple links or trip segments. If one segment of the path is inaccessible either or inefficient, it interferes with the correct completion of the user’s trip. As illustrated in Figure 22, numerous elements that influence the trip path.

Figure 22: Factors influencing user's trip (https://www.its.dot.gov/)

The sites involved in the project are responsible for conducting performance measurement and evaluation trough a three-phases program with a time horizon of over three years (Figure 23). The goal is to procure multiple large scale and real-world deployments of integrated technologies to address the challenges of planning and executing complete trips. Starting from the concept development in the initial phase and subsequently the design and operation phases, the deployment aims to encourage the applications through data sharing for a common framework. The collaboration among sites can be a powerful force to achieve the final objective and it is extended to other agencies considering similar deployments.

In the first phase, The USDOT has funded five large-scale deployments awarded to (Figure 24):

- Heart of Iowa Regional Transit Agency (Dallas County, IA);
- Atlanta Regional Commission (Gwinnett County, GA);
- California Association of Coordinated Transportation (CA, OR, WA);
- University of Washington (OR, WA, MD);
- ICF (Buffalo, NY).

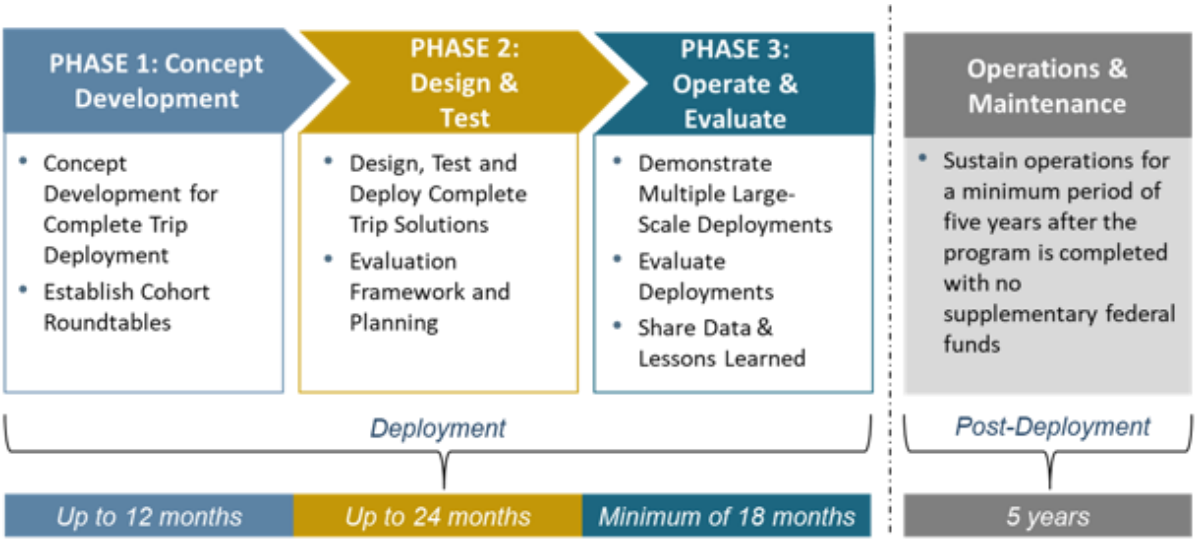


Figure 23: ITS4US's Phases Agenda (https://www.its.dot.gov/)

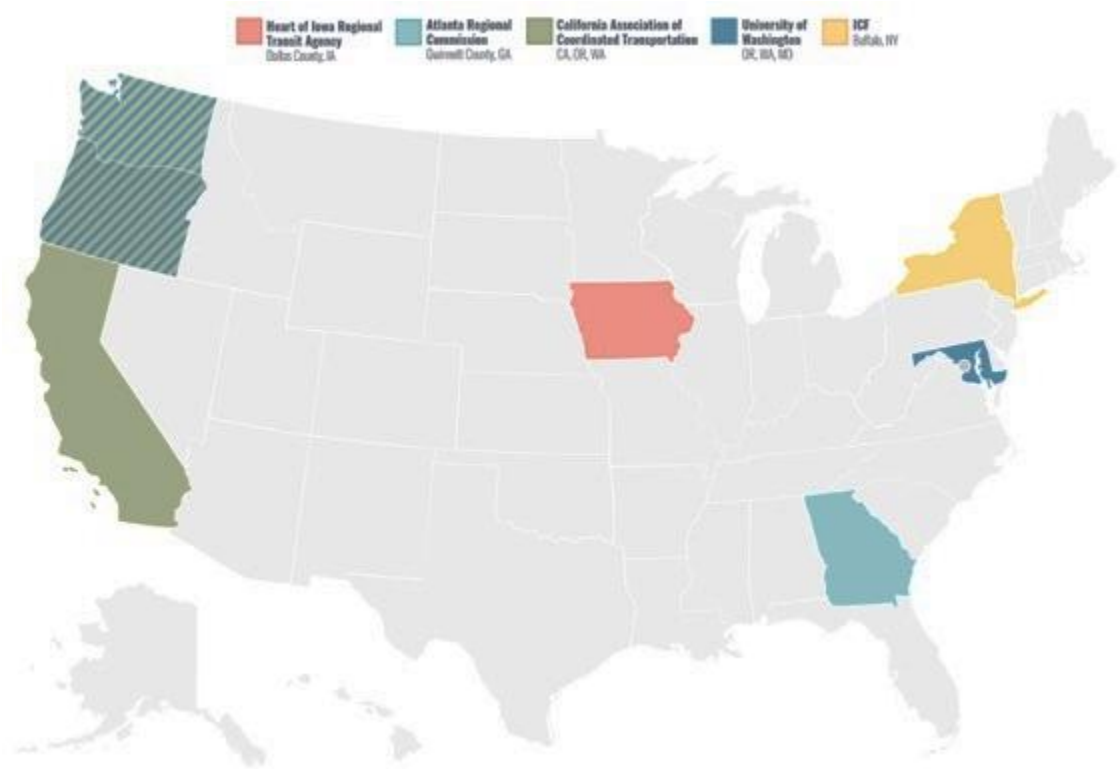


Figure 24: ITS4US Phase 1 Awardees (https://www.its.dot.gov/)

6.9.4 Purpose of the project

The program aims to address mobility issues for all travellers with a specific focus on underserved groups such as people with disabilities, aging adults, low-income individuals, rural residents, veterans, and travellers with limited English proficiency. This proposal will assist communities in creating local partnerships, developing and deploying integrated and repeatable mobility solutions to achieve complete trips for all travellers.

The main objectives are:

1) spur high-impact integrated complete trip deployments nationwide;

2) identify needs and challenges by populations;
3) develop and deploy mobility solutions that meet user needs;
4) measure impact of integrated deployments;
5) identify replicable solutions and disseminate lessons learned.

6.9.5 Macro-categories included in the assessment

Concerning the codification of the "new mobility" practice, the macro-category involved in the ITS4US project is:

(1) Persons with disabilities.

6.9.6 Contribution to innovation and sustainability

Currently, sites are in the planning phase, therefore detailed performance metrics will be developed in 2022. Provisions on how to program, design and perform a complete trip deployment is one of the main contributions to innovation. This means that other communities can adopt similar systems to integrate and replicate transportation solutions in their area. Future impacts can be summarized in:

- Develop individual traveller mobility with an inclusive design universally accessible, affordable and user-friendly;
- Simplify population accessibility by means of integrated, innovative and emerging technologies;
- Improve the transportation system efficiency and effectiveness;

The main contribution of the measure to sustainability is related to the **social** impact, which benefits all travellers, especially people with disabilities and underserved communities. The users will take advantages from seamless, optimize and efficient travel solutions for spontaneous or planned trips.

6.9.7 Status and finance

The project is in the planning phase. Currently, the sites involved in the project are working on phase 1 "Concept Development" that will end by 2022. The last phase "Operate&Evaluate" is planned to end by 2026.

The project has been financed by **public** (**>50%**).

6.9.8 Summary of the survey

Macro-categories dealt with: Persons with disabilities.

Status/Progress: Planned – End of Phase 2 "Operate&Evaluate" 2026

Finance: >50% financed by public

Main contribution to sustainability: Social

6.9.9 Respondent's Information

Elina Zlotchenko

US DOT, Intelligent Transportation Systems Joint Program Office

www.its.dot.gov

6.9.10 References

[1] https://www.transportation.gov

[2] https://www.its.dot.gov

6.10 C-ROADS ITALY 2

6.10.1 General information of the area involved in the practice

Country/Region: Italy

City/Metropolitan area: Metropolitan city of Turin

Overview of the area – Name: Metropolitan city of Turin

Area dimension: 6 827 km^2

Inhabitants: 2 208 662 people

6.10.2 Overview

The new C-ITS (Cooperative Intelligent Transport System), or cooperative systems, are a set of technologies and applications that enable the effective flow of data between components and players in the transportation system using wireless communication technologies.

The European project C-Roads Italy 2 is a pilot initiative in Italy of the European platform C-Roads for C-ITS services in urban areas, involving the city of Turin as an implementing body and test site. Turin has tasked 5T, a company that designs, implements, and manages mobility systems and services in Turin and Piedmont, to develop a subgroup of services known as DAY1 and DAY1.5, which are specific use cases targeted at improving traffic efficiency and safety. SINELEC has been chosen by 5T as a technology partner for the implementation of these services: in addition to supplying and integrating the communication hardware (V2X), SINELEC will supply the software modules to manage this equipment.

Figure 25: C-Roads Italy 2 deployment (https://www.c-roads.eu/)

6.10.3 Framework and goals

The implementation of C-ITS services in European urban areas will require the involvement and support of a wide range of public and private actors. In particular, both the Member States and the European Commission have the role of allowing adequate financial and technical support to facilitate the deployment of C-ITS systems. A set of “Day1” and “Day1.5” C-ITS services as recommended by the European Commission C-ITS Platform:

- Green Light Optimal Speed Advisory (GLOSA) [C-ITS Day 1 service]: technology that allows you to adjust the speed of your car to reach the traffic light with the green signal;
- Traffic signal priority request by designated vehicles [C-ITS Day 1 service]: priority request of green traffic light signal for some vehicles such as ambulances, police, etc.;
- Signal violation/Intersection safety [C-ITS Day 1 service]: alert system to the driver of the vehicle who is about to violate the red signal of the traffic light, or alert the same driver when another vehicle is about to violate the red signal of the traffic light;
- On street parking management & information - [C-ITS Day 1.5 service]: management and information system on street parking;

- Traffic Information and Smart Routing - [C-ITS Day 1.5 service]: traffic information and trips suggestions on the base of on street traffic flow conditions.

Figure 26: C-Roads Italy 2 (https://movalia.it)

In order to test such C-ITS services, it is necessary that the infrastructures are equipped with innovative technologies and also that the vehicles are equipped with systems in degree to receive information to supply to the driver, also with strategies of control of the vehicle. The main challenge is represented by the need of technological infrastructure update in order to assess vehicle control strategies and connectivity.

6.10.4 Purpose of the project

The main objective of the C-Roads Italy 2 action is to study and pilot, principally in real urban traffic conditions (Torino, Verona and Trento Municipality are involved), advanced technological systems for the integration of V2I C-ITS services and V2V information on roads. The new C-ITS systems have the potential to play a significant role in helping cities address the problems associated with increasing urbanisation. In C-Roads Italy 2, a number of C-ITS “Day 1” and “Day 1.5” service will be tested, which are expected to have positive impacts on transport, the environment and the economy. The expected positive impacts will be on:

- Transport: based on improved individual mobility and criteria for reducing congestion;
- Environment: based on reducing emissions and on energy efficiency criteria;
- Economy: policy of advanced road transport solutions.

6.10.5 Macro-categories included in the assessment

Regarding the codification of the “new mobility” practice, the macro-categories involved in the C-Roads Italy 2 project are:

(1) Smart-cities, using ICT and/or ITS;

(2) Autonomous driving.

6.10.6 Contribution to innovation and sustainability

C-Roads Platform's contributions to innovation are related to the definition of functional, technical and organizational requirements to ensure interoperability and harmonization of C-ITS services between national pilots across Europe. A common framework

The main contribution to sustainability is **environmental**.

6.10.7 Status and finance

The project is currently completed for **less** than **50%**, it is planned to be completely operating in Turin by the end of 2022.

The project is financed by **public,** the Coordinator (Member State) at the national level is the Ministry of Infrastructure and Transport and the project has been co-financed to 50% from City of Turin and European Union.

6.10.8 Summary of the survey

Macro-categories dealt with: Smart-cities using ICT and/or ITS, Autonomous driving

Status/Progress: <50% completed

Finance: by public

Main contribution to sustainability: Environmental

6.10.9 Respondent's Information

Angela Carboni

Italy

Politecnico di Torino

www.polito.it

6.10.10 References

[1] https://www.c-roads.eu

[2] https://www.ttsitalia.it

[3] https://www.sinelec.it

[4] http://www.comune.torino.it

6.11 EXPRESS BIKE NETWORK (EBN) PROJECT

6.11.1 General information of the area involved in the practice

Country/Region: Canada/Québec

City/Metropolitan area: Montréal

Overview of the area – Name: Ville de Montréal

Area dimension: 432 km^2

Inhabitants: 1 780 000 people

6.11.2 Overview

The Express Bike Network (EBN) project calls for the creation of 184 kilometres of bike paths across the entire island of Montréal. This network, consisting mainly of protected lane, includes 17 paths that will be accessible year-round. Within the next 10 years, cycling is expected to account for 15% of utility trips by bicycle in the metropolis. The EBN will allow residents to get around safely and effectively while enjoying all the benefits of cycling. In addition, to ensuring a harmonious cohabitation between the different users of the road network and connecting various points of interest around the city, the EBN will improve the quality of life of residents by easing traffic and reducing visual, noise and air pollution. The aim is also to offer long-distance cycle lanes with a direct, straightforward connection to enable efficient travel.

6.11.3 Framework and goals

The EBN paths will be one-way and measure 2.3 to 3 meters in width. The new bicycle lanes will be connected with existing bike paths in the local network. They will be bordered by bollards to ensure a physical separation between the different modes of transportation in order to improve bicycle users' comfort and sense of security. Moreover, a concrete structure will be built at intersections where traffic lights will be moved and synchronized. Currently, the completed axes are:

- AXIS 1 – Berri/Lajeunesse/Saint-Denis;
- AXIS 2 – Viger/Saint-Antoine/Saint-Jacques>;
- AXIS 3 – Souligny;
- AXIS 4 – Peel;
- AXIS 5 – De Bellechasse;

Further axes are being planned to expand the network in Montreal.

Figure 27: EBN axes planned to be built by 2022 (red) and projected future axes (black) (https://www.montreal.ca/)

Multiple forms of bike lanes have been developed and built depending on the surroundings. There are three main types of forms: evolutionary, transient and permanent. The evolutionary type of installation is preferred on roads where traffic is already calm, there are no trucks or buses and no civil engineering work is necessary on the street. With regards to this configuration, there are markings on the ground to define the path and bollards to physically separate it from the vehicle traffic lanes. This transient design is used when there is a desire to improve pedestrian and cyclist safety at specific locations without major construction. In correspondence of intersections and bus stops, there are additional features such as concreate walls. EBN permanent lanes are realized as part of major street construction project and mid-height bike lanes are installed between the sidewalk and the roadway.

1.

2.

3.

Figure 28: Evolutionary (1), Transition (2), Permanent (3) lanes (https://www.montreal.ca/)

6.11.4 Purpose of the project

The main Express Bike Network project's goal is to improve the safety of active users as cyclists developing reserved path networks which allow to travel long distances by the most direct route. The EBN offers numerous advantages, not only for cyclists, but also for all Montrealers:

- lower greenhouse gas emissions;
- easing of car traffic;
- reduced noise pollution and visual nuisances;
- safer bicycle transportation;
- improved access to downtown and points of interest;
- improved quality of life for residents.

6.11.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-category involved in the Express Bike Network project is:

(1) **Active users** (eg. pedestrians, cyclists, …).

6.11.6 Contribution to innovation and sustainability

The arrival of the Express Bike Network will create distinct spaces reserved for each mode of transportation. The main advantage of this application is related to the reduction of conflicts between road users. EBN paths will be cleared of snow during winter to improve the safety of the paths.

The main contribution of the measure to sustainability is related to the **social** impact, which benefits all travellers, especially active users thanks to reserved spaces and traffic calming solutions.

6.11.7 Status and finance

The project is **100% completed** and operating. Further network axis to increase the links will be developed.

The project has been **self-financed** by the managing operator.

6.11.8 Summary of the survey

Macro-categories dealt with: Active users

Status/Progress: 100% Completed – Operating

Finance: Self-financed

Main contribution to sustainability: Social

6.11.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.11.10 References

[1] https://montreal.ca

6.12 FAIR TRAVEL - (ENSURING HOV USERS USE HOV ONLY LANES)

6.12.1 General information of the area involved in the practice

Country/Region: USA/Virginia

City/Metropolitan area: Northern Virginia

Overview of the area – Name: Northern Virginia

Area dimension: 11 425 km^2

Inhabitants: 3 200 000 people

6.12.2 Overview

High Occupancy Vehicles (HOV) lanes are typically deployed in urban freeways across USA, allowing to HOV's users to bypass traffic congestion. The Fair Travel project has been implemented in several Northern Virginia's highways to ensure only HOV users use dedicated HOV lanes. This solution is operational on the I-95, I-495, and I-395 highways express lanes in Virginia. Indra's proprietary software developed an innovative ITS system called Vehicle Occupancy Detection (VOD) based on deep learning technology. The VOD system automatically counts the occupants in a vehicle. When a car is detected, a series of images of the vehicle's interior is captured to detect the number of occupants. This software, based on artificial vision techniques and deep learning, uses this technology to count the occupants in front and back seats with a high degree of accuracy.

Figure 29: HOV on Express Lane

6.12.3 Framework and goals

The Express Lanes keep traffic moving through multiple and integrated tolls. In Figure 30 examples of technologies implemented on Express and General-purpose Lanes are reported:

(1) *On-road technology*: Roadside technology reveals density of roadway to calculate proper toll;

(2) *Toll prices/traffic management*: toll prices displayed on variable message signs. Dynamic tolls manage demand to keep Express Lanes moving;

(3) *Flex transponder*: E-ZPass Flex allows cars with more than 3 people to travel toll-free in "HOV mode". If less than three people are in car, the Flex transponder should be set to toll mode.

(4) *HOV enforcement*: Virginia State Police use beacons on gantries to see which vehicles are in "HOV mode" and then issue tickets to vehicles, which do not meet the requirement of 3 people minimum.

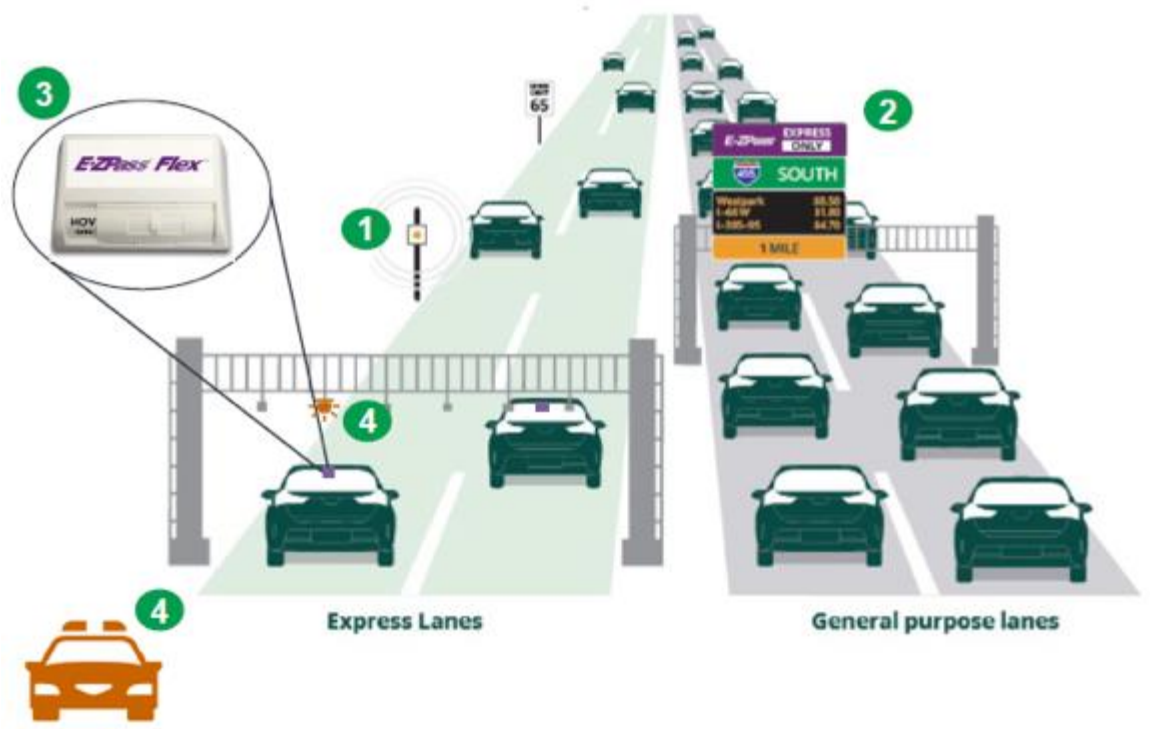


Figure 30: Tools to keep traffic moving

A solution for measuring Vehicle Occupancy on Express Lanes is needed. Indra's Vehicle Occupancy Detection (VOD) System meets the need. The process of training the intelligent algorithms based on deep learning to detect the occupants both in front and back seats has been the main Indra's challenge. The system has been assessed to bring a real benefit to the highway operator with enough accuracy and reliability of measures. Moreover, this training was an additional challenge due to COVID-19 pandemic since road users sharing a vehicle wore protective masks. Then, Indra trained the algorithms to detect occupants wearing these masks. Another challenge that has also been addressed while implementing the scheme has been to include robust privacy, security processes and protocols to ensure that all information collected by the system is aligned with General Data Protection Regulation (GDPR).

6.12.4 Purpose of the project

The Fair Travel Program's goal is to increase compliance of HOV. The main task to address is "HOV cheating", which inflates the toll prices and reduces the operator's ability to manage the traffic using congestion pricing. Many techniques have been implemented to encourage the proper use of HOV lane in relation to Virginia State Police (VPS) engagement and communication campaigns.

Virginia State Police:

- Repeat misuse beacons: beacon that indicates confirmed Flex misuser, shows about 80% increase in compliance after citation;
- Mobile beacon: beacons deployed that can move to easy-to-enforce sites for increased coverage;

- Increased VPS presence: increased fleet, however less than 2 in 1000 cheaters issued citation.

Communication:

- Media campaigns: social and earned media efforts to educate public on Flex rules;
- Direct notification: education letters sent to confirmed HOV cheaters, shows about 1% increase in compliance after letter;
- Enforcement messaging on DMS to discourage HOV cheating, reveals 3% decrease in HOV cheating.

6.12.5 Macro-categories included in the assessment

Concerning the codification of the "new mobility" practice, the macro-category involved in the Fair Travel program are:

(1) Innovative contracts and sharing systems;

(2) MaaS platforms;

(3) Smart-cities, using ICT and/or ITS.

6.12.6 Contribution to innovation and sustainability

The main contribution to innovation is related to the artificial intelligence developed for this program. The innovative ITS system is capable of minimizing problems in the capture process such as glare, reflections, different light levels, weather or lack of visibility in vehicles with tinted windows.

The main contribution of the measure to sustainability is related to the **environmental** impact. Maximizing the vehicle occupancy and raising awareness of road users, it is possible to reduce traffic congestion and the number of cars travelling on highways with a lowering of greenhouse gasses emissions.

6.12.7 Status and finance

The project has been completely **self-financed** by the managing operator and it is **100% operating**. Currently, the program is still in its early phase and will expand as more VOD installation points come on board.

6.12.8 Summary of the survey

Macro-categories dealt with: Innovative contracts and sharing systems, MaaS platforms, Smart-cities using ICT and/or ITS.

Status/Progress: 100% completed. Operating

Finance: Self-financed

Main contribution to sustainability: Environmental

6.12.9 Respondent's Information

Rodrigo Castiñeira

Indra, Spain/Madrid

www.indracompany.com

6.12.10 References

[1] Eric Coraggio, Transurban's Fair Travel Program, 2020

6.13 FUTURE TRANSPORT ZONE

6.13.1 General information of the area involved in the practice

Country/Region: West Midlands (United Kingdom)

City/Metropolitan area: West Midlands

Overview of the area – Name: West Midlands

Area dimension: 902 km^2

Inhabitants: 2.9 million of people

6.13.2 Overview

The Future Transport Zone is based on a strategy of testing innovative interventions in the West of England and incorporating the best solutions into the region's larger transportation plans. New technology, systems, services and data management approaches are trailed in a controlled manner based on a data-led approach to understanding travel behaviors and needs. Users' feedback on the service and information on how they would travel have been gathered through detailed surveys. The use of new technologies/systems/services combined with improved data capacity is implemented to promote sustainable travel choices. Promoting a clean and green recovery this activity is underpinned by a developing data capability and deployment of the mobility as a service (MaaS) model. The MaaS platform offer new mobility services integrated such as lift-sharing, car club, rapid transit, powered personal mobility (e-scooters) enabled by smart payments (including app) with incentives. The smart payment platform has been strengthened and a new level of 5G-enabled sensors have been developed.

Figure 31: E-scooter - mobility service provided in FTZ project (https://www.westofengland-ca.gov.uk/)

6.13.3 Framework and goals

The main challenge to address is the way users collectively choose to travel and move goods in an unsustainable way. The principal characteristics and features of the Future Transport Zone are:

- Public e-scooters: allow people to easily complete those first or last kilometres of the move, extending the catchment area of public transport and putting metrobus and MetroWest services at the reach of more people. The current e-scooter rental network in the West of

England is one of the most widely used in Europe and the government-supported trial has been extended until March 2022;

- Mobility Hub: will bring together established forms of transport with new forms, such as e-scooters, e-cargo bikes, and demand responsive bus services. The intention is to make it easier for people to switch between modes of transportation by bringing different transportation services conveniently together at these one-stop trial Mobility Hub sites. In this case the aim is to improve connectivity and make multi-modal journeys easier while also provide an opportunity to improve public spaces in a way that meets local community and business needs;
- Dynamic Demand Responsive Transport: puts passengers in control of when and where they travel, through small capacity but highly flexible bus services to help people access jobs, leisure and education. The trial services will be run in areas where people currently have difficulty getting around.
- Next generation app: travellers will be able to plan, pay for, and complete end-to-end journeys using a new mobile app that integrates route planning features with payment and ticketing. This one-stop-shop will include all types of transport, significantly increasing the convenience of multi-mode journeys.

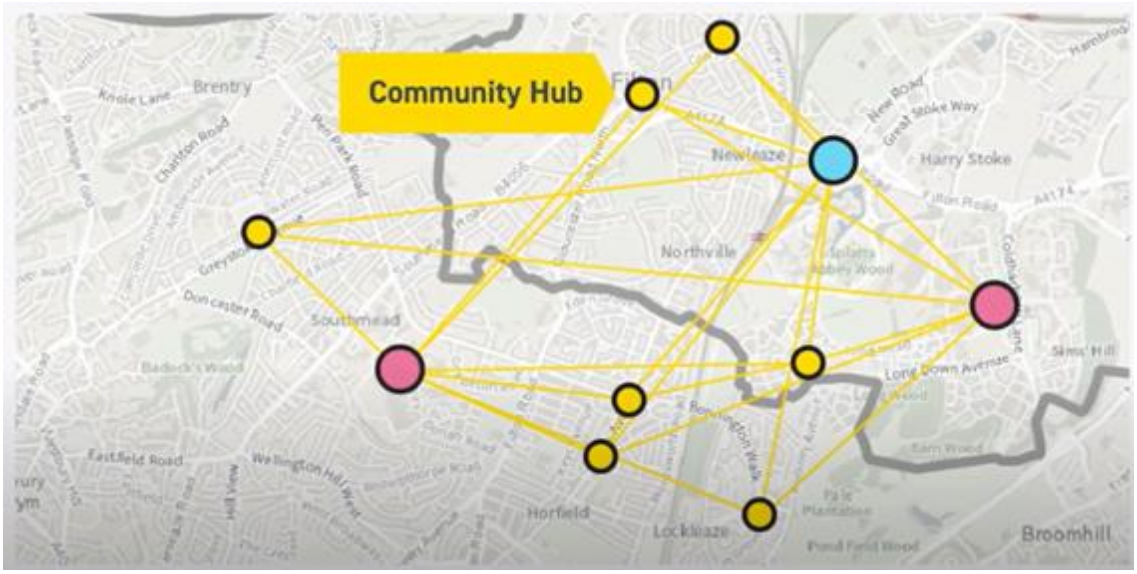
9. 

Figure 32: Example of corridor Hub (blue), campus hub (pink), local hubs (yellow) in South Gloucestershire and the north of Bristol (https://www.westofengland-ca.gov.uk/)

6.13.4 Purpose of the project

The aim of the Future Transport Zone is to develop new transport services to encourage modal shift and decarbonisation of transport. The objective is to empower people to make more sustainable travel decisions, aiming to revolutionize urban transport while keeping the focus on how to connect people in a sustainable and safe way. The strategy used in the project development is intentionally iterative. Based on population analysis, new technologies and systems are tested in a controlled way. Impacts are assessed considering environmental, economic and social variables and the subsequent activities are based on the resulting equilibrium of these factors.

6.13.5 Macro-categories included in the assessment

The macro-categories involved in the Future Transport Zone project are:

(1) MaaS platform;

(2) Smart-cities, using ICT and/or ITS;

(3) Innovative contracts and sharing systems.

6.13.6 Contribution to innovation and sustainability

The main contribution to innovation is represented by the implementation of a MaaS – app based platform which allow to access multiple travel choices. The main contribution to sustainability is related to the **environmental** impacts.

6.13.7 Status and finance

The project is in the **design** phase. The project started in July 2020 and the beta phase of the project will end by 2022. The full release is planned by 2023. The project is financed by **public** funds**,** in particular 24.4£ million have been destined by the Department of Transport to deliver this program of investment in the region and the Combined Authority will also invest a further £3.65 million.

6.13.8 Summary of the survey

Macro-categories dealt with: MaaS platform, Smart-cities using ICT and/or ITS, Innovative contracts and sharing systems

Status/Progress: Designed

Finance: By public

Main contribution to sustainability: Environmental

6.13.9 Respondent's Information

Ian Patey

United Kingdom

WSP

https://www.wsp.com/en-GB

6.13.10 References

[1] https://www.westofengland-ca.gov.uk

6.14 LINK MULTIPLE PAYMENT METHODS IN VARIOUS TRAVEL SCENARIOS

6.14.1 General information of the area involved in the practice

Country/Region: JiangSu Province, China

City/Metropolitan area: Suzhou

Overview of the area – Name: Suzhou

Area dimension: 8657 km^2

Inhabitants: 12 748 300 people

6.14.2 Overview

The mobility application provided in the city of Suzhou represents an integrated solution for transport intermodality and payment platform that encourage users to travel by means of different and sustainable transit modes. The key-elements and main aspects of the deployment are related to:

- Forming a closed loop and realizing the transition of MaaS platform from travel tool to business ecological platform;
- Provide multimode travel online services and also car sharing or bike sharing features;
- Collaboration and coordination between multiple service partners are involved in the project from five dimensions:

10. Customers (C): Provide digital inclusive travel benefits through App;
11. Operators (O): Provide online service channels to reduce costs and increase efficiency;
12. Business (B): Connection between transportation and consumer industry;
13. Finance (F): Combined with digital banking business, provide travel digital accounts;
14. Government (G): Promote the integration of transportation sector and other industries;

- Provide remote travel reservation services for the elderly and the disabled people.

(1) (2) (3)

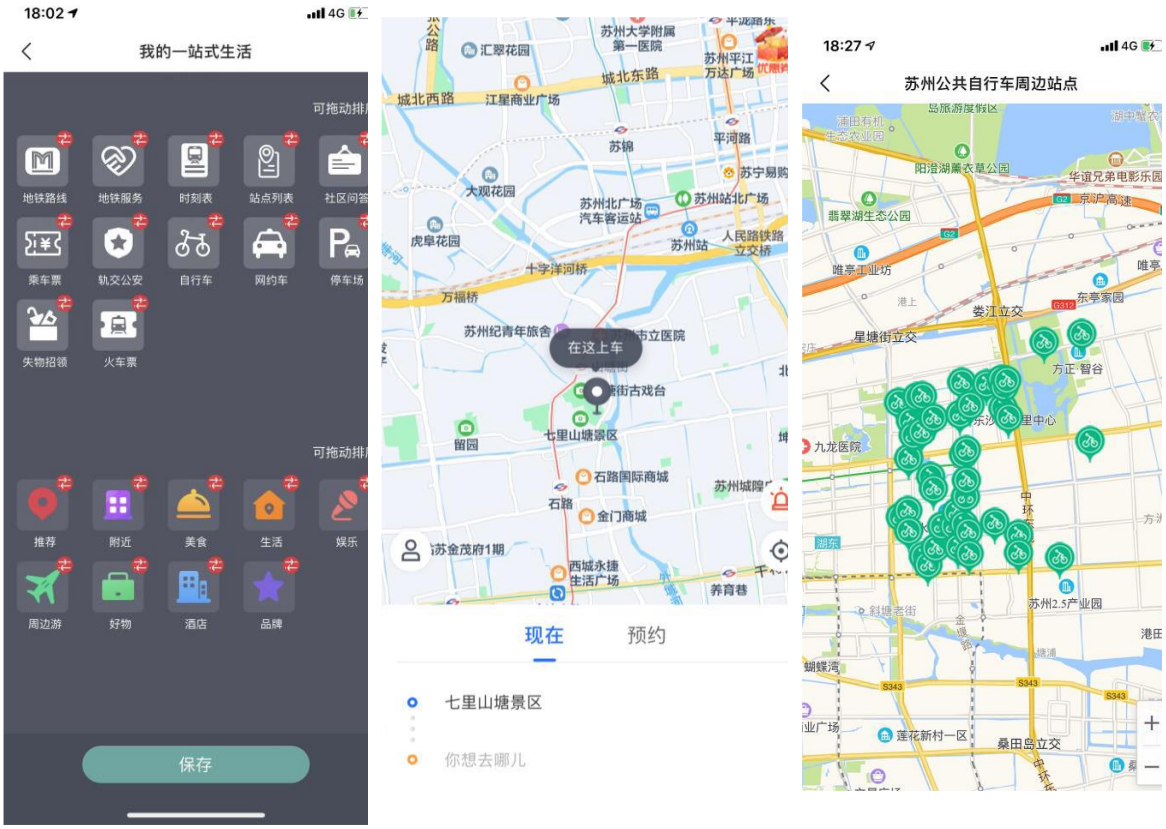


Figure 33: Multimode Travel Online Service (1) ; Car-Hailing Services and Reservation Order Supported (2) ; Bike-Sharing services (3)

6.14.3 Framework and goals

Suzhou is a city with a more than 4,000-year history. With the process of urbanization, Suzhou has become a multicultural and modern city. Considering the urban area, it often has a large number of commuters and on the other hand, as a city with rich tourism resources, it also has a large number of tourists on holidays. This is the reason way travelers in Suzhou have diverse travel demands. However, it brings some challenges and opportunities:

- Transport resources are limited during peak hours, but convenient and attractive services need to be provided at any time;
- Lack of travel info sharing and publishing channels, such as parking space info and so on;
- Limited access to preferential travel benefits;
- Limited incentives for people to participate in low-carbon travel, this represents an opportunity to provide cumulative carbon emission reduction accounts for travelers, encourage low-carbon travel (Figure 34).

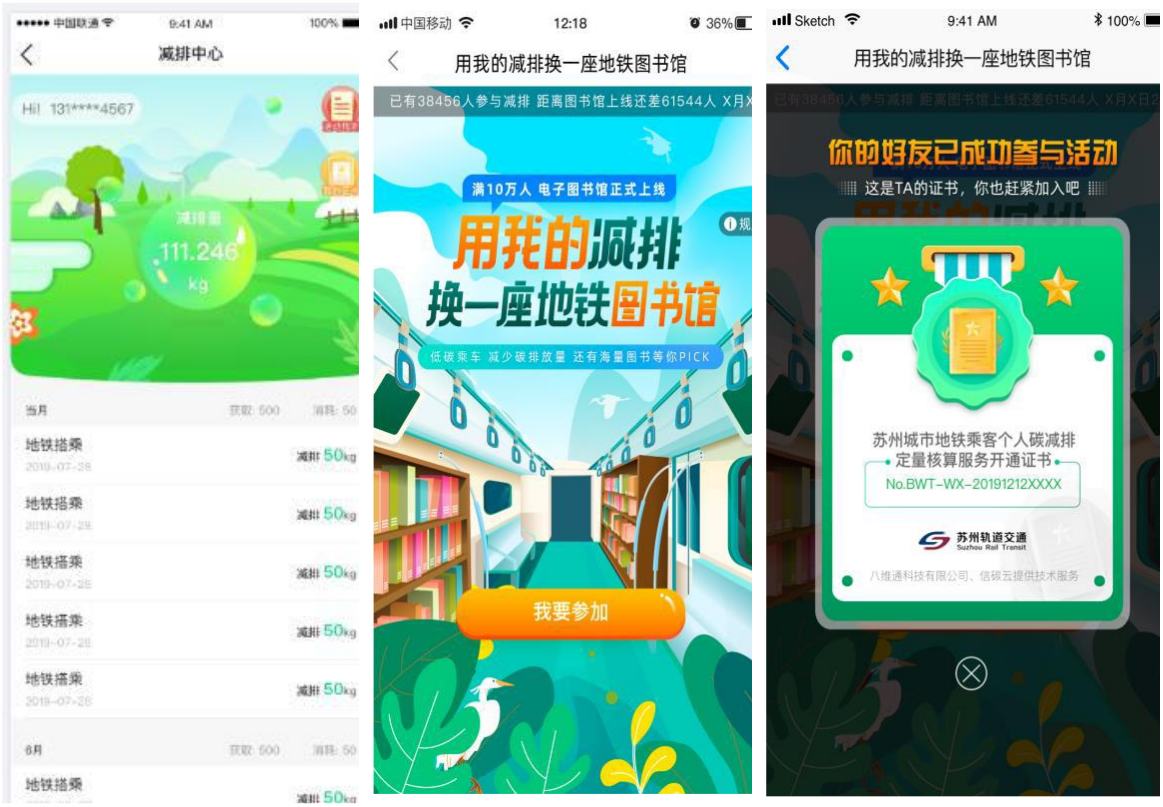


Figure 34: Carbon emission rewards for low-carbon travel

6.14.4 Purpose of the project

The main objectives MaaS platform developed for the city of Suzhou are:

(1) Enhance the connectivity of digital services in multi travel mode scenarios to simplify access to transport;

(2) Link multiple payment methods (e.g. DCEP) in a unique platform;

(3) Convert low-carbon travel mileage into carbon emission reduction and record it in personal account.

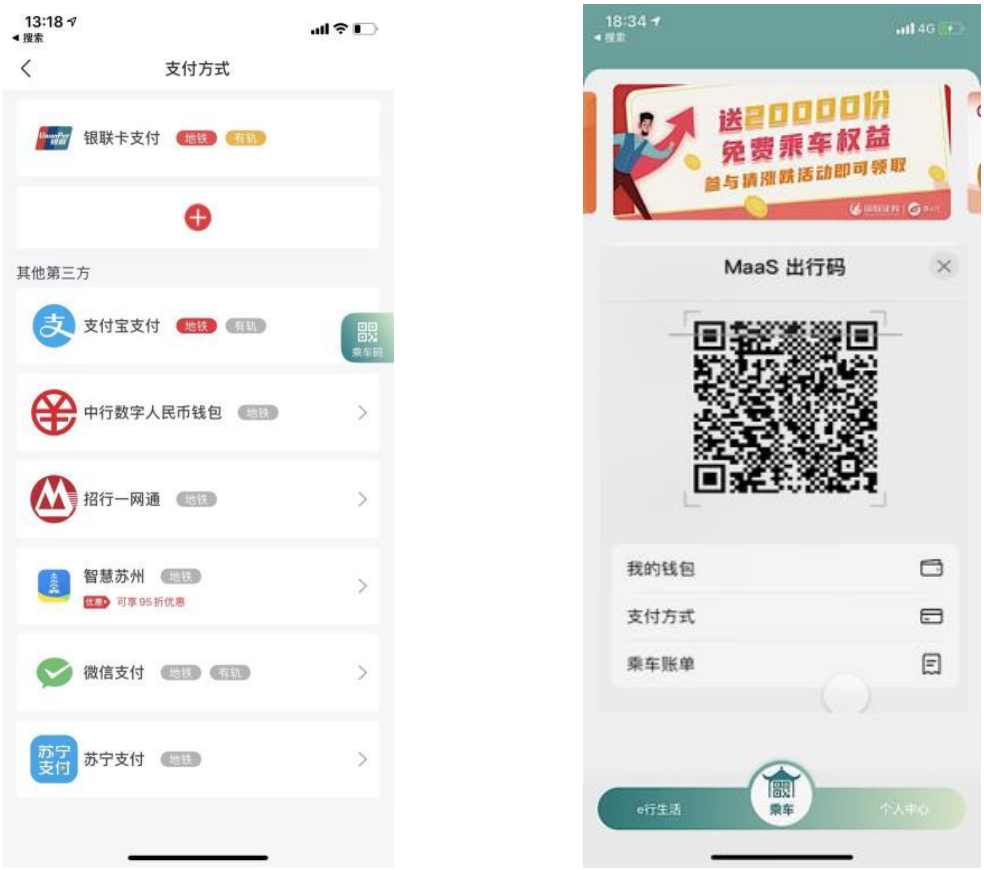


Figure 35: QRcode reading and multiple payments in App

6.14.5 Macro-categories included in the assessment

The mobility project involves the following macro-categories:

(1) MaaS platforms;

(2) **Active users** (eg. pedestrians, cyclists);

(3) Persons with disabilities.

6.14.6 Contribution to innovation and sustainability

The contribution to innovation is strictly connected with intermodality solutions provided through the application and integrated payments system that gather different payment method into a unique platform. Before: for the travelers driving from peri-urban areas to the city, it was not easy to know where to park around the metro station and for those who chose multiple travel modes need to hold many tickets for each mode.

After: more than 10 million users registered to use “Su-E-Go” App to experience one-stop digital travel services.

The main contribution to sustainability is **social** with special reference to people with disabilities.

6.14.7 Status and finance

The project is **100% completed** and it has been financed by **private**.

6.14.8 Summary of the survey

Macro-categories dealt with: MaaS platform, Active users, Persons with disabilities

Status/Progress: 100% completed. Operating

Finance: by private

Main contribution to sustainability: Social

6.14.9 Respondent’s Information

Hongxu Yang

China

Bwton Technology Co., Ltd

6.14.10 References

[1] https://www.suzhou.gov.cn

6.15 NAVAJO AUTONOMOUS SHUTTLE

6.15.1 General information of the area involved in the practice

Country/Region: Belgium

City/Metropolitan area: Louvain La Neuve

Overview of the area – Name: -

Area dimension: 9,2 km^2

Inhabitants: 10 710 people

6.15.2 Overview

The Navajo project consists in testing an autonomous shuttle in a complex environment and a dynamic transport in Louvein-La Neuve in the south of Belgium. The shuttles operate in mixed traffic conditions, sharing the road with other users (vehicles, cyclists, pedestrians, etc.). This challenging experiment was conducted in three evolving phases, testing the levels of acceptance of passengers and other road users. The project involves collaboration with public and private partners. The principal partners are: City of Louvain-la-Neuve, TEC (public transport in Wallonia), Region Brabant Wallon, Université Catholique de Louvain, Intercommunale du Brabant wallon and China Belgium Technology Center (CBTC).

Figure 36: Autonomous shuttle in mixed traffic (https://easymile.com)

6.15.3 Framework and goals

The city of Louvain-La-Neuve took advantage of the “Intelligent Territory” call for projects launched by Digital Wallonia in 2019 to finance two pilot initiatives for urban mobility under the name of “NAVAJO project”. One of them was the NAVAJO Autonomous Shuttle initiative. Over 6 months, riders were able to use a completely innovative soft and autonomous mobility service, connecting the Louvain-La-Neuve train station to the Einstein business campus (LLN Science Park).

The tested vehicle is a 4-level autonomous vehicle which operates along a define path. The travel path of the vehicle is defined along a fixed trajectory with a scheduled timetable.

The service is free of charge for users and the low speed (about 12km/h) was the only limiting parameter for an effective usage.

6.15.4 Purpose of the project

The implementation of this project in Louvain-la-Neuve enables Wallonia to test these promising technologies under particularly complex operating conditions. This is an important step for the development of tomorrow's mobility.

6.15.5 Macro-categories included in the assessment

Considering the codification of the "new mobility" practice, the macro-category involved in the Navajo Autonomous Shuttle project is:

(1) Autonomous driving.

6.15.6 Contribution to innovation and sustainability

The main contribution to innovation is represented by testing autonomous electric shuttles evaluating the user level of acceptance and the integration of the system into the real-life environment.

6.15.7 Status and finance

The project is **100% completed** and it has been financed by **public** funds for **more** than **50%**.

6.15.8 Summary of the survey

Macro-categories dealt with: Autonomous driving

Status/Progress: 100% completed. Operating

Finance: By public (>50%)

Main contribution to sustainability: -

6.15.9 Respondent's Information

Ertan DZHAMBAZ

Belgium

Belgian Road Research Center

https://brrc.be/en

6.15.10 References

[1] https://easymile.com

6.16 ONE-STOP MOBILITY SERVICE PLATFORM

6.16.1 General information of the area involved in the practice

Country/Region: China

City/Metropolitan area: Guangdong-Hong Kong-Macao Greater Bay Area

Overview of the area – Name: Guangdong-Hong Kong-Macao Greater Bay Area

Area dimension: 560 000 km^2

Inhabitants: 70 000 000 people

6.16.2 Overview

Yangchengtong's one-stop travel planning service is based on a MaaS approach. The application Yangchengtong APP provides multiple point-to-point travel services for bus and subway travel, in addition to shared bicycles and other useful services. The project aims to build a passenger-centric mobility app with a chain of one-stop travel services for transport solutions. It integrates different transportation and service methods to provide passengers with one-stop mobility services. The features provide one-ticket connecting service and customized public transportation information service related to the user needs. The system also includes a single payment system rightacross the Greater Bay Area, including buess and subway.

Figure 37: One interface for one city

6.16.3 Framework and goals

At present, urban agglomerations are developing rapidly in China, and the scale of intercity travel and cross-border travel in the Greater Bay Area has increased significantly. The demand for convenient travel services is urgent, and it is necessary to build a new and modern mobility service system across cities and transportation modes. The main challenges that need to be addressed are:

- Enlarge data sharing of passenger transport services in the Greater Bay Area, which is poor at the moment;
- Establish an efficient coordination mechanism of intermodal transport passenger service;

- Face the differences of standards and specifications in ticketing system for connecting passengers in the Greater Bay area;
- Strengthen the foundation of ticketing integration;
- Address the integration of passenger cards in the Greater Bay area that is severely blocked.

6.16.4 Purpose of the project

The objective of the project is to establish a new and innovative mobility service system that integrate transportation modes between the cities involved in the project.

(1) Establish a transaction system based on bus codes and electronic tickets to actualize the virtualization of transportation systems such as bus, subway, shared bicycles, and car rental services;

(2) Realize the integration and interaction of the public travel network and the consumer network;

(3) Realize point mutual recognition across the account system, offer passenger travel mileage awards, and exchange mileage points for public transportation services.

6.16.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-categories involved in the project are:

(1) MaaS platforms;

(2) Smart-cities, using ICT and/or ITS;

(3) Innovative contracts and sharing system.

6.16.6 Contribution to innovation and sustainability

The innovation of the transport sector brings up new solutions for a intelligent transport system in the Grater Bay area. In particular the main aspects are:

- Combine bus and subway transit codes into one;
- Integrate ticketing platform for urban transport, intercity roads and intercity rails;
- Provide responsive bus service.

The main contribution to sustainability is **social**.

6.16.7 Status and finance

The project is **more** than **50% completed**. The system is planned to be complete operating by 2025.

The project is **self-financed** by the managing operator.

6.16.8 Summary of the survey

Macro-categories dealt with: MaaS platform, Smart-cities using ICT and/or ITS, Innovative contracts and sharing systems

Status/Progress: >50% completed

Finance: Self-financed

Main contribution to sustainability: Social

6.16.9 Respondent's Information

Longtao Zhou

China

Guangzhou Yangchengtong Co., Ltd

6.16.10 References

[1] https://m.mp.oeeee.com

6.17 OPUS CARD

6.17.1 General information of the area involved in the practice

Country/Region: Canada/Québec

City/Metropolitan area: Montréal metropolitan community

Overview of the area – Name: Montréal metropolitan community

Area dimension: 4 259 km^2

Inhabitants: 4 099 000 people

6.17.2 Overview

The OPUS card is a smart card on which you can charge all public transport fares in the Greater Montréal area. The card is provided by "Autorité Régionale de Transport Métropolitain" (ARTM), in collaboration with the regional transit agencies. The Opus card is rechargeable and it is possible to encode up to four different types of transit fares, whether they are RTL, exo, STL or STM passes or metropolitan tickets.

It can contain several tickets at the same time, according to your needs. In particular, you can load the card with single-fare tickets, multiple ticket packages or monthly passes for the bus, metro or train.

This practical and flexible method of payment offers many advantages to public transit users in the metropolitan area.

6.17.3 Framework and goals

The Opus cards are used by most transit authorities in the Greater Montréal area and in the Québec City area. Buying an Opus card with or without photo ID, the inclusion of tickets or passes is not automatic. It has to be loaded with tickets. Tickets and passes can be added to the card by means of multiple systems:

- at a point of sale;
- a metropolitan ticket office;
- an automatic ticket machine located on the first level of a bus terminal, metro station or train station.

Both receipts (purchase and transaction) should be kept as proof of purchase.

In addition, OPUS en ligne allows you to load your OPUS card with transit fares using a card reader plugged into your computer. Once the OPUS card is reloaded, it is ready for use in transit system.

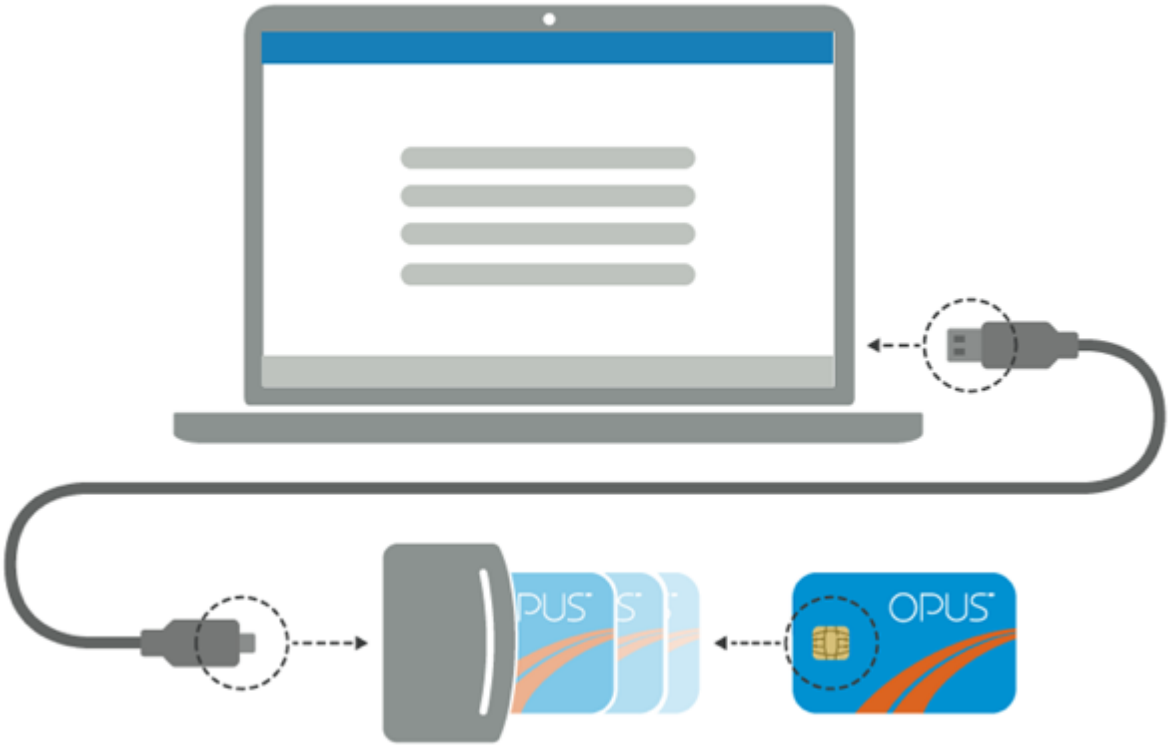


Figure 38 : Plugging in card reader (https://opusenligne.ca/)

When loading the card, the user has to check the available ticket types and choose the right one to add to their Opus card. Once the card has been loaded with the tickets or pass, the user simply needs to hold it above the card reader to validate it when entering a bus or metro station.

6.17.4 Purpose of the project

The objective of the project is to simplify the purchase and payment of transit tickets creating a unique card that can be used for multiple transport alternatives.

6.17.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-category involved in the OPUS card project is:

(1) MaaS platforms.

6.17.6 Contribution to innovation and sustainability

The service guarantees the direct access through OPUS card to the multiple public transportation system offered in the urban areas. The main contribution to innovation is represented by the simple access to multiple transport solution for pricing and promotions that meet the user's needs.

Regardless of the pricing in effect and where you travel in Greater Montréal, you can use the same Opus card to buy your bus, metro or train tickets, whether they are single tickets, monthly passes, booklets or other transit fares.

The main contribution of the measure to sustainability is related to the **economic** impact in terms of rates and benefits for OPUS card holders.

6.17.7 Status and finance

The project is **100% completed** and operating. The project was launched in 2008.

The project has been **self-financed** by the managing operator.

6.17.8 Summary of the survey

Macro-categories dealt with: MaaS platforms

Status/Progress: 100% Completed – Operating

Finance: Self-financed

Main contribution to sustainability: Economic

6.17.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.17.10 References

https://stlaval.ca/tickets/opus-card

https://www.stm.info/en

https://opusenligne.ca/

6.18 PEDESTRIAN LIGHTS WITH SOUND SIGNALS

6.18.1 General information of the area involved in the practice

Country/Region: Canada/Québec

City/Metropolitan area: Québec

6.18.2 Overview

This exploratory study aimed to evaluate three types of pedestrian light configurations with sound signals existing on the territory of the city of Québec, namely:

1) pedestrian lights with exclusive phases with non-directional sound signals;

2) pedestrian lights in exclusive phases with directional sound signals;

3) pedestrian lights in concurrent phases (parallel pedestrian and vehicle traffic) with directional sound signals.

A survey was first completed by 32 people with a visual impairment. Using scenarios, the main objective of this survey was to document the preferences and expectations of people with a visual impairment in terms of pedestrian light configurations with audible signals, as well as to document their sense of safety in connection with the three existing configurations.

6.18.3 Framework and goals

The City of Québec and several other small/medium-sized municipalities in Québec adopted a traffic management system many years ago with phased pedestrian lights. During this exclusive pedestrian phase, the traffic is completely stopped and only pedestrian can move. A non-directional audible signal has been installed at several of these intersections in Québec City (116 currently). Compared to the directional signal, the non-directional audible signal is emitted from a single source at one corner of the intersection and announces the phases of engagement (continuous signal) and release (intermittent signal).

In conjunction with ROP03, these organizations have set out three objectives specific to their questions:

1) Know the level of safety of the non-directional audible signal;

2) Assess the safety of its users and under what conditions;

3) Obtain recommendations for improvements.

Participants with various profiles were sought, in particular in terms of visual difficulties and technical assistance(s) used, the level of autonomy during familiar and unfamiliar journeys, as well as experience in the use of sound signals. The experimental study has been divided in three phases:

- Survey;
- Interview;
- Experiments in real-scale.

6.18.4 Purpose of the project

The main objective of this survey was to document the preferences and expectations of people with a visual impairment in terms of pedestrian light configurations with audible signals, as well as to

document their sense of safety in connection with the three existing configurations. The study aims more specifically to:

1) Document people with visual impairments' preferences and expectations for pedestrian light configurations with audible signals;
2) Document people with visual impairments' feelings of safety and comfort in relation to different pedestrian light configurations with audible signals
3) Assess the level of safety of the three types of pedestrian signal configurations that can be found in the territory of Québec City.

Overall, the results indicate that:

- Adding audible signals to pedestrian lights increases people's sense of safety visually impaired.
- More audible signals are desired by participants.
- Participants' views on the uniformity of pedestrian lights with audible signals are fairly shared.
- Unique phased pedestrian light configuration with directional audible signal is perceived as the safest for people with a visual impairment.

6.18.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-categories involved in the pedestrian light project are:

(1) Persons with disabilities;

(2) **Active users** (eg. pedestrians, cyclists).

6.18.6 Contribution to innovation and sustainability

The innovative aspect of the project lies in the greater understanding of needs for visually impaired people at intersection with pedestrian lights. This assessment establishes the pertinence of a pedestrian facility based on the needs of the requesting person with a visual disability, the design of the intersection and the possible alternative routes. The **social** impact of this survey leads to obvious benefits in terms of a sense of security and functionality for visually impaired people at traffic lights intersections.

6.18.7 Status and finance

The project is **100% completed** and operating.

The project has been **financed by public**.

6.18.8 Summary of the survey

Macro-categories dealt with: Persons with disabilities, Active users.

Status/Progress: 100% Completed – Operating

Finance: by public

Main contribution to sustainability: Social

6.18.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.18.10 References

[1] Centre interdisciplinaire de recherche en réadaptation et intégration sociale (CIRRIS), Évaluation de trois configurations de feux pour piétons avec signaux sonores sur le territoire de la ville de Québec: une étude exploratoire, Bibliothèque et Archives nationales du Québec, 2020.

[2] https://montreal.ca

6.19 PREFERENCES OF PT AND FIREFIGHTERS USING C-ITS

6.19.1 General information of the area involved in the practice

Country/Region: South-Moravian region (Czech Republic)

City/Metropolitan area: Brno

Overview of the area – Name: Brno

Area dimension: 230 km^2

Inhabitants: 382 000 people

6.19.2 Overview

C-ROADS is a pan-European pilot project. C-ROADS CZ is responsible for implementing the new C-ITS technology in real operation on the road network and defined paths of the Czech Republic. Czech Republic has, in accordance to the project proposal, defined implementation and pilot testing of hybrid C-ITS services in six phases (further reported as DT – Deployment & Tests) split based on their geographical location and responsible implementation bodies. The deployment in Brno city (DT2) involves first class radial roads connecting the city centre and outer ring of Brno, as well as the southern part of the Brno inner ring road (Figure 39). This deployment stage was closely coordinated with DT1 (in Brno agglomeration) in order to supplement highway RSUs with RSUs on the major city roads and to provide early notification about highway situation.

Figure 39: C-Roads deployment in Brno (https://www.bkom.cz/)

6.19.3 Framework and goals

The deployment is operating since August 2019 developing C-ITS services via G5 and cellular technologies. Currently, there are 31 roadside units (RSUs) deployed at the RSD's infrastructure and located at traffic light intersections and public lights masts. In addition, 11 on-board units (OBUs) are also installed in administrator vehicles and fire rescue response vehicle. System was evaluated by C-Roads Czech Republic project partners in national test day and undergone assessment by ČVUT

(Czech technical university in Prague). Therefore, the deployment has been verified and tested by national and international cross-tests. The OBU equipped cars are in regular service in the city and acquire data useful for the traffic analysis. In the city of Brno, it is present a C-ITS back office that manage the system. Many transport solutions, infrastructure and active employee have been involved in the deployment:

- more than 150 public transport vehicles (tram and BUS);
- more than 42 intersections with TL;
- more than 10 firefighters.

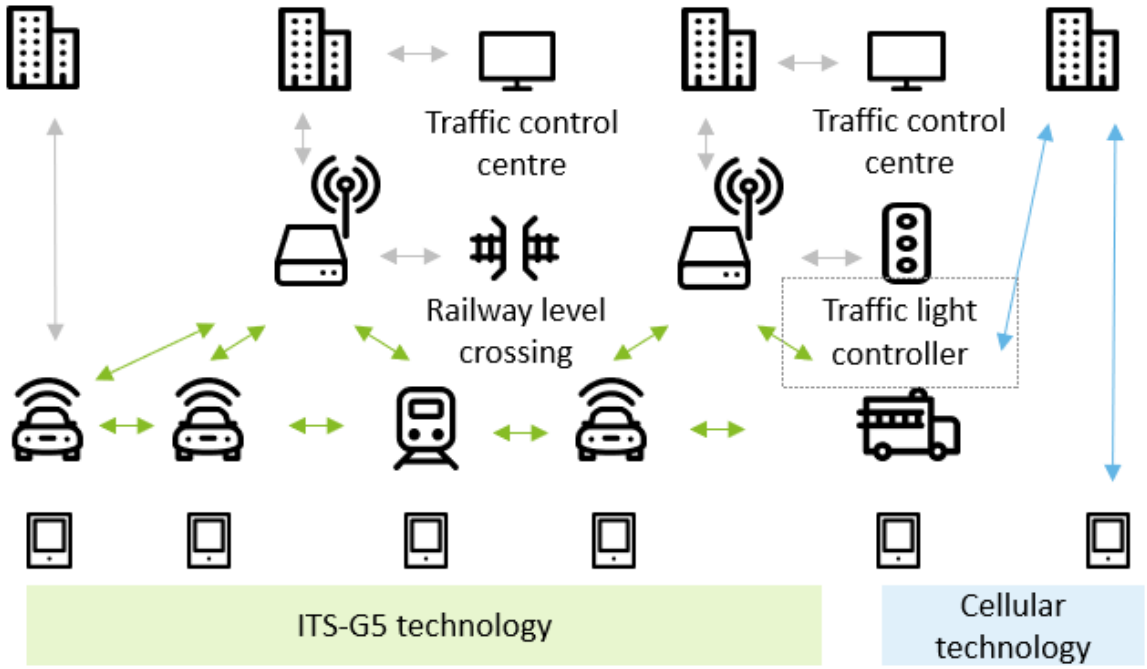


Figure 40: C-ITS integrated system via G5 and Cellular technologies

In Czech Republic, C-ITS systems will provide drivers with information on the current state of road traffic, contributing to driver traffic forecasting and make a to road traffic flow and accident reduction. The timely receipt of accurate information is absolutely essential for the driver to perceive the road traffic situation and to concentrate on a possible problem such as the presence of a worksite on the road.

Figure 41: C-ITS traffic information for road users (https://www.mdcr.cz)

6.19.4 Purpose of the project

Thanks to the implementation of the latest technology based on the principle of direct communication V2V or V2I, it is possible to increase road safety, health and personal protection, reducing accidents and increasing traffic flow. In addition, the project aims to harmonize the implementation of C-ITS systems in European member states creating a unique framework. The C-Roads project implement is Brno city is focused on providing rapid preference way of transit for public transport and firefighters using C-ITS systems

6.19.5 Macro-categories included in the assessment

The C-Roads project in Brno city involves the following macro-categories:

(1) Smart-cities, using ICT and/or ITS;

(2) Autonomous driving.

6.19.6 Contribution to innovation and sustainability

The deployment is focus on reducing the traffic road impact for public transport solutions and firefighters. This contribution to innovation can be realized implementing real-time C-ITS approach and controlling traffic lights phases.

The main contribution to sustainability is **environmental**.

6.19.7 Status and finance

The project is **less** than **50% completed** and an expansion of the project is planned.

The project is co-financed by the Connecting Europe Facility (CEF Transport). It is financed by the **public** for **more** than **50%**.

6.19.8 Summary of the survey

Macro-categories dealt with: Smart-cities using ICT and/or ITS, Autonomous driving

Status/Progress: <50% completed

Finance: >50% by public

Main contribution to sustainability: Environmental

6.19.9 Respondent's Information

Tomas Tichy

Czech Republic

CTU in Prague Faculty of Transport Science (FTS)

https://www.fd.cvut.cz

6.19.10 References

[1] https://www.bkom.cz

[2] https://c-roads.cz

6.20 REDUCTION OF THE UNCONTROLLED PARKING (COMFORT OF PEDESTRIANS)

6.20.1 General information of the area involved in the practice

Country/Region: Belgium

City/Metropolitan area: Liege

Overview of the area – Name: Liege

Area dimension: 69.39 km^2

Inhabitants: 200 000 people

6.20.2 Overview

The City of Liege is developing a parking area suitable for e-scooters on its municipality. These zones are recognizable thanks to e-scooter drawing on the ground between 2 bicycle racks, either in the extension of a bicycle parking zone. The e-scooter parks have been installed in the most frequented places of the city: Place de la Cathédrale, Place Xavier Neujean, Liège-Saint-Lambert, rue Grétry-Longdoz, Place de l'Yser and rue du Parc. In these places, the parking of the e-scooters will be mandatory in the demarcated areas. Thus, they will no longer represent an obstacle for the users who daily transit on sidewalks. This solution could influence the e-scooter usage due to the fact that e-scooter are used freely.

Figure 42: Signs on the ground for e-scooter drawnings (https://www.liege.be)

6.20.3 Framework and goals

In Belgium, the number of e-scooters and e-scooter vendors increased highly in last years. The main issue was parking, which was completely free and uncontrolled. Abandoned everywhere on the sidewalks, the e-scooters obstruct the circulation of pedestrians and they pose serious problems of safety for people with disabilities, such as visually impaired people. With defined parking zones, the city of Liege aims to reduce the uncontrolled parking and enhance the circulation of pedestrian on sidewalks. On the other hand, the realization of define e-scooter parking areas can be contradictory to the fact of free usage of scooters (everywhere and every time). Defined parking zones, even if

distributed regularly in the municipality, could reduce the usage. The main challenges to address are:

- acceptance of users
- necessity to control
- negotiations with vendors

6.20.4 Purpose of the project

The purpose of the project is to realize specific parking areas dedicated to e-scooter to reduce uncontrolled parking improving the comfort of pedestrians especially in the most frequented areas. Side effects of the project could be related to the possible decrease in the e-scooter usage but long term effects should be analysed.

6.20.5 Macro-categories included in the assessment

The macro-categories involved in the e-scooter parking project are:

(1) Innovative contracts and sharing systems;

(2) **Active users** (e.g. pedestrian, cyclists…).

6.20.6 Contribution to innovation and sustainability

The main contribution to innovation is represented by the realization of defined areas destined to e-scooters in order to avoid uncontrolled parking which is a serious road safety issue. The main contribution to sustainability is related to the **social** effects of the initiative. It is notable that the comfort of pedestrian and active users in general is improved through this implementation.

6.20.7 Status and finance

The project is **100% completed** and operating in multiple areas of Liege city.

The implementation has been financed by **public** for **more** than **50%**.

6.20.8 Summary of the survey

Macro-categories dealt with: Innovative contracts and sharing systems, Active users

Status/Progress: 100% completed. Operating

Finance: By public (>50%)

Main contribution to sustainability: Social

6.20.9 Respondent's Information

Ertan DZHAMBAZ

Belgium

Belgian Road Research Center

https://brrc.be/en

6.20.10 References

[1] https://www.liege.be

6.21 REPLICABILITY OF THE DIGITALIZATION OF PUBLIC TRANSPORT

6.21.1 General information of the area involved in the practice

Country/Region: Spain

City/Metropolitan area: Madrid

Overview of the area – Name: Madrid

Area dimension: 604.5 km^2

Inhabitants: 3 334 730 people

6.21.2 Overview

Madrid Mobility 360 is a MaaS platform developed by "Empresa Municipal de Transporters de Madrid" (EMT Madrid) and launched in 2020 in Madrid. As part of the environmental sustainability strategy Madrid 360, this application represents Madrid's mobility planner in order to promote multi-modal transit solutions by integrating several transport services into a MaaS system. It is an innovative tool to improve sustainable mobility that offers a unique and fully functional MaaS solution. In addition to the standard benefits from a MaaS platform, the deployment aims to establish a simple and transparent model that can be replicated to other cities with shared benefits. The app's goals in terms of mobility correspond to those of the City of Madrid's 2019 Sustainability Strategy, which aims to reduce nitrogen oxides (NOx) by 20% by 2023. Assisting the behavioural shift toward sustainable mobility, it is achieving the transfer from private to collective transportation and the advantages are related to the reduction of congestion and emissions.

Figure 43: Madrid Mobility 360 App - MM360 (https://www.mobility360.app/)

6.21.3 Framework and goals

Changing the urban mobility model is one of the biggest challenges of all cities. The 2030 Strategy for Safe, Sustainable, and Connected Mobility and the EU Mobility Strategy have focused on daily mobility, digitalization, intermodality, and security solutions. The promotion of sustainable transit solutions involves the provision intelligent mobility towards a digital and innovative mobility

experience, which provides the users efficient alternatives to make their travels in a simple and intuitive way. The main characteristics and features of the mobile app are:

(1) Level of occupation – provide information on the level of occupation of the bus, both during transport planning and at the bus stop. In case the planned route includes a high-occupancy section, the tool offers the user two possible options: a second alternative path simultaneously with low occupation rate or the same path later with a lower level of occupation. This feature allows to plan routes taking into account this service data and to have the necessary information to distribute, temporarily or spatially, the transport demand.

(2) Route planner – by means of the MPlanner route calculator, Madrid Mobility 360 allows the user to identify, on the same map, the wide range of mobility solutions available in the city such as: EMT buses, metro, light rail, commuter trains, intercity buses, bicycles, scooters, cars, motorcycles. It enables the calculation of intermodal routes by integrating all available options and optimizing routes based on their economic cost or travel duration. Moreover, the application also considers user preferences, such as a preference for walking or the use of some means of transportation over others. It also includes an estimate of the route's CO2 emissions, as well as information on real-time air quality, in order to raise public awareness and sustainability about the travel and its environmental impacts.

(3) Direct&Online Payment – allow the payment via QR code of some services such as: BiciMAD (free-floating bike sharing system based on stations) and bus services, as well as at the car parks that support the bonus system "park&ride" that the company offers. In addition, the app is the only channel to buy and use the new "Transbus" ticket.

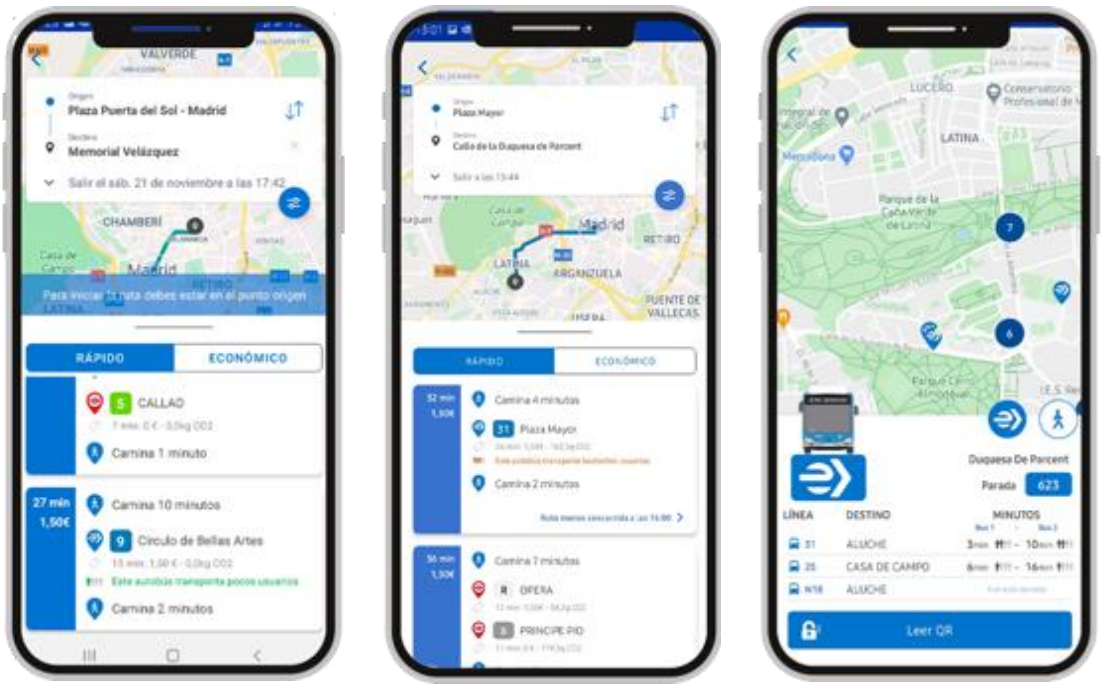


Figure 444: Intermodal solution, occupation level and QR Code payment via MM360 (https://www.mobility360.app/)

6.21.4 Purpose of the project

The project aims to address sustainable mobility issues through a MaaS platform model developed for the city of Madrid. The main objectives are:

- encourage the use of public transport and active mobility, facilitating the mobility of citizens, improve information to users and operators, and promote multimodal initiatives;
- React quickly and apply technological measures to address the Covid-19 pandemic, developing a predictive mathematical model that allows the user to know the level of passenger employment in real time through EMT communication channels.

The developed application is replicable to other cities, supporting digitalisation of public transport, reduction in the use of private vehicles and improvement of the environment. The public-private collaborations and the involvement of public administrations has been fundamental to implement sophisticated technologies.

6.21.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-categories involved in the MM360 project are:

(1) MaaS platform;

(2) Smart-cities, using ICT and/or ITS.

6.21.6 Contribution to innovation and sustainability

The most innovative feature of the application is the ability to offer the user real-time information on the level of occupation of buses. Bus occupancy is determined by a predictive statistical model that uses both passenger load validation data and information provided by sensors installed on buses. It is a particularly relevant feature to help make mobility decisions in a more user-friendly way, aligned with the goal of flattening the rush hour of public transport. Using an intuitive color coding (green, yellow, orange and red) and a message about the estimated frequency level, the user gets information about the bus occupancy on the calculated route section. The mobile app integrates floating mobility services (first/last mile) with public transport in a multimodal planner. It incorporates bus occupancy levels in planning and ticketing solutions and bus, bike sharing and park&ride fares. The main contribution of the measure to sustainability is related to the **environmental** impacts especially focused on the reduction of CO_2 emissions.

6.21.7 Status and finance

The project is **100% completed** and operating since December 2020.

The project has been **self-financed** by the managing operator.

6.21.8 Summary of the survey

Macro-categories dealt with: MaaS platform, Smart-cities using ICT and/or ITS.

Status/Progress: 100% completed. Operating

Finance: Self-financed

Main contribution to sustainability: Environmental

6.21.9 Respondent's Information

Carlos Mateo/Juan Corro

Spain/Madrid

Empresa Municipal de Transportes de Madrid (EMT Madrid)

https://www.emtmadrid.es

6.21.10 References

[1] https://www.mobility360.app

[2] https://www.movilidadsostenible.com

6.22 SELLING TICKETS AND PROVIDING INFO / TRAVEL-PLANNING

6.22.1 General information of the area involved in the practice

Country/Region: Emilia-Romagna Region (Italy)

City/Metropolitan area: Metropolitan city of Bologna

Overview of the area – Name: Metropolitan city of Bologna

Area dimension: 3 702 km^2

Inhabitants: 1 003 000 people

6.22.2 Overview

Roger is an application, downloadable for mobile devices, that allows you to buy tickets for transport throughout Emilia-Romagna, including car sharing and car parking. In particular, since March 2019 the ROGER app sells public transport tickets also including bus and train tickets throughout 9 provinces. Today, more than 100 000 profiles have been activated. The system is on-going: parking on streets (23 cities involved), taxis, people-mover. Moreover, the application is a travel-planner providing to users the numerous offered solutions for a define trip. The next step is towards sharing systems in order to integrate multiple transport solution in a unique platform as in MaaS system.

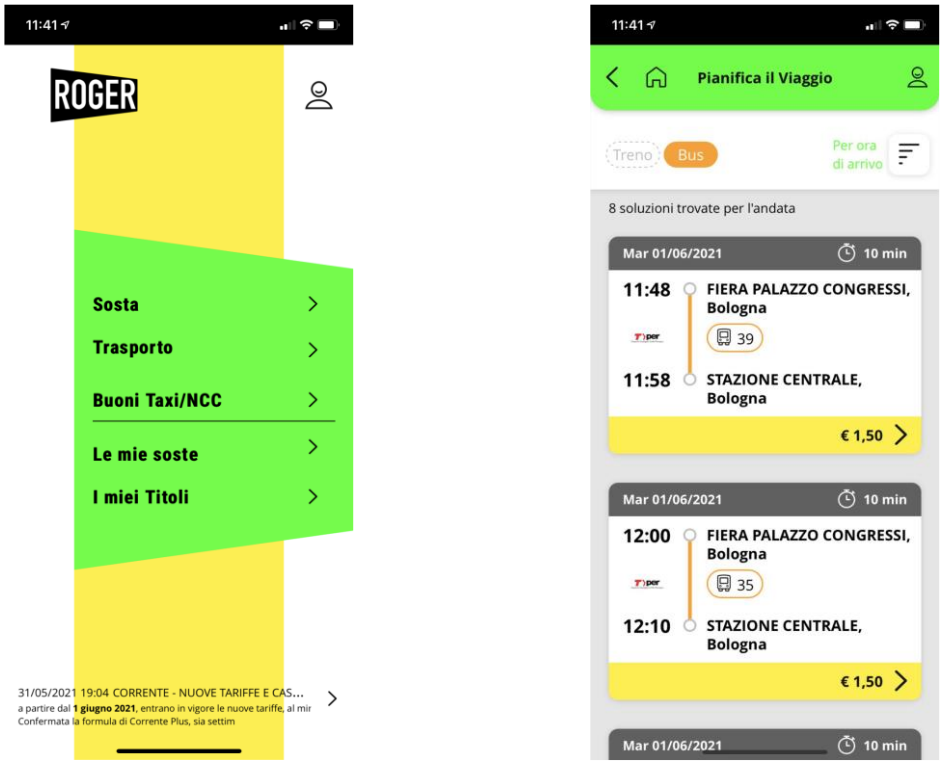


Figure 45: Roger's app home page and travel-planner

6.22.3 Framework and goals

The Roger application was presented in March 2019 in the city of Bologna by the presidents of the local public transport companies Tper, Seta, Start and Tep. Since November 2020 to address Covid-19 pandemic concerns, Roger estimates and communicates via app to users the real-time bus loading. The occupancy level is estimated through the measurement of wi-fi devices on-board with

an accuracy of ± 9 passengers. Through the implementation of an estimation model, three real-time esteems are given:

- Green: occupancy level < 25%;
- Yellow: 25% < occupancy level < 50%;
- Red: > 50% (maximum capacity during the emergency).

In Figure 46 the analysis of the first three weeks of March 2021 is provided revealing the low level of buses load in the municipality of Bologna. To inform users about real-time occupancy level, a small bus is displayed on the app coloured according to the aforementioned key-legend.

	01-07 Marzo '21			08-14 Marzo '21			15-21 Marzo '21		
	BASSO carico (< 25%)	MEDIO carico (25% - 50%)	ALTO carico (> 50%)	BASSO carico (< 25%)	MEDIO carico (25% - 50%)	ALTO carico (> 50%)	BASSO carico (< 25%)	MEDIO carico (25% - 50%)	ALTO carico (> 50%)
Lunedi	91,9%	6,3%	1,8%	93,6%	5,3%	1,2%	94,3%	4,8%	0,9%
Martedi	92,0%	6,3%	1,7%	95,0%	4,2%	0,8%	98,4%	1,5%	0,1%
Mercoledi	91,1%	7,1%	1,7%	94,1%	4,8%	1,1%	94,3%	4,7%	1,1%
Giovedi	94,3%	4,7%	1,0%	94,4%	4,4%	1,2%	95,2%	3,8%	0,9%
Venerdi	93,9%	5,0%	1,1%	94,6%	4,4%	1,0%	93,7%	5,4%	0,9%
Sabato	97,3%	2,3%	0,4%	95,5%	3,6%	0,9%	95,9%	3,3%	0,9%
Domenica	97,1%	2,5%	0,4%	98,1%	1,7%	0,2%	99,1%	0,6%	0,3%

Figure 46 : Bus load in the first three weeks of March 2021 (Green-Low; Yellow-Medium; Red-High)

In addition, other useful features are provided:

- Travel-planner: indicates many possible transit solutions as trains or buses, to reach the destination chosen and proposes solutions updated in real time;
- Purchase tickets: once the trip is planned and the transport solution chosen that best suits travel needs, users can proceed to purchase the ticket, which must then be validated;
- Pay for parking: paying the parking with Roger app, the user pays only the actual time and without any commission;
- Real-time information: shows the stops closest to the user and their schedules planned and in real time.

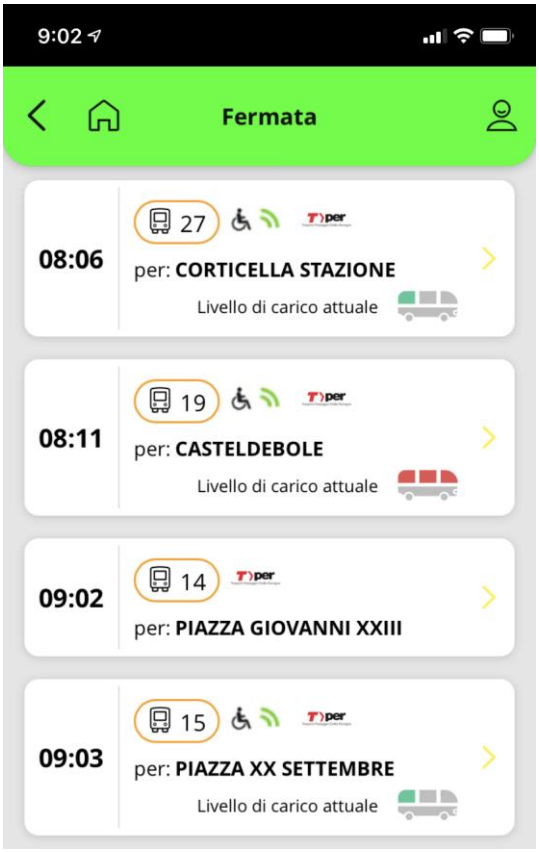


Figure 47: Real-time occupancy levels information on different buses

6.22.4 Purpose of the project

The unique app for public transport is a way to create an open and united region with the aim to improve sustainable way of travel for both citizens and tourists. The expected impacts deriving from this application are:

- user satisfaction;
- containment of loss of passengers;
- innovative way to measure demand.

6.22.5 Macro-categories included in the assessment

Regarding the codification of the "new mobility" practice, the macro-categories involved in the Roger app project are:

(1) Smart-cities, using ICT and/or ITS;

(2) MaaS platforms.

6.22.6 Contribution to innovation and sustainability

The main contributions to innovation are represented by:

- Real-time information to potential users;
- Quality trips during peak-time;
- Analysis of public transport "resistance" to pandemic emergency;

It was recorded a lower use during pandemic than in the previous period.

The main contribution of the measure to sustainability is related to the **social** advantage, which benefits users, citizens and tourist simplifying the access to public transport through suitable travel solutions.

6.22.7 Status and finance

The project is 100% completed and operating and it has been financed **less** than **50%** by **public** institutions.

6.22.8 Summary of the survey

Macro-categories dealt with: Smart-cities using ICT and/or ITS, Maas Platform

Status/Progress: 100% completed. Operating

Finance: By public (<50%)

Main contribution to sustainability: Social

6.22.9 Respondent's Information

Mirco Armandi

Italy

TPER – Trasporto Passeggeri Emilia-Romagna

www.tper.it

6.22.10 References

[1] https://rogerapp.it/

6.23 SHARING MOTORCYCLES AND PLATFORM PROJECT IN HUAI'AN CITY

6.23.1 General information of the area involved in the practice

Country/Region: China

City/Metropolitan area: Huai'an

Overview of the area – Name: Huai'an

Area dimension: 10 030 km^2

Inhabitants: 4 556 230 people

6.23.2 Overview

The departments of the municipal government of Huai'an have launched in 2021 a motorcycle sharing system to facilitate access to eco-friendly solutions for urban trips. The number of motorcycles available is increasing up to 20 000 in order to enlarge the distribution and make the usage more convenient for citizens. In the urban areas there are many drop-off points (5000-10000 points) that streamline the access and return of motorcycles. The deployment, which currently is not completed, aims to build a monitoring platform for shared motorcycles in order to realize service quality evaluation, analysis of customer usage, dispatching of vehicles and real-time flow monitoring in the network. The number, the position and the booking of the motorcycles can be verified via online platform and mobile application. The city management departments could manage shared motorcycles, guide Internet rental bicycle operators to ensure the healthy and orderly development of the industry and safe operation.

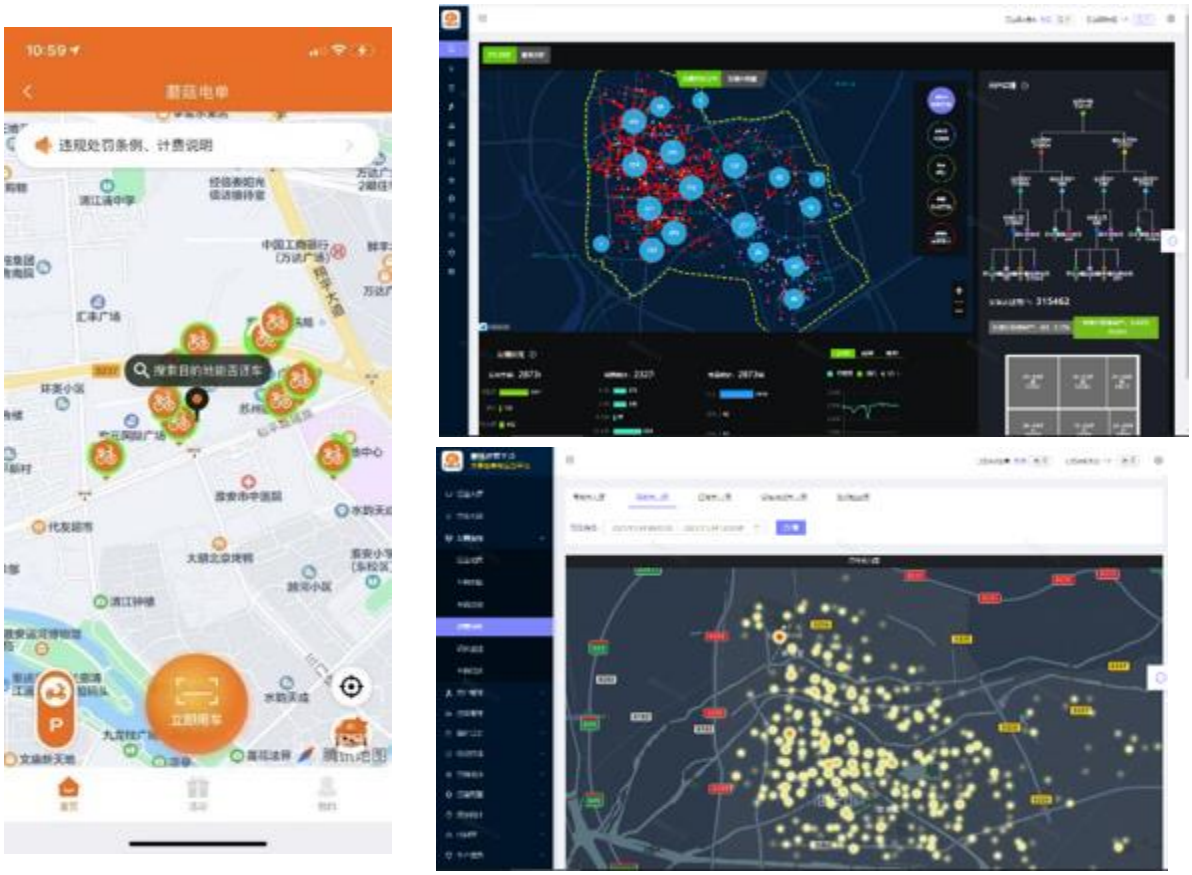


Figure 48: Mobile application and online platform

6.23.3 Framework and goals

The deployment is oriented to the construction of the “1 hour traffic circle” which need to be adapted to the growth of urban traffic demand. The target is the creation of a “bus+slow” mobility mode which can cover both long and short daily trips. Many challenges need to be addressed related to motorcycles sharing system, most notably gaps in the number of shared motorcycles disorderly parking of them after use. The shared motorcycles background management system needs to be optimized, especially because there are possible risks in the business model of sharing motorcycles.

Figure 49: Motorcycles sharing stations in Huai'an

6.23.4 Purpose of the project

The objective is to provide easy-to-use shared motorcycles that users can rent and return seamlessly to move rapidly within the urban area. The government authorities are increasing the service offer and implementing a new monitoring solution in order to meet growing transport demand. At the beginning 360 000 users registered to the system and 3000 motorcycles were available for use. Today, the number of motorcycles distributed in the different stations is increasing up to 20000.

6.23.5 Macro-categories included in the assessment

Focusing on the codification of the “new mobility” practice, the macro-categories involved in the motorcycles sharing project in Huai’an are:

(1) Innovative contracts and sharing systems;

(2) Smart-cities, suing ICT and/or ITS;

(3) **Active users** (e.g. pedestrians, cyclists, ...).

6.23.6 Contribution to innovation and sustainability

The contribution to innovation can be summarised as:

- providing fixed-point and directional parking technology for shared motorcycles to beautify the appearance of the city;
- motorcycles equipped with electronic helmet lock to ensure user safety;
- payments feasible through transportation card.

The main contribution to sustainability is principally **economic**.

6.23.7 Status and finance

The project is **less** than **50% completed**. The system is planned to be complete operating by 2022.

The project is **self-financed** by the managing operator.

6.23.8 Summary of the survey

Macro-categories dealt with: Innovative contracts and sharing system, Smart-cities using ICT and/or ITS Active users

Status/Progress: <50% completed

Finance: Self-financed

Main contribution to sustainability: Economic

6.23.9 Respondent's Information

Kaiwei Sun

China

Huai'an Jianghuai Intelligent Technology Co., Ltd

6.23.10 References

[1] https://baijiahao.baidu.com

6.24 Sustainable Business Model of Bike Sharing using ICT Technologies

6.24.1 General information of the area involved in the practice

Country/Region: Japan

City/Metropolitan area: Tokyo

Overview of the area – Name: 11 cities in Tokyo area

Area dimension: 241 km^2

Inhabitants: 3 530 000 people

6.24.2 Overview

Recently, the use for bicycles for commuting to work and/or school has been increasing due to changes in social conditions, such as the mobility shift from cars to walking and bicycling, and the growing use of electrically assisted bicycles.Bicycles have long been used as "feeder transport mode" in Japan, which connects railway stations and bus stops with home. Often the problem of illegally parked bicycles has come up in metropolitan areas and regional core cities. With the increasing need for bicycles, there is a need for the introduction of easy-to-use shared bicycles that anyone can rent and return anywhere in order to supplement public transport networks including railway and bus, to lower environmental impact, and to reduce the number of illegally parked bicycles.

Tokyo is one of the urban regions with the highest population density of the world. For a metropolitan area of this size, transportation mobility is a major challenge, which is why numerous sustainable business models for travel have been established in recent years. Multiple municipalities of the city of Tokyo have collaborated to launch a shared bicycle system. As of 2021, 11 cities in the Tokyo area are implementing this shared system, which allows remote renting and returning of bicycles in designated locations. Its features include many additional equipment, which simplify the use of the bicycles and the access to the service. For instance, the bicycles are electrically assisted and they are equipped with contactless card-based renting, returning, and payment system. Moreover, a smartphone display system helps identify the number of available suitable bicycles.

Figure 50: KotoCity Waterfront Bicycle Sharing Service (https://www.gotokyo.org)

Figure 51: Additional equipment - electric system and lock/unlock system (https://www.gotokyo.org)

6.24.3 Framework and goals

Since 2011, a shared bicycle system has been introduced in Tokyo to meet the increasing demand for sustainable transport solutions. Changes in the social context have encouraged transport modal shift from vehicles to walking and bicycling. The need for bicycles is particularly directed to commuting trips: home-school and home-work. In Japan, bicycles have long been used for feeder trips that represent only a part of the total daily trip. The distance between home and railway stations or bus stops can be easily and efficiently covered by cycles. Originally, the public bicycle systems started in each ward independently, but the mutual operation between 4 Wards in central Tokyo started in April, 2016. There were 1,760 bikes and 153 ports as of May 2016. After this first trial, 2 wards also joined the partnership, so there were 2,580 bikes and 240 ports in the central area in Tokyo as of January 2017. Each local government choose the public bicycle operating company independently, but under the conditions that the network could be spread, so finally, the same company operates the system in the 6 wards. The number of users has increased dramatically, especially related to single trip users. Moreover, the number of usages has increased around 2.85 times in comparison with before and after the mutual operation. On the other hand, even though the mutual operation started, over 80% of trips are in each ward. Actually, the highest-used ports are in front of large apartment and the nearest railway station. It means that public bikes are used as the regular bicycles as an access mode to public transport in short distance. In Tokyo, it can be concluded that monthly memberships that use public bicycles contribute steadily to the number of users, whereas single trip memberships that use public bicycles contribute flexibly to the number of users.

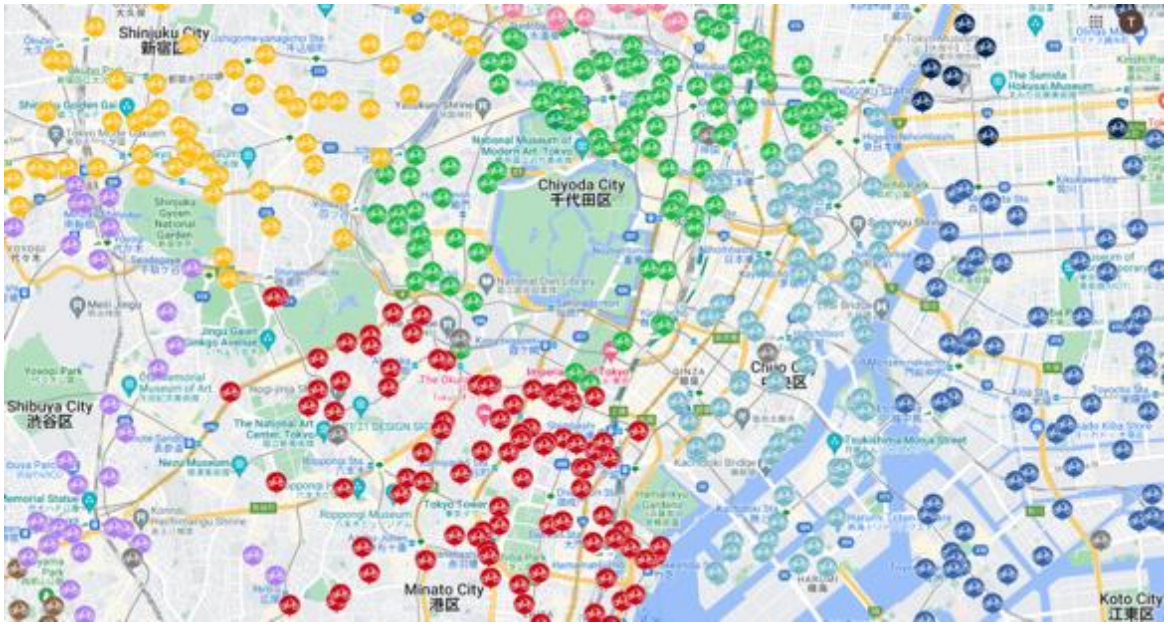


Figure 52: Tokyo Bike Share Station Map (https://docomo-cycle.jp/)

6.24.4 Purpose of the project

The objective is to provide easy-to-use shared bicycles that allows to citizens and tourists to rent and return them seamless at the station chosen as final destination of their trip. In addition, this application is aimed at reducing the urban environmental impact decreasing air pollution and greenhouse gas emissions. The development of this sharing system is finalized to providing intermodality and to supplement public transport offer. Furthermore, the intention of Japanese government is to maintain the steady increase of bike sharing users. In 2021, the system recorded a number of rentals per year equal to 12 million that is 300 times the initial data from the launch of the platform. Lastly, the ports destined to the parking, distributed in the districts, face the problem of illegally parked bicycles in metropolitan areas and regional core cities.

6.24.5 Macro-categories included in the assessment

Regarding the codification of the “new mobility” practice, the macro-categories involved in the bike sharing system in Tokyo are:

(1) **Active users** (e.g. pedestrians, cyclists, ...);

(2) Innovative contracts and sharing systems;

(3) MaaS platform.

6.24.6 Contribution to innovation and sustainability

The contribution to innovation is represented by:

- the application of GPS-controlled system for bicycles renting and returning that allows to overcome the traditional mechanical parking system;
- the promotion of transport intermodality for commuting trips including the bike sharing among the route search alternatives in addition to busses, cars and railway;
- the creation of a seamless bike sharing system developed by multiple municipalities that have synergy of purpose and common goals;

The main contribution to sustainability is principally referred to the reduction of **environmental** impacts promoting transport modal shift to shared solution integrated with the public transport system to decrease the CO_2 emissions and traffic congestion. In Tokyo, the development of this sharing system includes also social benefits focusing on the issue of illegal bicycles parking. In fact, using this system, the users have designated spaces to park the bicycles reducing the number of private cycles on sidewalks, bike paths or roads.

6.24.7 Status and finance

The project is completely operating and it is more than half-financed (**>50%**).

6.24.8 Summary of the survey

Macro-categories dealt with: Active users, Innovative contracts and sharing system, Maas Platform.

Status/Progress: 100% completed. Operating

Finance: >50% by public

Main contribution to sustainability: Environmental

6.24.9 Respondent's Information

Okuda Etsuo,

Ministry of Land, Infrastructure, Transport, and Tourism, Japan

Nishimura Takumi,

Transport and Socioeconomic Division

Institute of Behavioral Sciences (IBS)

2-9 Ichigayahonmura-cho

Shinjuku-ku, Tokyo 162-0845 JAPAN

6.24.10 References

[1] https://www.gotokyo.org/it/plan/getting-around/bicycles/index.html

[2] https://docomo-cycle.jp/tokyo-project/en_index.html

[3] https://docomo-cycle.jp/

6.25 The Chrono mobile application for Greater Montreal

6.25.1 General information of the area involved in the practice

Country/Region: Canada/Quebec

City/Metropolitan area: Montréal metropolitan community

Overview of the area – Name: Montréal metropolitan community

Area dimension: 4 259 km^2

Inhabitants: 4 099 000 people

6.25.2 Overview

The Chrono is a mobile application which brings together all the services offered by public transit organizations and other transport partners in the Greater Montreal area. The Chrono application, which is owned and created by the Autorité Régionale de Transport Metropolitain (ARTM), was implemented in Montréal, in conjunction with the region's public transit organizations, for smartphones using iOS or Android. Chrono tracks the movement of buses and trains on the map in real time, allowing users to plan their trips by public transportation or bicycle and to find the quickest routes to optimize their time. The application offers the only trip planner that can broadcast a live message on the condition of the metropolitan public transit networks provided by the operators themselves.

6.25.3 Framework and goals

As travel needs are currently less predictable, the ARTM and its partners are constantly developing new solutions and features for users to start using safe, flexible and efficient public transit. Chrono mobile application offers practical tools that give users more control and awareness of the trip. The main features and goal to improve the transit experience are:

1) Real Time Tracking

15. In the Chrono app, real-time information is used to show the actual positions of buses and trains on mobile map so that the schedules you see are more accurate. The real-time feature is a precious tool for busy commuters. With the advent of General Transit Feed Specification (GTFS) real-time files, schedules and routes can now be updated on the basis of real-time information. A device on board the vehicle relays its GPS position so that this information can be used to locate the train or bus on a map, providing schedules that are more reliable.

Figure 53: The Chrono app (https://www.artm.quebec/)

2) Bike planner

16. The application provides the fastest route for a bike or BIXI ride to get to a defined destination. Chrono helps to find nearby bicycle stations and gives information on the number of bicycles available.

3) Complete Network Information and bus occupancy rate

17. The application updates network including alternate routes due to work on the Réseau Express Metropolitain (REM) or other roadworks. The ridership level feature allows users to plan their trips by considering the level of ridership and occupancy rates in all routes.

4) Trip Companion

18. Chrono's features let app users to customize their profile in order to obtain messages of interest. The mobile app homepage can be personalized adding favourites routes and stops frequently used. In addition, alerts can be set to receive specific services interruption notices. For example, this information is important because advise users about disruptions on their daily route.

5) OPUS reader

19. Moreover, the "OPUS Card Reading" feature lets you check the status of fares loaded on your OPUS or non-reloadable smart card using NFC (Near Field Communication) technology., without having to go to a point of sale or use an automatic ticket vending machine to verify your status. It is a simple and intelligent feature through which the content of an OPUS card can be consulted, obtaining useful information about transit fares, such as the number of remaining trips on a multi-trip fare.

Figure 54: "OPUS Card Reading" feature (https://www.artm.quebec/)

6.25.4 Purpose of the project

The main Chrono's goal is to help public transport users planning their trips in the Great Montreal area. The mobile application, developed by ARTM, provides useful tools and feature that simplify the access to public transport assisting the modal choice of the users. The main services are:

- Bus schedules in real time;
- Bus occupancy level;
- View the content of your OPUS card or a non-rechargeable smart card;
- Planned bus schedules;
- Access to schedule planners in off-line mode;
- Option for creating favorites;
- Trip planner;
- Map displays;
- Bus service alerts;
- Information about buses with front ramps and accessible bus stops;
- Metro service status.

6.25.5 Macro-categories included in the assessment

The macro-category involved in the Chrono project, related to the codification of the "new mobility" practice, is:

(1) MaaS platforms.

6.25.6 Contribution to innovation and sustainability

The Chrono application will allow users to buy and add transit fares to their OPUS card via smartphone. This is an important contribution to innovation because the user has not to go to the point of sale or use an automatic ticket vending machine to complete this operation. The main contribution of the measure to sustainability is related to the **social** impact, simplifying the trip choice in the urban area.

6.25.7 Status and finance

The project is **100% completed** and operating.

The project has been **self-financed** by the managing operator.

6.25.8 Summary of the survey

Macro-categories dealt with: MaaS platforms

Status/Progress: 100% Completed – Operating

Finance: Self-financed

Main contribution to sustainability: Social

6.25.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.25.10 References

[1] https://montreal.ca

[2] https://www.stm.info

[3] https://www.artm.quebec

6.26 TRANSITIONAL CYCLING FACILITIES

6.26.1 General information of the area involved in the practice

Country/Region: France – whole country

City/Metropolitan area: -

Overview of the area – Name: -

Area dimension: 543 940 km^2

Inhabitants: 67.39 million of people

6.26.2 Overview

In France, lockdowns have led to an unprecedented decline in all travel, in particular motor vehicles on the road, giving many opportunities to rebalance public space. The use of cycling and walking in everyday life has multiple benefits and is a sustainable way to travel. As solutions for adapting to climate change and the transition to calmer, more resilient cities, these modes of transport help to strengthen social ties and improve local life. To improve public space and provide alternative paths for cyclists who have to travel, the government has taken measures to encourage cycling through the development of temporary bike paths and the launch of a 20 million euro plan by the Ministry of Ecological and solidarity transition. The Cerema, a state-owned public institution, operator of the ministry, has developed technical recommendations for communities that are interested in testing fit-up solutions to enable efficient and safe cycling. The French government aims to triple the use of bicycles and reach 9% of journeys by 2024 throughout this deployment.

Figure 55: Transitional cycling facilities dynamic

6.26.3 Framework and goals

A recent study has drawn up a report on the state of the bicycle economy in France in 2020, which is rather positive about the development of cycling. Over the last ten years, cycling practices have changed considerably, with very significant but localized growth. Despite the strong development in recent years, the results show that the modal share of cycling is lagging behind other European countries: the modal share of cycling is around 3% in France, whereas the European average is

around 9%, with the Netherlands at over 35% and Denmark and Hungary at over 20%. Considering the French case, with +28% of journeys compared to 2019 and -2% compared to 2020 (excluding confinements), bicycle traffic maintained its level of activity during 2021. In 2020, bicycle traffic remains its course at national level. These good results can be found regardless of the environment observed, but with some nuances.

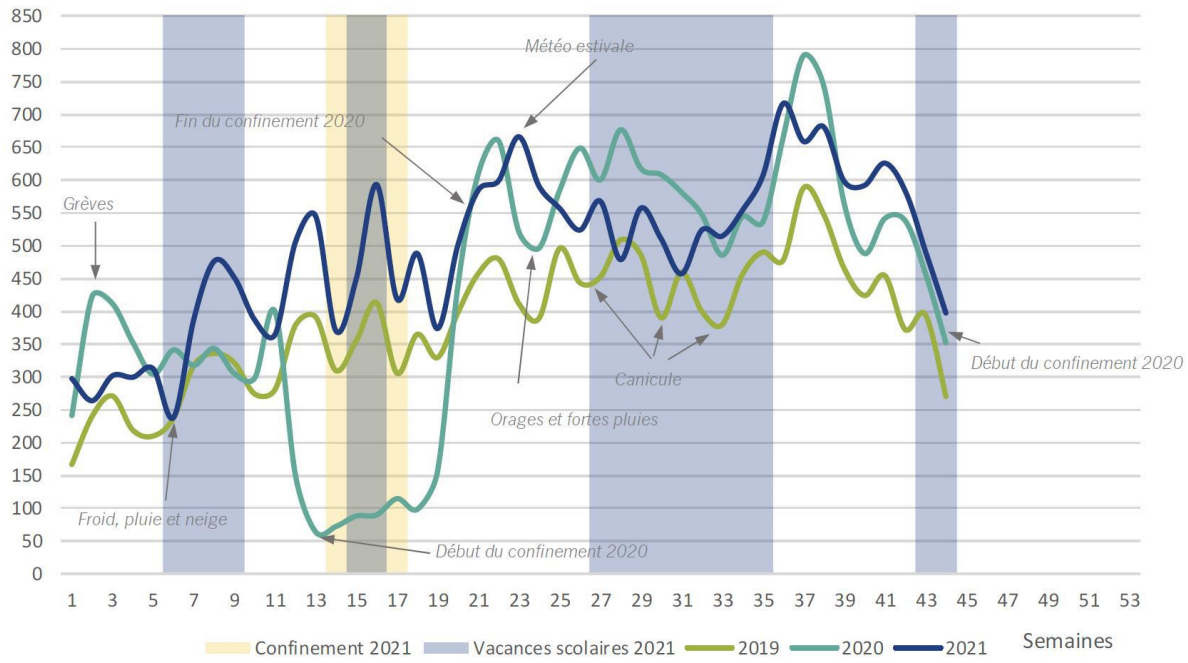


Figure 56: Average daily bicycle frequence in France

Cycling in urban areas increased by 32% compared to 2019 (-2% compared to 2020 excluding confinements) to reach an average of 1,427passages per day and per meter. A figure twice as high as the national the national average (595 passages/day/meter). The peri-urban areas and rural territories are not left behind. The number of visits in these environments is 21% and 14% respectively compared to 2019 and reached 212 and 120 passages per day on average. A level almost equivalent to that of 2020 (excluding confinements).

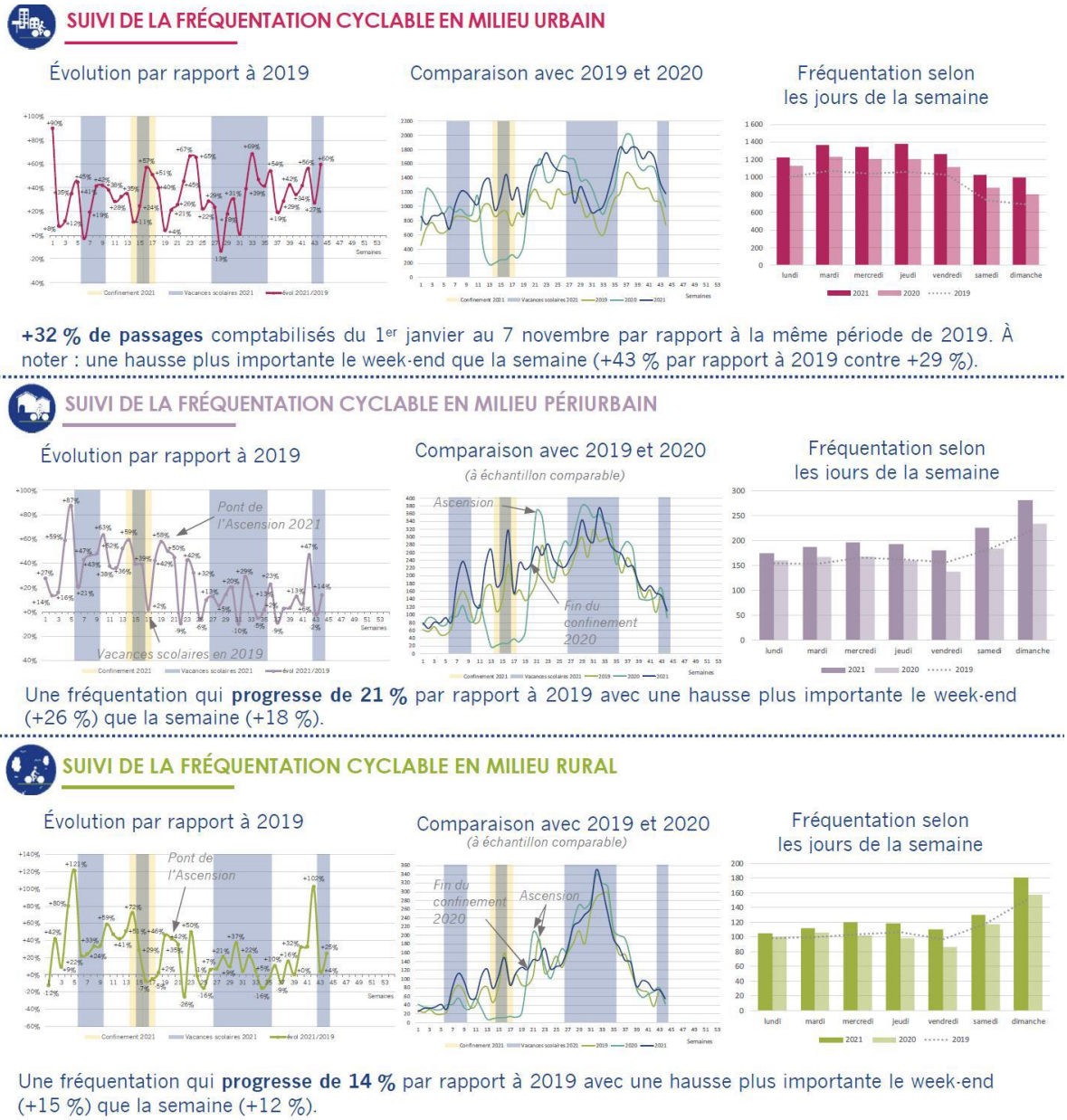


Figure 57: Data analysis about bicycles frequence in urban, peri-urban and rural areas

In this scenario, it is important to rethink the way urban development can be improved and technical solutions for bikes can be applied. The assessment developed by Cerema are technical solutions with distinct advantage of being able to be set up fast and reversibly. In particular these solutions provide temporary cycling facilities to use as a test for future permanent implementation. One of the solutions proposed aims to reduce the number of lanes dedicated to motorized vehicles, creating new bicycle lanes separated on the road and rethinking the infrastructural spaces. Urban arteries with 2X2 or 2X3 lanes without side motorized parking are particularly suitable to accommodate such bicycle developments. The diagram below illustrates a scenario.

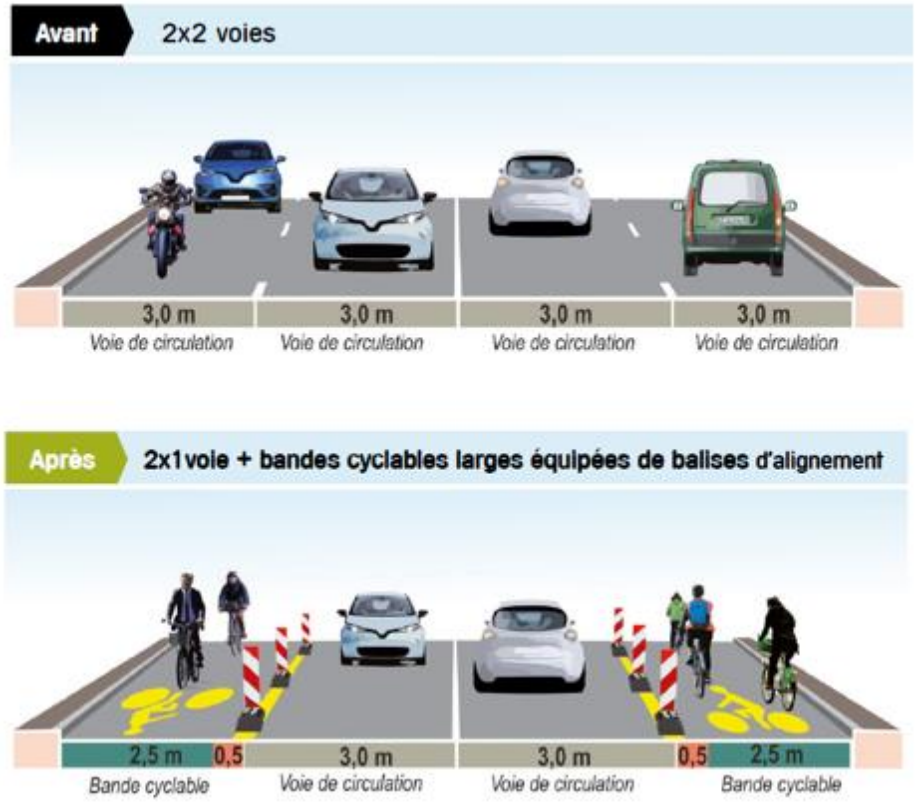


Figure 58: New configuration of urban arteries with lateral bicycle lanes

6.26.4 Purpose of the project

The aim of the project is to rethink road infrastructure in urban areas and rural territories in order to increase the space dedicated to cyclists encouraging the use of sustainable transportation modes. Improving the traffic conditions of cyclists through the creation of bike facilities also means strengthening the safety of cyclists by providing them with a dedicated space, away from motorized traffic. More than 100 local authorities have committed themselves to the transitional cycling facilities dynamic due to the health crisis. Most of these were urban areas, although rural areas accounted for almost 30%. The commitment of the local authorities was voluntary and 38% of them indicated that they had directly designed permanent facilities in connection with the State's financial aid to users and cities.

6.26.5 Macro-categories included in the assessment

The macro-category involved in the transitional cycling facilities deployment is:

(1) **Active users** (e.g. pedestrians, cyclists, ...);

6.26.6 Contribution to innovation and sustainability

The containment measures have led to a decline in individual motorised traffic and the space freed up provides opportunities for temporary cycling facilities for cyclists. This is a great opportunity to encourage the use of bicycles creating safe and sustainable solutions.

The main contribution to sustainability is related to the **social** aspects, changing travel behaviour towards healthy and active mode of transport.

6.26.7 Status and finance

The project is **100% completed** and operating and it has been financed by **public** for **more** than **50%**.

6.26.8 Summary of the survey

Macro-categories dealt with: Active users

Status/Progress: 100% completed. Operating

Finance: By public (>50%)

Main contribution to sustainability: Social

6.26.9 Respondent's Information

Sandrine Rousic

France

CEREMA

https://www.cerema.fr

6.26.10 References

[1] https://www.cerema.fr

[2] https://villes-cyclables.org

[3] https://www.velo-territoires.org

6.27 VISION ZERO ACTION PLAN

6.27.1 General information of the area involved in the practice

Country/Region: Canada/Quebec

City/Metropolitan area: Montréal

Overview of the area – Name: Ville de Montréal

Area dimension: 432 km^2

Inhabitants: 1 780 000 people

6.27.2 Overview

Montréal has made a strong commitment to road safety by signing the Vision Zero Action Plan. Through this plan, launched in 2018, Montréal and its 33 partners have committed to reducing the number of deaths and serious injuries on roads to zero by 2040. The implementation of concrete and mobilizing measures will allow to gradually achieve the objective of zero deaths and serious injuries on city roads. The plan includes about sixty commitments, organized under 22 multilateral actions. A leading role in the open action plan has been given to the community. The commitments are divided in three major objectives:

- Promote collaboration
- Shift the mindset
- Transform the road network

6.27.3 Framework and goals

The collision record has considerably improved with the introduction of the city's Transportation Plan in 2008. Since 2014, the annual mortality rate has remained generally steady. The number of major injuries per collision has been gradually decreasing over the last decade, but has plateaued in the last two years. In Figure 59 is reported the total number of fatalities and serious injuries in the Greater Montréal area per year. According to statistics, the number of deaths per 100 000 inhabitants in Montreal is among the lowest in North America. Moreover, considering the international situation, Montreal has one of the best ranks compared to other major cities in the world.

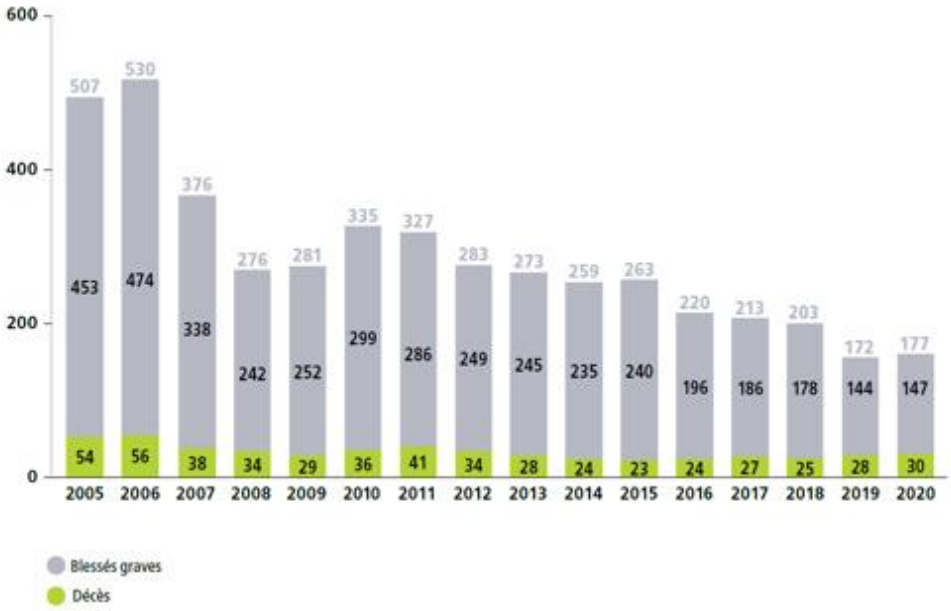


Figure 59: Total number of major injuries and deaths in Greater Montreal area

Despite the pandemic effect on travels, in 2020 it has been recorded a slightly increase in the number of fatal and serious injuries compared to 2019. In particular, more vehicle occupants and cyclists were involved in serious collisions. In Figure 60, the types of users killed or seriously injured in 2020 are categorized.

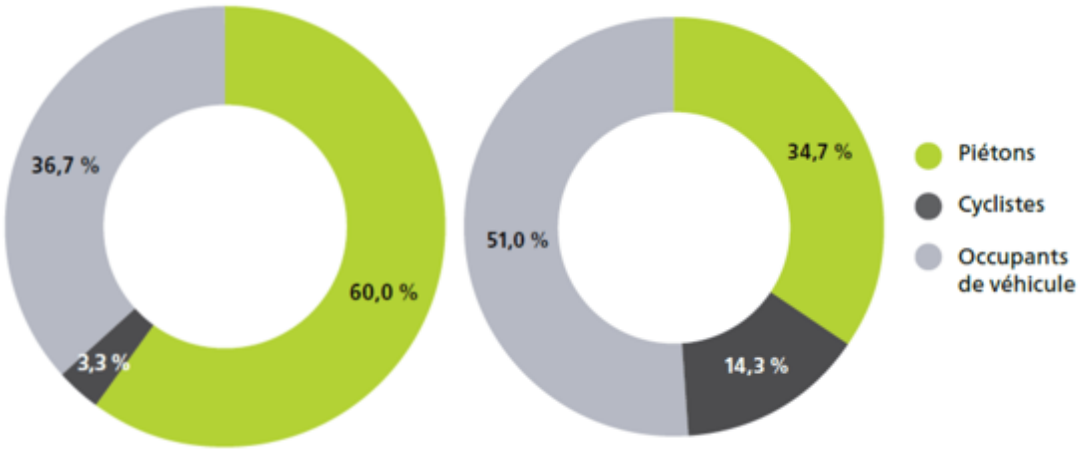


Figure 60: Percentage of users involved in collision: killed (left) and seriously injured (right)

In addition, further statistics on the state of road safety in Montreal are provided:

- Every 41 hours, someone is killed or seriously injured on Montréal roads.
- Half of all pedestrian fatalities are aged 65 or older.
- More than 75% of drivers who die are young men (20-24 years old).
- 14 pedestrians die each year.
- Over three quarters of all collisions occur at intersections.

6.27.4 Purpose of the project

The Vision Zero Action Plan aims to have zero deaths and zero serious injuries on Montreal's road by 2040 through the application of concrete and multilateral action supported by the project partners. The actions are focused on safe mobility and they are principally related to three major themes: the promotion of collaboration, the change of mentality and the transformation of the road network.

Promoting collaboration

- Establish a Vision Zero Steering Committee comprised of the most powerful stakeholders in road safety;
- Form a post-fatal collision analysis team;
- Publish an annual status report regarding "Road Safety in Montréal".

Changing the mentality

- Focus on three relevant themes: crossing the street, heavy vehicles and speed management;
- Improve the synchronization of public awareness initiatives;
- Enhance professional drivers training;
- Improve the tools to evaluate collisions and their consequences on the population.

Transforming the road network

- Implement a "School Zone Safety Program";
- Improve current bicycle lanes and expand the express bicycle network;
- Add more pedestrian lights with the digital countdown feature;
- Enhance illumination of all passageways under beneath bridges and viaducts.

6.27.5 Macro-categories included in the assessment

Considering the codification of the "new mobility" practice, the macro-category involved in the Vision Zero Action Plan is:

(1) **Active users** (eg. pedestrians, cyclists, …).

6.27.6 Contribution to innovation and sustainability

The main actions taken by the City include the creation of a post-fatal collision team, the development of a school zone safety program and the formation of themed working groups. The collision record has greatly improved. However, a slowdown has occurred in recent years and the annual number of people dying has stagnated since 2014. The main contribution to sustainability is **social,** due to the improvement of safe mobility and the reduction of social costs caused by road accidents.

6.27.7 Status and finance

The project is **100% completed** and operating.

The project has been **self-financed** by the managing operator.

6.27.8 Summary of the survey

Macro-categories dealt with: Active users

Status/Progress: 100% Completed – Operating

Finance: Self-financed

Main contribution to sustainability: Social

6.27.9 Respondent's Information

Mélanie St-Cyr

Ministère des Transports du Québec

6.27.10 References

[1] https://montreal.ca

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