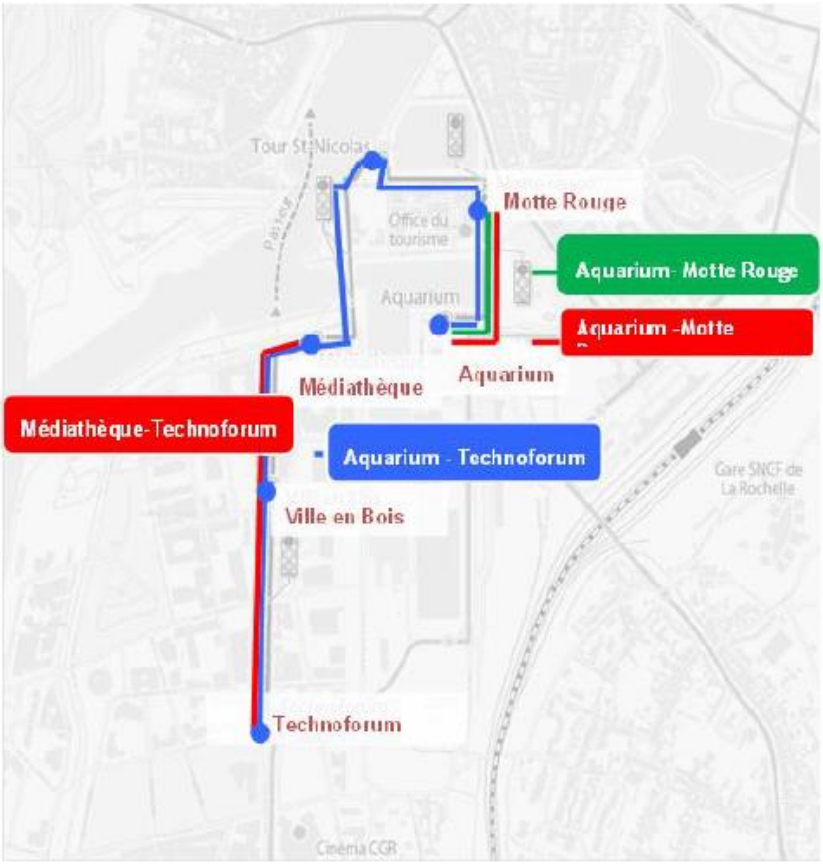
Description d'un projet, d'une expérimentation ou d'un service pilote

City Mobil 1 (2011) et 2 (2015)

NB 1 : la présente fiche est destinée à partager des informations entre porteurs de projets ou d'expérimentation ou organisateurs de services de mobilité routière automatisée.

NB 2 : les rubriques ci-dessous sont indicatives, chaque porteur de projet ou de service peut choisir d'y mentionner ou non, et d'y développer le cas échéant les éléments qu'il juge pertinent de partager avec d'autres acteurs au sein d'un base de connaissances ouverte

1. Description du projet / de l'expérimentation / du service	
Localisation	La Rochelle (17)
Type de service (passagers / marchandises)	Passagers
Offre de service visée (y.c. horaires, fréquences, vitesse commerciale…)	À la demande, sans réservation, ni coût pour l'utilisateur.
Enjeux identifiés	- Faire circuler 6 véhicules dans le cœur de l'agglomération entre l'office de tourisme de La Rochelle et le Technoforum. - Logique d'acculturation du public à cette nouvelle mobilité. - Tester la technologie dans le cadre d'un projet européen sur 6 mois.
Type de zone / parcours (ex : rural, péri-urbain, urbain)	Urbain : 

<table>
<tr><td>Longueur et description du parcours (ex : types de voies, intersections, éléments saillants...)</td><td>Voirie urbaine.
Maximum 3 kms de voirie urbaine</td></tr>
<tr><td>(cartographie le cas échéant)</td><td></td></tr>
<tr><td>Eléments de volumétrie (nombre de véhicules, nombre-cible de passagers quotidiens)</td><td>6 véhicules de transport collectif électriques – 14 661 personnes transportées durant l’expérimentation
Table 3.2 Users during the demonstration
<table><tr><th>Number /Phase</th><th>20/12/14-24/01/15
Phase 1</th><th>26/01/15-3/03/15
Phase 2</th><th>4/03/15-25/04/15
Phase 3</th><th>Total</th></tr><tr><td>Users(n)</td><td>2623</td><td>3844</td><td>8194</td><td>14661</td></tr><tr><td>Circulated days (n)</td><td>32</td><td>32</td><td>44</td><td>108</td></tr><tr><td>ARTS operation hours (h)</td><td>182</td><td>336</td><td>877</td><td>1395</td></tr><tr><td>Average Users/day</td><td>82</td><td>120</td><td>186</td><td>136</td></tr><tr><td>Average operation hours/day for all vehicles</td><td>6</td><td>11</td><td>20</td><td>13</td></tr></table></td></tr>
<tr><td>Eléments sur le type de véhicule (marque, modèle, autres éléments notables, etc.)</td><td>Véhicule conçu par l’entreprise française Robosoft
 
</td></tr>
<tr><td>Eléments sur l’équipement spécifique de l’infrastructure (ex : connectivité, signalisation)</td><td>Pour permettre la circulation des 6 navettes, quelques modifications légères étaient requises :
- Conception, réalisation et intégration de quais/stations
- Restriction d'accès pour les voitures
- Installation de feux de circulation aux passages à niveau donnant la priorité au véhicule ARTS sur les autres véhicules ;
- Suppression d'un nombre important de places de stationnement en voirie non contrôlées ;
- Installation de panneaux de signalisation et marquages routiers.</td></tr>
<tr><td>Modalités de supervision / intervention à distance</td><td>Un opérateur à bord pour reprendre la main.</td></tr>
<tr><td>Etat d’avancement avec date
(avant-projet ; projet approuvé ; en service ; achevé le cas échéant)</td><td>Projets terminés en 2015
Roulage entre décembre 2014 et avril 2015</td></tr>
<tr><td>Date de début de projet</td><td>Décembre 2014</td></tr>
</table>

Date de mise en service	8 mois d'expérimentation (3 mois de préparation + 5 mois de test)
Date de clôture (le cas échéant)	Avril 2015
Autre élément de description utile	Le projet dispose d'une évaluation ex-post, en annexe
Personne à contacter	david.robibn@agglo-larochelle.fr – 07 82 80 42 88
Site Internet (le cas échéant)	
2. Organisation des acteurs	
Pilote(s) du projet / expérimentation ou organisateur du service	Projet européen City Mobil, La Rochelle était l'une des 5 villes sélectionnées dans le projet. Côté CdA : Mathieu Graindorge, Stéphanie NAIR (service Mobilité) ; Côté EIGSI : Nicolas Malhéné (EIGSI), Tatiana Graindorge (EIGSI) ;
Partenaires impliqués dans la fourniture du service	Fabricant véhicule (Robosoft), EIGSI, Service Voirie de la Ville de La Rochelle
Cadre de financement	Cadre de financement européen
Partenaires financiers	Europe, Agglomération de La Rochelle (à la marge)
3. Retours d'expériences sur la conception, la préparation et l'évaluation du projet	
NB : les rubriques ci-dessous sont destinées à recueillir toute référence considérée comme utile (y compris des études, des articles, des présentations, des liens vers des vidéos, etc…) afin de permettre à d'autres acteurs de bénéficier des retours d'expérience du porteur du projet présenté	
Définition des besoins, dimensionnement du projet	Voir annexe
Cadre règlementaire de référence (ex : déploiement expérimentation, directive machine)	Voir annexe
Financement	Quais intégralité des coûts portés par le projet européen. La CdA n'a contribué que à la marge sur ce projet.
Evaluation des coûts, recettes, bénéfices socio-économiques	Voir annexe
Communication, sensibilisation	Voir annexe
Démonstration de sécurité	Voir annexe
Impacts environnementaux	Voir annexe
Dispositifs de suivi, évaluation	Voir annexe
Enseignements positifs / bénéfices obtenus	- 16 000 personnes transportées - 0 accident
Enseignements négatifs / difficultés	Voir annexe
Suite prévue (le cas échéant)	
Autres éléments d'intérêt	

CITIES DEMONSTRATING AUTOMATED ROAD PASSANGER TRANSPORT

La Rochelle Ex-post Evaluation Report

SEVENTH FRAMEWORK PROGRAMME

THEME SST.2012.3.1-4.

AUTOMATED URBAN VEHICLES

COLLABORATIVE PROJECT – GRANT AGREEMENT N°: 314190

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Brief Description	This report is a deliverable of Workpackage 25 (Ex-post Evaluation) of CityMobil2 project. The main objective was to assess the impacts of the automated road transport system (ARTS) demonstrated in La Rochelle on awareness and acceptance. The study was mainly based on survey results of ARTS users, stakeholders and a wider public.
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Contents

Executive summary

This report is a deliverable of Workpackage 25 (Ex-post Evaluation) of the CityMobil2 project. The main objective has been to assess the impacts of the automated road transport system (ARTS) demonstrated in La Rochelle on awareness and acceptance of ARTS users, stakeholders and a wider public.

Overview of the ARTS demonstration

A public transport service using automated vehicles was demonstrated in La Rochelle, with six automated mini buses running on a route linking Aquarium to Technoforum (6 stops/stations in the harbour area) from December 17th December 2014 to April 25th 2015. The on-site tests of the ARTS vehicles began on 13rd October 2014. Considering the challenges faced in running automated vehicles in an urban environment, it was decided to implement the ARTS route in three phases in a step-by step approach. The operation of the ARTS vehicles on the first part of the route (0.35 km) began on the 17th December 2014, and operation of the ARTS vehicles on the whole route (1.9km) began on 4th March 2015.

A maximum speed of 7km/h was set up for the operation of ARTS vehicles to ensure the safety of the system. All the ARTS vehicles were operated with a member of staff on board. The role of the on-board operator was crucial to ensure safety through intervention in case of deviations or malfunctions of the system. Because of the training delivered by the local teams, operators were very well received by users as they could give information on the system, explain the context of the demonstration, and reassure the users as to the safety of such innovative transportation systems.

Many information campaigns were organised before and during the demonstration to increase awareness and understanding of ARTS. This included:

- The local media (Sud-Ouest, France3, various radio programs), national media (France2, BFM, AFP, RMC radio, le Figaro), and iInternational Media (e.g. BBC)
- Specialized Press on Public Transport edited some articles on La Rochelle demonstration.
- An information desk was installed in front of the Tourist Office, one of the most frequented places on the route.
- A specific dissemination action targeted school children, with two articles published in a newspaper dedicated to children aged 6-10 and to teenagers aged 11 to 15. In addition, local partners worked with of the newspaper journalist distributed for a special edition of “Le Petit Quotidien” distributed toto all pupils of every school of the territory. La Rochelle partners supported these awareness-raising efforts by organizing workshops and visits to 10 classes (nearly 300 pupils).
- La Rochelle partners wrote scripts and contributed to the film proposed to show the vehicles in operation and the enthusiasm.
- Part of the dissemination consisted of explaining and exchanging with representatives and technicians of other cities, firms and various other organizations.
- Major national actors in Public Transport such as RATP (Paris public transport operator) came in La Rochelle to study the acceptability of such systems among the population and to see the vehicles circulate in the urban environment.

Many lessons have been learned from the demonstration of ARTS vehicles. These include:

1) It is important to limit the ambition of the route and to be aware of the limits of system implemention. The reality is very often more demanding than the plans. In order to tackle this issue, a very reactive local team (from the setup phase) is crucial taking into account the “real urban conditions” of a city, and to support changes in plans;

2) Reactivity/flexibility was needed by the operator team to cope with the limitations of the system. Furthermore, operators are a key contact point for users. Their presence is a response to both technological and social (job loss) concerns of the users.
3) It is important to keep the public informed on the progress of demonstration preparation and implementation, especially in situations of unexpected delay;
4) It is essential to engage the citizens from the youngest age to the elderly. An action like the special edition of "Le Petit Quotidien" was of benefit not only for the pupils, but for all, as it generated exchanges between generations, discussions (even basic) on a topic often considered as "reserved for experts only".

ARTS operation and performance

The total number of users (one way journey) was to 14, 661 during the 108 days of demonstration with an average 136 users per day. A significant number of people used the ARTS vehicle for return trips as well, and the total number of trips with the ARTS vehicles was estimated to be 21,991.

Energy consumption

Energy consumption was tracked using the following indicators:

1) Number of vehicles representing the number of vehicles that were in operation at a given day.
2) Daily consumption representing the energy consumption by all vehicles in operation on a given day.
3) Total hours of activity representing the total number of hours of activity for all the vehicles in operation at a given day. The total number of ARTS vehicle operations was 1395 hours, and total energy consumption was 2540 kWh. This gives an average energy consumption of 1.75 kWh per hour of ARTS vehicle operation.

Incidents

Incidents or technical failures of ARTS systems were recorded during the demonstration. During the experiment, all data have been collected by operators and consolidated by supervisors. Each operator used a data sheet in order to report all incidents or failures during trips. These failures can be put into two main categories:

- **Failures related to the system**. For example, in February the leg between "Aquarium" and "Motte Rouge" was under control whereas the deployment of the second leg from "Technoforum" to "Médiathèque", generated a lot of problems. These problems were due to technology issues such as GPS or SLAM failures and organizational reason such as traffic modification.
- **Failure related to the reliability of the vehicle itself**. This is the case for mechanical failures which occurred more or less regularly throughout the demonstration.

Weather influenced the performance of the vehicles. LASER sensors were disrupted when heavy rain fell. Whilst rainy days impacted negatively on ARTS performance, it was also noted that reflections of light from roadside furnature could interfere with the operation of the vehicles when the weather was sunny.

Analysis of speed and acceleration profiles of ARTS vehicles

During the demonstration, vehicle data were logged by ROBOSOFT including vehicle and sensor data (e.g. speed, GPS and Laser and others). For this analysis, one return trip from each of the 6 vehicles was sampled to examine vehicle performances.

The results of the analysis demonstrated that automated vehicles were able to control speeds and accelerations/decelerations more accurately and consistently than human driven

vehicles. Users of automated vehicles would be expected to benefit from such improvements. Firstly, accurate and consistent speed control would mean less likely to exceed the speed limits, which will reduce accident rate and severity. Secondly, accurate and consistent acceleration/ deceleration control would reduce excessive accelerations and decelerations at starting and stopping, which will have positive impacts on reducing fuel consumption and pollutant emissions. Thirdly, accurate and consistent accelerations/deceleration control would mean smooth vehicle movement and improved riding comfort to users.

From the data logged, automated control of the vehicles was the normal situation. However, the on-board operator had to intervene relatively frequently. For the 6 vehicle data sampled, the average length of manual control was 177.5s which accounted for 7.5% of the running time.

Ex-post survey of ARTS users

The main objective of this survey was to gain a better understanding of users and their transportation needs, and to collect feedback on the ARTS system as demonstrated. The survey was administered as face-to-face interviews in two phases to a total of 310 participants.

For the majority of users, the demonstration was their first experience of automated vehicles. Therefore, it was not possible to identify any significant difference in the feedback provided by experienced users – i.e. participants in the 2011 CityMobil demonstration in La Rochelle. Users were mainly students, employees and retirees. Employees had the highest return rate.

Approximately half of the users became aware of the ARTS demonstration by chance. Therefore. it is suggested that the visibility of the demonstration area had an impact on the frequentation of the service. Most users declared having used the system only once and just to travel as their trip propose. Therefore, it is not possible to make solid conclusions on the ARTS as a real transportation service. However, according to the responses, ARTS led to a modest reduction of the use of cars by participants in the demonstration area, although other factors may have influenced this result.

Respondents declared a relatively high level of satisfaction, with approximately 56% of opinions being good or very good when all criteria were combined. The criterion of comfort requires particular attention for future experiments as it was the most poorly rated. Other criteria needing attention were on-board waiting time and jerkiness.
Approximately half of the users combined the ARTS ride with walking to complete their journey. The vast majority of users did not travel with luggage. When they did, they usually carried small items such as backpacks. Therefore, the need of extra storage space might not be critical for future demonstrations.

The presence of incidents on 13% of the trips requires attention. Approximately one third of respondents were only willing to use the ARTS in the presence of a human operator. For future experiments, it might be necessary to better understand those concerns and how to address them.

Ex-post stated preference questionnaire

The objectives of the Ex-post Stated Preference (EPSP) survey carried out in La Rochelle were: 1) To investigate users' relative preferences for an Automated Road Transport System (ARTS) versus a conventional one; 2) To be able to assess attitudinal changes following user

experience of ARTS by comparing the results with those of the ex-ante survey. (User preferences for ARTS were determined in an ex-ante stated preference survey in all cities hosting a demonstration. The results were presented in a report in WP14 “Report on the Stated Preferences surveys in the twelve cities”). Comparing the ex-post and ex-ante survey results enables an assessment to be made as to whether experience of the system and more information about it (thanks to the awareness raising campaigns carried out in the cities hosting a demo) might have resulted in changes in user attitude towards the ARTS; 3) To assess users’ willingness to pay for the ARTS, and their attitude towards the use of the ARTS system in the future.

The EPSP survey carried out in La Rochelle was based on face-to-face interviews using structured questionnaires. The number of respondents was 110.

About half of the users were willing to pay less for ARTS than for the current public transport system, and just 7 out of 100 users surveyed were willing to pay more for ARTS than for current public transport.

8 out of 10 users thought it was useful to implement the service on the route demonstrated. However, the majority of the users (3 out of 4) thought that it would be better to implement the ARTS system on a different route.

The EPSP survey shows that users’ have a relatively higher preference for ARTS (ASC positive ex-ante and ex-post and has the same order of magnitude) regardless of whether or not they had experienced ARTS.

User utility was significantly reduced if an extra fare was applied. Ex-ante, the extra fare effect is slightly lower than that of ASC, while ex-post it is higher and users tend to prefer the traditional system. Just 7 out of 100 users were willing to pay more than the current PT fare to use ARTS.

In the ex-post model estimation, the attributes of waiting time, riding time and gender did not affect user decisions (the calibration produced a statistically insignificant estimation of its beta coefficient, which therefore has a high probability of being equal to zero). A preference of older people for the ARTS system was confirmed.

Those with a lower educational background found the ARTS system to be better in practice than anticipated, whilst those with a higher educational background found it to be worse than expected. If this indication is carried forward to other sites, it can be used to better target the promotion of ARTS.

A questionnaire of a wider public

This survey aimed to examine public opinions regarding automated vehicles in urban areas. The survey was undertaken once the demonstration of ARTS in La Rochelle was completed. Two survey methods were used: an online questionnaire and telephone interviews. The online survey targeted people working/studying/living adjacent to the ARTS route. A total of 148 people responded to the online survey. A telephone interview was undertaken from 1-17 July 2015 to reach people over a wider area of the city. A total of 500 people were recruited to participate in the interview. The data from the two surveys were combined and resampled taking into account of distributions of age, gender, and education of people observed in La Rochelle. Responses from a total of 425 people were used for the analysis.

A majority of the respondents had previously heard of automated vehicles and about a quarter had riding experience of the automated mini buses demonstrated in La Rochelle. A majority of the respondents had high expectations of the benefits from the introduction of

automated vehicles, especially reductions in fuel consumption and pollutant emissions. However, only a quarter of the respondents expected that automated vehicles would be safer than human driven vehicles.

Overall, public attitudes towards automated buses were positive, with two thirds stating that they would consider taking automated buses if both automated and conventional buses were available on a route. The most attractive benefit of automated buses was seen as being reduced fares because of no costs for drivers. Passenger security was the one of the issues of most concerned for automated buses especially during night services. For the automated mini buses demonstrated, the most supportive role was seen to be as a complement to public transport with a feeder/distributor function.

Reduced fares were the most attractive benefit of automated taxis to the respondents. With such a benefit, together with the advantage of door-to-door services, automated taxis were considered able to become a practical alternative of buses in urban areas, especially for small groups (e.g. 2-4 persons) travelling together.

Public attitudes were positive towards the implementation of automated vehicles in car-sharing and car-pooling services. Regarding car-sharing services, the most appealing benefit was to call up a remote automated car at a trip origin and to release it at a destination. Regarding car-pooling, the expected benefits of automated cars were attractive to the respondents including reduce travel cost, increased passenger space and automated driving.

The people surveyed were interested in automated cars. For the respondents, the most attractive benefit of automated cars was to increase mobility for all, followed by reduced fuel consumption and pollutant emissions. Other potential benefits which appealed to the respondents included reduced insurance rates and parking costs. The issue of most concern with automated cars was equipment or system failures. Other issues included higher vehicle purchasing cost, legal liability in case of an accident, risk of vehicle security (from hackers), Software/databases not updated in time, and risks of disclosive of locations to others without consent. More than half of the respondents stated that they would consider using automated cars, and about one third would not consider using automated cars at all. Of the respondents who stated they would consider using automated cars, 73% said they would like to own an automated car, and 27% to share cars through services such as car sharing and pooling.

Stakeholder survey

The stakeholders' survey carried out in La Rochelle was based on face-to-face interviews using a structured questionnaire. A total of 20 stakeholders were interviewed including representatives from public authorities, urban planning authorities, public transport operators, freight transport operators, tourist officers, manufacturers, residents, shopkeepers, etc.

Safety could be one the most important factors influencing people's attitudes towards automated vehicles. In theory, automated vehicles would be safer than human driven vehicles because of the removal of human errors, and increased safety will be a prerequisite for the introduction of automated vehicles on public roads. The negative responses from some of the respondents could be a result of a lack of awareness/understanding and low trust in the self-driving technology. Convincing the public of the safety benefits of automated vehicles is a topic which needs to be addressed in future research projects.

The objectives of the stakeholder survey were to assess stakeholders awareness and acceptance of the automated road transport system, and investigate the expected impacts with respect to the role of each stakeholder, and potential drivers and barriers connected with

a spread implementation of automated mobility. The stakeholders survey carried out in La Rochelle was based on face-to-face interviews using a structured questionnaire. The people targeted were stakeholders selected by La Rochelle through a process to ensure the best possible coverage of relevant stakeholder categories: local transport authorities, urban planning authorities, passengers transport operators, manufacturers and freight operators. Concerning knowledge and attitudes towards automated vehicles 95% of participants had a positive view of automated vehicles. Also stakeholders responded that automated vehicles could give advantages mainly for safety, environment and transport efficiency. The stakeholders considered automated vehicles in a future scenario to be a useful technology for public transport, taxis and other on-demand services, car sharing and freight transport. The majority of them considered that automated vehicles should not interact with other modes preferring total segregation with dedicated lines, or on low speeds roads, with pedestrians and cyclists. The actions to most enable a wide spread implementation of automated mobility are 1) Public authorities and urban planning operators should be proactive and include automated vehicles discussions in SUMP process; 2) Private sector and automotive should invest in this technology and consider more about selling a service instead of selling cars; 3) Public authorities and private sector should consider automated vehicles to be a mixed mode for passengers and goods delivery. For the majority of stakeholders automated vehicles will impact positively on safety, comfort and convenience and on the creation of new jobs. They did not consider the possibility of modal shift from soft modes of walking and cycling to self-driving cars. Respondents considered that collective automated cars will have a positive impacts on energy emission and will allow a saving in land. However, they did not consider that private automated cars would have negative impacts on energy emission and land consumption. The three most important drivers stressed are the commitment of key actors, an accurate or visionary technical planning and analysis to determine requirements for the implementation, and the presence of a sustainable development agenda or vision.

The most important barriers ranked by respondents were the analysis of and proposals to change rules, structures, legislation etc. which constrained automated vehicle implementation. Different views and interests on the sustainable development of the cities, and the lack of involvement of key stakeholders. Priorities for the research and development of automated vehicles in the future were: 1) large scales field operational tests to collect empirical evidence of changes in modal choice behavior, 2) vehicle tests and evaluation under various traffic/road/weather conditions to ensure safety, and 3) assessment of social, economic and environment impacts of wider implementation of automated vehicles.

1 Introduction

1.1 Objective

This report is a deliverable of Workpackage 25 (Ex-post Evaluation) of the CityMo-bil2 project. The main objective was to assess the impacts of the automated road transport system (ARTS) demonstrated in La Rochelle on awareness and acceptance by users, stakeholders and a wider public.

1.2 Background

In the previous CityMobil project (2006-2010), several innovative concepts of automated road transport systems were demonstrated including CyberCars, PRT and BRT. Three main barriers were identified for the deployment of automated road transport systems in urban environment: implementation framework, legal frame-work, and unknown wider economic effects. The goal of CityMobil2 is to address and remove these barriers.

The main objective of CityMobil2 is to implement large-scale pilot platforms in different cities to undertaken technical and socioeconomic testing, and to validate and evaluate the potential for automated transport systems in urban environments. Furthermore, CityMobil2 partners will undertake research activities into technical, financial, cultural, behavioural aspects and effects on land use policies and how new systems could be fitted into the existing infrastructures of different cities. Field data were collected during the demonstrations for ex post evaluation using approaches including interviews, questionnaires, focus groups, operator observation and recording, and the automatic logging of vehicle data.

Five cities were selected to host large scale of demonstrations up to 6 months from the 12 cities initially interested in implementation of an ARTS system. La Rochelle was one of the cities selected.

1.3 Scope and structure of the report

In CityMobil2, evaluation of the ARTS system is a key part of the project and involves several workpackages, particularly WP18 (Vehicle Technical Monitoring), WP25 (Ex-post evaluation), and WP27 (Socio-economic study). The results reported in this deliverable are a part of the work of WP25, and are on an ex-post evaluation of the ARTS demonstrated in La Rochelle. The focus of CityMobil2 demonstrations is on public transport applications of automated vehicles, especially automated buses. Other potential applications of automated vehicles (e.g. freight transport) and their impacts are beyond of the scope of this project.

An overview of the ARTS system demonstrated in La Rochelle is presented in Section 2. An analysis of the ARTS operation and performance is given in Section 3. For those who rode the ARTS vehicles, survey results are presented in two parts: an assessment of user perceptions in Section 4, and a comparison between ex-ante and ex-post preferences in Section 5. An assessment of public opinion towards potential applications of automated vehicles in urban areas is presented in Section 6.

2 Overview of the demonstration

2.1 ARTS system demonstrated

The Automated Road Transport system (ARTS) was demonstrated in La Rochelle between December 17th December 2014 and April 25th 2015. A city centre route was chosen taking into account the requirements of the CityMobil2 project to increase visibility and access of the system (Figure 2.1).

The route initially proposed included a leg between the main train station and the University (Technoforum) with 6 vehicles (automated minibuses) in operation.[1] The period of operation was planned to be from November 2014 to March 2015.

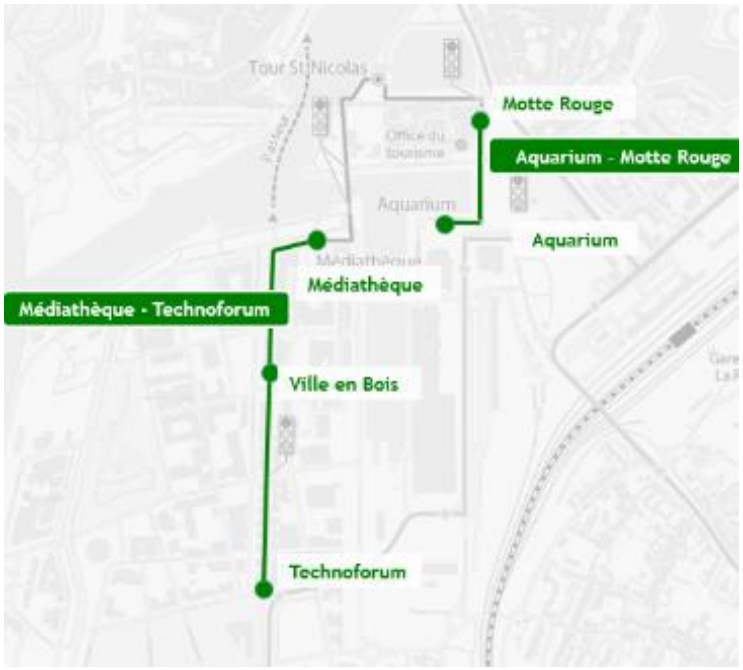
Figure 2.1 Demonstration area in La Rochelle

The on-site tests of an ARTS vehicle began on 13rd October 2014. The first test showed that the system was not robust enough for immediate implementation, and the manufacturer (ROBOSOFT) staff was inexperienced in setting up ARTS systems in an urban environment. Consideration of the technical difficulties faced (only the GPS system was operating, and the sensor mix of the laser and GPS was not ready), a decision was taken by the local partners, the manufacturer, with the support of CM2 coordinator to implement the demonstration in several phases.

The approach agreed upon was to start the demonstration on an “easy” leg of the route, without having to wait for all problems to be solved for implementing the ARTS systems on the whole route. The limited number of vehicles available was also a factor in the decision.

The step-by-step approach proposed consisted of 3 different phases as shown in Figure 2.2 and 2.3).

1 Due to technical delays in the delivery of the vehicles and the operational uncertainties described above, it was decided to phase the opening of the route (see below).



Phase 1 and 2

Planned operation:
Aquarium – Motte rouge and Technoforum – Mediatheque from November 2014 to January 2015

Actual operation:
Aquarium – Motte Rouge from 17th December 2014

Technoforum – Mediatheque from 26th January 2015.

Figure 2.2 Phase 1 and Phase 2

Phase 3

Planned operation:
Aquarium – Technoforum from January 2015

Happened to be:
Aquarium – Technoforum from 4th March 2015

Schedules: 10h – 17h30

Figure 2.3 Phase 3

The fourth and last leg to the train station was not able to be implemented as too many technical uncertainties still existed which may risk to degrade the operation of other parts of the system. The agreement on this was reached on 1st January 2015 between the manufacturer, the coordinator and the local partners.

2.2 Demonstration setting up

2.2.1 Infrastructure and road adjustments

La Rochelle's local team decided at the study phase that no major works and changes to the infrastructure would be needed. Many visits to the selected route were made between March and October 2014 in order to identify the work which needed to be carried out. However, most of the actual work had to wait for the first tests to be conducted by Robosoft as little information on the vehicles was made available to the local partners at an early stage. More generally, a continuous dialogue with various local stakeholders was needed in order to adapt the infrastructure/the route.

The changes to enable the demonstration were:

- Design, build and integration of platforms / stations
- Restriction of access for cars
- Installation of traffic signals at crossings giving priority to the ARTS vehicle over other vehicles
- Removal of a significant number of uncontrolled on-street parking places
- Installation of road signs and road markings.

2.2.2 Setting-up the operation

Prior to the demonstration itself, efforts had been made to prepare for the arrival of the vehicles, to assess the impact of the automated vehicles on the organization of Proxiway's vehicle depot, and to organize the future operation. It was noted that the implementation may require deviates from these initial plans.

The depot was equipped with additional and adapted electric plugs and meters in order to enable charging of the vehicles. Reorganization and some works were undertaken to provide ARTS vehicles with an appropriate access. As the ARTS vehicles were located in the same depot as electric cars, electric vans and electric trucks, parking lots were reorganized in order to facilitate the entrance/exit of the CityMobil2 vehicles.

A dedicated room was allocated for supervisors and a direct internet access was implemented for the purpose of the demonstration. Unfortunately, contrary to what was expected in the initial plan, the Robosoft supervision technology did not prove to be sufficiently mature to be installed in the control room (Figure 4.2)

Figure 2.4 Installation of the electric plugs and meters

An early task was to anticipate the number of operators who needed to be recruited for the demonstration. This proved to be quite complicated as the demonstration itself had to be adapted and a step-by-step approach was taken in the end. Specific attention was paid to defining the public transport services to be demonstrated (time schedules, frequency) in order to manage the recruitment process. After staff were recruited, a reference timetable was designed, and the training of the staff started.

2.2.3 Preparing the public for the demonstration

Awareness-raising among the local population on the potential ARTS demonstration in La Rochelle began early in the project. Institutional magazines were used by the La Rochelle Urban Community to promote the potential demonstration by presenting expected added-value of ARTS demonstration compared to a previous demonstration carried out in 2011 in the city.

Once La Rochelle was selected as a site for a large scale demonstration, the awareness-raising actions were reinforced to inform the wider public of the ARTS system to be demonstrated, of the service proposed and of its potential impact on their day-to-day life. Local partners used various means to inform the local people through their main contacts. The ARTS demonstration in La Rochelle was presented as news in the “Grands Projets” section of La Rochelle Urban Community website, as well as EIGSI’s website. Proxiway’s newsletter focused on the future CityMobil2 demo.

Significant efforts were made to meet inhabitants as well as local stakeholders, in particular the ones located along or near the demonstration route. The purpose was to present not only

the demonstration itself (objectives, route, vehicles, etc), but also to inform them of the potential impact that could result from the demonstration (notably regarding the removal of uncontrolled parking spaces, see D19.1), the influence of the demonstration on car traffic, and on urban goods deliveries.

Above all, the main focus was to make every stakeholder aware of the unique opportunity and benefits of this innovative demonstration.

Interaction with stakeholders was a key concern for local partners in the setting up of the demonstration. As a consequence, many information/exchange meetings were organized with key stakeholders identified [2] (Figure 2.5).

Figure 2.5 *Public meeting in October 2014 involving local partners – notably Vice-president B. Desveaux*

In order for the inhabitants and visitors to immediately identify the activities related to the CityMobil2 demonstration, a specific logo was designed (an adaptation of the graphic chart chosen by the European project). The logo and motto were used in various communication

[2] Meetings were organized with :
- "districts/inhabitants associations " (2/06/2014 and 15/09/2015)
- Shopkeepers of "Le Gabut" district (20/06/2014 and 24/06/2014)
- Shopkeepers impacted by the demonstration route (notably the pharmacy of "Av des Amériques" : 15/09/2015)
- Police department and fire department(10/2014)
- Public meeting (15/10/2014) with the where 35 persons attended
- Aquarium : a crucial point on the route to provide information and advice on the way to inform the visitors to the Aquarium (28/10/2014)
- Tourist Office : provider of information on the demonstration, notably towards visitors (04/11/2014)
- "La Poste" delivery center : crucial information in order to prevent mail and parcel postmen to park on CM2's route. (31/11/2014);
- La Rochelle Port Authorities (05/2014 and 10/2014)
- La Rochelle University (05/11/2014).

media including flags that were installed along the demonstration route. The latter provided a real identity to the demonstration.

Figure 2.6 *CM2 Flags along ARTS route*

Flyers (5000) and posters (250) were designed and distributed to firms, shopkeepers, and attraction/tourist sites to provide information on the scope of the demonstration, the route and the various implementation phases. Flyers were also delivered during the demonstration.

Figure 2.7 *CM2 flyers*

The first Robosoft vehicle was delivered in October 2014 and the first tests on the ground were an opportunity to show the vehicles and provide information to the local people, who were curious and eager to ride on-board.

A press conference was organized, a press release edited and sent to media. Local newspapers and television started to report on these tests.


La Rochelle Agglo

La Rochelle, ville pilote des véhicules sans pilote

Figure 2.8 *Article on La Rochelle's demonstration on CM2 demonstration – published in October after the Public Meeting*

2.3 Demonstration process

The demonstration was launched on 17th December 2014. This followed extensive exchanges between the State authorities and the local partners to obtain the legal approval by the French Transport Minister. However, the service could not be operated as foreseen in the initial plans because of:

i) Delay in the delivery of the fleet of vehicles. (i.e. 6 vehicles to operate at the same time), and the technical problems encountered.
ii) The lack of an effective and robust supervision system. This had a serious impact on the operation of the ARTS service, and on the user perception. For instance, the users could not be aware of waiting times at stops.
iii) The risk assessment analysis identified speed limitation as one of measure needed to ensure the safety of the system. A speed limit of 7km/h on major parts of the route could seriously impact the decisions of potential users

For these reasons, the local partners and the manufacturer, with the support of the coordinator, decided to gradually introduce the system. The full route of ARTS demonstration was implemented only from March 4th until April 25th 2015.

The role of the on-board operators proved to be crucial not only because of the actions needed in case of deviations or malfunctions of the system, but also because they were one of the key contact points with the users and the public. Thanks to the training delivered by the local teams, operators were well perceived by the users as they were able to give information on the system, explain the context of the demonstration, and reassure the users as regards such innovative transportation systems.

The achievement of having 14,661 users is considered a considerable success in the overall context of the demonstration.

2.4 Awareness/dissemination campaigns

As note in Section 2.3, awareness-raising actions were initiated very early by the local partners, and this process was continued actively throughout the demonstration.

The launching event organized on the 17th December was an important formal milestone in terms of awareness-raising. Local stakeholders and inhabitants met for the event.

Figure 2.9 *Demonstration launching event*

A press release was written to attract the press and the media. The local media (Sud-Ouest, France3, various radio programs) reported the launch of the demonstration. Furthermore, once the demonstration started, many media gave significant coverage. National media (France2, BFM, AFP, RMC radio, le Figaro) and even International Media (BBC) came to report on the ARTS service, interviewed La Rochelle's Mayor Jean-François Fountaine and local partners on La Rochelle's demonstration.

Specific efforts were made to keep people informed on the demonstration and several articles were dedicated to CityMobil2 demonstration in the institutional magazines of both La Rochelle City and the Urban Community.


On a testé pour vous le véhicule sans conducteur

Figure 2.10 *Article published in institutional magazine Point Commun June 2015*

Articles on the La Rochelle demonstration were edited at a specialized Press on Public Transport. Throughout the demonstration period, an information desk was available in front of the Tourist Office, one of the most frequented places on the route, to guide the potential users. A display was available on the desk to present the information and the desk was manned for a few hours each day.

A hotline ("*numéro vert*") was implemented so that people interested in the demonstration could make comments, and ask questions if needed.

Figure 2.11 *Information Desk*

A specific dissemination action was targeted at primary school children. Two short articles were published in "*Le Petit Quotidien"* on 21/12/2014 – a newspaper dedicated to children aged 6-10, and in *"Mon Quotidien"* on 19/12/2014 – a newspaper dedicated to teenagers aged 11 to 15. Also local partners worked with the journalist from the newspaper delivered for a special edition of *"Le Petit Quotidien"* fully dedicated to the ARTS demonstration in La Rochelle. This edition was distributed to all pupils of every school of the territory.

Figure 2.12 *"Le Petit Quotidien"*

La Rochelle partners supported these awareness-raising efforts by organizing workshops and visits on the ground for 10 classes (nearly 300 pupils). The workshops were aimed at making the pupils aware on the possibility offered by ARTS and its potential to be integrated in the Public Transport systems of the future. Animations and interactive debates were organized with the support of EIGSI students.

Figure 2.13 *Visits on the ground organized for pupils*

La Rochelle partners wrote scripts and contributed to the film proposed by the dissemination partner of the CityMobil2 project, Polis. This resulted in a short film (4'40) to show the vehicles in operation.

- Part of the dissemination was aimed at explaining and exchanging opinions with representatives and technicians from other cities, firms and various other organizations. The focus of these activities included seeing demonstrations on the ground, discussing the main barriers (technical, operational, legal…) and the difficulties of organizing and implementing such a demonstration in an urban environment. Key representatives visited La Rochelle included: A delegation of high ranking representatives from the Yamaha Corporation from Japan prior to the demonstration.
- A delegation from the Land Transport Authorities and Economic Development Agency from Singapore came in January 2015.

Figure 2.14 *La Rochelle Mayor and Vice-President in charge of Mobility and Transport welcoming Singapore delegation, in presence of CityMobil2 coordinator*

Major national actors in the Public Transport areas such as RATP (Paris public transport operator) came in La Rochelle to study the acceptability of such systems operating in areas with high density and to see the vehicles circulating in an urban environment.

In addition, and as noted in Deliverable D19.1, various high ranking civil servants from French Ministries (Sustainable Development, Home Affairs, Industry…) came in La Rochelle before and during the demonstration. We were informed that the national authorities were

quite satisfied with the La Rochelle's ARTS demonstration, and that the dialogue initiated with the national authorities would be helpful to facilitate the implementation of other future demonstrations in France.

All the above discussions were seen to be very fruitful for all parties, though quite demanding for the local partners to organize.

2.5 Lessons learned

Lessons learned from La Rochelle demonstration can be drawn at several levels:

The **set-up phase** of such a demonstration is crucial not only from a technical point of view, but also from the acceptance point of view of stakeholders and the wider public as automated transport systems are innovative in an urban environment.

From a technical point of view, exchanges between a demonstrator city and an ARTS manufacturer need to be extensive before the demonstration, in order for the vehicles to be adapted to the reality of an urban environment. In the case of La Rochelle, The link between the infrastructure developments and vehicle communication should not have had to wait for the arrival of the vehicles. Although a general definition of the infrastructure can be undertaken beforehand, it was clear that detailed adjustments can only be made on the ground with the vehicle on site during the test phase[3].

It is important to limit the ambition of the route and to be aware of the limits of the system to be implemented. The reality is very often more demanding in practice. In order to tackle this issue, a very reactive local team (from the setup phase) is crucial, to take into account the "real urban conditions" of a city, and to address the changes needed.

From an awareness-raising point of view, it is a key to provide the users with information on the operation of the demonstration itself. Due to the work carried out in the press, institutional magazines had announced for months that ARTS systems were going to be implemented. People had retained the message that the service was going to be implemented in November. But due to issues related to the delivery of the vehicles and technical adjustments, the launch was postponed to December. The public were then quite curious about the vehicles running in the test phase, which sometimes disturbed the manufacturers' staff. Keeping the public informed on the state of the demonstration is important.

A very clear and identifiable marking of the ARTS route would contribute to a better interaction with pedestrians and cyclists. In the demonstration, some route markings were made for the operation of ARTS vehicles. Whilst, the marking could have been improved and better highlighted, this was demonstrated by the focus group carried out in June 2015.

As regards the **demonstration and operation**, though the transport service offered to the users was limited, some lessons were learned.

The step-by-step deployment approach (several legs, several steps) was useful to enable technical difficulties to be identified and solved.

Risk anticipation and safety are the top priorities. "Safety first" was the credo of both the Robosoft engineer in charge of the vehicles and the local operation team. Whilst the limited

[3] The example of the adequation of the station platforms to the vehicles are quite explicit on this matter. Indeed, although the size, the weight, the height of the vehicles were known beforehand – and that the platforms were specifically designed according these measurements - there was an issue of the door opening on station platforms, which required the vehicles to be present on site with the maximum load capacity.

speed of the vehicles was not optimal from an operational point of vehicle, the outcome of zero accidents was a success. It is to be noted that the vigilance of the operators played also a significant role in this achievement.

The continuous presence of humans (operators) on-board proved to be crucial. The reactivity/flexibility of the operator team was needed to cope with the limitations of the system. Furthermore, operators were a key contact point for users. Their presence is needed to respond to both technological and social (job destruction) apprehensions of the users. We believe they would be needed in such automated vehicle systems, at least during a transition period (like grooms in the first elevators).

Enforcement of the laws applied to car/truck drivers is necessary. We had to make sure that the operation of the ARTS vehicles was not detrimentally impacted by illegal parking etc. Whilst the police were reactive, as they were involved in the preparation phase, they could not always be on site. This was why the stakeholder's consultation (notably towards shopkeepers and restaurant owners) carried out before the demonstration was an important first step in order to reach a maximum number of persons on what can or cannot be done.

Operating ARTS in real urban conditions is not an easy task. Changes and adaptations may become necessary at any time. A good governance and organization of the information between stakeholders is essential.

ARTS systems are described as "vehicles of the future". The systems and vehicles delivered for La Rochelle demonstrations were still prototypes and to some extent were not fully ready to be implemented. For example, the lack of an active supervision system was detrimental to the operation, and the vehicles did not provide a satisfactory standard as regards accessibility for handicapped people, which is crucial for a vehicle of the future.

La Rochelle partners have demonstrated the benefit of starting informing and awareness raising campaigns early in the project. It is essential to engage the citizens from the youngest to the oldest. An action like the special edition of "Le Petit Quotidien" was of benefit not only for the pupils, but for all, as it generated exchanges between generations, discussions (even basic) on a topic often considered as "reserved for experts only".

The overall success of the demonstration and positive reaction of the public to the demonstration proves that people are often less reluctant to change their attitudes towards innovative vehicles without fully understand their potential impacts. This was a major positive outcome, despite the limitations of the demonstration itself.

3 ARTS operation and performance

3.1 Overview of the ARTS operation

The ARTS demonstration project implementation was organised in three phases (Figure 3.1):

- Phase 1: Line 1 (Aquarium- Motte Rouge) was open to users from 17 December 2014 to 24 January 2015 (▬)
- Phase 2: two Line 1 (Médiathèque –Technoforum) and Line 2 (Aquarium –Motte Rouge) were open to users from 26 January 2015 to 3 March 2015(▬).
- Phase 3: the connection between phase 1 and phase 2 was implemented and Line 3 (Aquarium – Technoforum) was open to users from 4 March 2015 and 25 April2015 (▬).

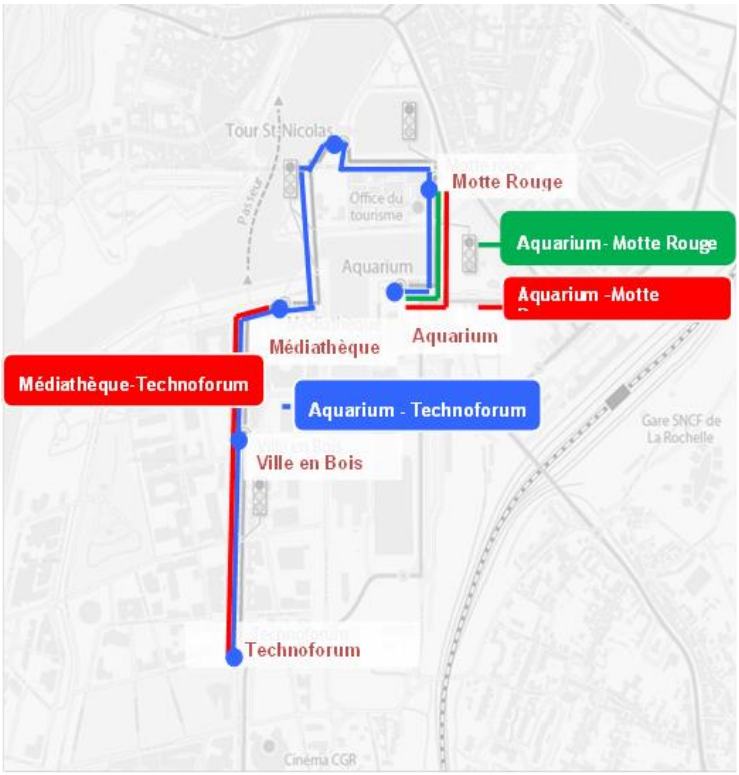


Figure 3.1 ARTS demonstration phases

The characteristics (total circulation time, distance, number of stations, average stop time on the stations, and average travel time) of each phase are presented in Table 3.1:

Table 3.1 Descriptions of the different lines operated by ARTS

	Circulation time (minutes)	Distances (km)	Number of stations	Average stop time on the station (minutes)	Average travel time (minutes)
Line 1 Aquarium-Motte Rouge	3	0,35	0	0	3
Line 2 Média-Technoforum	6	0,75	1	3	9
Line 3 Aquarium-Technoforum	17	1,9	4	12	29

The ARTS users had to register at the beginning of each trip for legal reasons. The total number of users (one way journey) was 14,661 during the 108 days of the ARTS demonstration, with an average of 136 users per day (Table 3.2). However, as curiosity of automated vehicles in an urban environment was one of the main motivations for riding the vehicles, a significant number of the people used the ARTS vehicles for return trips as well (Approximately half of them according to the operator on-board vehicles). Thus, the total number of trips with the ARTS vehicles was estimated to be 21,991.

Table 3.2 Users during the demonstration

Number /Phase	**20/12/14-24/01/15 Phase 1**	**26/01/15-3/03/15 Phase 2**	**4/03/15-25/04/15 Phase 3**	**Total**
Users(n)	2623	3844	8194	**14661**
Circulated days (n)	32	32	44	**108**
ARTS operation hours (h)	182	336	877	**1395**
Average Users/day	82	120	186	**136**
Average operation hours/day for all vehicles	6	11	20	**13**

The number of users was higher in the third phase (i.e. the complete route), compared to those in the other two phases. The length of the third phase was about 2 months (44 days) with 4 or 5 vehicles in circulation.

Based on the data collected, there was a difference between the ARTS circulated hours and ARTS operation hours.

- ARTS **operation** hours (h) were defined as the total time of the service including the time needed for the automated vehicles to travel to a station to start a service and the time needed to go from the route to the depot in the evening.
- ARTS **circulated** hours represent the total hours on route excluding stop times at the stations and the times to arrive/leave the first/last station on the route.

Table 3.2, it was possible to identify the most frequented route sections and to calculate the total kilometers travelled on each of demonstration lines (Figure 3.3).

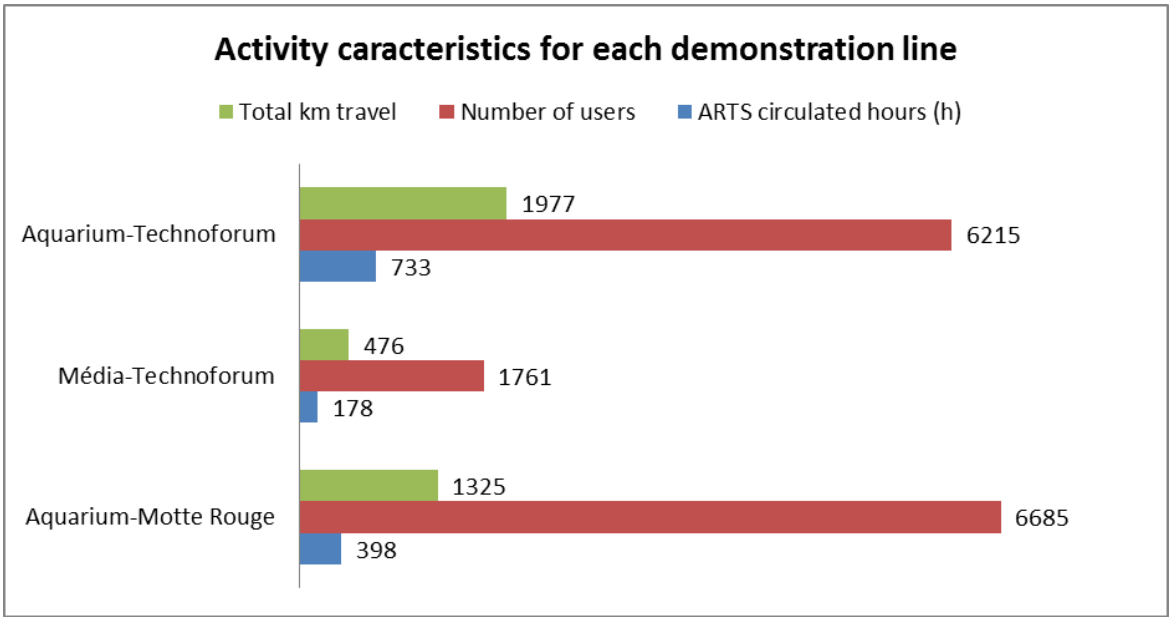


Figure 3.3 Demonstration lines characteristics

The most frequently used line was Aquarium – Motte Rouge, where the total number of one way trips was about 6,685 (i.e. a total of 10,027 trips extrapolated including return trips). This equated to 17 users per circulated hours. It can be explained as these two stops were located in the most visited areas of La Rochelle. Though the vehicles circulated for limited hours on the Aquarium – Motte Rouge line (398 hours), the circulation period was quite extensive (about 76 days).

On the Médiathèque –Technoforum line, the number of one way trips was 1,761 (a total of 2 640 trips extrapolated) with an average of 10 users per circulated hour. The activity period on this line was about 32 days. Of the three lines, this line was least visible to the users.

On the Aquarium-Technoforum line, the total number of one way trips was 6 215 (a total of 9 324 trips extrapolated including return trips) during 733 circulated hours with an average of 8 users per circulated hour.

The total distance travelled was about 3,777 kilometres during the whole demonstration period.

3.2 Energy consumption

Energy consumption was tracked using the following indicators:

- Number of vehicles (n): represents the number of vehicles that were in operation at a given day.
- Daily consumption (Kwh): represents the energy consumption by all vehicles in operation on a given day. The meter was read every day at 9:00 am.

- Total hours of activity (h): represents the total number of hours of activity for all the vehicles in operation on a given day.

The evolution of these three indicators during the demonstration can be seen in Figure 3.4. Three peaks of consumption were observed (see the red circles in the Figure 3.4). These peeks corresponded to the beginning of each of the three phases of the demonstration. At the beginning of each phase, new vehicles were introduced in the service, and usually required a full charge of battery.

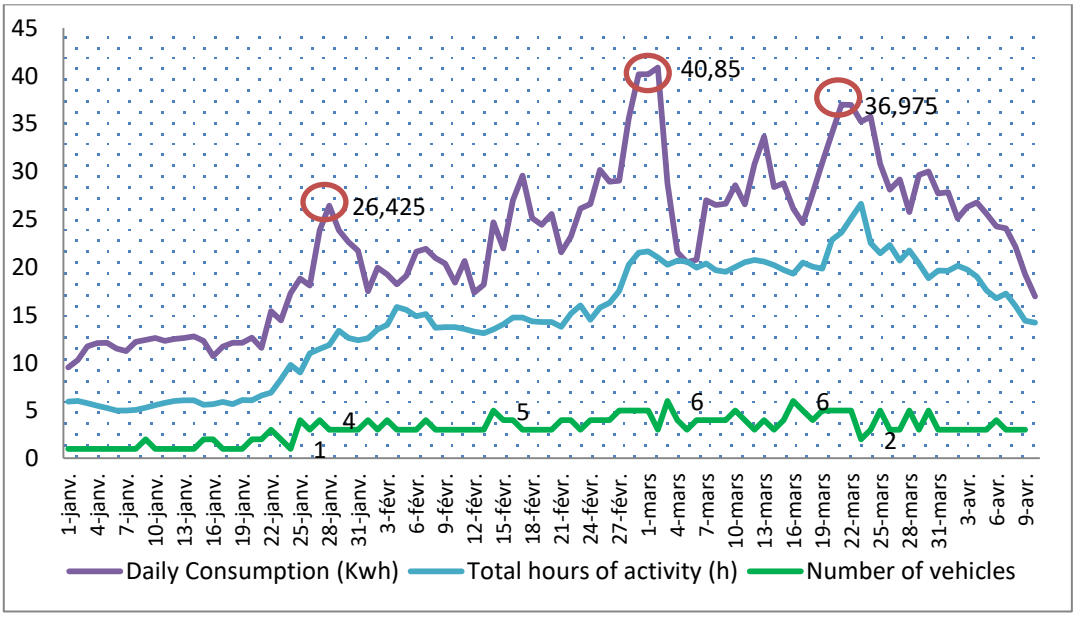


Figure 3.4 Daily energy consumption.

The daily energy consumption is highly correlated to both the number of vehicles in operation and the total number of hours of service.

Table 3.3 Correlation matrix for energy consumption

	Number of vehicles	Daily consumption	Total hours of activity
Number of vehicles	1		
Daily consumption	0.76	1	
Total hours of activity	0.82	0.892	1

The high correlation is observed between the daily energy consumption and the total hours of operation. This relationship is represented in the following Figure 3.4.

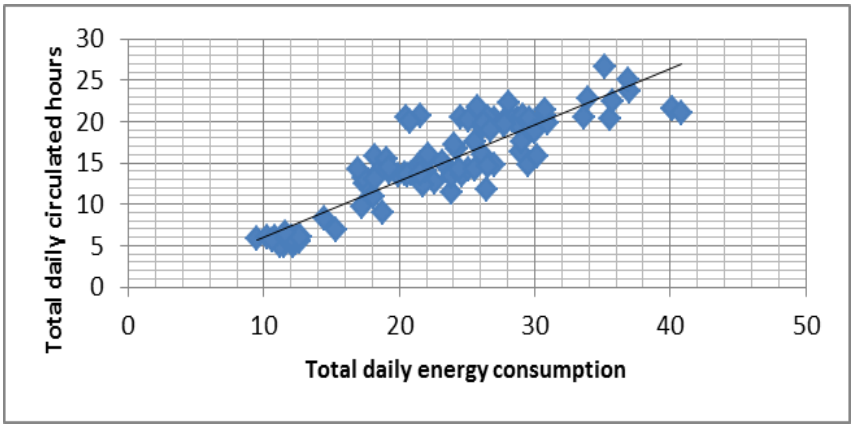


Figure 3.4 Correlation between daily energy consumption and daily circulated hours

The fact that daily consumption is also highly correlated to the number of vehicles in operation might suggest that reducing the number of vehicles while keeping the same activity (in number of hours) could lead to energy savings. For future demonstrations, it would be interesting to investigate this possibility.

The accumulated number of hours of operation was 1,395 hours during the whole period of demonstration. The accumulated energy consumption was 2,540 kWh. The average energy consumption per vehicle per hour was 1.75 kWh.

3.3 Incidents recorded

3.3.1 Data collection

This section reports ARTS failures which occurred during the La Rochelle demonstration and analyses key reasons of the failures. Data collection was undertaken through a three level process as shown in Figure 3.5.

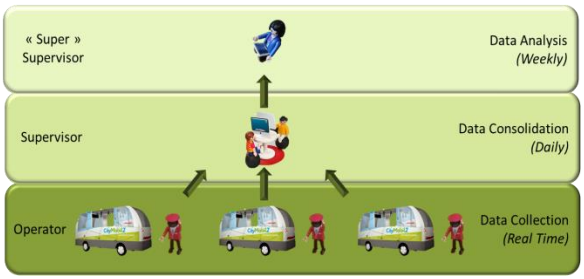


Figure 3.5 Data collection process

During the experiment, all data were collected by operators and consolidated by supervisors. Each operator used a data sheet in order to report incidents or any failures during the trips. Figure 3.6 presents an example of such a data sheet.

VEHICLE #1	DAILY REPORT CITYMOBIL2	
Date	07-févr	
Start Hour	12:31 PM	
End Hour	5:23 PM	
Operator	Alex	
Battery level	100%	81.20%
Trip	N°0	
Weather	Suny, Cold -1°C, wind 25 km/h	
Number of passengers	101	
Passengers' remarks		

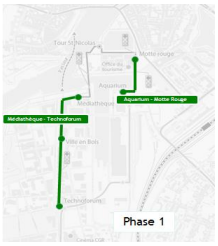
PART 1: General Information

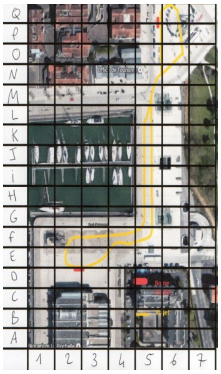
Details				
Failure Type	Number	Start hour	Duration	Map square and description
GPS				
LASER	5	12:51 PM	0:01:00	F4: deceleration then stop
	11	12:52 PM	0:02:00	F2: Strong decelaration then stop. Need to switch on manual mode
	1	2:55 PM	0:00:30	Q6: Deceleration - automatic recovery
SLAM				
LIGHT				
TRAFIC				
MECANICAL				
ELECTRICAL				
OTHER	1	12:47 PM	0:01:00	I5: Mechanism wheels blocked on manual mode . Departure on automatic mode OK
	1	2:12 PM	0:00:30	E2: Accidental desarm

PART 2: Failures details

Important event	At "Aquarium" station, in auto mode , too close to the dock and metallic stairs. The steps have strongly hit the wooden dock .

PART 3: Remarks





PART 4: Map

Figure 3.6 Data sheet used to collect information (XLS format)

3.3.1.1 Information collected in section Part 1 (General information)

Part 1 of the sheet focusses on general aspects of data collection. It allows identification of vehicle deployed. As observed, performances of the each vehicle were quite different. It indicates the date of the data collection. Start hour and End hour allow the duration of the vehicle operations to be calculated. Battery level information and weather conditions were also be recorded.

VEHICLE #1	DAILY REPORT CITYMOBIL2	
Date	07-févr	
Start Hour	12:31 PM	
End Hour	5:23 PM	
Operator	Alex	
Battery level	**100%**	**81.20%**
Trip	N°0	
Weather	Suny, Cold -1°C, wind 25 km/h	
Number of passengers	101	
Passengers' remarks		

Figure 3.7 Part 1 of the data sheet

3.3.1.2 Information collected in section Part 2 (Failures details)

Part 2 of the data sheet allows an operator to report problems encountered during the various trip of the day. The 4th column gives the opportunity to identify clearly the location of the problem on a map. This identification helped ROBOSOFT staff to identify the source of defaults/issues that occurred during the trip.

During the experiment, many problems occurred due to sensor weaknesses between the vehicle and its environment (trees, trash, reflecting sunlight, etc.).

The focus was on micro failures that interfered with the service level for passengers during operations. Major failures which resulted in long periods of vehicle immobilization were not reported here.

In order to address the frequency of failure between vehicles, the driving time of each vehicle was reviewed and used to provide comparison basis. This approach enabled the performances of different vehicles to be compared independently of the operators involved.

Details				
Failure Type	Number	Start hour	Duration	Map square and description
GPS				
LASER	5	12:51 PM	0:01:00	F4: deceleration then stop
	11	12:52 PM	0:02:00	F2: Strong decelaration then stop. Need to switch on manual mode
	1	2:55 PM	0:00:30	Q6: Deceleration - automatic recovery
SLAM				
LIGHT				
TRAFIC				
MECANICAL				
ELECTRICAL				
OTHER	1	12:47 PM	0:01:00	I5: Mechanism wheels blocked on manual mode . Departure on automatic mode OK
	1	2:12 PM	0:00:30	E2: Accidental desarm

Figure 3.8Part 2 of the data sheet

3.3.1.3 Information collected in section Part 3 (Remarks)

Part 3 of the sheet consisted of a free text zone, in which the operator had the opportunity to detail a specific problem. In this section, the operator also often reported comments from passengers about ARTS and the associated service.

Important event	*At "Aquarium" station, in automated mode, too close to the dock and metallic stairs. The steps of the vehicles have strongly hit the wooden dock.* *"The vehicle is loud: when it turns, it is very noisy."*

Figure 3.9 Part 3 of the data sheet

3.3.1.4 Information collected in section Part 4 (map)

Par 4, the last part of the sheet, contains a reference map that allowed operators to locate where the problem occurred on the route during a trip.

Figure 3.10 Part 4 of the data sheet

3.3.2 Failures analysis

Many problems occurred in January 2015 because the technology was found to be difficult to be adapted to the complex environment of the demonstration site.

As the demonstration moved forward, the problems were gradually solved. After January, the number of failure decreased. Nevertheless, at the end of the demonstration some problems still remained unsolved. Examples are the limited number of vehicles that could circulate on the route, and the supervision limitation.

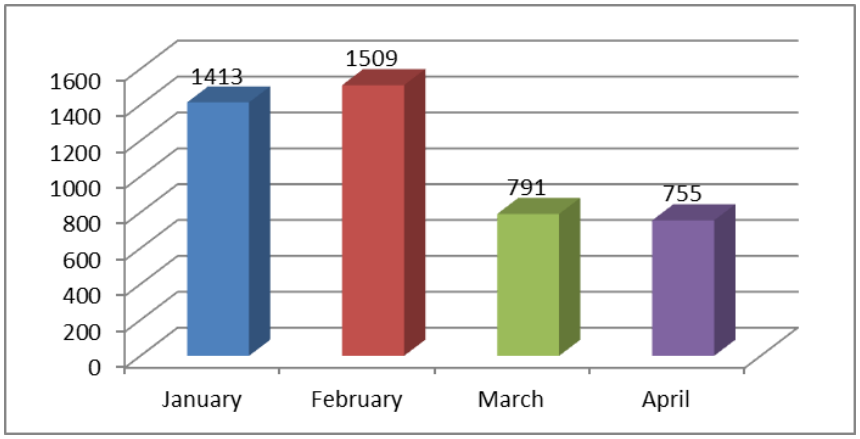


Figure 3.11 Global number of failures per month

An indicator which is very important is the duration of a failure - i.e. the lead time necessary to allow service to continue. Thanks to the presence of ROBOSOFT staff on-site, most of the problems were solved quickly (average failure duration < 2 min). In addition to interventions by ROBOSOFT staff, it is important to note that the ARTS operators and supervisors were very reactive during the demonstration. Most often, when a significant problem occurred, they switched off the vehicle control. Thanks to this manipulation, major failures appeared as minor failures to users.

Table 3.4 Failure occurrences per category and per month

	Occurrence	Duration	Average duration	Occurrence	Duration	Average duration	Occurrence	Duration	Average duration	Occurrence	Duration	Average duration
Type of failure	*January*	*January*	*January*	*February*	*February*	*February*	*March*	*March*	*March*	*April*	*April*	*April*
GPS	322	6:50:44	0:04:11	700	10:47:36	0:01:26	60	1:00:00	0:01:00	138	2:34:03	0:01:32
LASER	746	17:28:12	0:04:37	315	4:39:31	0:01:23	238	2:16:00	0:00:34	136	1:47:01	0:01:04
SLAM	59	1:04:04	0:03:34	56	0:42:39	0:01:11	60	1:52:00	0:01:52	68	1:02:02	0:01:14
RED LIGHT	33	0:46:00	0:04:36	47	5:04:48	0:10:10	34	0:46:00	0:01:21	46	0:58:37	0:01:43
TRAFIC	102	1:30:22	0:02:55	155	2:06:25	0:01:16	129	1:49:00	0:00:51	112	1:59:58	0:01:28
MECHANIC	39	0:39:26	0:03:17	47	0:56:37	0:01:53	73	9:13:00	0:07:35	33	1:47:42	0:04:29
ELECTRIC / AUTOMATIC	82	12:52:11	0:30:53	16	8:41:58	0:52:12	108	7:12:30	0:04:00	189	9:36:40	0:04:09
OTHERS	30	0:52:34	0:05:50	175	5:46:41	0:03:04	89	2:19:30	0:01:34	33	2:39:30	0:06:39
TOTAL	**1413**	**42:03:33**	**0:01:47**	**1509**	**38:46:15**	**0:01:32**	**791**	**26:28:00**	**0:02:00**	**755**	**22:25:34**	**0:01:47**

As the demonstration moved forward, the number of failures decreased. However, even at the end of the demonstration, the vehicles encountered different failures (Figure 3.12 and Figure 3.13). As an example, during April, Vehicle 4 was immobilized all the time (not in operation). In order to analyze the failures in detail, we first adjusted data to consider the same driving time for each vehicle per month (if the vehicle was used at least once of course). So, the driving time for a month was brought back to 100 as a basis. As a consequence, we could compare performances of different vehicles independently from the operators.

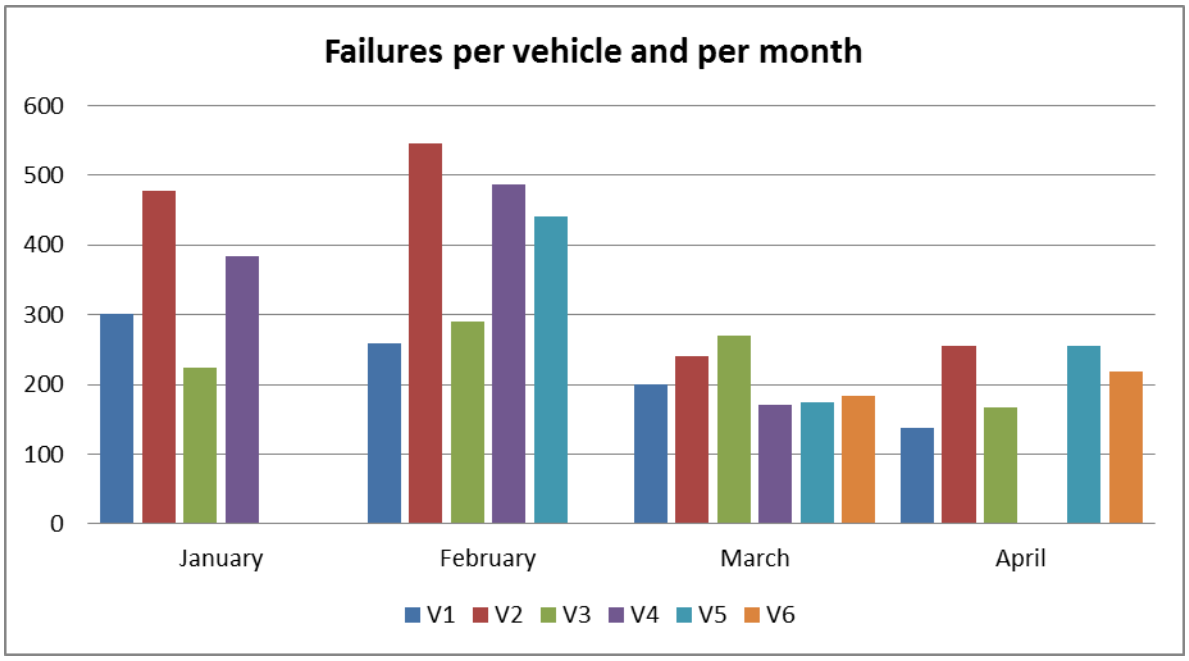


Figure 3.12 Evolution of failures number per vehicle and per month

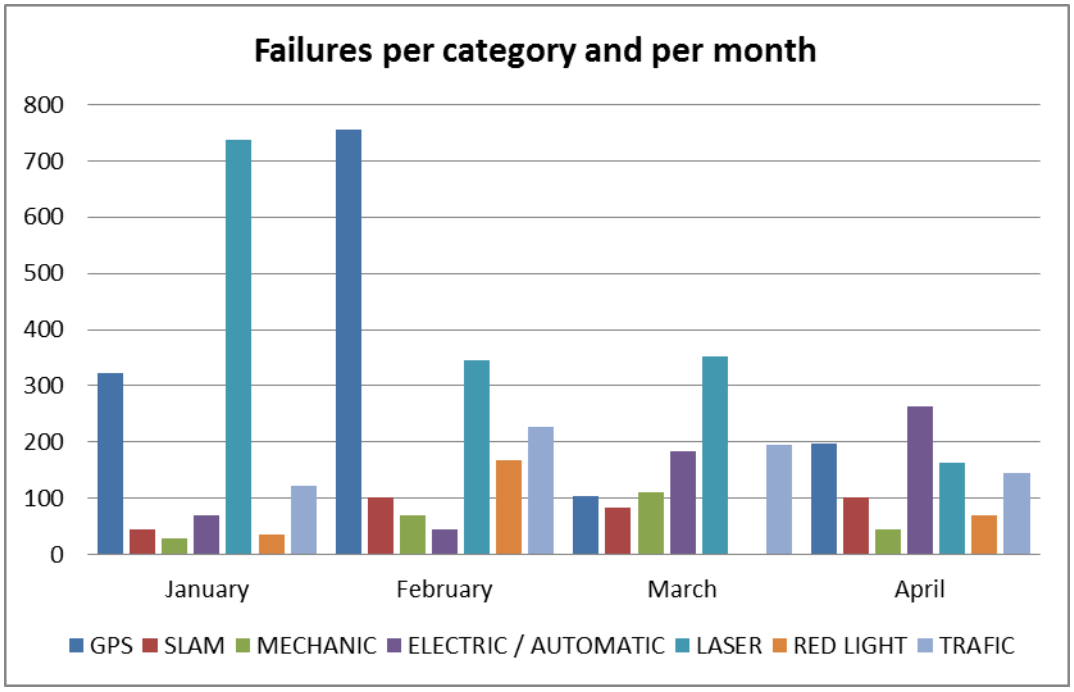


Figure 3.13 Evolution of failures number per category and per month

These failures can be decomposed into two main categories:

- **Failures related to the system.** For example, in February 2015 the leg between “Aquarium” and “Motte Rouge” was under control whereas the deployment of the second leg from “Technoforum” to “Médiathèque”, generated a lot of problems. These problems were due to technology issues such as GPS or SLAM failures, and also due to organizational reasons such as traffic modification.

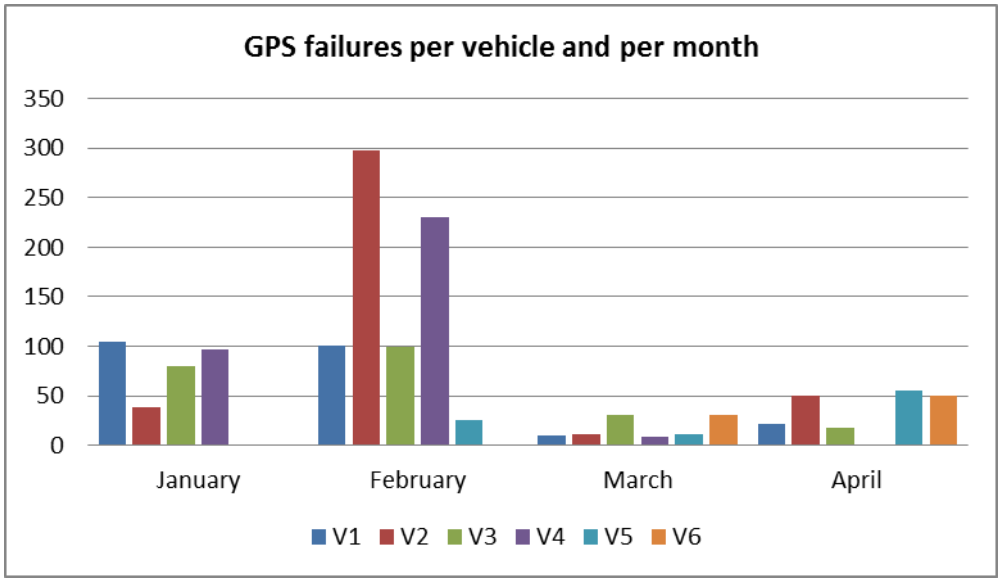


Figure 3.14 Evolution of GPS failures number per vehicle and per month

- The second category of **failure illustrates the reliability of the vehicle itself**. This was the case for mechanical failures which occurred more or less throughout the demonstration.

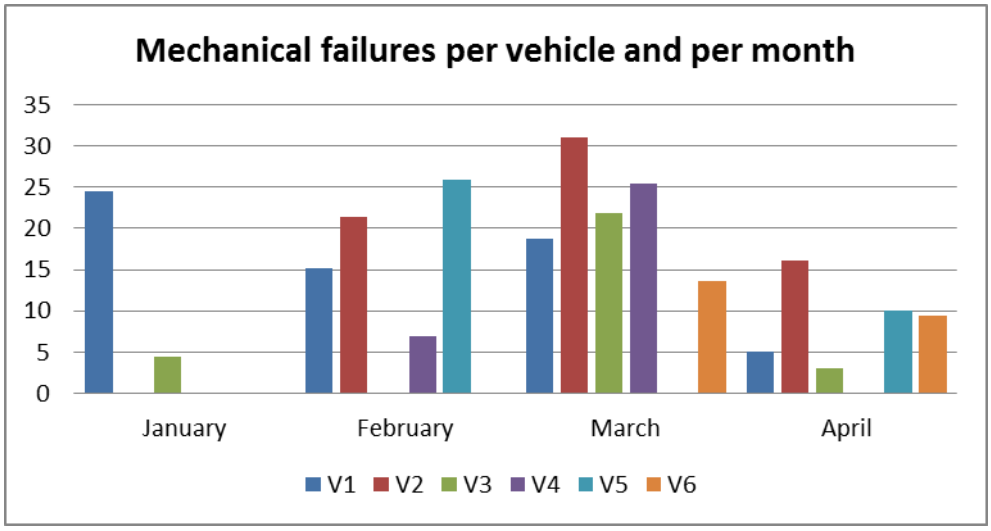


Figure 3.15 Evolution of mechanical failures number per vehicle and per month

Weather conditions influenced the performance of the vehicles. Under some adverse weather conditions, technological sensors such as the LASER were disrupted. This was particularly the case when heavy rain fell.

Figure 3.16 Example of rainy days during La Rochelle demonstration

That rainy days impacted negatively on the ARTS performance can be seen in Figure 3.17. It also demonstrates that sunny days cannot be considered to be the best weather conditions, as reflections of light could interfere with the operation of the vehicles. (For example, a light reflection from a public trash).

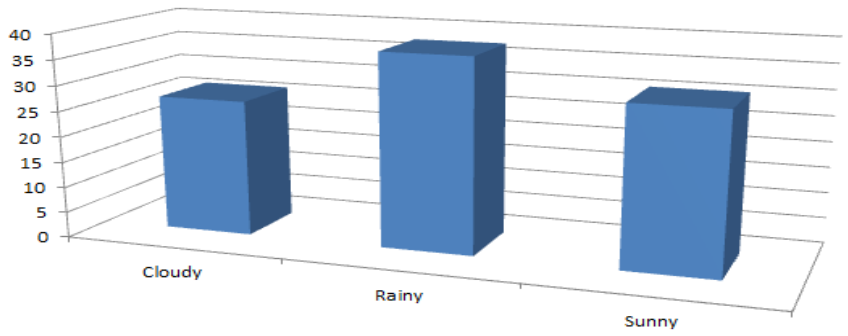


Figure 3.17 Weather and average failure occurrences

3.4 An analysis of speed and acceleration profiles of ARTS vehicles

During the demonstration, vehicle data were logged by the vehicle manufacturer ROBOSOFT (for debugging) including vehicle and sensor data (e.g. speed, GPS and Laser and others). A total of 762 batches of vehicle data were uploaded to a server hosted by CTL (V1/153, V2/212, V3/139, V4/71, V5/124, V6/63). As the data were not recorded according to trip status, a batch could include a part of a round trip data, the whole of a round trip data, or more than one round trip data.

The data were filed according to vehicle status (e.g. starting-up, cruising, and stopping) while moving along the route. In addition, each manual control process was recorded in a separated file. The number of the files included in a batch depended on the length of operation and frequency of manual interventions. Taking V5 data considered as an example, it included 90 speed data files, so did GPS and other sensor data.

Table 3.5 General information about the vehicle data sampled

	V1	V2	V3	V4	V5	V6
Date	21/04/2015	25/04/2015	21/04/2015	27/03/2015	21/04/2015	24/04/2015
Recording started	11:48:17	13:44:54	11:11:34	10:59:36	10:05:06	10:05:06
Recording length	55.4 min	127.1 min	59:1 min	42.2 min	84.6 min	51.9 min
Distance travelled	3682m	8581m	2894m	2760m	5397m	2747m

For this analysis, one round trip data from each of the 6 vehicles were sampled during Phase 3 of the demonstration (the ARTS vehicles running between Aquarium and Technoforum). In order to analyse vehicle performance, firstly, the individual files of the vehicle movement had to be pieced together based on their time ID; secondly, GPS data were referenced to track vehicle locations along the route; and finally, missing data were identified to complete the round trips.

Speeds

For the analysis, cruising speeds of the ARTS vehicles were examined. In the demonstration, the maximum speed of cruising was set up to be 2m/s (7.6km/h). From the data recorded, this targeting speed was well controlled during the demonstration. For the six vehicles, an average cruising speed of 1.966m/s and standard deviation of 0.027 m/s were delivered.

Table 3.6 Cruising speeds

	V1	V2	V3	V4	V5	V6
Min (m/s)	1.80	1.81	1.82	1.85	1.81	1.82
Max (m/s)	2.18	2.17	2.16	2.13	2.16	2.16
Average (m/s)	1.997	1.996	1.996	1.995	1.996	1.997
StD (m/s)	0.034	0.025	0.026	0.023	0.026	0.028

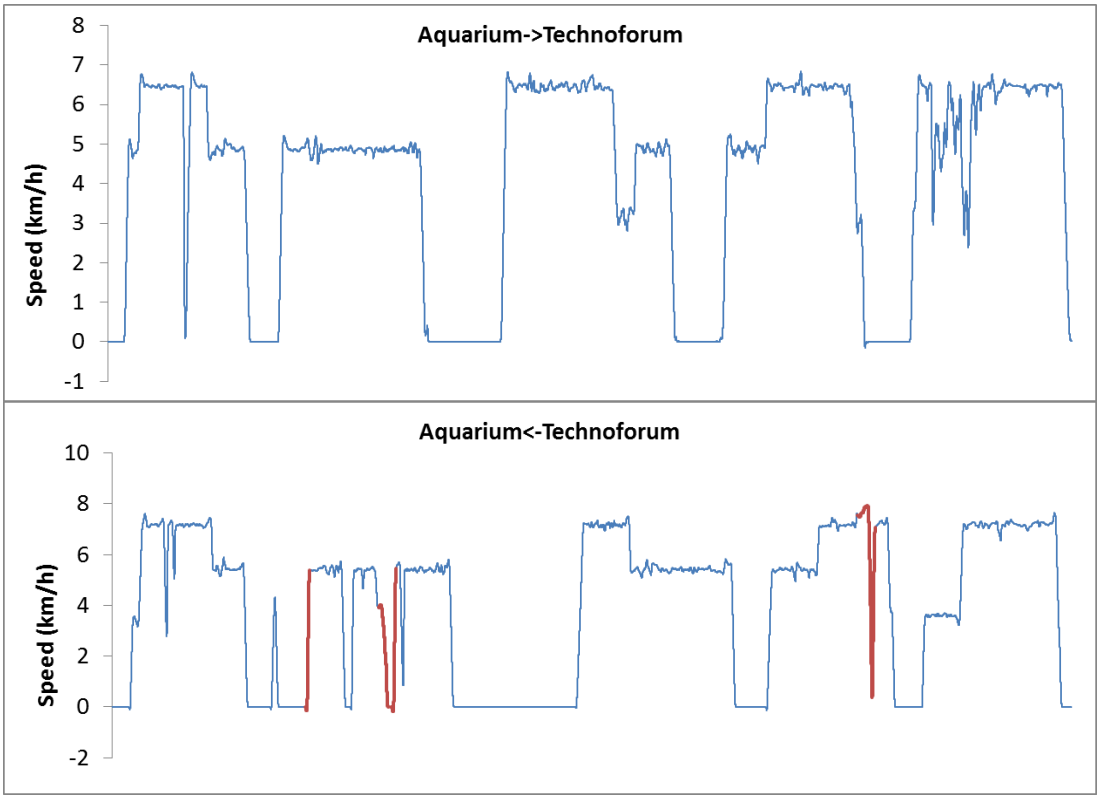


Figure 3.18 Speed profiles of the automated buses demonstrated (V1, blue: automated control; red: manual control)

Accelerations and decelerations

For accelerations, two kinds of situation were considered: starting up from stops and other starting-up processes. When starting up from stops, an average of the maximum accelerations was calculated to be of 0.38m/s^2 with a standard deviation (StD) of 0.018m/s^2. When starting up in other situations, the maximum acceleration recorded was 0.42m/s^2 when under automated control, compared to 0.64 m/s^2 when under human control.

Table 3.7 Maximum accelerations during starting-up

	Control mode	Average (m/s^2)	StD (m/s^2)
Starting up from stops	Automatic	0.38	0.018
	Human	-	-
Accelerating in other situations	Automatic	0.42	-
	Human	0.64	-

For decelerations, two kinds of situation were considered: expected stopping and unexpected stopping. For a planned stop, the decelerations of the vehicles were found to be smoother when under automatic control than when under human control. The average of maximum decelerations of the 6 vehicles sampled was calculated to be -0.33m/s2 under

automatic control, compared to -0.70m/s2 when under human control. However, when in situation of unexpected stops, a maximum deceleration of -1.55 m/s2 was recorded when under automatic control, compared to -0.77 m/s2 when under human control. One possible reason was that the detection systems of the ARTS vehicles did not perform as efficiently and effectively as a human driver (e.g. the later detection of an object needed a larger deceleration to ensure safety).

Table 3.8 Maximum decelerations

	Control mode	Average (m/s^2)	StD (m/s^2)
Expected stopping (e.g. fixed stops/stations)	Automatic	-0.33	0.043
	Human	-0.70	-
Unexpected stopping/deceleration	Automatic	-1.55	-
	Human (at 59049)	-0.77	-

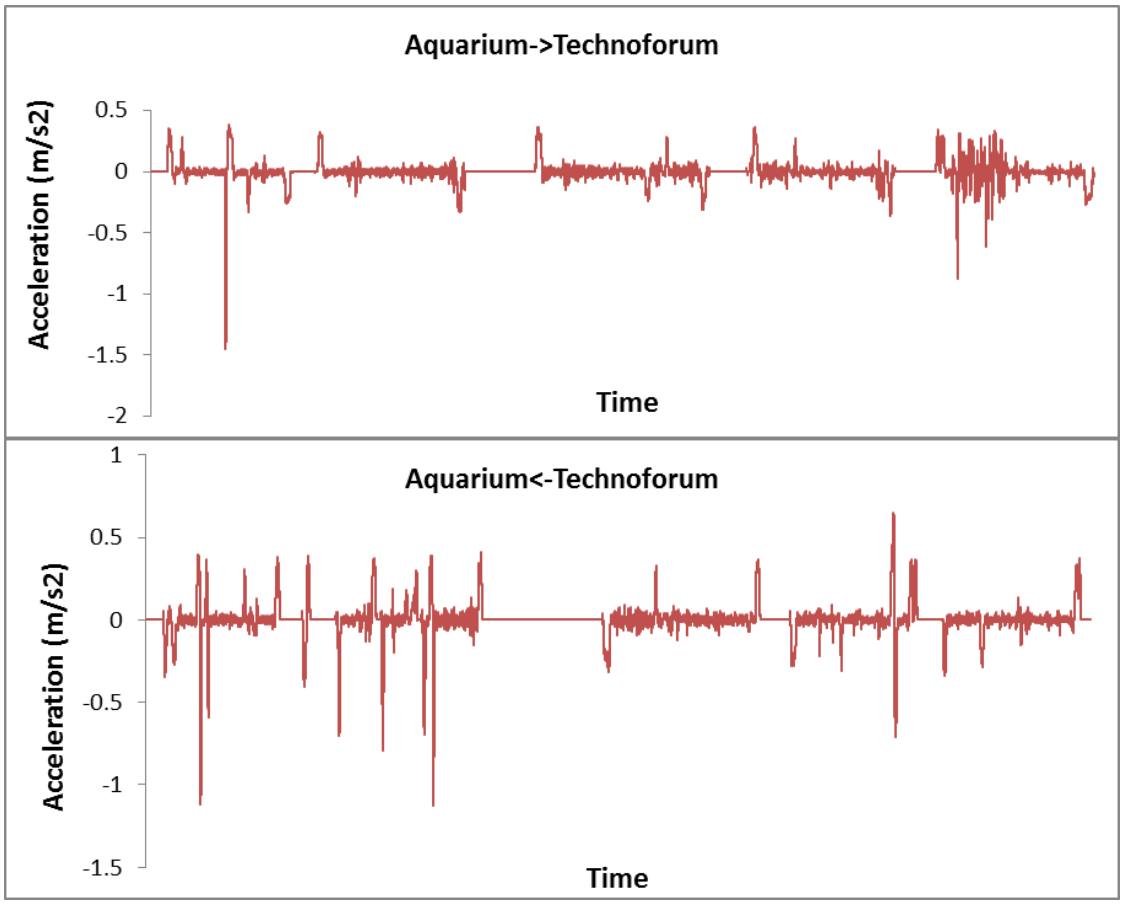


Figure 3.19 An example of acceleration profiles of the automated buses demonstrated (V1)

Auto and manual control

In La Rochelle, the ARTS vehicles were demonstrated on a route with adjacent cyclists and pedestrians. From the data logged, the ARTS vehicles were able to cope with most of the situations under automated control. However in some situations, the on-board operator had to intervene to ensure safety (e.g. three interventions for vehicle V1). For the six vehicle data sampled, the average length running under manual control was 177.5s which accounted for 7.5% of the total running time.

Table 3.9 Vehicle operation under manual control (speed>0)

	V1	V2	V3	V4	V5	V6
Time	138s	302s	142s	64s	174s	245s
Percentage	5.9%	9.1%	7.7%	3.7%	5.1%	13.2%

Safety and environmental implications

An analysis of vehicle performance shows that automated vehicles are able to control their speeds and accelerations/decelerations more accurately and consistently than human driven vehicles. Users of automated vehicles are expected to benefit from such improvements. Firstly, accurate and consistent speed control would mean less likelihood of exceeding speed limits, which should reduce accident rate and severity. Secondly, accurate and consistent acceleration/ deceleration control would reduce excessive accelerations and decelerations for starting and braking, which will have positive impacts on reducing fuel consumption and pollutant emissions. Thirdly, accurate and consistent accelerations/deceleration control would mean smooth vehicle movement which will increase ride comfort to users.

The levels of intervention by the operator showed that the ARTS technology demonstrated needs to be improved in terms of both hardware and software (e.g. object detection and collision avoid systems).

It was difficult to understand how ARTS vehicles will impact on safety and the environment compared to human driven vehicles. One of the key reasons was that the ARTS vehicles were operated at low speed (less than 8km/h), and no comparable bus data were available from current transport.

4 Ex-post survey of users

4.1 Objective

Different types of information were collected from the ex-post survey of users:

- The characteristics of the users and their mobility behaviour;
- Their levels of awareness of the system in order to assess notably the effectiveness of the information campaigns;
- Information on their experiences with ARTS and the trip characteristics;
- Their feedback on the quality of the service offered.

4.2 Survey method

As recommended, the surveys were carried out through face-to-face interviews. Respondents were randomly selected among the users on-board automated vehicles or shortly after getting off at a station. The answers from the respondents were collected using a touchpad, with an application designed specifically for the survey.

The survey was carried out in two waves.

Phase 1: The first wave survey was carried out from 9/02/2015 to 16/02/2015. It is important to note that, at this stage, only part of the route was available.

The ARTS users had the choice of riding on the ARTS vehicles on two distinct route sections:

- Aquarium-Motte Rouge (2 stations) (500m roundtrip)
- Technoforum - Médiathèque (3 stations). (1.5 km round trip)

4 vehicles were operating from Monday to Saturday, 12:30-17:00 on Aquarium-Motte Rouge leg and from 10:00-17:00 on Technoforum - Médiathèque branch (Figure 4.1).

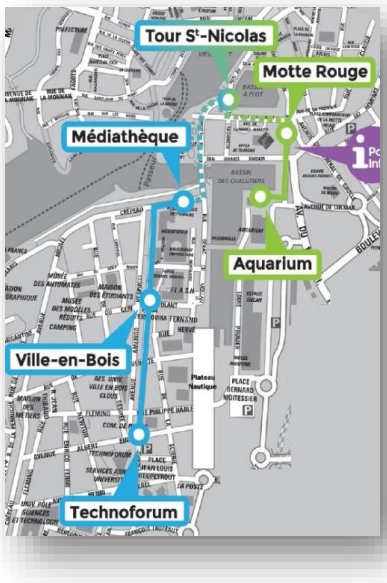


Figure 4.1 CityMobil2 demonstration map.

The surveys were conducted by EIGSI students (48 groups of 2 students each). The groups were deployed at different time slots (Table 4.1).

Table 4.1 Planning of the first Phase

Phase 1	11:30-13 :00	14:00-15 :30	15 :30-17 :00
Monday, 09/02/2015		6 groups	
Tuesday, 10/02/2015			6 groups
Wednesday, 11/02/2015			6 groups
Thursday, 13/02/2015	6 groups		
Monday, 16/02/2015			6 groups
Tuesday, 17/02/2015	6 groups		6 groups
Friday, 20/02/2015			6 groups

Phase 2: The second wave was carried out between 13/04/2015 and 25/04/2015. This was a period when the ARTS vehicles were operated on the whole route of Aquarium – Technoforum (2.5 km) from 10:30-17:30 (Figure 4.3). A total of 5 vehicles were available for operation (Table 4.2).

Table 4.2 Planning of the second Phase

Phase 2	10:30-12h30	14:00-17 :00	15 :30-17 :30
Tuesday, 14/04/2015		6 groups	
Wednesday,15/04/2015			6 groups
Thursday,16/04/2015	6 groups		
Friday, 17/04/2015		6 groups	
Monday, 20/04/2015	6 groups		
Wednesday, 22/04/2015			6 groups
Friday, 24/04/2015	6 groups	6 groups	

The first phase was conducted in winter - very often under rainy and cold weather conditions, and the second one was carried out in spring with milder weather conditions. These factors may be important to take into consideration when analysing the results and could explain some of the differences in responses between both phases.

4.3 Respondents

Over the two waves of the survey, 310 users participated in surveys (149 users in the first wave and 161 users in the second wave)

4.3.1 Gender

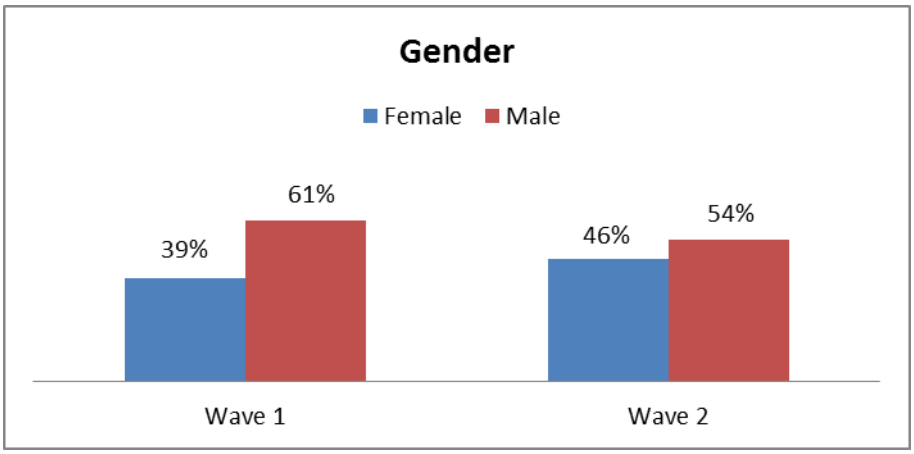


Figure 4.2 Gender of respondents

Figure 4.2 shows the gender distribution of respondents in both waves. In both waves, male participants outnumbered females, the gender gap was more obvious during the first wave (20% approximately) than during the second (10% approximatively).

4.3.2 Age

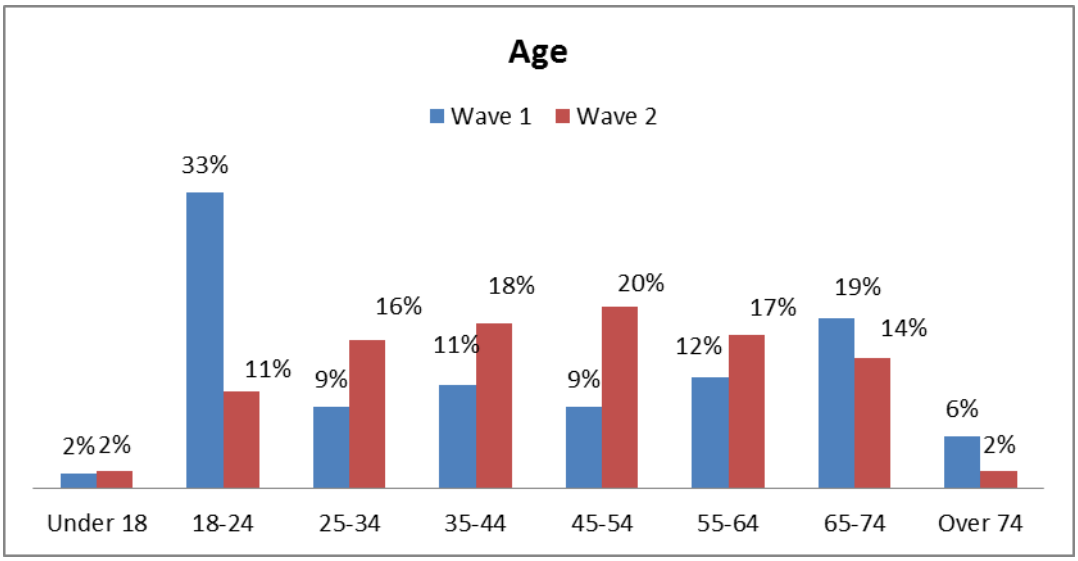


Figure 4.3 Age distribution of respondents in both waves

Figure 4.3 shows the age distribution in both waves of the survey. During the first wave the 18-24 year-old group represented approximately a third of the people sampled. The second wave was observed with a relatively even distribution. The dominance of the 18-24 year old group could be explained by the proximity of the University Campus to the demonstration area.

4.3.3 Level of education

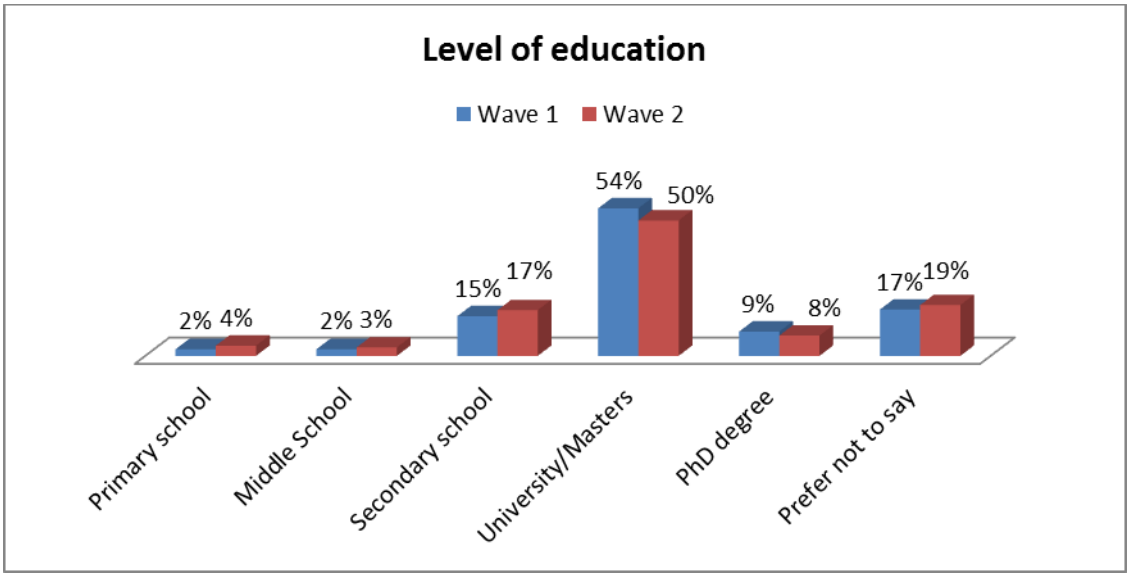


Figure 4.4. Level of education of respondents in both waves

Figure 4.4 shows distributions of education levels in both waves. Approximately 60% of participants reached the level of university studies. This was certainly related to the proximity of the University Campus. There was no significant difference observed between the two waves.

4.3.4 Main occupation of respondents

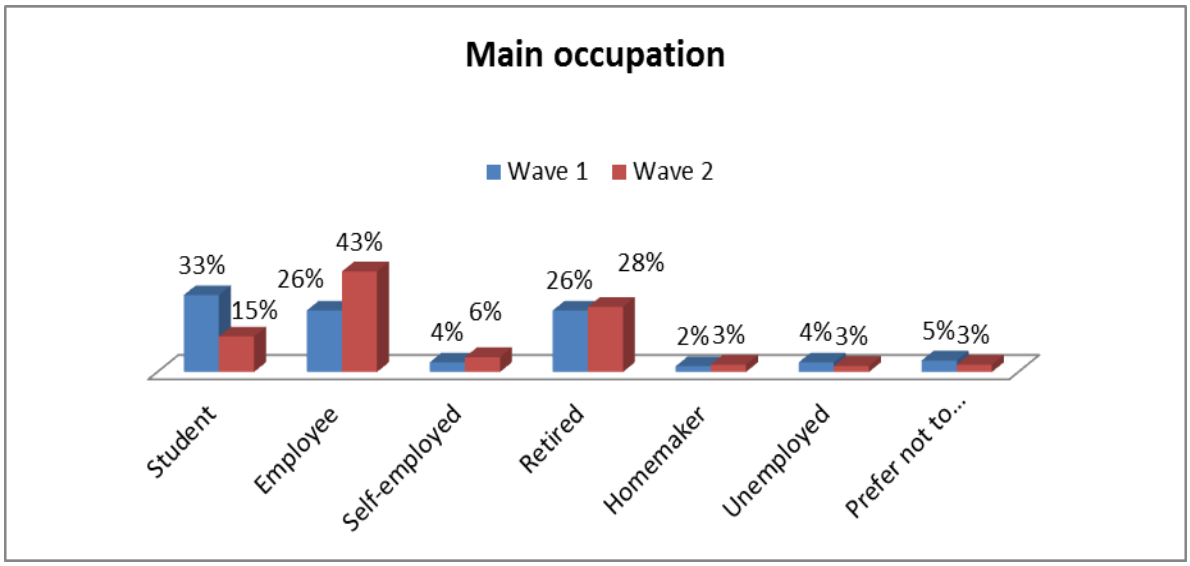


Figure 4.5 Main occupations of respondents

Of the respondents from the two waves, approximately 34% were employees, 27% retired, 24% students and approximately 8% declared having another different main occupation (Figure 4.5). Students and employees were the respondent groups most represented in the

first and second waves respectively. This can probably be explained because interviewers were recommended to observe a more balanced age distribution in the second phase.

4.3.5 Home location

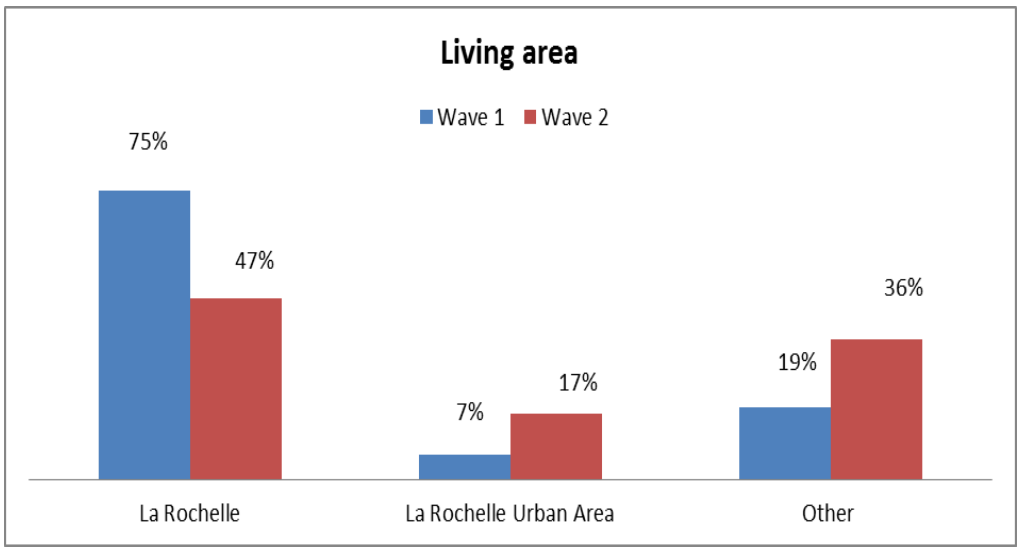


Figure 4.6 Living area of respondents in both waves

75% of respondents in phase 1 declared themselves to be residents of La Rochelle municipality (Figure 4.6). The proportion of this group decreased to 47% in phase 2. The proportion of inhabitants of La Rochelle Metropolitan Urban Area (excluding La Rochelle municipality itself) varied from 7% to 17% between phases. Another significant variation observed was that the proportion of people living outside the Metropolitan Area increased from 19% to 36%. This could be explained to some extent as the tourist season starts in spring, whereas the period of January-February was an off-peak.

4.3.6 Disabilities

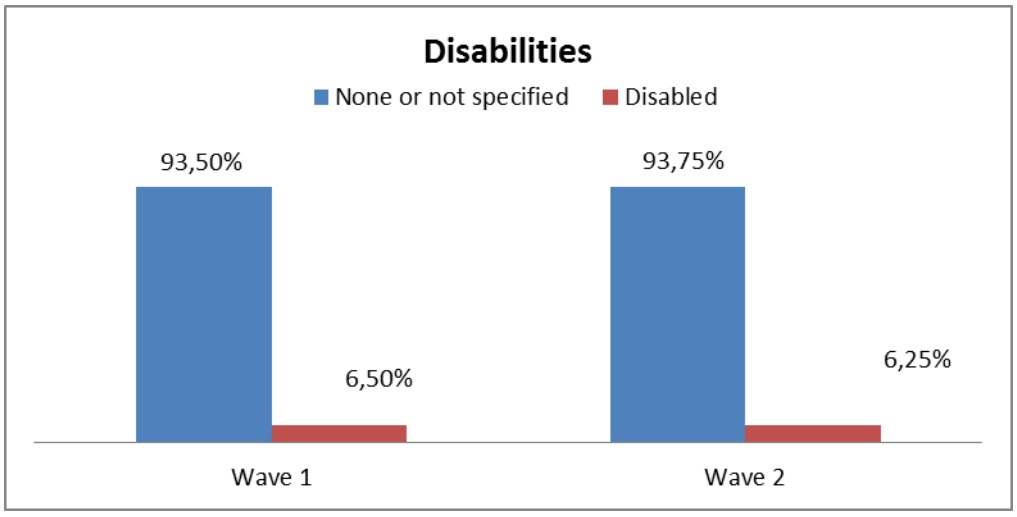


Figure 4.7 Declared disabilities of respondents in both waves

Figure 4.7 shows the incidence of disabilities according to respondents' answers in both phases. Approximately six percent of respondents indicated some kind of disability among the following categories: visual impairment, mobile by wheelchair or other disabilities. There were no significant differences observed between phases. Figure 4.8 shows the accessibility ramp deployed at a stop. This service was not satisfactory at all as it could not be adapted to

the platform (as the photograph shows) and the time to install the ramp was long (nearly 10 minutes according to the operators on-board).

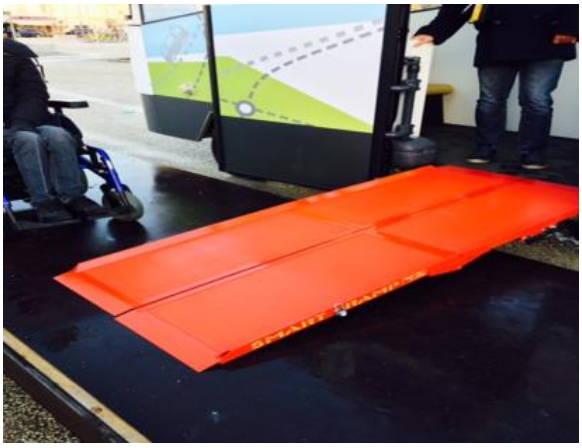


Figure 4.8 Accessibility ramp to the automated vehicle

4.4 Experience with the ARTS: some results

4.4.1 Frequency of use

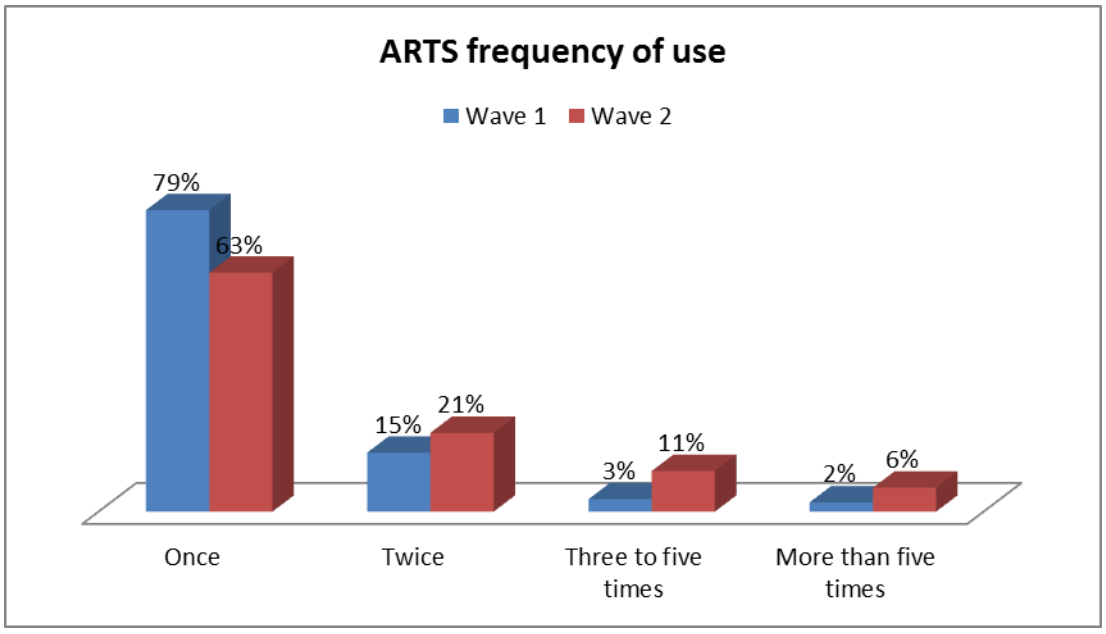


Figure 4.9 Frequency of use of the ARTS

Figure 4.9 shows the frequency of using ARTS in both waves. The proportion of people having used the system more than once increased from 21% to 37% between the two waves. This variation provides some useful information to understand the adoption process of the system by users during the demonstration. Of the people surveyed (both waves included), approximately 70% of the people only used the system once, with 40% of them from La Rochelle and 28% from outside La Rochelle Urban Area.

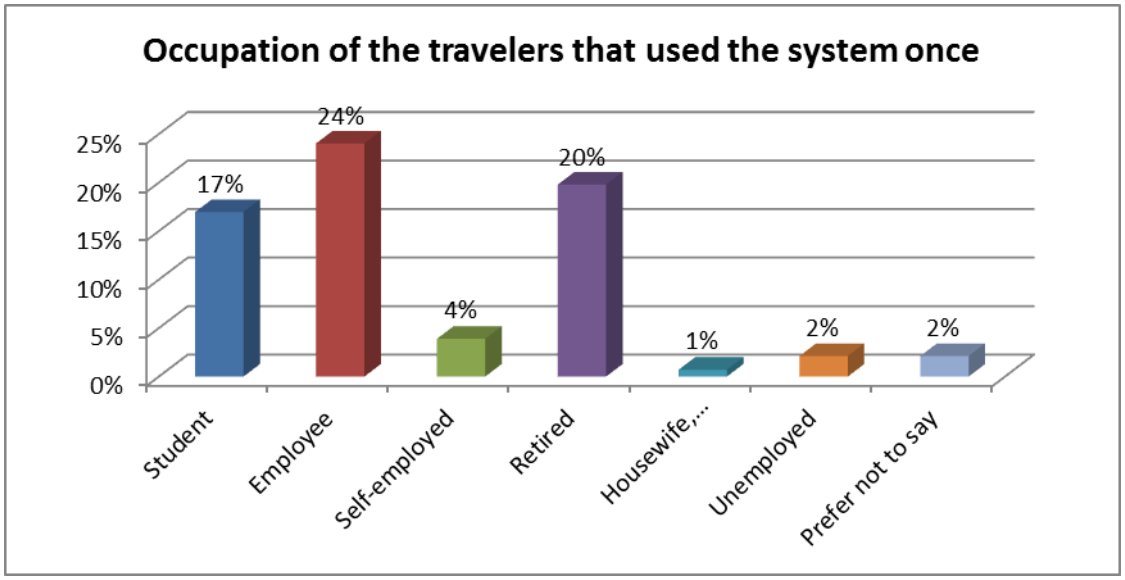


Figure 4.10 Occupation of respondents that used the system once (percentages are based on the size of the overall sample).

Figure 4.11 shows the main occupation of the respondents having used the system at least twice. In the overall sample, approximatively 30% of respondents used the system at least twice.

If we focus on the three most represented occupations (namely students, employees and retirees), employees had the highest proportion of the people having used the system more than once: with 33% relative to the total number of employees. In contrast, students and those retired having used the system at least twice were 18% and 25% respectively relative to the size of their own occupational categories.

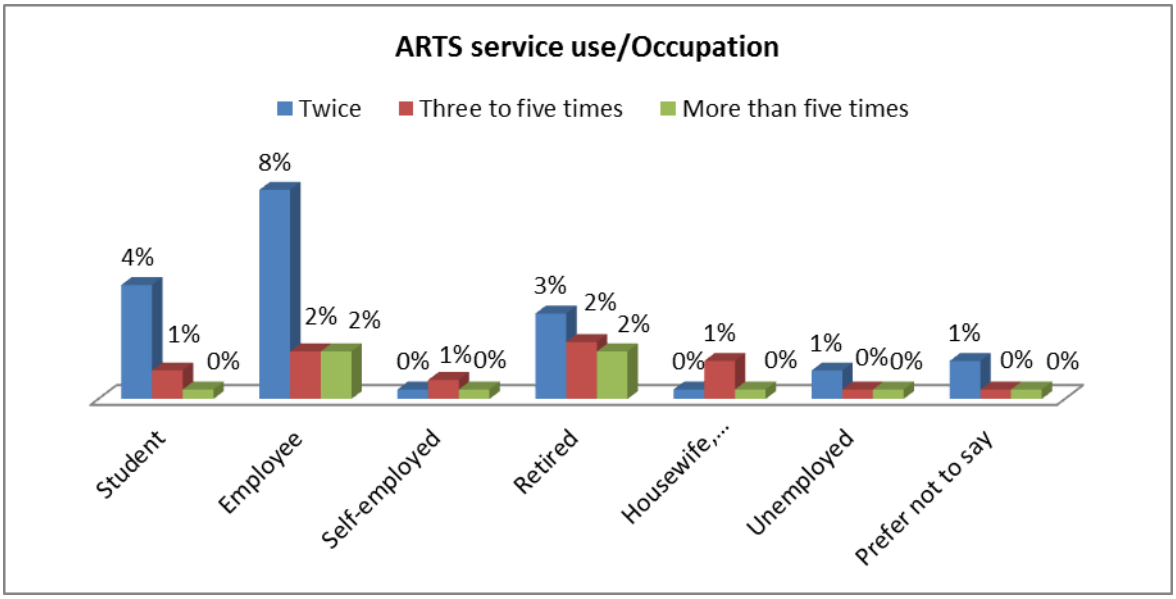


Figure 4.11 Occupation of respondents having used the system more than one (percentages were based on the size of the overall sample).

4.4.2 ARTS Awareness

As described in the section 2.2, the communication campaigns on CityMobil2 project among the local population began early in the project using the local and national media and wide public information meetings.

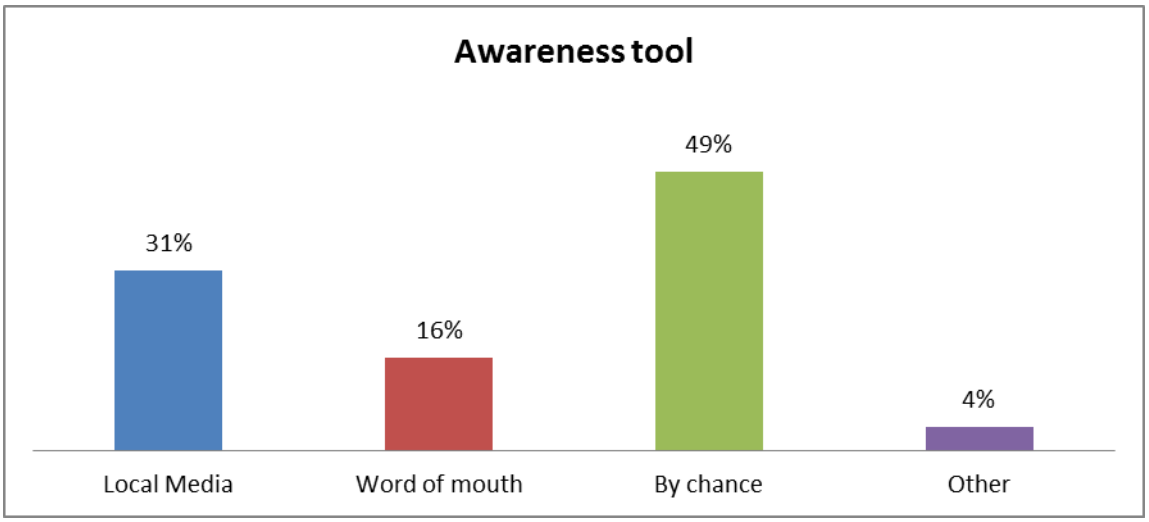


Figure 4.12 Means by which respondents declared having become aware of the ARTS experiment.

Figure 4.12 describes the user responses concerning the sources of information on CityMobil2 demonstration. About half of the respondents (49%) became aware of the demonstration by chance. The local media (31%) was more popular for the users aged 65-74 ARTS Trip

4.4.2.1 Initial stop

During the first wave of the survey, 47% of the people got on the vehicle at the Aquarium station (**Figure** 4.13). This station was situated in front of city's main tourist attraction. Most users of the vehicles at this stop became aware of the demonstration when walking around the Aquarium stop/station.

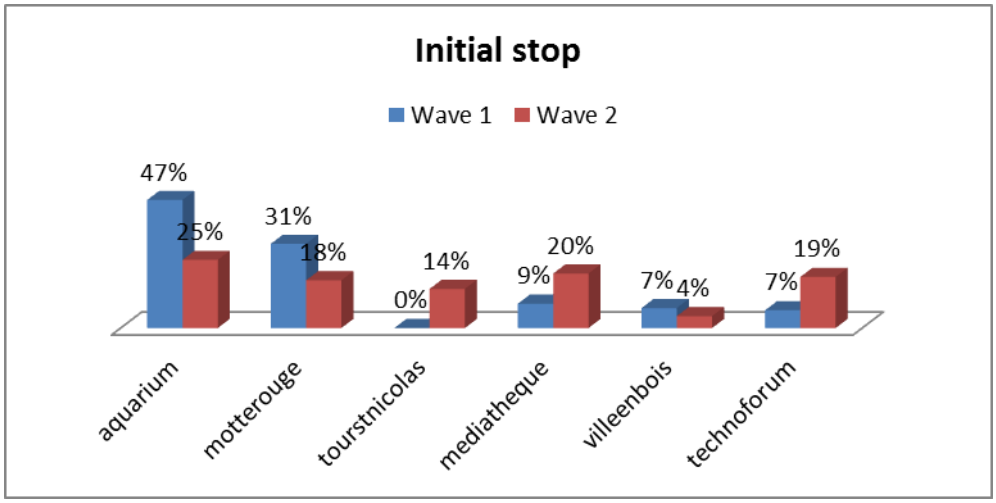


Figure 4.13 Initial stop for respondents in both wavess.

During the second wave of the survey when the full route was in operation, the stations where people boarded were observed to have a relatively even distribution. The “Ville en Bois” station was the least frequently used as an initial stop (only 4% of the respondents).

4.4.2.2 Trip purpose

The most frequent purpose of the ARTS trips (62%) was curiosity (“just to travel using ARTS”). 56% of the “curious” respondents were from La Rochelle, 31% from outside La Rochelle Urban Community and 13% from the Uban Community (but not from La Rochelle municipality) .

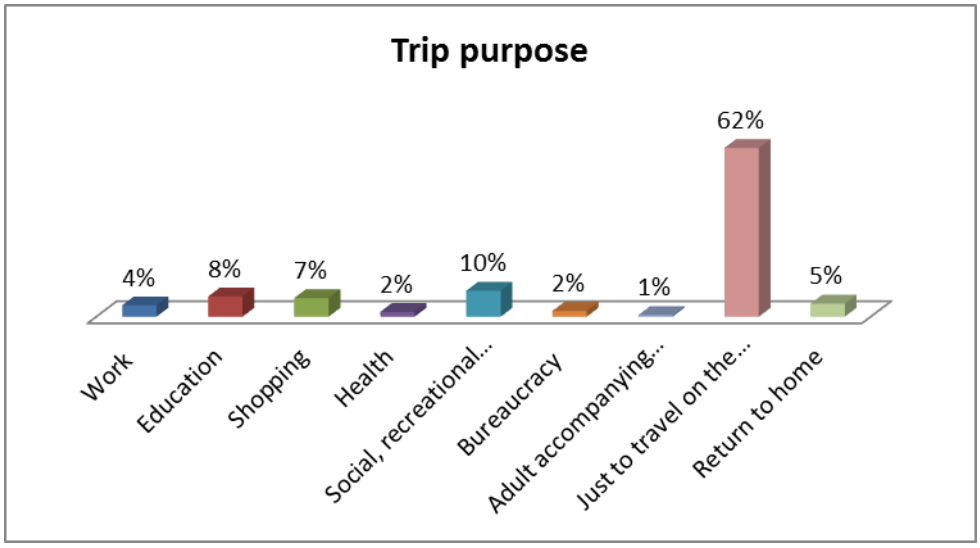


Figure 4.14 Purpose of trip as declared by respondents.

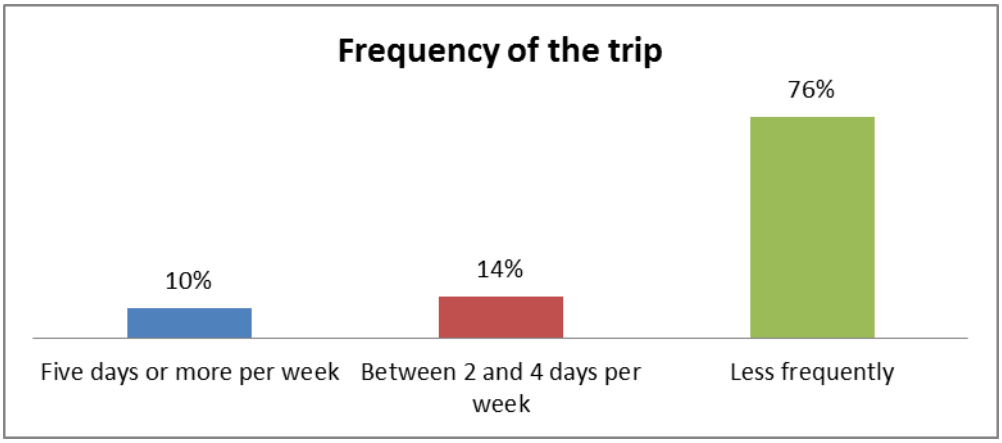


Figure 4.15 Frequency of the whole trip of respondents.

According to **Figure** 4.15, 76% of respondents declared travelling on the route (either with ARTS or not) with a frequency of less than 2 days per week. In this category, we found that the most frequent reason for travel was curiosity or just to try the system. 40% of respondents in that same category were from La Rochelle and 28% were from outside the city.

Respondents with a travel frequency of higher than two days a week represented 24% of the sample, and the typical purposes to travel were “just to travel using ARTS” or “another social or educational propose”. Typical age ranges in this category were 35-44 and 55-64 year old.

Partipants with a frequency of at least five days a week were mainly inhabitants of La Rochelle.

Figure 4.16 shows the transport modes of the respondents before and after the ARTS trips. In most of the situations users arrived to the ARTS station and to the final destination by using soft modes of transport (62% walking and 10% cycling).

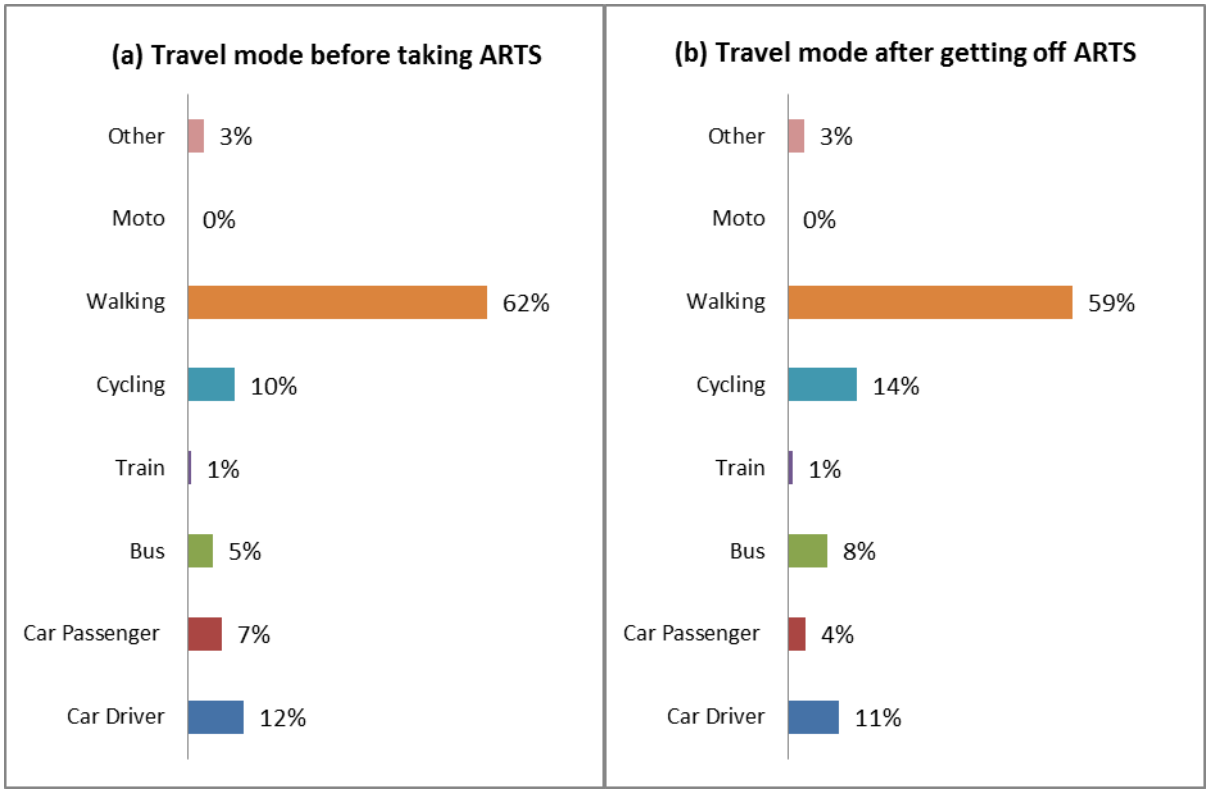


Figure 4.16 Mode of transport (a) before taking the ARTS and (b) after getting off the vehicle as declared by respondents

Figure 4.16 (a) shows that the most frequent mode of transport before taking an ARTS vehicle was walking (for 62% of the respondents). Travelling by car (either as a driver or as a passenger) represented approximately 15% of the sample. Cyclists represented approximately 10% of respondents. Respondents getting to the ARTS stop by public buses represented 5% of the sample.

Figure 4.16 (b) shows that the most frequent mode of transport after getting off the ARTS was walking (for 59% of the respondents). Cycling and travelling by car (either as a driver or as a passenger) represented approximately 15% of the sample for each of them. Respondents completing their ride by taking public buses represented 8% of the sample.

Users traveling by ARTS vehicles for curiosity took public buses as the most common means of transportation before and after ARTS. The surrounding area of the demonstration was more appropriated for the users to arrive by walking.

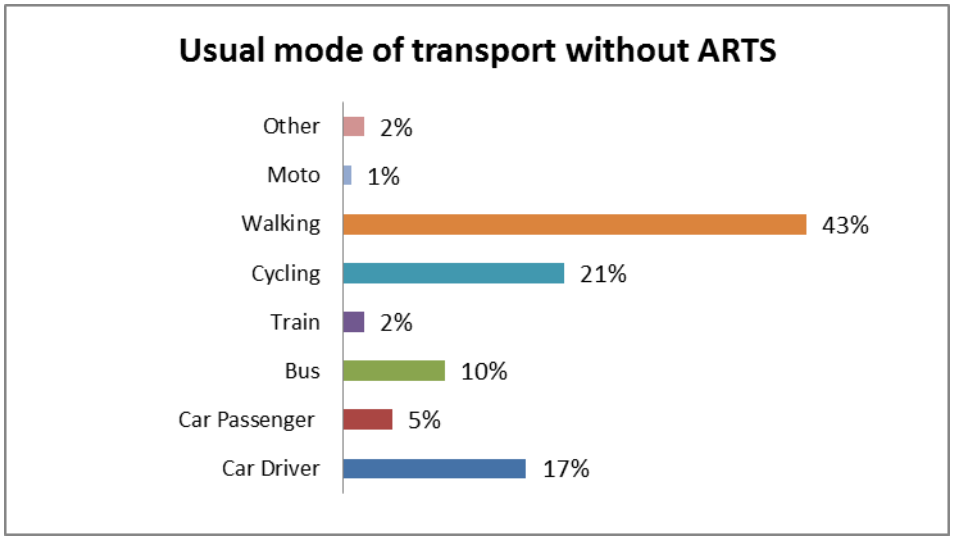


Figure 4.17 Usual mode of transport on the same route before the ARTS demonstration

Figure 4.17 shows that the most frequent means of transport in the area would have been walking (with 43% of respondents) if without ARTS vehicles on the same route. Cycling and travelling by car (as a driver or as a passenger) represented approximately 20% of the sample each of them. Respondents completing their ride by taking public buses represented 10% of the sample.

It is interesting to note that the implementation of ARTS may have contributed to reducing the use of car by 5% during the demonstration period and to increase the using of soft means of transportation (walking), although this result is tenuous given the sample and the changes in local verses 'tourist' proportions

The decrease in using cars as a mode of transport was more significant for the respondents aged 45-54 and 64-74.

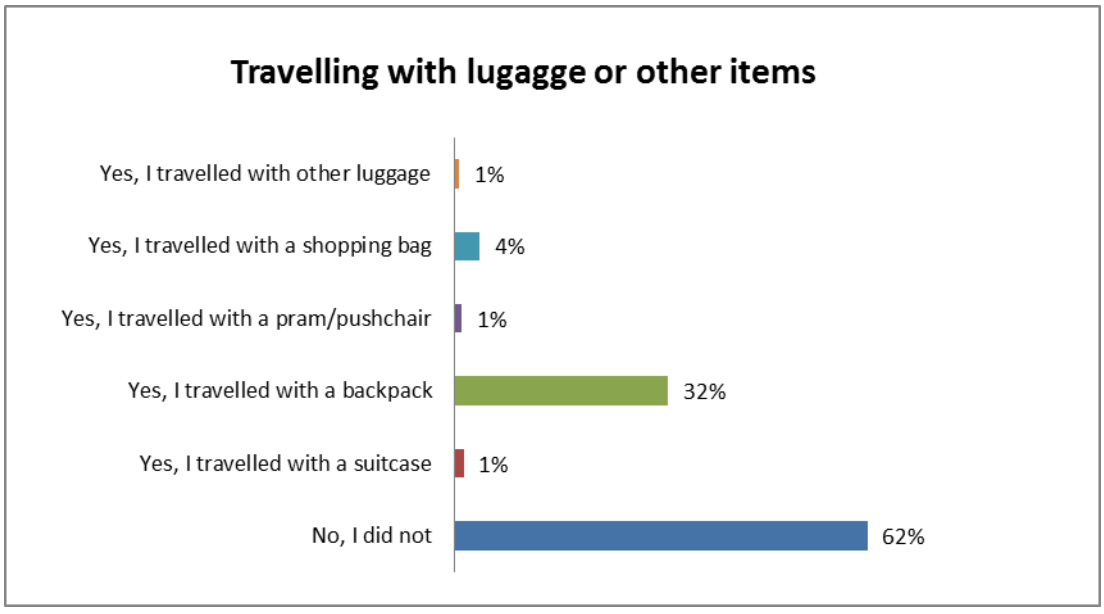


Figure 4.18 Respondents travelling with luggage or other items in both phases

According to Figure 4.18, approximately 62% of respondents travelled without a luggage or any other of the mentioned items. Approximately 32 % of respondents travelled with a

backpack. 4% travelled with shopping bags and approximately 1% with either luggage, a suitcase or a pushchair. This information is useful to analyse user's needs concerning space distribution and storage space inside the vehicle and accessibility at stops.

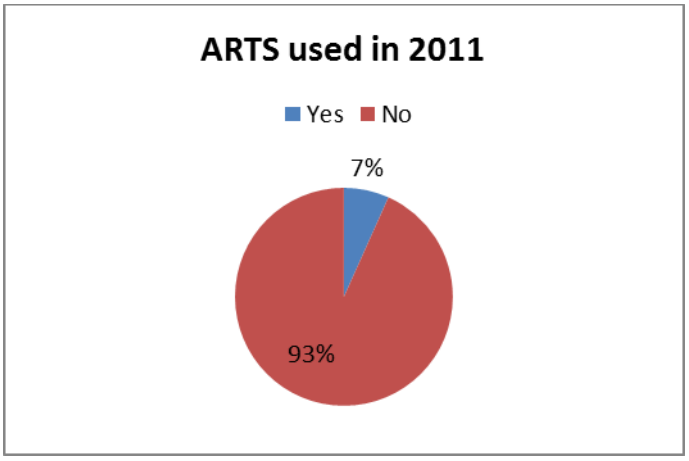


Figure 4.19 Respondents having used the previous demonstration of ARTS in 2011

Figure 4.19 shows that 7% of respondents declared having used an automated vehicle during the previous CityMobil1 demonstration that took place in the city of La Rochelle in 2011. This figure is quite high taking into account the short duration of the demonstration (1 month, 3h/d), and the relatively low proportion of users (around 1000). However, 7% was a small percentage and it did not allow identifying significant differences with the rest of the sample for the different evaluated criteria.

4.4.3 ARTS User satisfaction

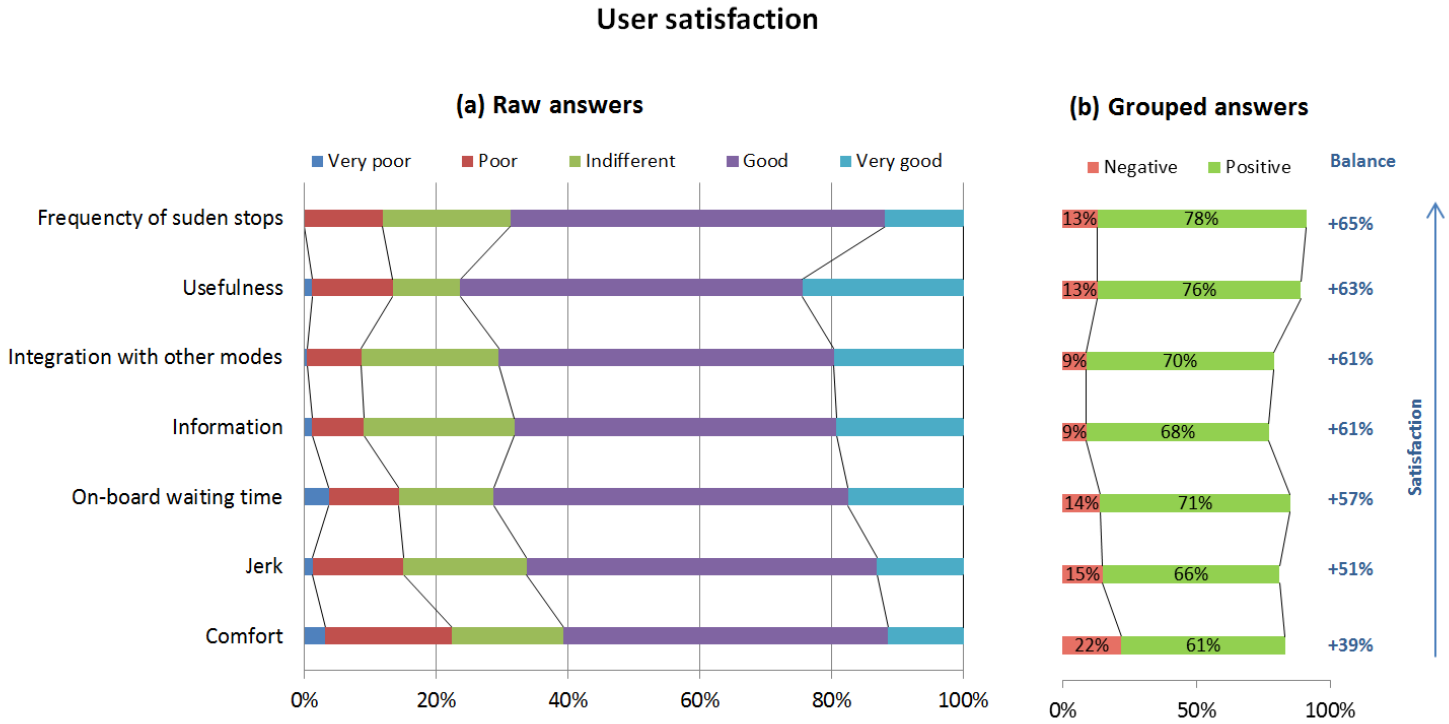


Figure 4.20 User satisfaction level on different criteria in both phases of the survey

Figure 4.20(a) shows the answers of participants on the different evaluated criteria concerning user satisfaction. Figure 4.20(b) shows the responses grouped in the following categories: negative (poor and very poor) and positive (good and very good). The last column on the figure shows the overall balance per criteria which was obtained by the sum of the percentages of the positive category minus the percentage of the negative.

The comfort of the system was rated the least positive with an overall balance of +39% and it will certainly require improvement for future experiments. The frequency of sudden stops and the usefulness of the system were rated the most positive with overall balances of +65% and +63% respectively. The criteria of jerkiness and on-board waiting time obtained overall balances of +51% and +57% respectively that might require attention for future experiments.

The overall result on user satisfaction was positive with all considered criteria and between 60% and 80% of respondents declaring a positive opinion on them. The average overall balance for all criteria was +56%.

4.4.3.1 Accessibility

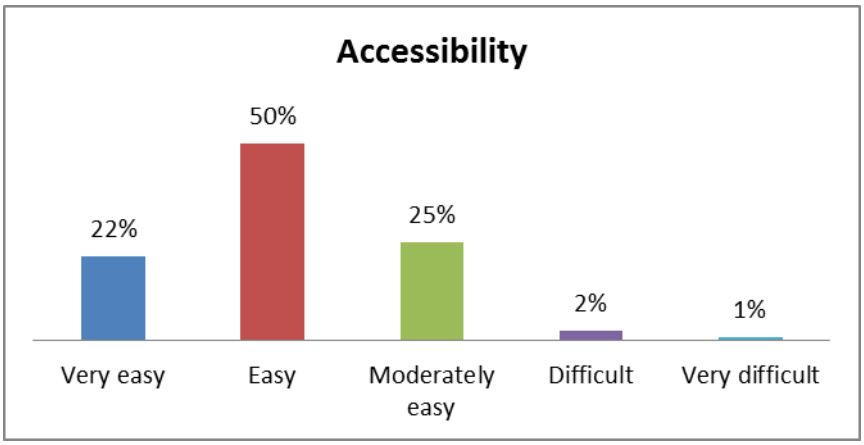


Figure 4.21 Accessibility to ARTS according to respondents in both phases

Figure 4.21 shows that only 3% of the respondents considered the accessibility to the system to be difficult or very difficult. Respondents were in general positive on the accessibility of the system which is quite surprising taking into account the reality[4]. However, it has to be noted that a quarter of the respondents found the accessibility "moderately easy" which from a transport authority or operator perspective is in no way satisfactory and acceptable. Furthermore it would be of interest to analyse separately the opinion of respondents having declared a disability.

[4] The concept of « Accessibilité » in French can have various meanings and we assume that some of the respondents might have misunderstood the question.

4.4.3.2 Incidents

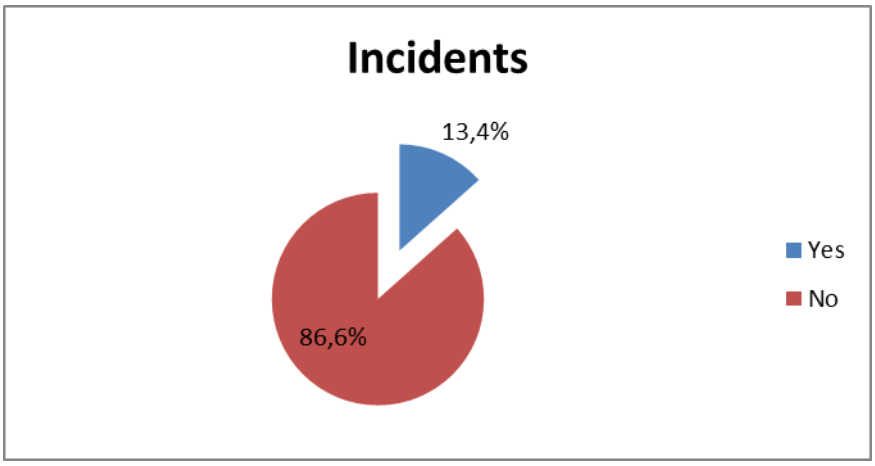


Figure 4.22 Presence of technical incidences during trip according to respondents

Figure 4.22 shows that approximately 13% of respondents declared having experienced an incident during the trip, which are referred indistinctively to minor or major events. The reported events varied from the following identified group: sudden stops, the on-board screen not working, the automatic door being blocked, the vehicle getting slightly off the path, and vehicle being manually operated during a part of the trip among others.

Even if respondents were rather positive on the system during the demonstration period, the presence of incidents for 13% of the users is not really satisfactory and needs to be improved for future experiments.

4.4.4 ARTS Future use

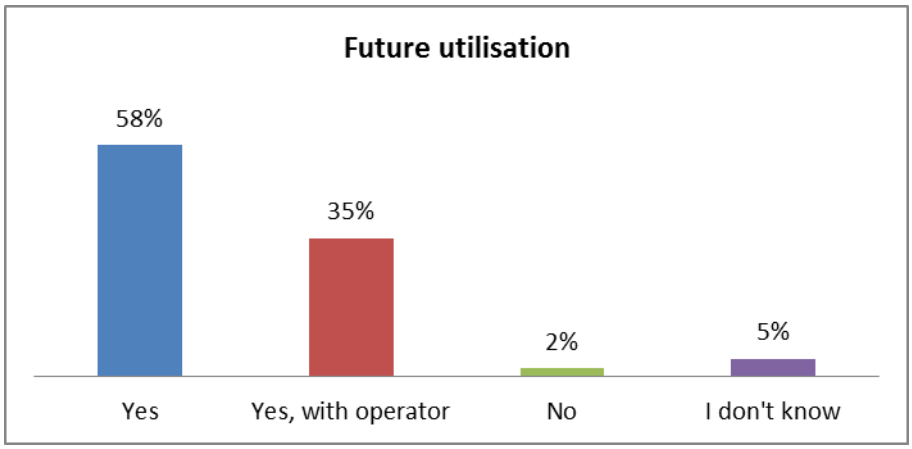


Figure 4.23 Willingness to travel on an ARTS vehicle in the future

Figure 4.23 shows that 93% of respondents were willing to travel on a similar system in the future. Approximately 58% of respondents would like to use it without a human operator on-board. This category was characterised in the most of the situations by the users between 34-54 year old and usually with the employee professional status. However, 35% of the sample would only use it if there would be a human operator on-board. This category was represented by the users aged than 64 year old. In most of the situations they were retired. For the future adoption of the system, it is critical to

understand the concerns of this category (more than 1/3 of the sample) and to consequently determine how they could be addressed.

There were few reluctant respondents (at 2%). Indecisive users represented approximately 5% and it will also be of interest to study their concerns more in depth. This category was characterized by the young users less than 24 years old.

4.5 Comments from respondents

Participants were given the possibility to make comments at the end of the survey. Hereafter, below is a selection of those comments made on the basis of their frequency and representativeness.

- The seats were too low.
- The windows were too high.
- The visibility was poor when seated.
- Would the service becoming permanent after the demonstration?
- The vehicle was too slow.
- The quietness of the vehicle was a good point.
- The vehicle was not serving areas outside the city centre.
- The human operator provided relevant information.
- Handles were too high and there was no holding bar.
- I would not take the vehicle without a human operator on-board.
- The vehicle should be controlled remotely in case of need.

4.6 Summary

This section summarises the results of the ex-post survey for users of the ARTS demonstration. The main objective of this study was to gain a better understanding of users and their transportation needs, and to collect feedback to assess the demonstration on the basis of different criteria. The surveys were administered through face-to-face interviews in two phases with a total of 310 participants.

For the vast majority of users, the demonstration was their first experience with automated vehicles. Therefore, it was not possible to identify any significant difference in the feedback from the users of the 2011 CityMobil demonstration in La Rochelle. Users were mainly students, employees and retirees. Employees observed the highest return rate compared to other occupations.

Approximately half of the users became aware of the ARTS demonstration by chance. It is therefore suggested that the visibility of the demonstration area had an impact on the frequentation of the service. Most of the users declared having used the system only once and just to travel as their trip propose. Therefore, it is not possible to make solid conclusions on the ARTS as a real transportation service. However, according to answers, ARTS led to a modest reduction of the use of cars by participants in the demonstration area.

Respondents declared a relatively high level of satisfaction with approximately 56% of opinions being good or very good when all criteria are combined. The criterion of comfort requires particular attention for future experiments as it was the most poorly rated. Other criteria needing attention are on-board waiting time and jerkiness.

Approximately half of the users combined the ARTS ride with walking to complete their journey. The vast majority of users did not travel with any luggage. When they did, they

usually carried small items such as backpacks. Therefore, the need of extra storage space might not be critical for future demonstrations.

The occurrence of incidents at a rate of 13% requires attention particularly assuming that the reduction of minor incidents could be easily achieved. Approximately a third of respondents were only willing to use the ARTS in the presence of a human operator. For future experiments, it might be necessary to better understand their concerns and how to address them.

5 Ex-post stated preference questionnaire

5.1 Objective

The objectives of the Ex-post Stated Preference (EPSP) survey carried out in La Rochelle were:

1) To investigate users' relative preferences for Automated Road Transport System (ARTS) versus a conventional one.
2) To be able to assess attitudinal changes following user experience of ARTS by comparing the results with those of the ex-ante survey. (User preferences for ARTS were determined in an ex-ante stated preference survey in all cities hosting a demonstration. The results were presented in a report in WP14 "Report on the Stated Preferences surveys in the twelve cities"). Comparing the ex-post and ex-ante survey results enables an assessment to be made as to whether experience of the system and more information about it (thanks to the awareness raising campaigns carried out in the cities hosting a demo) might have resulted in changes in user attitude towards the ARTS.
3) To assess users' willingness to pay for the ARTS, and their attitude towards the use of the ARTS system in the future.

5.2 Survey method

The EPSP survey carried out in La Rochelle was based on face-to-face interviews using structured questionnaires (see Annex B for the questionnaire form used for the survey).
The people targeted were users of the ARTS vehicles, who were interviewed as they left the vehicles. The interviewees were selected randomly in order to be representative of the population of users. The EPSP survey was anonymous to address privacy issues.

The general version of the questionnaire was customised in order to adapt it to the specific characteristics of La Rochelle demonstration (whose application matrix case is within city centre) including the translation into French.

The interviews were performed from 13/04/2015 to 25/04/2015.

The questionnaire was structured into several sections preceded by a filter question to avoid interviewing the same person more than once.

In the section of "Willingness to pay" (WtP), users' WtP for the ARTS service were assessed with reference to the current public transport fare as well as users' WtP for the current PT services.

The section "Future utilisation" investigated the attitudes towards ARTS services in the city in terms of whether or not to implement the ARTS service permanently on the ARTS route demonstrated, or elsewhere in the city.

For the section "Stated Preference", for four different scenarios the user was asked to choose between two different transport options (ARTS and conventional minibus) operating on a frequency basis (not on-demand), offering the same service in terms of route and stops, and using the same vehicles in terms of propulsion (electric-powered), design and capacity.
Each scenario was described in terms of the three variables extra fare, waiting time at stops and riding time each assuming two different values as shown in Table 5.1

Table 5.1 EPSP design - attribute and levels

Alternative	attribute	number of levels	Levels
minibus/ARTS	waiting time	2	10/15 minutes
	riding time	2	7/10 minutes
	extra-fare	2	1,30 (current PT fare)/1,80 EUR

The section on “Socio-economic characteristics” included questions to collect information useful to characterise users sampled in terms of gender, age, level of education, occupation and handicaps.

The stated preference data collected in La Rochelle were used to estimate discrete choice models based on multinomial logit probability functions. Common marginal utilities of waiting time, riding time and fare across the two alternatives were used in all specifications.
Denoting by the number 1 and 2, the conventional minibuses and automated minibuses (i.e. ARTS) respectively, the specifications of the systematic utilities were:

$$V_1 = \beta_1 \cdot WT + \beta_2 \cdot RT + \beta_3 \cdot FA$$
$$V_2 = \beta_1 \cdot WT + \beta_2 \cdot RT + \beta_3 \cdot FA + ASC \quad (5.1)$$

Both alternatives included attributes of waiting time (WT), riding time (RT) and fare (FA). For ARTS, this was as other public transport or extra-fare. The alternative ARTS also included an ASC (Attribute Specific Constant).

Waiting and riding time variables assume the values used in the EPSP questionnaire (Table 5.1), for fare, the “effects coding” -1/1 has been used (instead of “dummy coding” 0/1 to avoid confusion with the ASC) with “-1” for an extra-fare, and (+1) for the same fare as other public transport.

The other model was built on the basic model, but its utility function also included one attribute related to a socio-economic characteristic (SE) of the users and the corresponding marginal utility:

$$V_1 = \beta_1 \cdot WT + \beta_2 \cdot RT + \beta_3 \cdot FA$$
$$V_2 = \beta_1 \cdot WT + \beta_2 \cdot RT + \beta_3 \cdot FA + ASC + \beta_{SE} \cdot SE \quad (5.2)$$

The socio-economic attributes considered were:

- age considered as ordinal variable. The average value of each defined age intervals was considered (e.g. for the interval “18-24”, it was considered the average value 21);
- education considered as ordinal variable. The levels 1, 2, …, n have been assigned to each of the answer options starting from the lowest (1 to the option “primary school”, 2 to the option “secondary school”, 3 to the option “university degree”, 4 to the option “PhD degree”);

- Gender, for which effects coding has been used: +1 for male, and -1 for female.

The model with socio-economic variables allowed the assessment of the impacts of each variable on user preference.

The t-test with a null hypothesis of a zero coefficient was adopted to assess the statistical significance of the attributes that appeared in the econometric specifications of the utilities the t-test. The 10% significance level (two-tailed test) was considered, with 1.65 being the value of reference for the t-statistic.

5.3 Respondents

110 EPSP interviews were carried out in La Rochelle (in the Ex-ante Stated Preference Survey 200 interviews were carried out).

The socio-economic data collected shows that the sample composition was well balanced in terms of user gender (Figure 5.1).

3 out of 5 interviewees were aged over 34 and were almost evenly distributed between the age intervals 35-44, 45-54, 55-64 and over 65. However 1 out of 4 interviewees was aged between 18 and 24 (Figure 5.2).

Slightly more than half of the sample had a university degree, and 3% a primary school education, while 1 out of 5 interviewees accomplished the secondary school level of education (Figure 5.3).

1 out of 4 interviewees were students, 2 out of 5 employees and 1 out of 5 were retired (Figure 5.4).

3 out of 5 interviewees lived in the city of La Rochelle and less than 3 out of 10 lived outside La Rochelle metropolitan area (Figure 5.5).

7% of users interviewed declared to have a disability, but most of them preferred not to specify it. This percentage of disabled users suggests the need to fit ARTS vehicles with appropriate equipment for disabled people (Figure 5.5).

A comparison between the ex-post and the ex-ante stated preference survey shows that in both surveys the gender of the users sampled was approximately balanced between male and female (Figure 5.1) even though the number of females in the ex-post sample was slightly lower while in the ex-ante is slightly higher than the number of males.

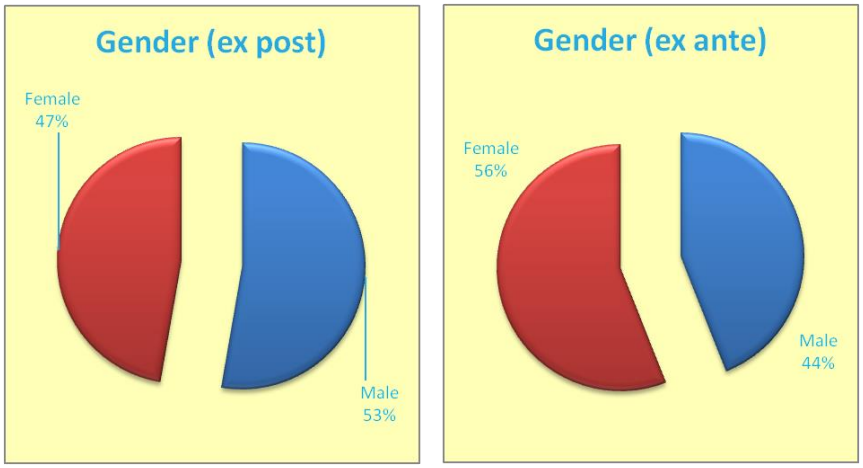


Figure 5.1 Ex-post and ex-ante SP sample gender

The age distribution of the people sampled in the ex-post survey was similar to that in the ex-ante survey even though the percentage of under 44's was little greater in the ex-post (57%) compared to ex-ante (53%) (Figure 5.2).

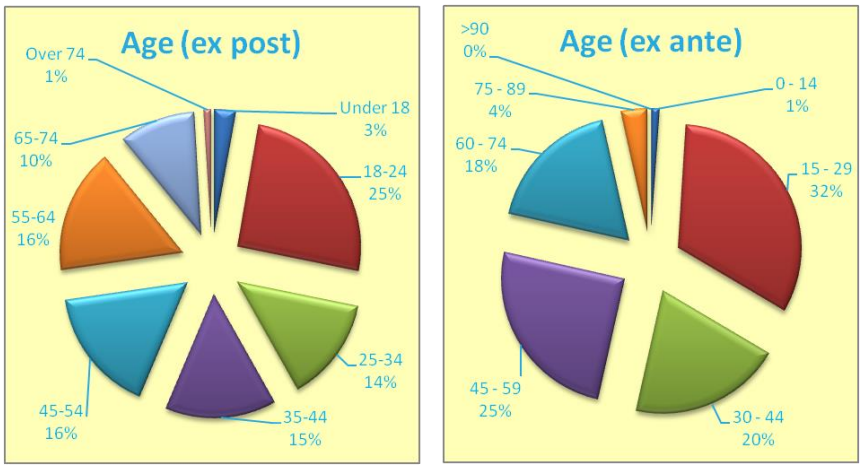


Figure 5.2 Ex-post and ex-ante SP sample age

The ex-post sample distribution of the level of education shows a significantly lower percentage of primary school graduates (3%) compared to the ex-ante sample (35%), and a greater number of university and PhD graduates (Figure 5.3)

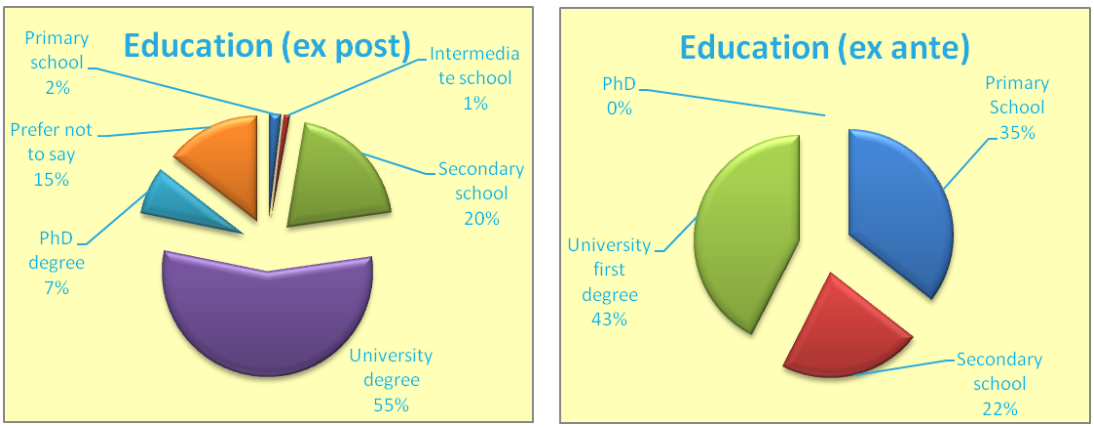


Figure 5.3 Ex-post and ex-ante SP sample level of education

A lower percentage of employees (38%) was sampled in the ex-post survey compared to the ex-ante sample (49%), and there were slightly higher percentages of students and self-employed in the ex-post survey (Figure 5.4).

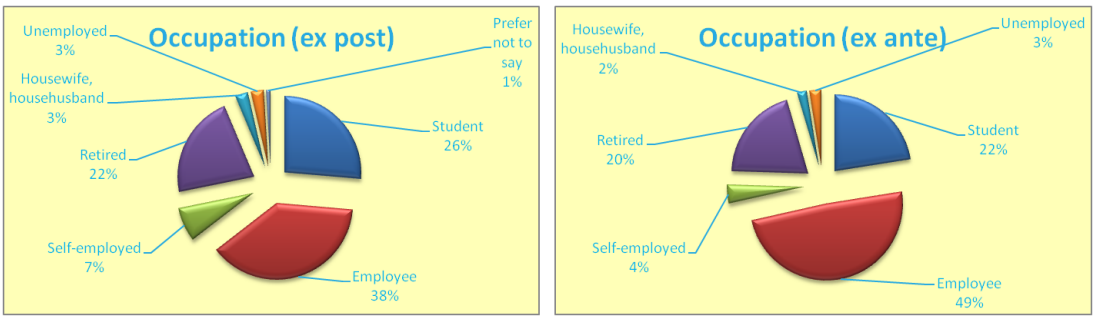


Figure 5.4 Ex-post and ex-ante SP sample occupation

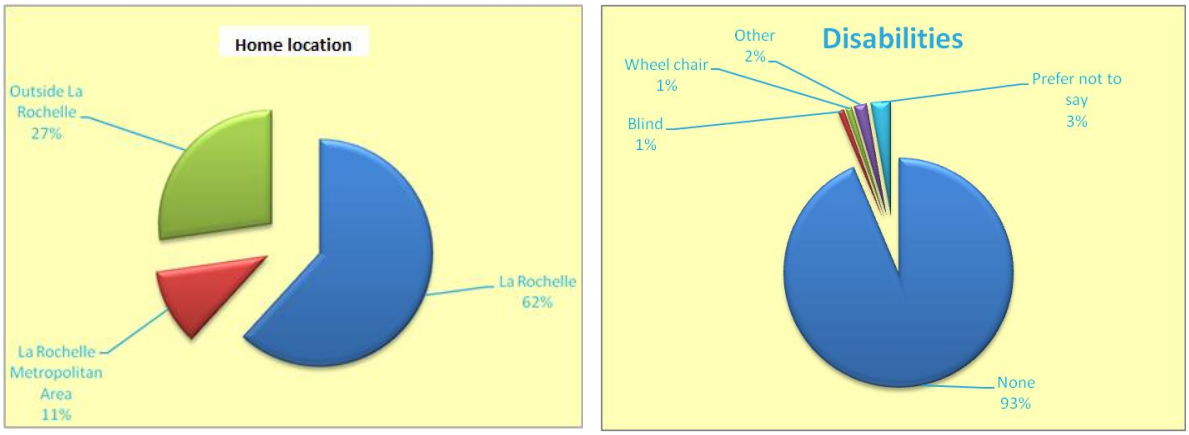


Figure 5.5 EPSP sample home locations and disabilities

5.4 Results

The La Rochelle EPSP survey assessed users' willingness to pay (WtP) and their attitude towards the future use of the ARTS in addition to the real stated preference survey.

5.4.1 Users' willingness to pay (WtP) and their attitude towards the future use of the ARTS

The results relating to WtP (Figure 5.6) show that 6 out of 10 users considered the current PT fare fair and just 3% of users were willing to pay more. For ARTS, almost half of the users were willing to pay less than the current PT fare (an additional 11%), but the number of users willing to pay more almost doubles (7% vs 3%) compared to the WtP for the current PT. The most important result is that just 7 out of 100 users were willing to pay more than the current PT fare for ARTS. As we will see in the econometric model analysis the relative higher preference for the ARTS (shown by the positive value of the alternative specific attribute ASC) is more than counterbalanced by an increase in the fare for using ARTS.

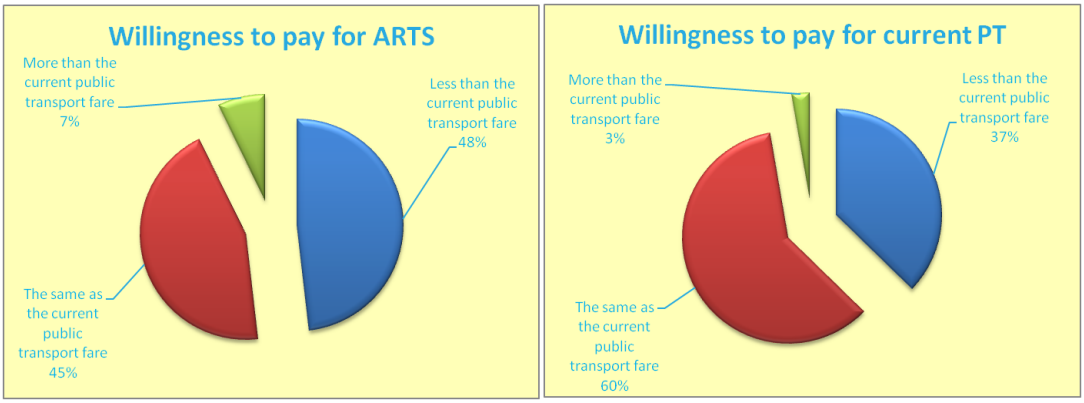


Figure 5.6 Ex-post SP Willingness to Pay.

8 out of 10 users thought it useful to implement the ARTS service on a permanent basis (Figure 5.7). However, the majority of these users (3 out of 4) thought that it would be better to implement the ARTS system on a different route from the one in the demonstration.

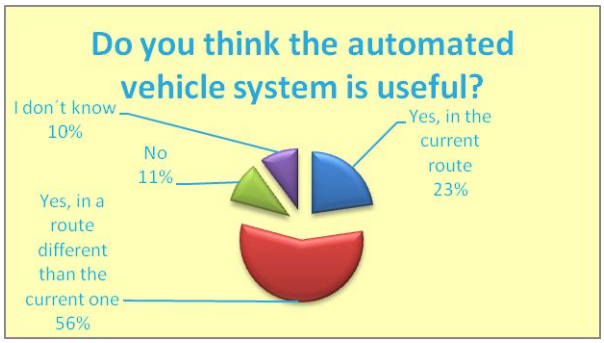


Figure 5.7 Ex-post SP users' attitude towards ARTS future use.

5.4.2 Econometric model estimation

The ex-post basic model estimation shows a positive and statistically significant value of the ASC of the same order of magnitude as in the ex-ante model estimation (Table 5.2). Thus, the ARTS was relatively more preferred than the minibus because, as the observed attributes were the same, the ARTS had a higher utility.

Waiting time (Table 5.2) did not affect user decisions as the calibration produced a not statistically significant estimation of its beta coefficient, i.e. there is a high probability of it being equal to zero). This is a similar result to that obtained in the ex-ante survey.

Riding time (Table 5.2) was not found to affect user decisions (its coefficient was not statistically significant). However, in the ex-ante survey the beta coefficient was statistically significant and had the right sign.

The extra-fare coefficient (Table 5.2) had the expected positive sign and significantly affects user decisions as it did in the ex-ante survey.

Table 5.2 SP basic model estimation

Variable		Ex-post	Comment	Ex-ante	Comment
waiting time	Coefficient t-statistics	- -	Not statistically significant	-0.045 -1.11	Not statistically significant
riding time	Coefficient t-statistics	0.082 1.21	Not statistically significant	-0.056 -1.95	statistically significant right sign
extra-fare	Coefficient t-statistics	0.682 6.74	statistically significant right sign	0.505 4.03	statistically significant right sign
ASC (ARTS)	Coefficient t-statistics	0.539 3.13	Positive and statistically significant, same order of magnitude as ex-ante	0.564 3.90	Positive and statistically significant

Statistical significance (5% confidence level): t-stat>1,96

Table 5.3 shows the impact of the three socio-economic variables considered on user preferences.

Gender coefficient was not found to be statistically significant and, consequently, did not seem to affect user decisions. A similar result was obtained in the ex-ante survey.

The ex-post model assessment found that preference for ARTS increases with age. This confirmed the preference of older people for the ARTS system found in the ex-ante model. However, the beta coefficient is more statistically significant in the ex-post results.

Table 5.3 SP estimation of impact of socio-economic variable on users' preference

Variable		Ex-post	Comment	Ex-ante	Comment
Gender	Coefficient t-statistics	-0.143 -1.40 -	Not statistically significant	-0.019 -0.27	Not statistically significant
Age	Coefficient t-statistics	0.011 1.91	Preference for ARTS increases with age (statistically significantly)	-0.090 1.52	Preference for ARTS increases with age (but with low statistical significance)
Level of education	Coefficient t-statistics	-0.125 -1.92	Preference for ARTS decreases with education (statistically significantly) OPPOSITE RESULT	0.177 2.15	Preference for ARTS increases with education (statistically significantly)

Statistical significance (5% confidence level): t-stat>1,96

The ex-post model estimation results show that preference for ARTS decreases with level of education because of the negative value of the coefficient. This result is opposite to that obtained in the ex-ante model estimation, but of similar order of magnitude.
Naturally, this finding is consistent with the users' preference shares in each scenario according to the users' level of education. Table 5.4 shows the values of the scenario variables in the Ex-ante and Ex-post Stated Preference surveys. Table 5.5 shows that in the two Ex-post survey scenarios unfavourable to the ARTS (scenario 2 compared to scenario 1 and scenario 4 compared to scenario 3) the preferences of the users who accomplished the intermediate level of education are more or less balanced between minibus and ARTS, while users who accomplished primary school studies and those who accomplished academic studies show a clear preference for the ARTS and minibus respectively. Ex-post preference shares across the four scenarios also show that extra fare affects users' decision more than waiting and riding time.

Table 5.4 Ex-ante and Ex-post Stated Preference scenario variables

		Ex-ante				Ex-post			
		Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Waiting time (minutes)	ARTS	3	8	3	8	10	10	10	10
	Minibus	8	8	3	3	10	10	15	15
Riding time (minutes)	ARTS	5	10	10	5	10	10	10	10
	Minibus	5	10	5	10	10	10	7	7
Fare	ARTS	extra fare	extra fare	as other PT means	as other PT means	1,30€	1,80€	1,30€	1,80€
	Minibus	as other PT means	as other PT means	as other PT means	as other PT means	1,30€	1,30€	1,30€	1,30€

For users' preferences in the Ex-ante survey scenario unfavourable to the ARTS (scenario 2), the same considerations made for the ex-post unfavourable scenarios can be made, but in this case users' preferences for the ARTS increase with the level of education even though ARTS shares are always lower than minibus shares. The percentages in the Ex-ante scenarios 1, 3 and 4 (Table 5.5) show that highest educated users have always preference shares higher than lowest educated people.

Table 5.5 Users' preference shares in the Ex-ante and Ex-post four scenarios according to their level of education

		Ex-ante				Ex-post			
		Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Before high school diploma	ARTS	29,6%	28,2%	50,7%	59,2%	66,7%	66,7%	100,0%	66,7%
	Minibus	70,4%	71,8%	49,3%	40,8%	33,3%	33,3%	0,0%	33,3%
High school diploma	ARTS	65,9%	50,0%	72,7%	79,5%	81,8%	40,9%	72,7%	54,5%
	Minibus	34,1%	50,0%	27,3%	20,5%	18,2%	59,1%	27,3%	45,5%
After high school diploma	ARTS	45,9%	42,4%	54,1%	62,4%	58,0%	23,2%	62,3%	33,3%
	Minibus	54,1%	57,6%	45,9%	37,6%	42,0%	76,8%	37,7%	66,7%

A possible explanation for this result might be that people with lower levels of education had insufficient familiarity with the notion of automation and its actual feasibility before experiencing the ARTS service. However, once they experienced it they realised the advantages of the ARTS. On the other hand, the low service speed due to safety reasons resulted in a level of service that did not live up to the expectations of people with higher level of education. However, in the ex-ante SP survey some cities established preferences which decreased with the level of education. It will be possible to see whether this opposing result is an outlier or it might be ascribed to specific reasons when the results of all surveys are considered at the end of the project.

In conclusion, the EPSP survey shows that users' have a relatively higher preference for ARTS (ASC positive ex-ante and ex-post and has the same order of magnitude) with or without experiencing the ARTS.

However, users' utility is significantly reduced if an extra fare is applied and the ARTS preference share decreases from 63% (when no extra-fare is applied) to 30% (when an extra-fare is applied). Ex-ante, the extra fare effect is slightly lower than that of ASC, while

ex-post it is higher, and users tend to prefer the traditional system. Just 7 users out of 100 were willing to pay more than the current PT fare.

5.5 Summary

The objectives of the Ex-post Stated Preference (EPSP) survey carried out in La Rochelle were to:

- investigate users' relative preferences for Automated Road Transport System (ARTS) versus a conventional one;
- to compare the results of the ex-post stated preference survey with those of the ex-ante survey to assess whether experience of the system and more information would result in changes in users' attitude towards the ARTS;
- to assess users' willingness to pay (WtP) for the ARTS and their attitude towards the use of the ARTS system in the future.

The EPSP survey carried out in La Rochelle was based on face-to-face interviews using structured questionnaires. The number of respondents was 110.

Key results found were:

i) About a half of users were willing to pay less for ARTS than current PT, and just 7 out of 100 users surveyed were willing to pay more for ARTS than current PT.

ii) 8 out of 10 users thought it was useful to implement the service on the route demonstrated. However, the majority of the users (3 out of 4) thought that it would be better to implement the ARTS system on a different route.

iii) The EPSP survey shows that users' have a relatively higher preference for ARTS (ASC positive ex-ante and ex-post and has the same order of magnitude) regardless whether or not they experienced ARTS.

iv) User utility was significantly reduced if an extra fare was applied. Ex-ante, the extra fare effect is slightly lower than that of ASC, while ex-post it is higher and users tend to prefer the traditional system. Just 7 out of 100 users were willing to pay more than the current PT fare.

v) In the ex-post model estimation, the attributes of waiting time, riding time and gender did not affect user decisions (the calibration produced a not statistically significant estimation of its beta coefficient, which therefore has a high probability of being equal to zero). A preference of older people for the ARTS system was confirmed.

vi) Those with a lower educational background found the ARTS system to be better in practice than anticipated, whilst those with a higher educational background found it to be worse than expected. If this indication is carried forward to other sites, it can be used to better promote ARTS.

6 A survey to a wider public

6.1 Objective

The objective of the survey was to get a clear understanding of public opinions towards implementation of automated vehicles in urban areas. The key questions to be answered included:

- How much are the public aware of the self-driving technology?
- How attractive would implementation of automated vehicles in urban areas be to the public?
- What would the main concerns of implementation of automated buses in urban areas be to the public?
- What would public attitudes be toward owning or sharing automated vehicles?

6.2 Method

The survey included 28 questions to address topics including: 1) Public awareness and understanding about automated vehicles, 2) Attractiveness and concerns of automated buses, 3) Attractiveness and concerns of automated taxis, 4) Attractiveness and concerns of car sharing applications, 5) Attitudes towards owning or sharing automated vehicles.

The survey was undertaken once the demonstration of ARTS in La Rochelle completed. Two survey methods were used: an online questionnaire and phone interviews. First, an online survey was conducted in May/June targeting people working/studying/living around the route of the automated buses demonstrated in La Rochelle. The survey was distributed through e-mails, advertised through flash codes (see below) and distributed physically in a number of attraction points such as shops/restaurants/media library/aquarium/tourist office – located in the neighbourhood of the demonstration route. A total of 148 people responded to the online survey. Then a telephone interview was undertaken from 1-17 July 2015 to reach people in the wider areas of the La Rochelle. A total of 500 people were recruited to participate in the interview.

Figure 6.1 Flash code used for online survey

Some imbalances were found in the demographics of people participated in the surveys (e.g. too many females in the telephone interview). In order to remove the bias, the data from the two surveys were put into one pool and resampled taking into account of

distributions of age, gender, and education of people observed in La Rochelle. In situations where the distributions of people sampled did not match the local demographic trend observed, the extra number of the people were randomly removed. After resampling, a total of 425 people were selected for the study.

6.3 Respondents

Five different demographic groups were considered including gender, age, education, employment, and mode of transport.

Age
In the surveys, adults over 18 years were targeted. Figure 6.2 shows age distributions of the people sampled for the study.

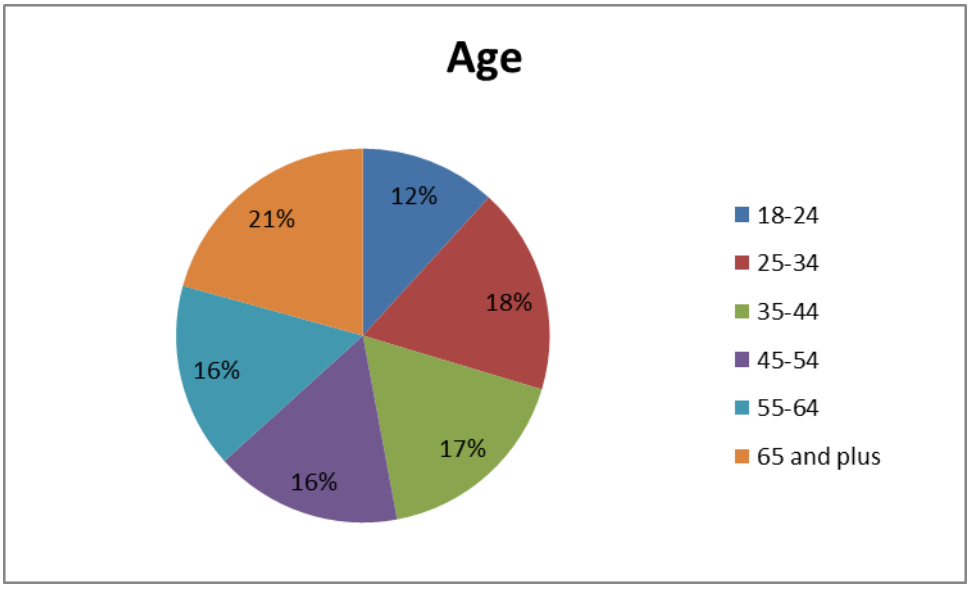


Figure 6.2 Age distributions

Gender
Of the 425 people sampled, 53.6% were female and 46.4% male. The genders were evenly distributed for younger adults aged from 18 to 25, but the gap between females and males increases with the age. For people aged 65 and over, 59% were female and 41% were male which followed the current trend of gender/age distribution in La Rochelle (Figure 6.3).

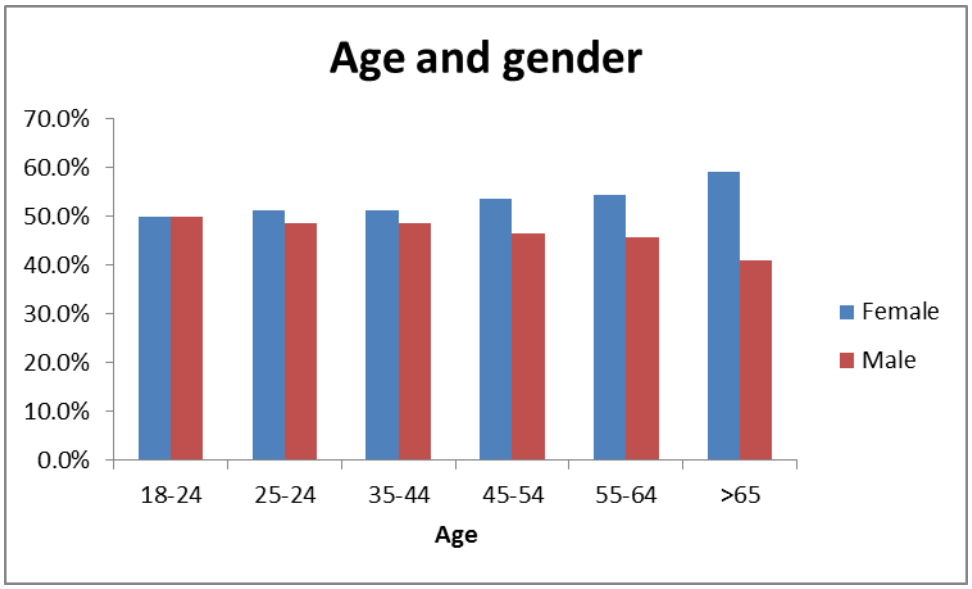


Figure 6.3 Gender distributions by ages

Education

Of the people sampled, about a third (34%) reached the level of secondary school, less than a fifth (18%) colleges, and over a third university (Bachelor degree or above). The distribution is shown in Figure 6.4.

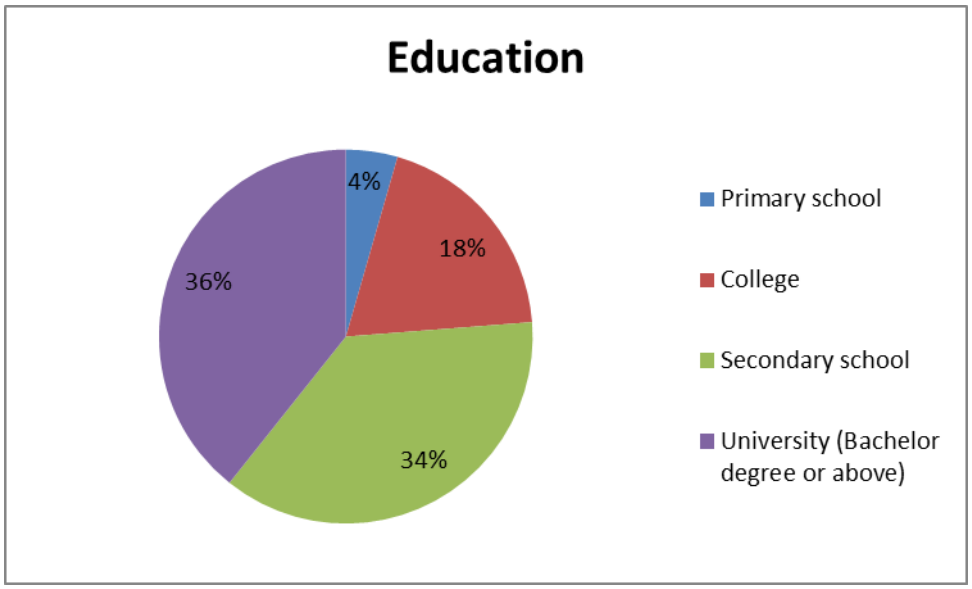


Figure 6.4 Education

Employment

Of the respondents, 52% were employed, 11% unemployed, 8% students, and 28% retired (Figure 6.5).

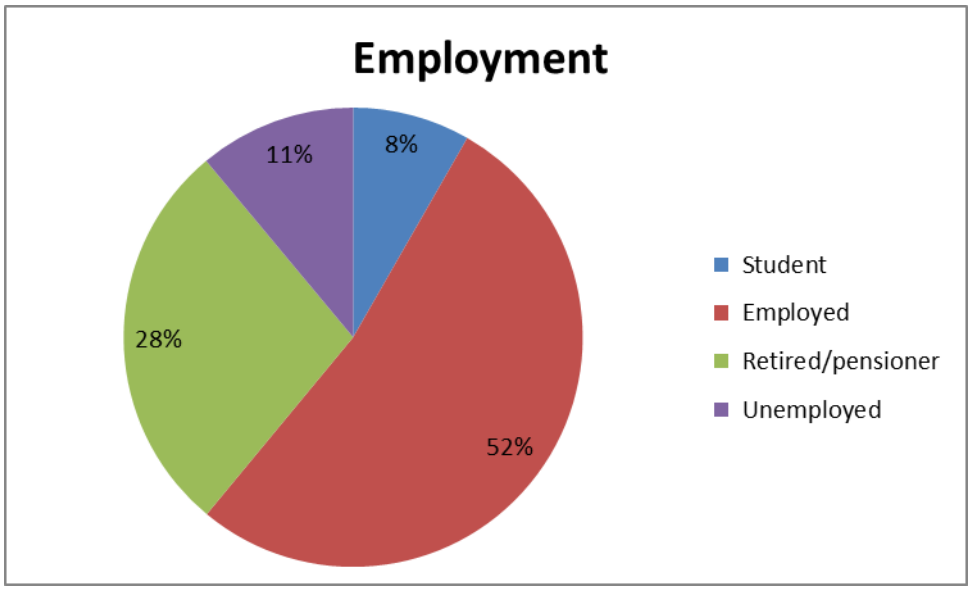


Figure 6.5 Employment status

Travel mode

Of the people surveyed, majority of them travel by cars (66% as drivers and 4% as passengers). Other popular modes of travel included buses (14%), cycling (11%) and walking (3%).

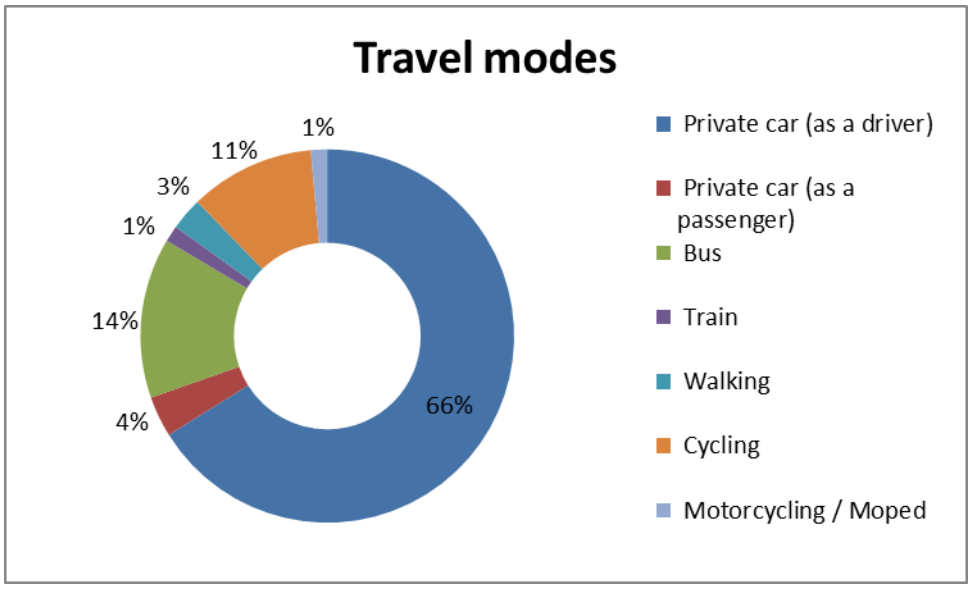


Figure 6.6 Travel modes

6.4 Results

6.4.1 Awareness and general attitudes toward self-driving vehicles

Of the people surveyed, a majority (87%) had heard of automated road vehicles before participating in the survey.

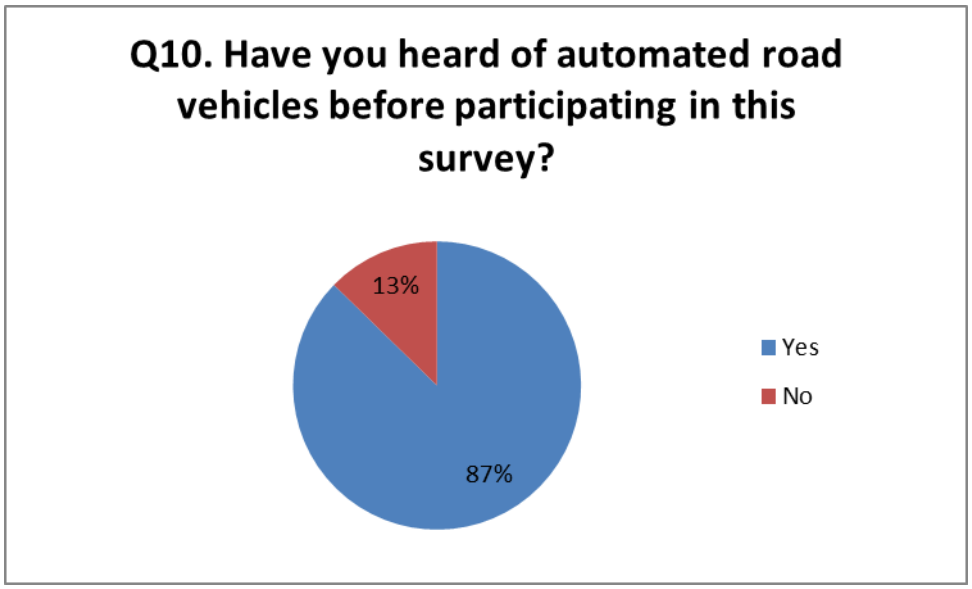


Figure 6.7 Awareness of automated vehicles

Of the respondents, over a half (60%) had experiences of conventional cruise control, about a third (35%) experiences of automated parking systems, and a quarter experiences of 'automated vehicles' demonstrated in La Rochelle.

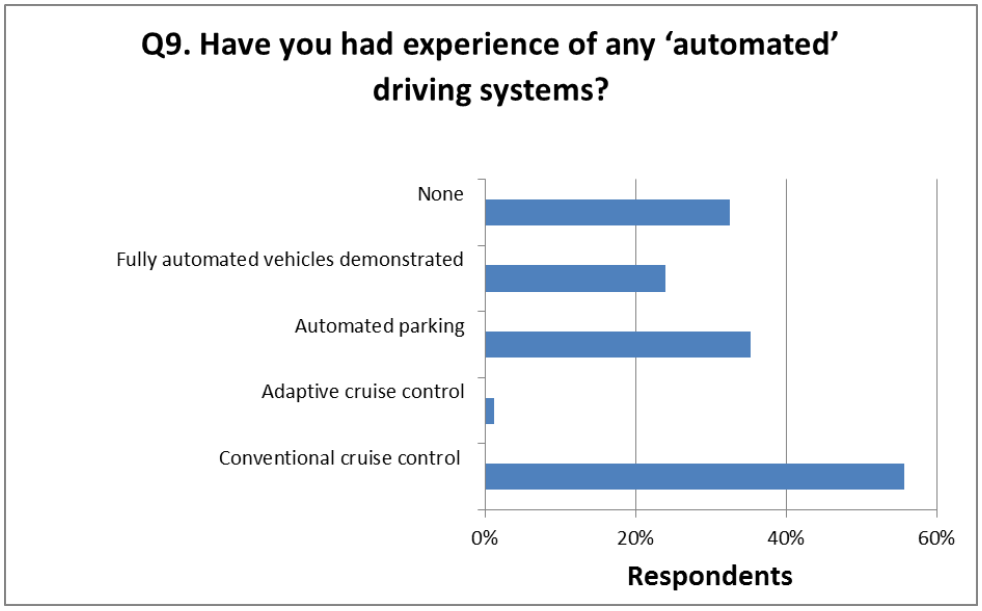


Figure 6.8 Experience of automated driving systems

In the survey, the participants were asked of their favoured driving mode. Of the respondents, over a third (36%) preferred manual driving, less than a half (45%) partial automation of driving, about a ten percent fully automated 'driving'. About 8% of the respondents would not consider travelling by cars and did not give answers to the question.

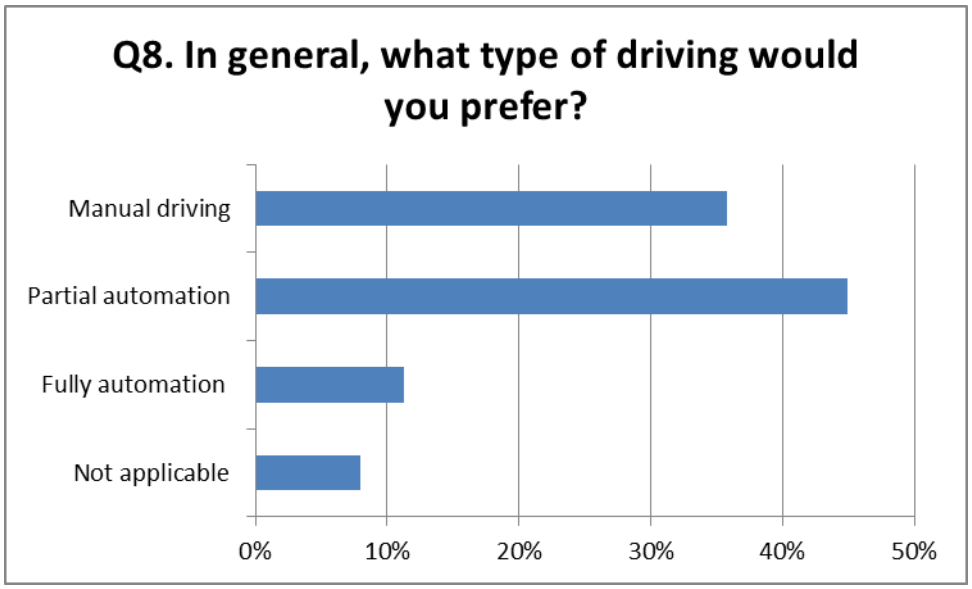


Fig 6.9 Preferred driving mode

In the survey, the participants were asked how likely they thought automated vehicles would deliver the benefits expected. A majority of the respondents were positive that each of the benefits listed would occur (very likely or somewhat likely). From the responses, the top three most confident benefits were 'Reduced energy consumptions' (51% answered 'very likely'), 'Reduced pollutant emissions (45%), and 'Reduced accidents' (24%).

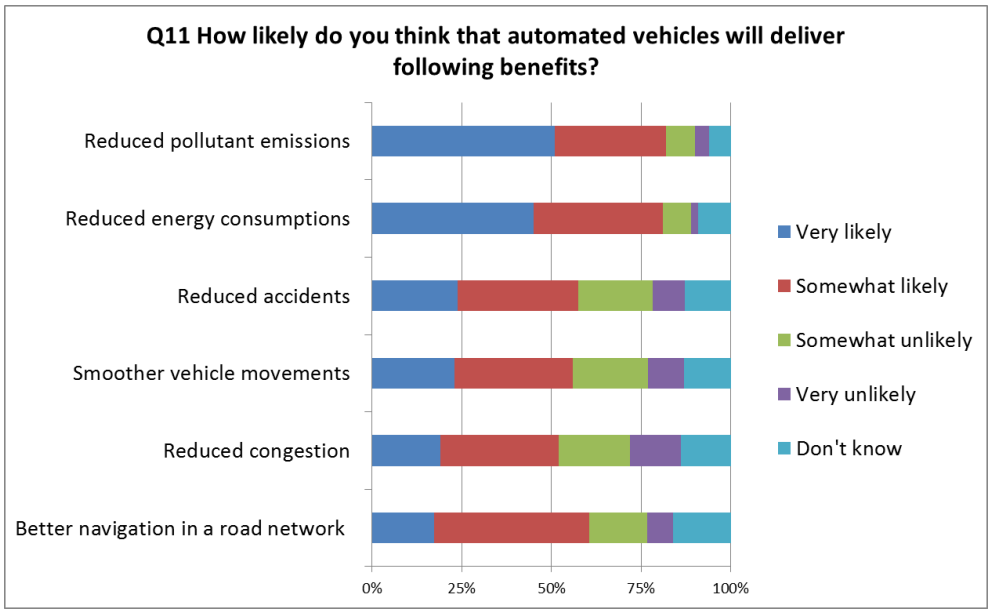


Fig. 6.10 Trust to the benefits promised

Of the respondents, only a quarter believed that automated vehicles would be safer than human driven vehicles. A majority of the respondents did not trust that automated vehicle will deliver any safety benefits, with 46% believing automated vehicles to be as safe as, and 29% less safe than human driven vehicles.

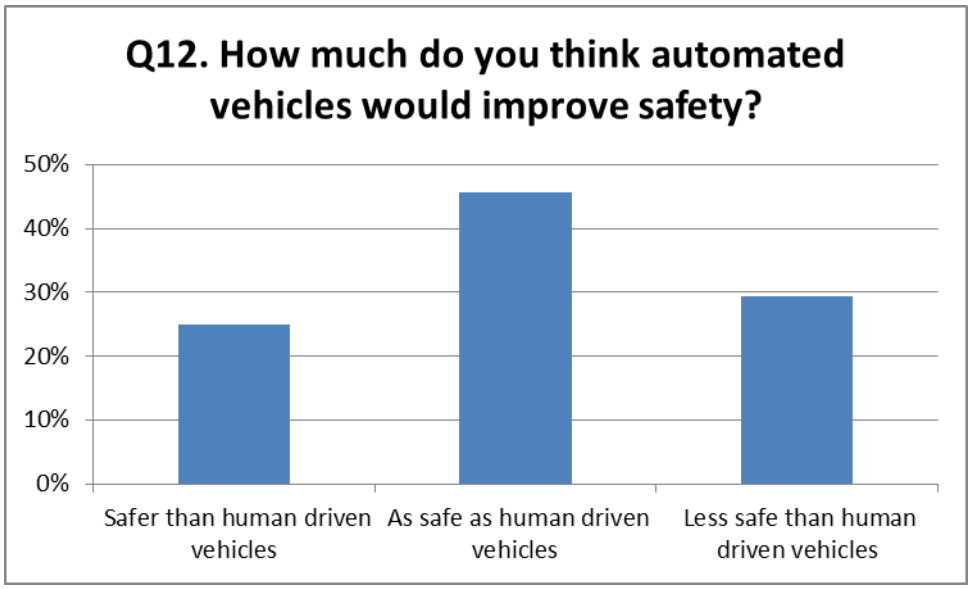


Fig 6.11 Improving safety

6.4.2 Automated buses

Of the respondents, a quarter was aware of the ARTS vehicles demonstrated in La Rochelle. The major sources of the information included local media (claimed by 28% of the respondents), project partners such as CDA and EIGSI (28%), and own observation (30%).

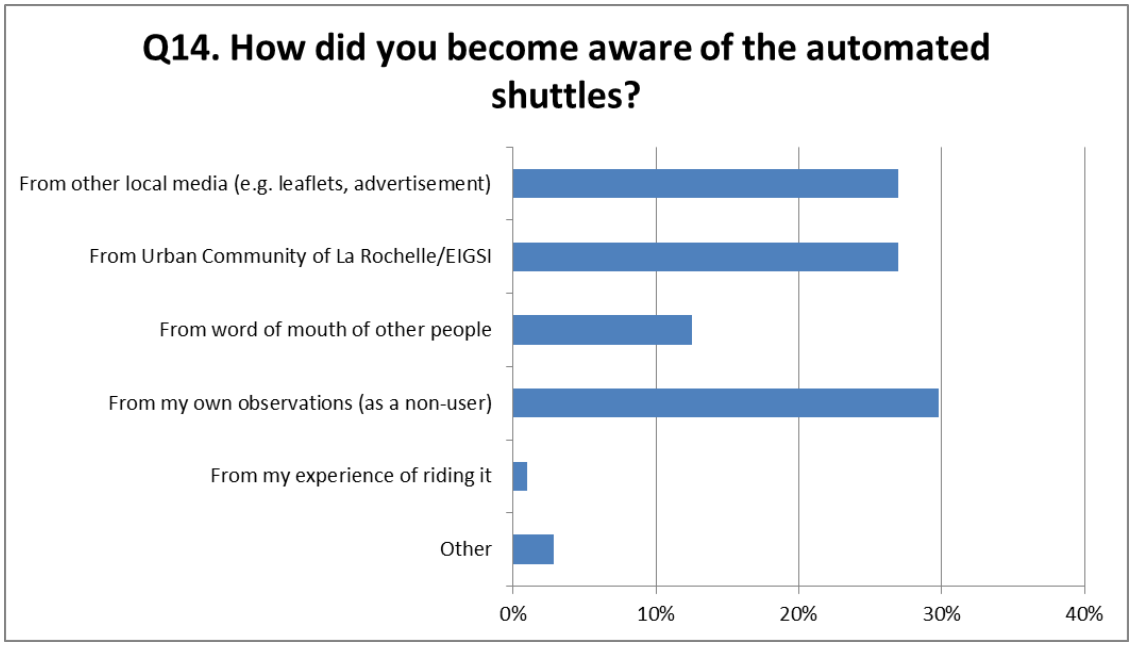


Figure 6.12 Source of information on ARTS

Of the 104 people aware of the ARTS vehicles demonstrated, 54% had ridden the buses once, 35% 2-4 times, and 10% more than 5 times (Figure 6.13).

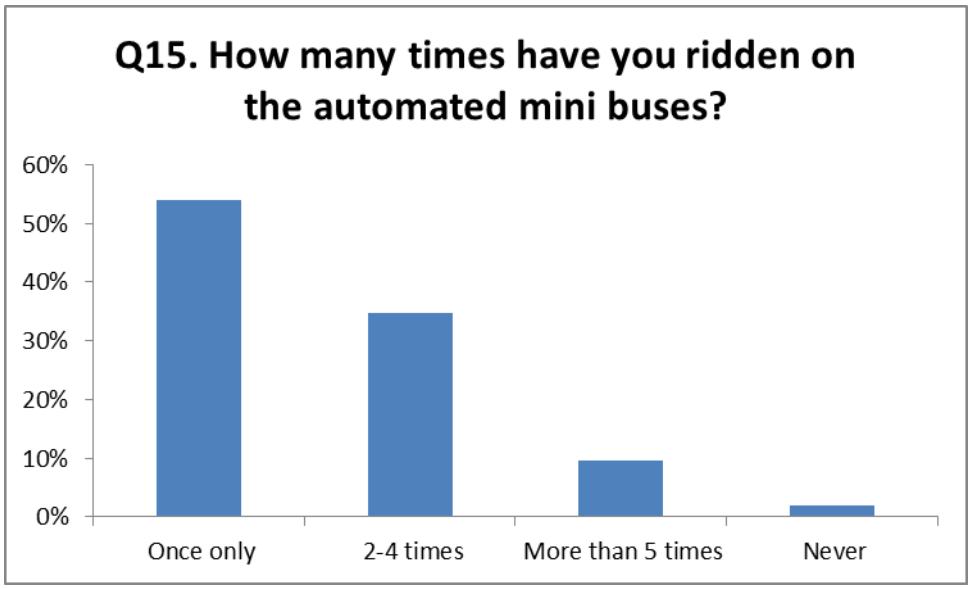


Figure 6.13 Experience of riding the automated mini buses demonstrated

Automated buses have a potential to reduce fares because of no driver costs. In the survey, a question was asked about attractiveness of such a feature. A great majority of the respondents reacted positively to it (44% answered “very attractive”, 26% “moderately attractive”, and 4% “slightly attractive”).

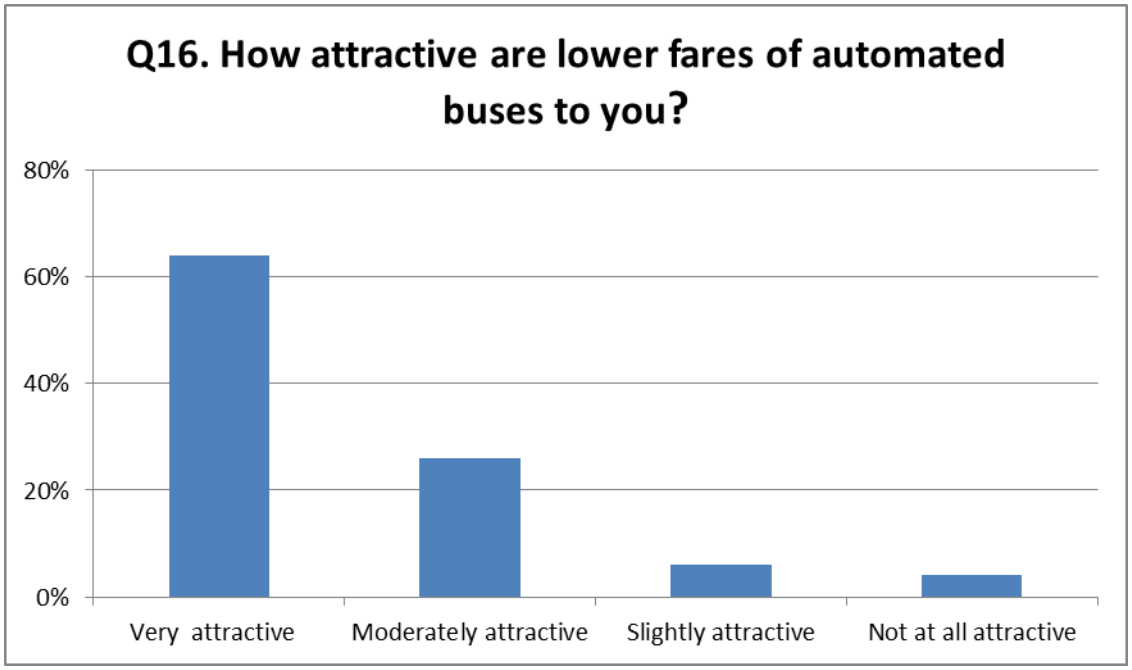


Figure 6.14 Attractiveness of lower bus fares

In the survey, a question was asked about how people concerned of the security and safety issue with the automated buses. A majority of the respondents expressed some concerns (very, moderately or slightly concerned) especially for evening/night services. Of the respondents, 22% said they were very concerned of the issue for day time services, the compared to 44% for evening/night services.

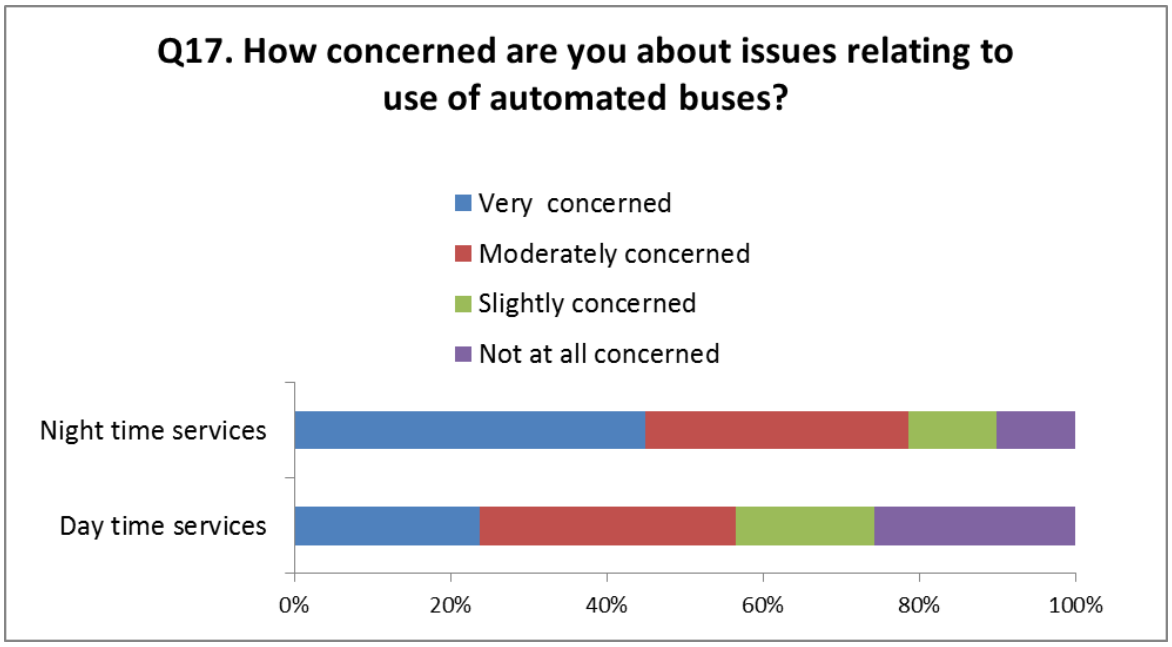


Figure 6.15 Security and safety issues of automated buses

The survey participants were asked of their opinions about the potential roles of automated mini buses in public transport. Of the four roles listed, the most supportive role was 'To provide feeder service' (67%), followed by 'To provide service in tourist zones' (54%), and 'To provide night service' (45%). About 6% of the respondents did not support any use of the buses for public transport.

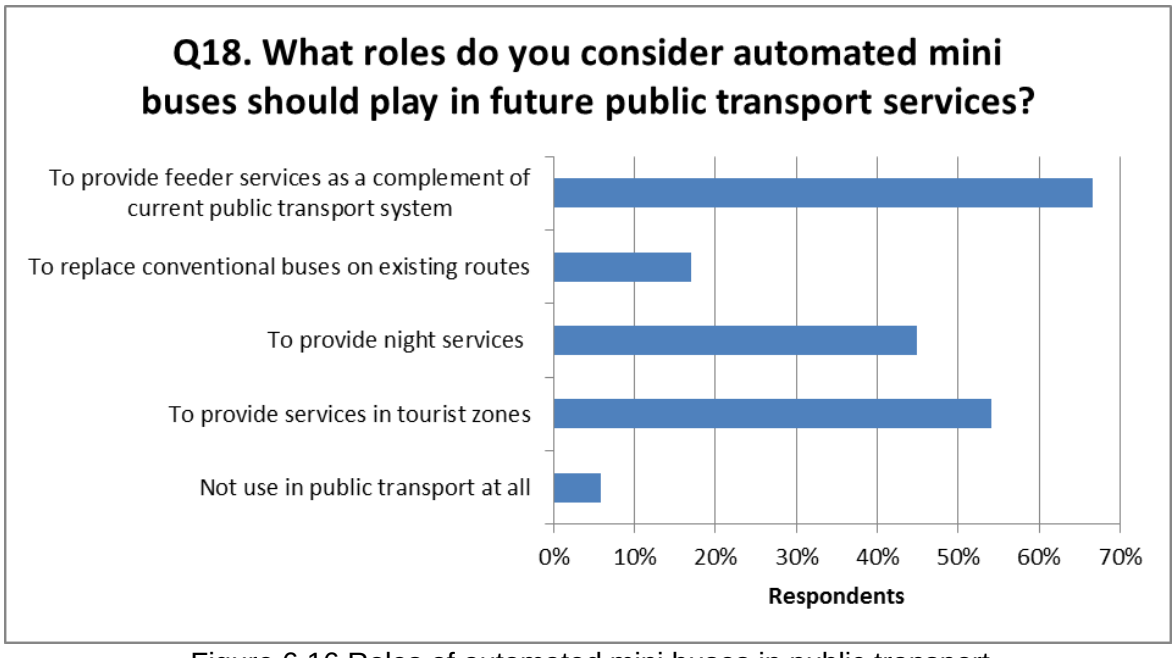


Figure 6.16 Roles of automated mini buses in public transport

For automated buses, savings in operating costs (no driver costs) could be used to improve service quality. In the survey, a question was asked about participants' opinions on priorities of service quality improvements. 45% of the respondents favoured increasing bus network coverage, about 30% increasing bus frequency, and about 24% reducing bus fares.

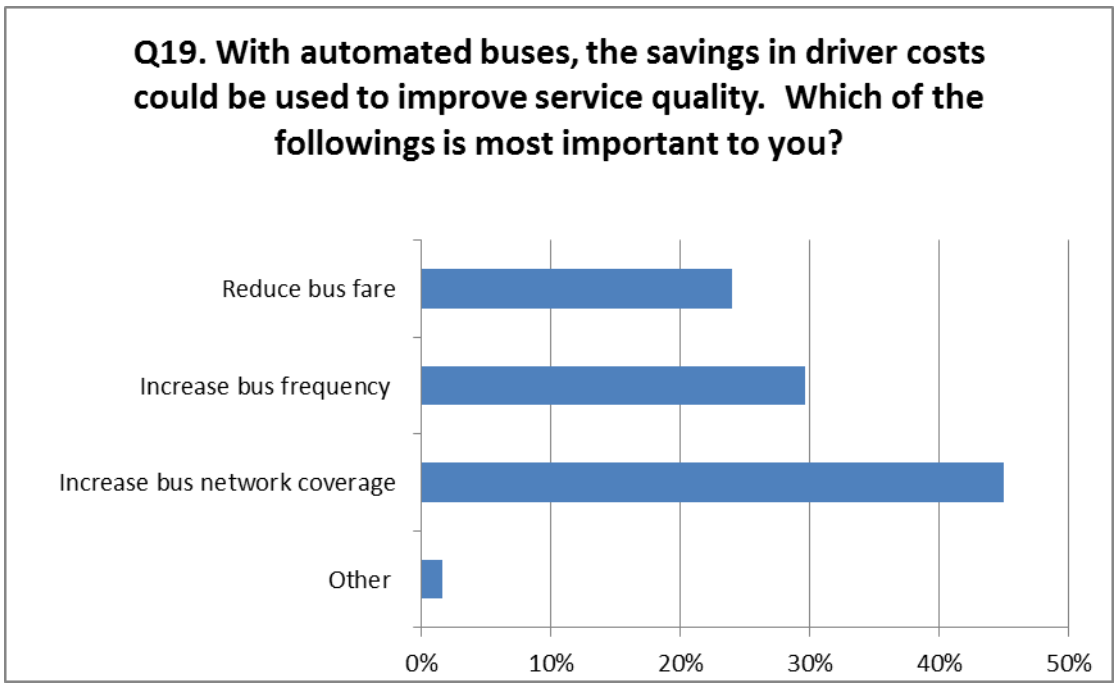


Figure 6.17 Improve service quality with automated buses

Having staff on board would improve security, but increase operating cost of the service. In the survey, a question was asked whether people support having a staff on board of automated buses. Of the respondents, 46% preferred having a staff on board during night service only, 40% having a staff on board in all services, and 13% not having a staff on board automated buses (Figure 6.18).

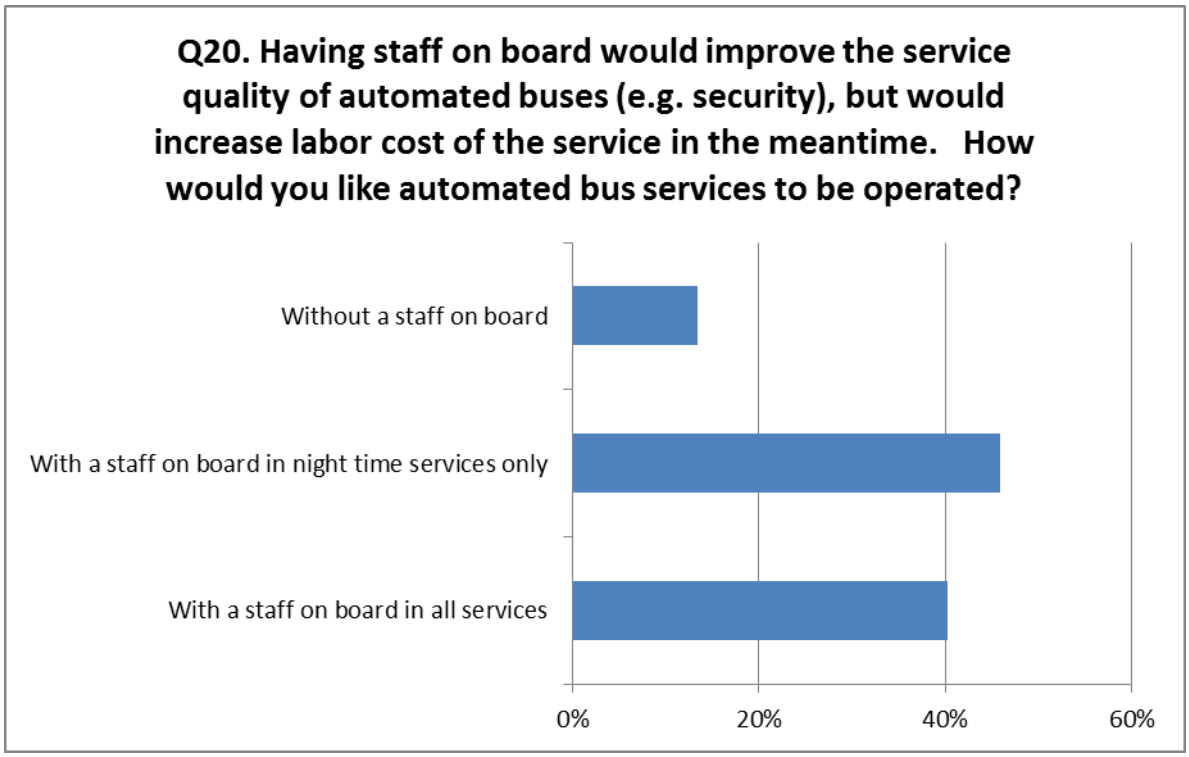


Figure 6.18 Having a staff on board

A question was asked about people's preferences between conventional and automated buses if both were available on the same route. Of the people surveyed, the majority responded positively towards automated buses, with 38% indicating that they would take automated buses if with a staff on board, and 25% without. In the question, it was assumed that both the automated and human driven buses had the same fares. In reality, automated buses could be expected to have lower fares compared to human driven buses because of not having driver costs. However, the extent to which fares could be reduced depends largely on whether or not on-board staff are used, what kind of staff are used (labour costs compared to those of bus drivers), and when on-board staff are used (e.g. night services only). Any reductions in fares would be expected to increase the attractiveness of automated buses.

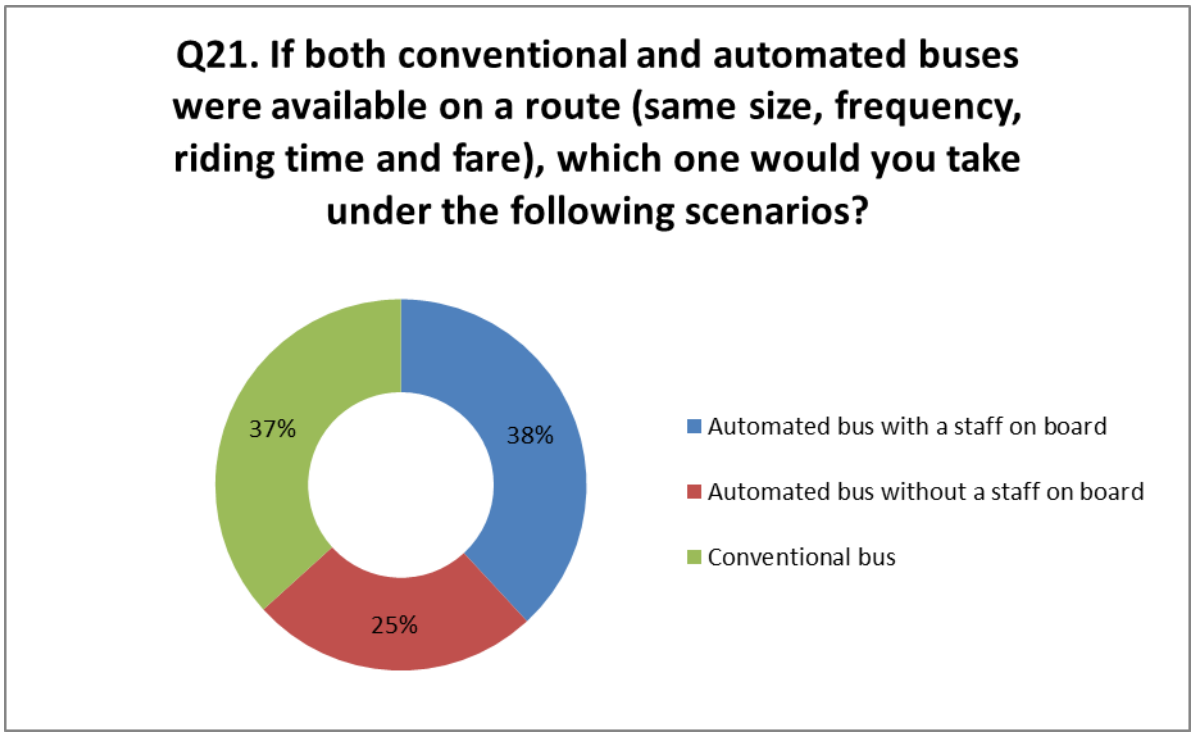


Figure 6.19 Choice between automated and human driven buses

Responses to Q21 were broken down by demographics and experience of the automated buses demonstrated in La Rochelle.

Gender

From the responses, the males were more positive towards automated buses than the females. Of the respondents, 67% of the males preferred automated buses, compared to 60% for the females. It seemed that males were less concerned security issues with the automated buses. Of the respondents, 30% of the males would take automated buses without staff on board, compared to 21% for the females.

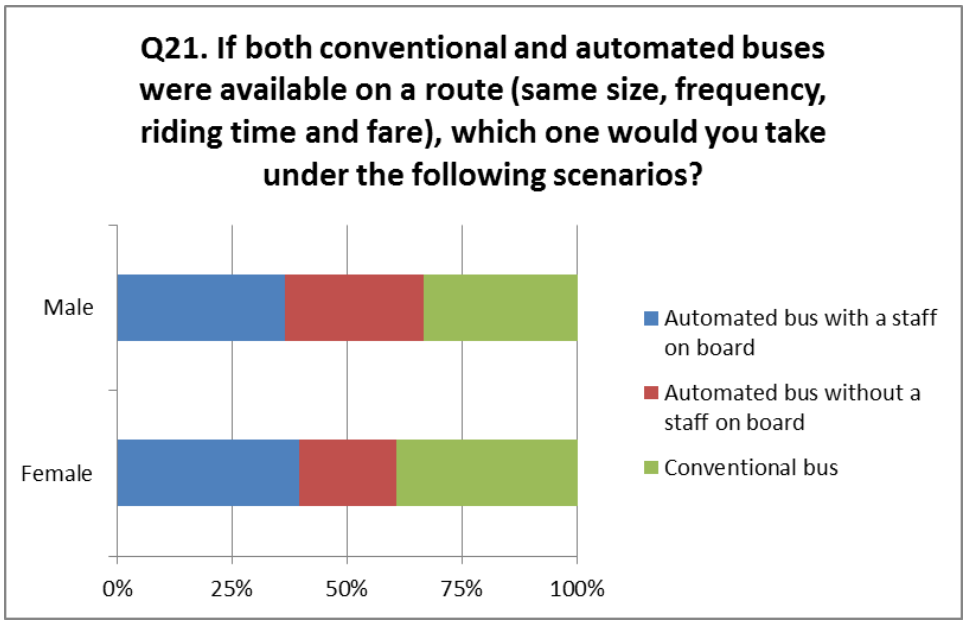


Figure 6.20 Choice between automated and human driven buses by gender

Education

More educated people (bachelor degree or above) seemed to be more positive towards automated buses than less educated people. For respondents with higher education (bachelor degree or above), 66% would take automated buses rather human driven buses if both were available, compared to 62% for people with lower education (below bachelor degree). In addition, more educated people seemed to be less worried security with automated buses. For respondents with higher education (bachelor degree or above), 32% would take automated buses if without a staff on board, compared to 21% for people with lower education (below bachelor degree).

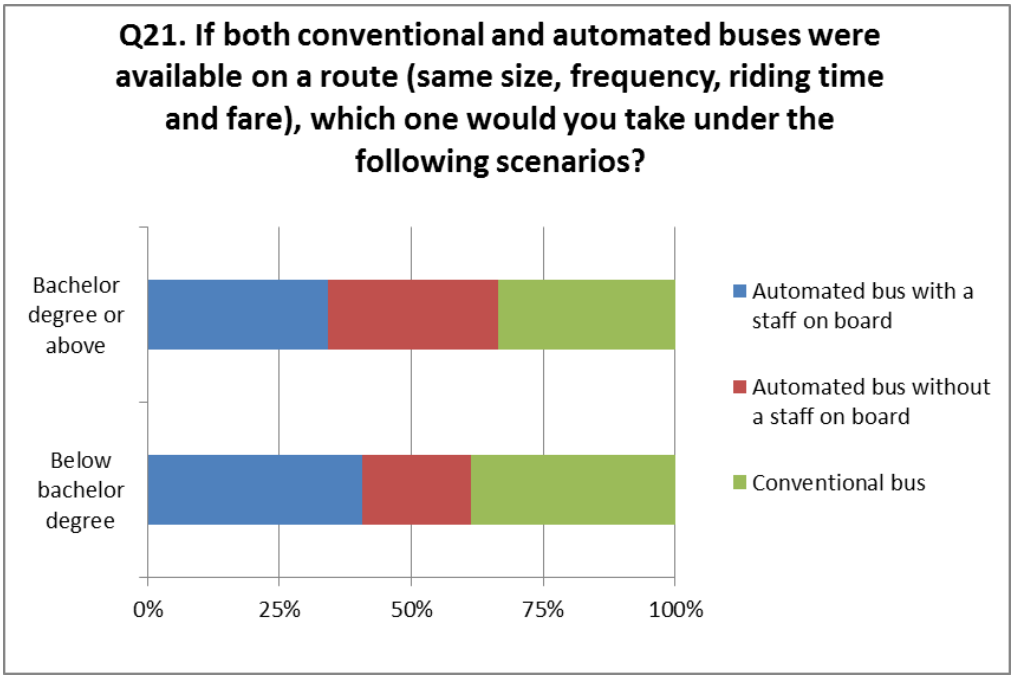


Figure 6.21 Choice between automated and human driven buses by education

ARTS Experiences

People with ARTS riding experiences were more positive towards automated buses. Of the respondents with ARTS riding experience, 77% would take automated buses instead of human driven buses, compared to 59% for respondents without the experience. In addition, respondents with ARTS riding experience were less worried about security with the automated buses. For respondents with the experience, 42% would choose automated buses, compared to 20% for respondents without the experience.

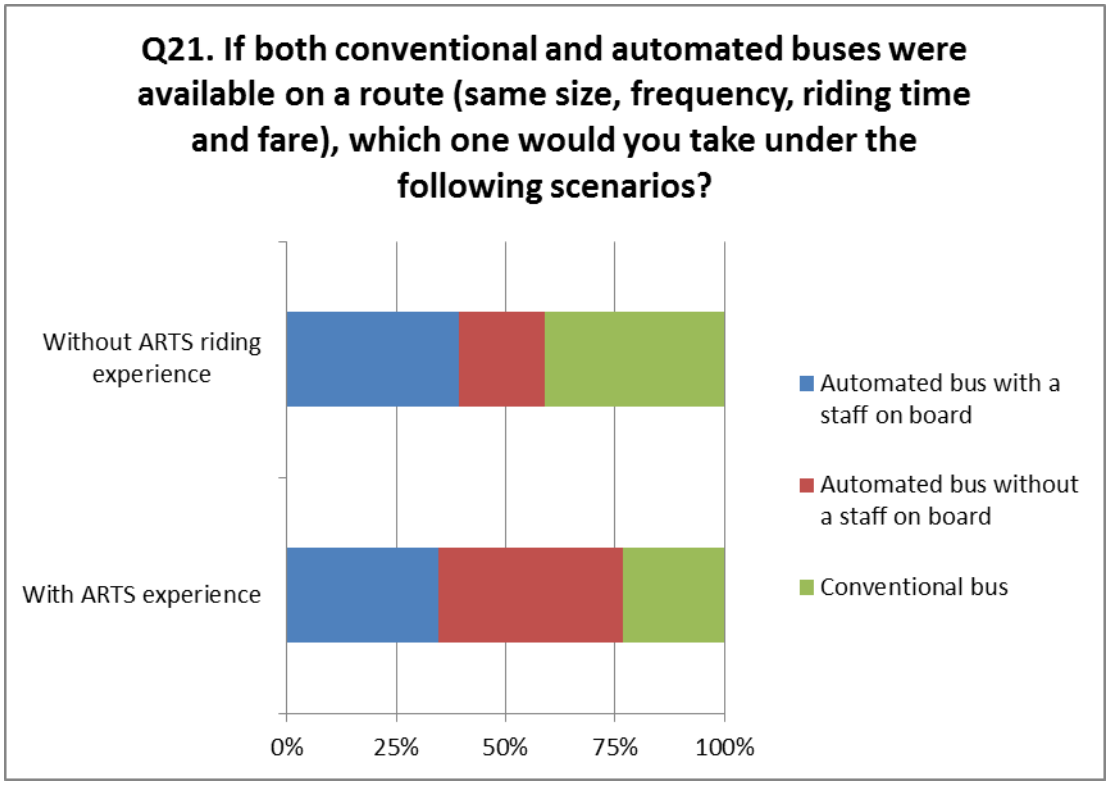


Figure 6.22 Choice between automated and human driven buses by ARTS experiences

6.4.3 Other potential applications in urban areas

6.4.3.1 Automated cars

People's attitudes towards automated cars were tested regarding attractiveness and risks of the technology. The majority of the respondents were interested in each of the 8 expected benefits listed (very attractive, moderately attractive, or slightly attractive). Of the benefits addressed, the top three most appealing ones were 'Increase mobility for the elderly, disabled and others' (58% answered 'very attractive'), 'Reduce fuel consumptions and emissions' (56%), and 'Lower insurance rates'(53%).

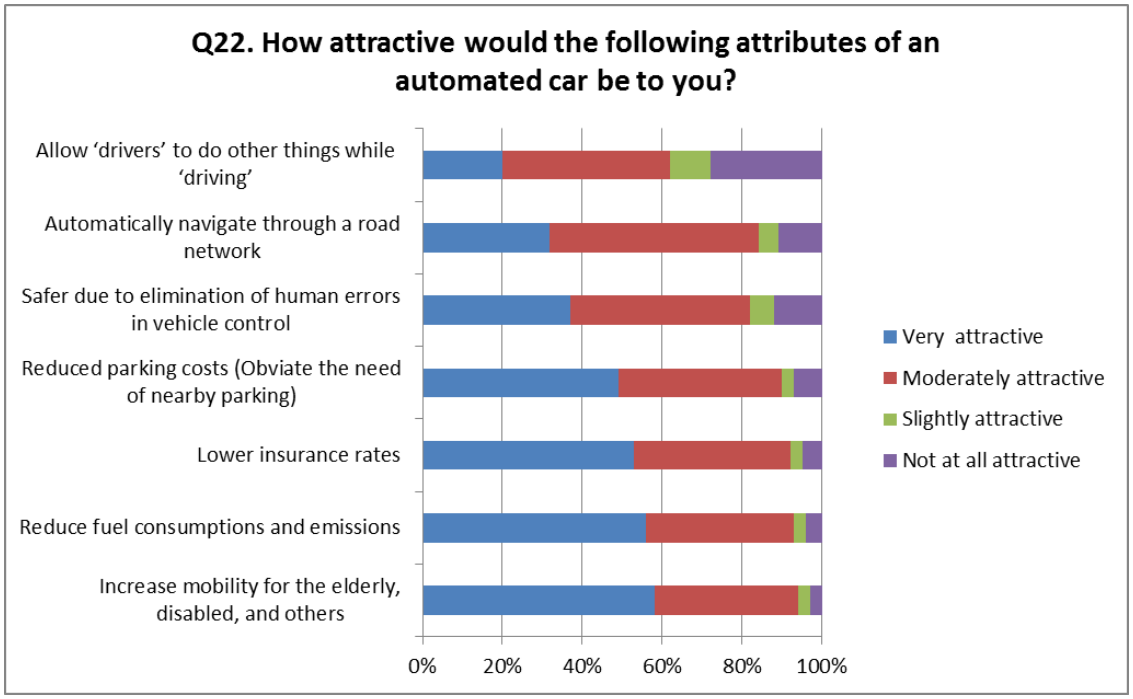


Figure 6.23 Attractiveness of automated cars

For automated cars, most respondents expressed some concerns to each of the issues listed (very concerned, moderately concerned, or slightly concerned). Of the issues, the top three concerns were: 'Equipment or system failures' (66% of the respondents answered 'very concerned'), 'Legal liability in case of an accident' (56%), and 'Risk of vehicle security' (54%).

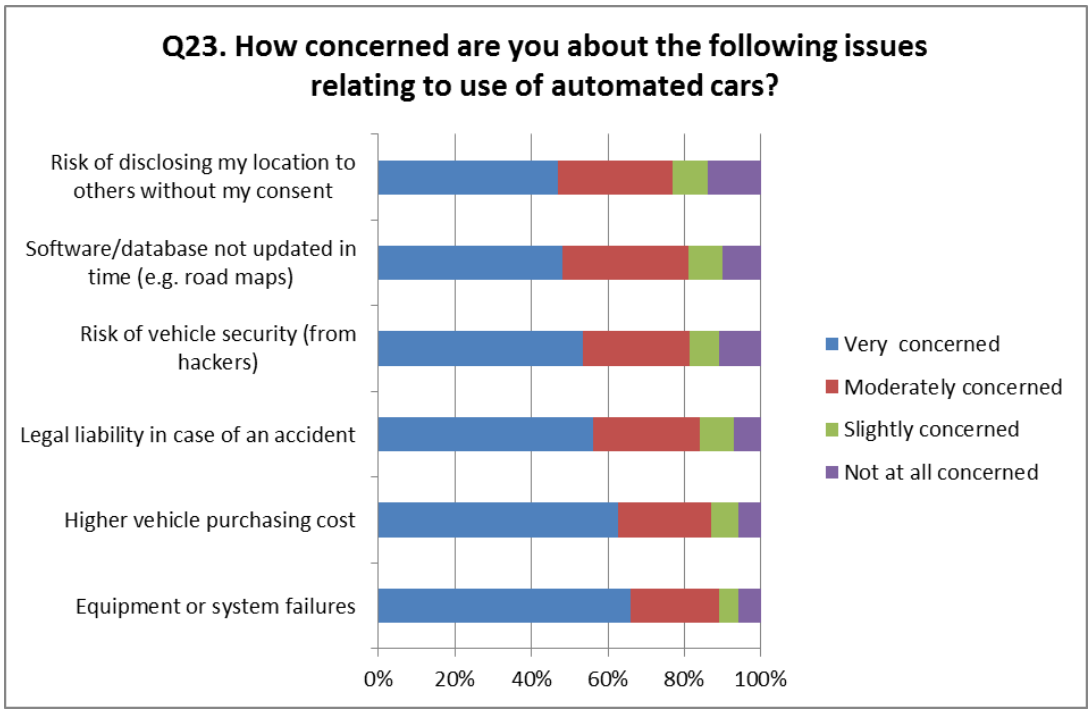


Figure 6.24 Key issues related to use of automated cars

6.4.3.2 Automated taxis

Automated taxis would be expected to have several advantages compared to conventional taxis including lower fares, increased privacy and increased passenger spaces. In the survey, a question was asked about attractiveness of such features. According to the responses, the most appealing benefit was 'Reduced fares' (36% answered 'Very attractive'), followed by 'Larger passenger space' (27%), and 'Increased privacy' (20%).

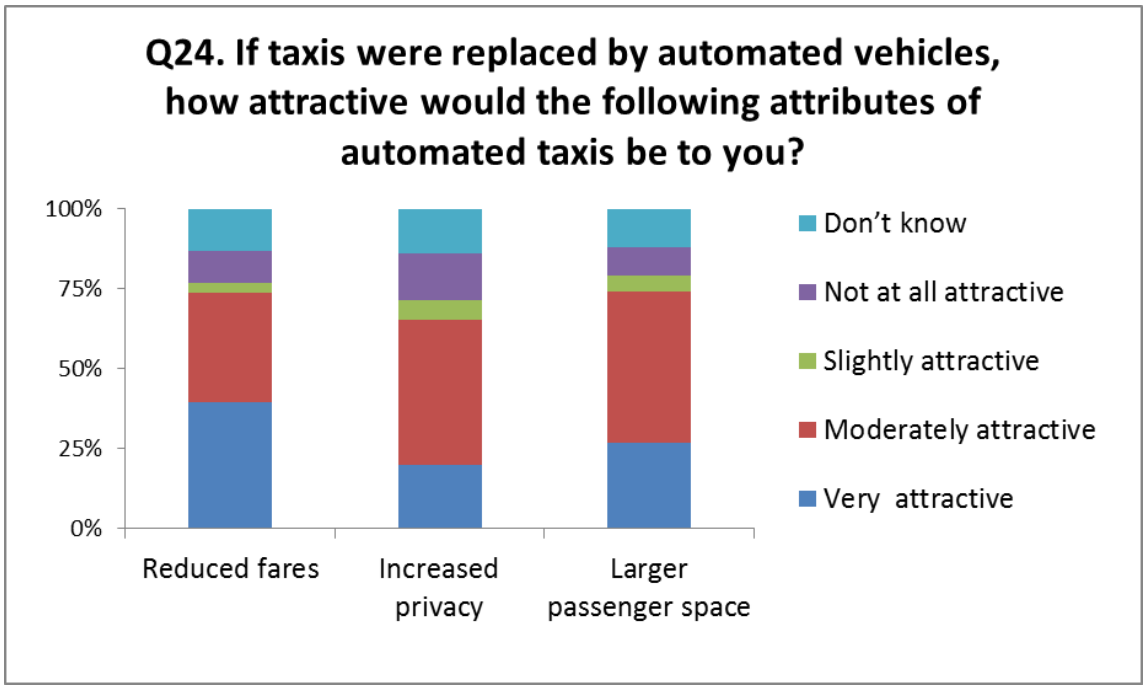


Figure 6.25 Automated taxis

Of the people surveyed, over a third stated that they would consider using taxis more if automated taxies became available (Figure 6.26).

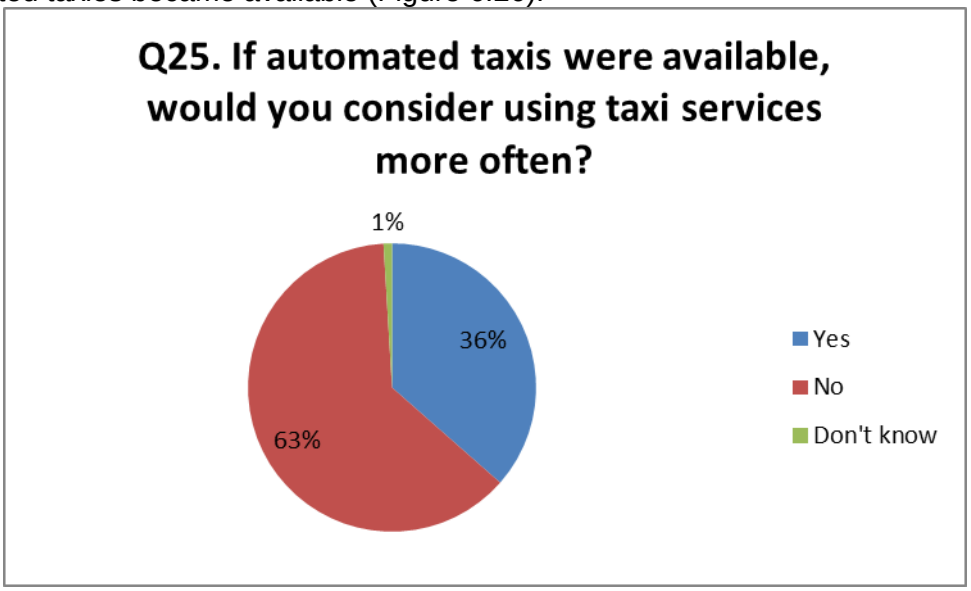


Figure 6.26 Automated taxis

6.4.3.3 Car-sharing

Compared to car-sharing services using conventional cars, automated cars are expected to have several advantages including larger passenger space, calling up remote cars, and releasing cars at desired place. The majority of the respondents were interested in the new features brought by the automated cars (very attractive, moderately attractive, or slightly attractive). Of the benefits, the most appealing one was 'Releasing a car at a desired place' with 35% claiming it to be very attractive, this was followed by 'Calling up a distant automated car' (31%), and Larger passenger space (18%). About one third answered 'Don't know'. This was likely due to the fact that most people surveyed did not have experiences of car-sharing services and not sure how they would be impacted.

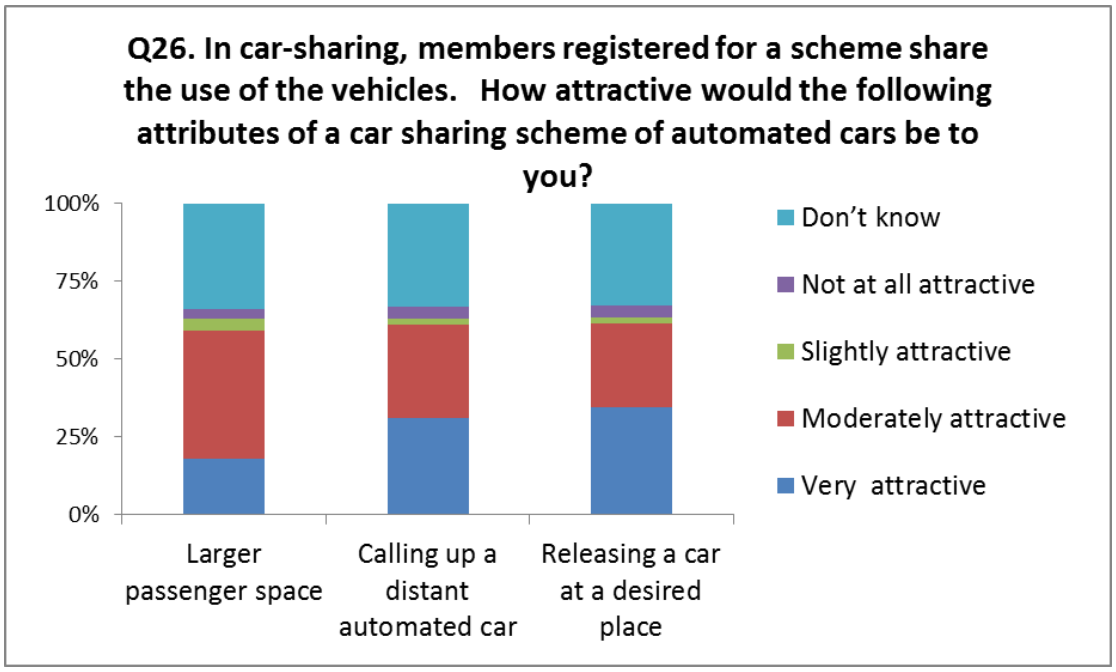


Figure 6.27 Attractiveness of car sharing with automated vehicles

6.4.3.4 Car-pooling

Compared to conventional cars, automated cars are expected to have several advantages for car-pooling services including driverless, reduced fares, and increased passenger space. The majority of the respondents were interested in the benefits claiming them as either very attractive, moderately attractive, or slightly attractive. Of the benefits, the most appealing one was 'Reduced travel cost' with 36% of the respondents taking it as very attractive, this was followed by 'Larger passenger space' (24%), and 'Driverless' (21%). There were a fifth of the people surveyed answered 'Don't know'. One possible reason is that they had limited knowledge about car-pooling, and do not know how implementation of automated cars would impact on the service.

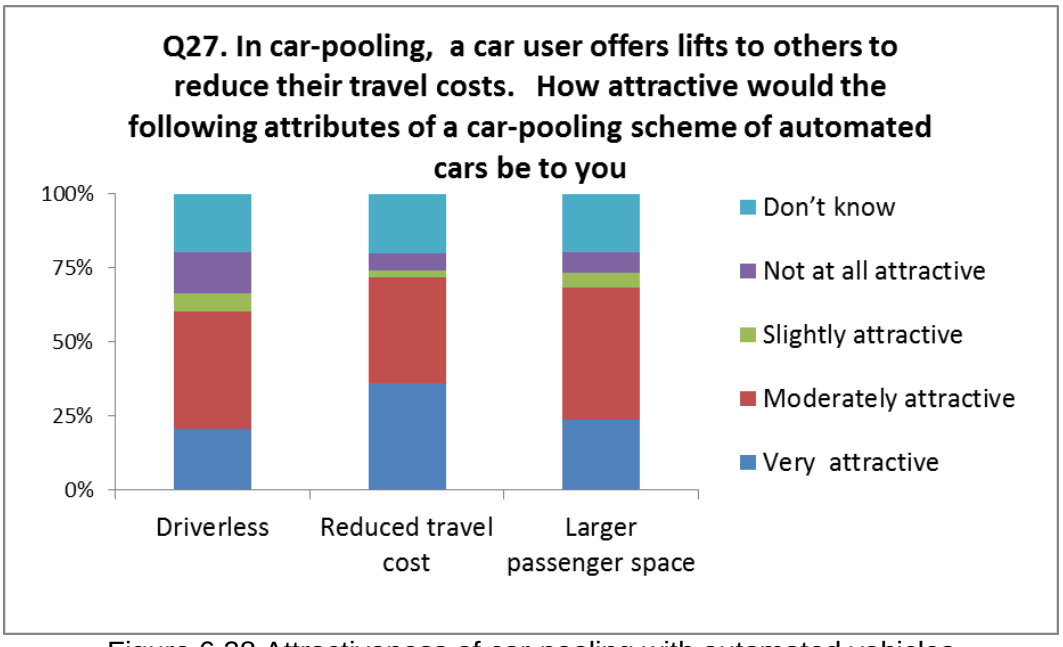


Figure 6.28 Attractiveness of car-pooling with automated vehicles

6.4.4 Own or share automated cars

More than half of the respondents (60%) stated that they would consider using automated cars, and about a third (38%) would not consider using automated cars at all. Of the potential users of automated cars, about three quarters (73%) said they would like to own an automated car, and the rest (27%) to use automated cars through car sharing, carpooling, and taxis.

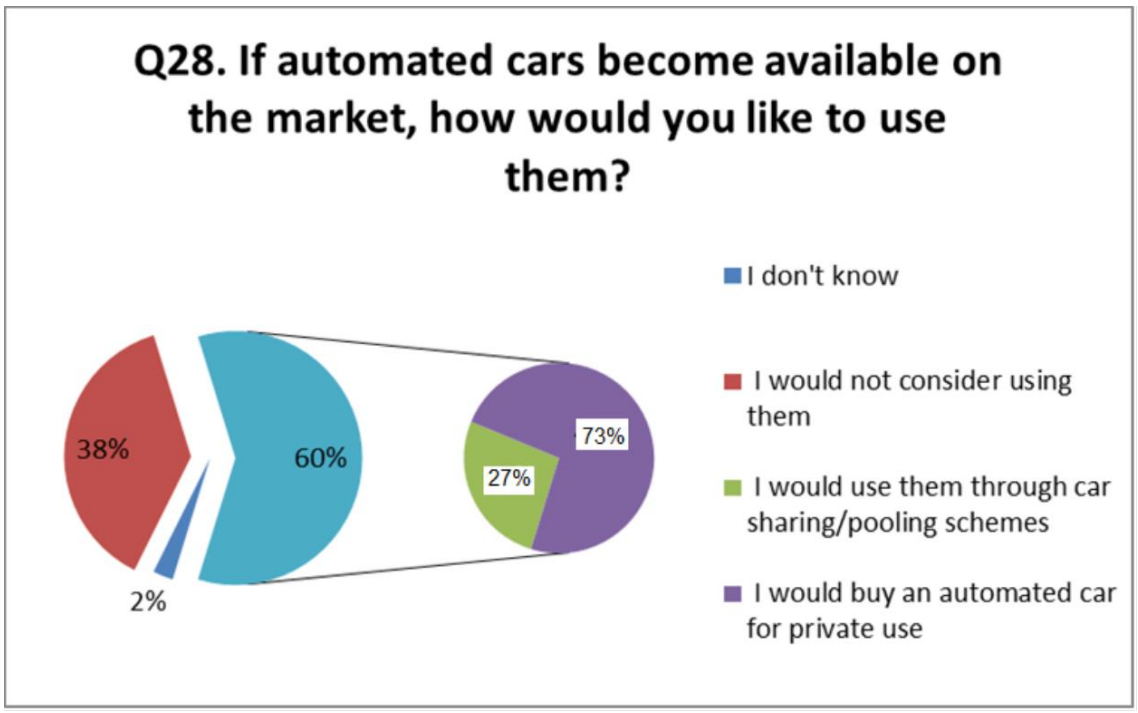


Figure 6.29 Attitudes towards owning/sharing automated cars

Responses to Q28 were broken down by demographics and experience of the automated buses demonstrated in La Rochelle.

Age

Older people showed less interest in using automated cars than people in other age groups. For respondents aged over 65, 56% said they would consider using automated cars, compared to 62% for people aged between 18 and 34, and 61% for people aged between 35-64. For those who would consider using automated cars, young adults were more likely to own an automated car. For people aged 18-34, 52% stated that they would like to own automated cars, compared to 39% for people aged of 34-65, and 43% for people aged over 65.

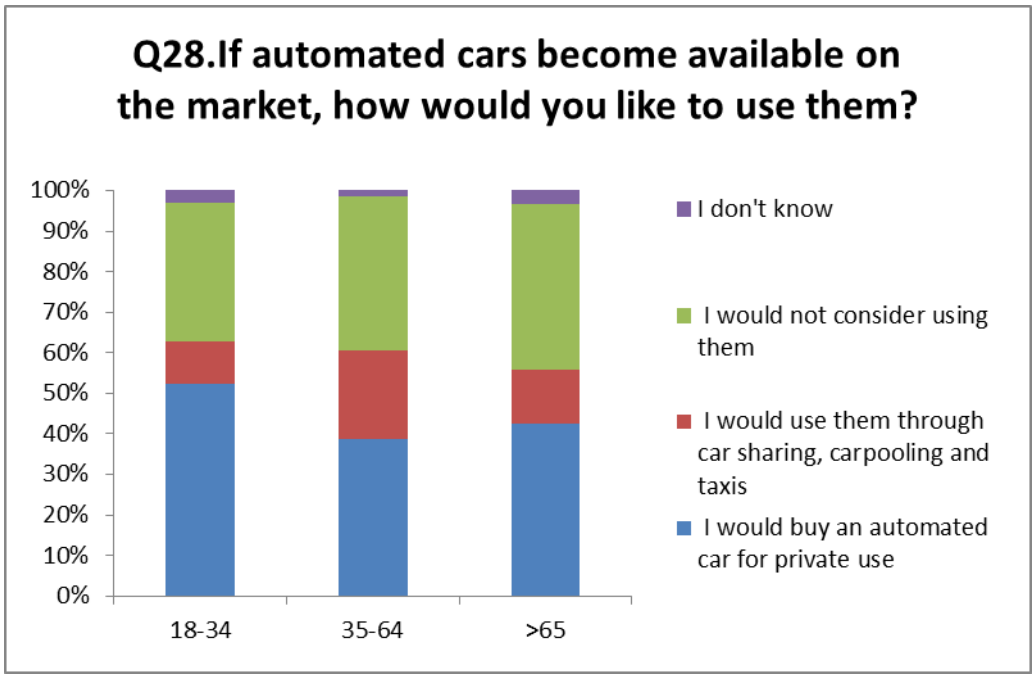


Figure 6.30 Owning/sharing automated cars by ages

Gender

From the responses, males would be more likely to use automated cars than females. Of the male respondents, 64% stated that they would consider using automated cars, compared to 55% for the females. In addition, males would be more likely to own an automated car than females, with 49% of the males stating that they would buy an automated car for private uses, compared to 39% for the females. Regarding using automated cars through sharing cars (e.g. car-sharing, car-pooling, and taxis), similar trends were found between the female and male respondents.

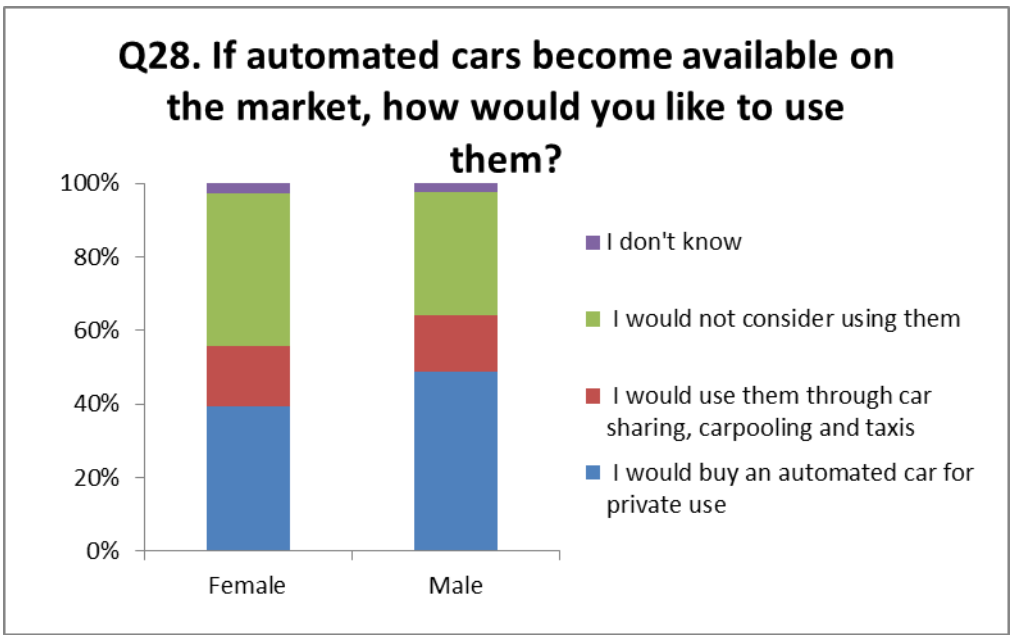


Figure 6.31 Owning/sharing automated cars by gender

Education

From the response, people with higher education (bachelor degree or above) were more positive towards automated cars, with 71% stating that they would consider using automated cars, compared to 52% for people with lower education (below bachelor degree). For the respondents with higher education, 28% stated that they would con-sider use automated cars through services such as car-sharing/car-pooing/taxis, compared to 8% for respondents with lower education. The percentages of people who would consider owning automated cars were similar regardless whether or not they received high education.

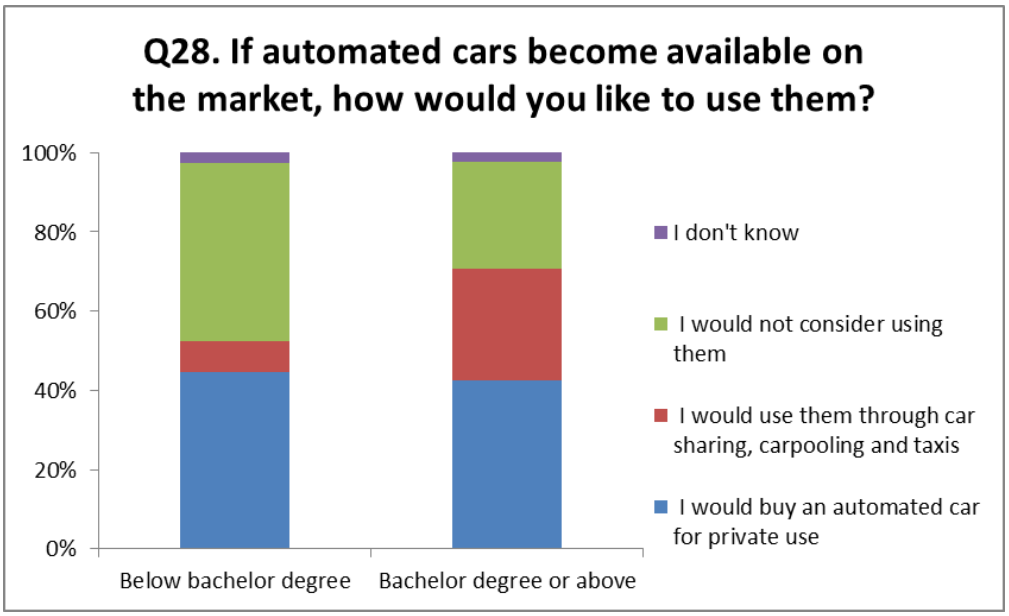


Figure 6.32 Owning/sharing automated cars by education

Experience of automated vehicles

Of the respondents with riding experience of the ARTS vehicles demonstrated in La Rochelle, 73% stated that they would consider using automated cars, compared to 55% for respondents without the experience. Respondents with the riding experience were more interested in sharing than owning automated cars, with 43% of them stating that they would use automated cars through car-sharing/car-pooling/taxis, compared 7% for respondents without the experience.

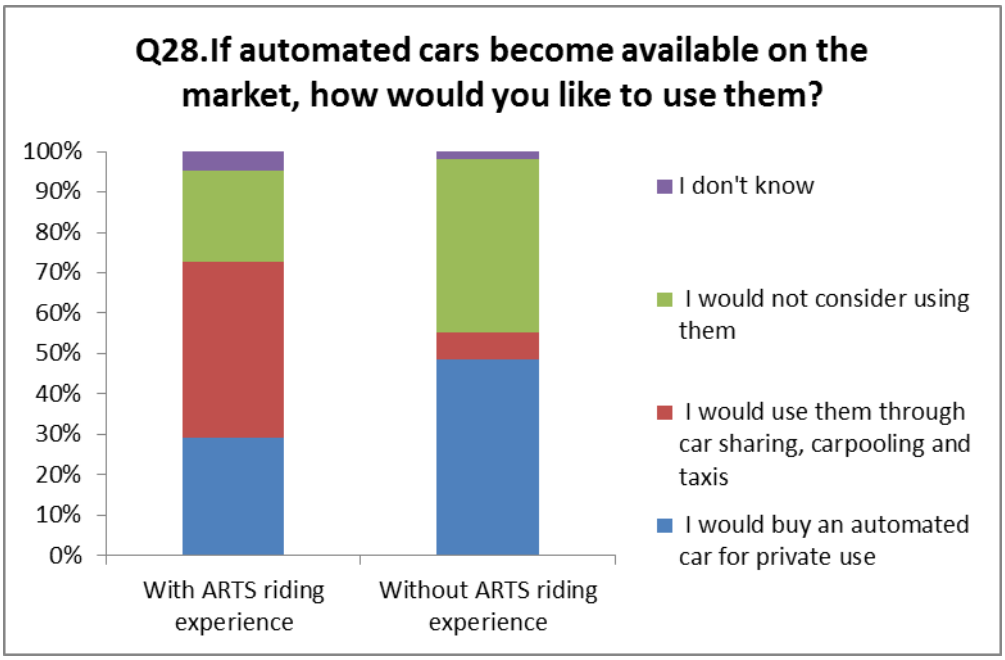
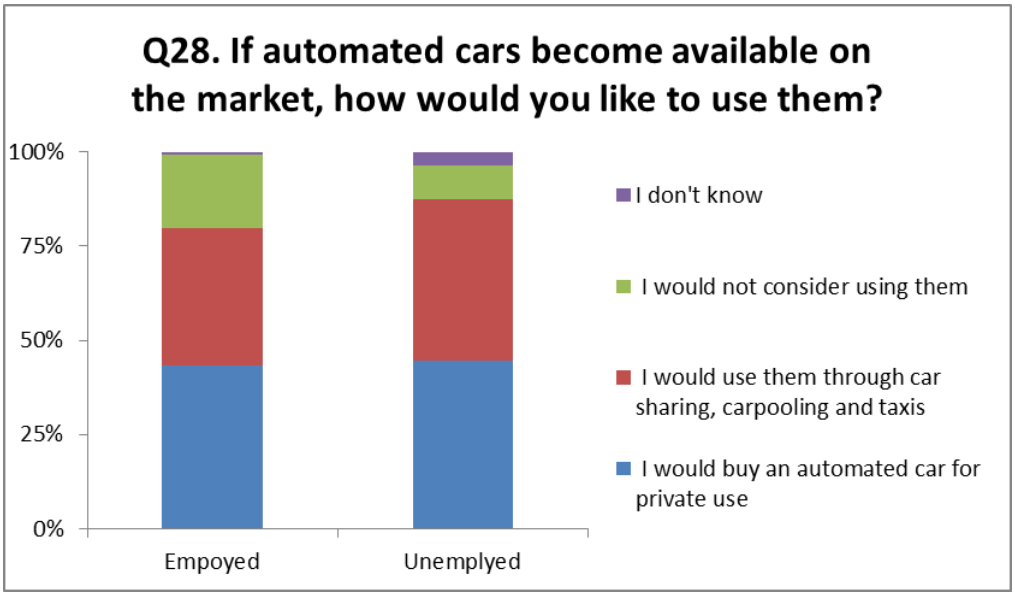


Figure 6.33 Owning/sharing automated cars by ARTS experiences

Employment status

Responses were compared between employed and unemployed. In terms of percentages of owning automated cars, the trends were similar between the two groups. However, the employed were less interested in using automated cars collectively. Of the unemployed, 43% would consider using carsharing/carpooling/taxis, compared to 37% for the employed. One explanation is that for employed, a high level of mobility is very important for commuting. Carsharing/carpooling/taxi services cannot guarantee an instant availability of a car for travelling, especially in peak times.



6.4.5 Influencing factors

Automated vehicles are expected to provide a wide range benefits which were appealing to most of the people surveyed. These expected benefits are believed to have positively influenced the attitudes of the people surveyed. In terms of benefits to a society as whole, they included 'Increased mobility for the elderly, disabled and others' (58% of the respondents answered very attractive), and 'Reduced fuel consumptions and emissions' (56% of the respondents answered very attractive). The most attractive benefits to end users included Reduced bus fares (64% of the respondents answered very attractive), 'Reduced insurance rates' (53% of the respondents answered very attractive), 'Reduced parking costs' (49% of the respondents answered very attractive), 'Safer driving due to elimination of human errors in vehicle control' (36% of the respondents answered very attractive), 'Reduced taxi fares' (36% of the respondents answered very attractive), and Allow 'drivers' to do other things while 'driving' (20% of the respondents answered very attractive).

Some issues were reflected in the survey which may have negatively influenced the attitudes of the people surveyed. These included safety, security, privacy and legal issues with the use of automated vehicles. For automated buses, the most concerned issue was security when no staff on board, especially during evening/night time services. For automated cars, the most concerned issues included 'Equipment or system failures' (66% of the respondents answered very concerned), 'Legal liability in case of an accident' (56% of the respondents answered very concerned), Risk of being hankered (54% of the respondents answered very concerned), and Risk of disclosing travel location (47% of the respondents answered very concerned).

Safety could be one of key factors influencing public attitudes towards automated vehicles. This was supported by the responses from the people surveyed. Of those who believed that automated vehicles would be safer than human driven vehicles, the majority of them stated that they would consider using automated vehicles (80% for buses, and 89% for cars); and of those who believed that automated vehicles would be less safe than human driven vehicles, the majority of them stated that they would not consider using automated vehicles (57% for buses and 65% for cars).

It seemed that there were some misconceptions about the benefits of automated vehicles, especially the safety benefits. Safer than human driven vehicles is one of the major driving forces for the development of automated vehicles and a prerequisite for implementation of automated vehicles on public roads. Automated vehicles should be safer than human driven vehicles because of removing human errors. From the survey, only a quarter of the respondents believe automated vehicles would be safer than human driven vehicles. This could be results of low levels of awareness or/and understanding of the self-driving technology. In La Rochelle, although most respondents have previously heard of automated vehicles, only a quarter of them have riding experiences of ARTS vehicles demonstrated. In La Rochelle, the automated buses were demonstrated in experimental condition, where the vehicle ran in low speed and with little interactions with other motorised vehicles. Such demonstration was good for increasing awareness and demonstration of automated vehicle concept, but not enough to convince the public what automated vehicles can do in real conditions, especially the safety benefits. This implied that further demonstrations are needed in the future to test automated vehicles (e.g. in operational speed and under different road/weather/traffic conditions), to increase awareness and experiences, and to convince the public.

6.5 Summary

This survey aimed to examine public opinion regarding automated vehicles in urban areas. A total of 425 people were sampled for the study. The main findings can be summarised as follows.

- A majority of the respondents had previously heard of automated vehicles and about a quarter had riding experience of the automated mini buses demonstrated in La Rochelle. A majority of the respondents had high expectation of the benefits from automated vehicles, especially reduction of fuel consumption and pollutant emissions. However, only a quarter of the respondents expected that automated vehicles would be safer than human driven vehicles.
- Overall, public attitudes towards automated buses were positive, with two thirds stating that they would consider taking automated buses if both automated and conventional buses were available on a route. The most attractive benefit of automated buses was reduced fares because of no driver costs. Passenger security was the one of the most concerned issues for automated buses especially during night time services. For the automated mini buses demonstrated, the most supportive role was to complement public transport as feeders/distributors.
- Regarding automated taxis, the people surveyed were interested in the expected benefits from the vehicles. Of the benefits, reduced fares were the most attractive one to the respondents. With such a benefit together with the advantage of door-to-door services, automated taxis could become a practical alternative of buses in urban areas, especially for a small group (e.g. 2-4 persons) traveling together.
- Public attitudes were positive to implementation of automated vehicles in car-sharing and car-pooling services. Regarding car-sharing services, the most appealing benefit was to call up a remote automated car and to release them at desired places which have a great potential to increase the serving area of car-sharing clubs. Regarding car-pooling, the expected benefits of automated cars were attractive to the respondents including reduce travel cost, increased passenger space and driverless.
- The people surveyed were interested in automated cars. For the respondents, the most attractive benefit of automated cars was to increase mobility for all, followed by reduced fuel consumption and pollutant emissions. Other benefits appealing to the respondents included reduced insurance rates and reduced parking costs. The most concerned issue with automated cars was Equipment or system failures. Other issues concerned included Higher vehicle purchasing cost, Legal liability in case of an accident, Risk of vehicle security (from hackers), Software/database not updated in time, and Risks of disclosing my location to others without my consent. More than half of the respondents stated that they would consider using automated cars, and about one third would not consider using automated cars at all. Of the respondents who stated they would consider using automated cars, 73% said they would like to own automated cars, and 27% to share cars through services such as car sharing and pooling.
- Safety could be one the most important factors influencing people's attitudes towards automated vehicles. In theory, automated vehicles would be safer than human driven vehicles because of removal of human errors, and increased safety will be a prerequisite for introduction of automated vehicles on public roads. The negative responses from some of the respondents could be a result from lacking awareness/understanding and low trust to the self-driving technology. How to convince the public the safety benefits of automated vehicles will be a topic which needs to be addressed in future research projects.

7 Stakeholder survey

7.1 Objective

The main objective of the stakeholders' survey is to assess stakeholders' awareness and acceptance of the automated road transport system.

The survey investigates also the expected impacts in relation with the role of each stakeholder, and potential drivers and barriers connected with a spread implementation of automated mobility.

The key stakeholder groups considered for this survey are local transport authorities, urban planning authorities, passengers transport operators, manufacturers and freight operators.

7.2 Survey method

The stakeholders' survey carried out in La Rochelle was based on face-to-face interviews using a structured questionnaire.

The targeted people were stakeholders selected by La Rochelle through an accurate process to ensure the best possible coverage of all relevant stakeholders' categories. The number of interviewed people doesn't need to be high but to take a picture of the relevant actors identified in the city.

The survey is composed by eleven questions that request different type of answers; multiple choice, ranking options and open comments offer interesting data and results with a short and smooth questionnaire.

The interviews were made directly in French by La Rochelle partners and were performed from the beginning of July until the mid of the month.

The first section is about personal information and investigated the role of the stakeholders in the city. The second section "General knowledge and attitudes towards automated vehicles" assessed the opinion regarding automated vehicles, possible advantages and the prevision of utilization for this technology.

In the section "Impacts of self-driving vehicles in the field of expertise" the interviewed was asked to answer about needed actions from the other stakeholders' categories to enable a wide spread implementation of self-driving vehicles and to agree or not on possible impacts connected with automated mobility.

The section "drivers and barriers" investigated the point of view of respondents on what are the most important drivers and barriers for a wide spread implementation of automated vehicles.

The last section concerned the willingness to pay for this new service and the opinion on which activities should be prioritised in the future research and development of automated vehicles.

7.3 Respondents

La Rochelle carried out 20 stakeholders surveys interviewing 8 women and 12 men.

The roles of the interviewed people are described in the figure below:

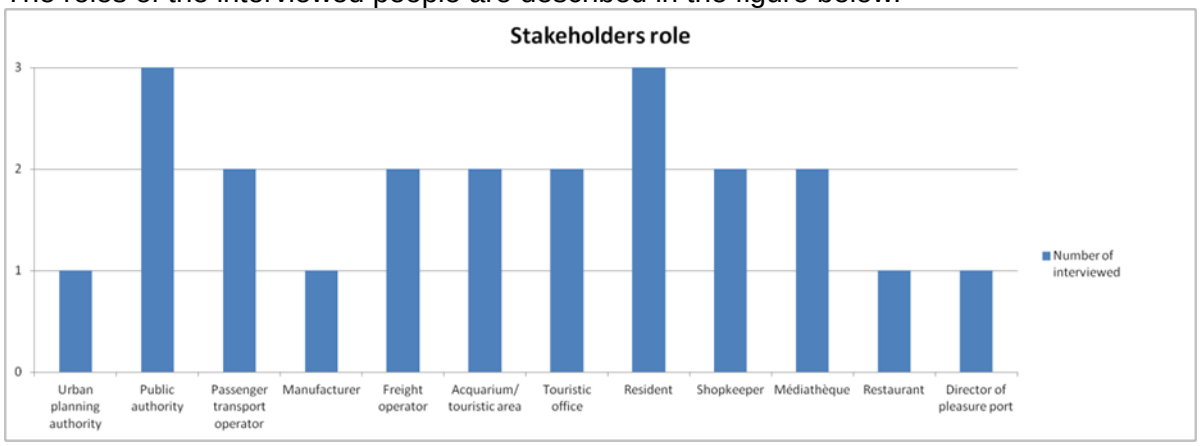


Figure 7.1 Stakeholders role

7.4 Results

In the section **"General knowledge and attitudes towards automated vehicles"** participants gave their **opinion regarding automated vehicles**. 95% of participants have a positive consideration of the automated mobility for different reasons and motivations:

- its innovation and technicality
- a source of intellectual and economic dynamism
- an alternative transport mode
- less congestion during peak hours
- environmental friendly, quite and practical

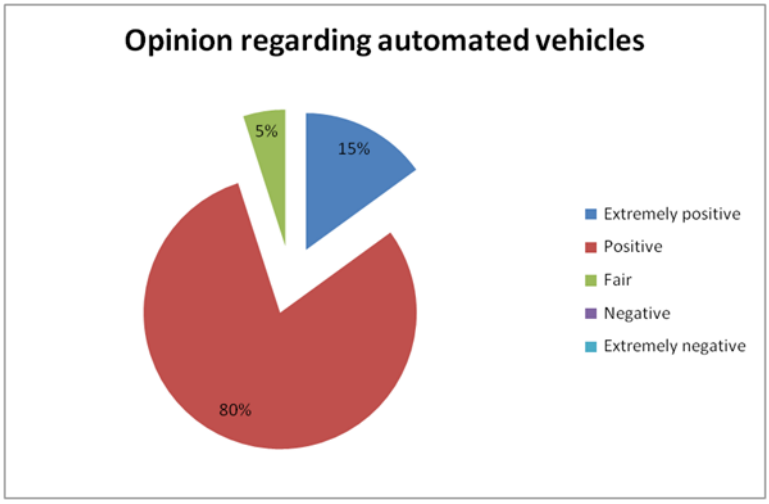


Figure 7.2 Opinion regarding automated vehicles

Stakeholders answered also that **automated vehicles can be an advantage** for several aspects. The majority of respondents considered safety (22%), environment (30%) and transport efficiency (26%) the most important field of improvement.

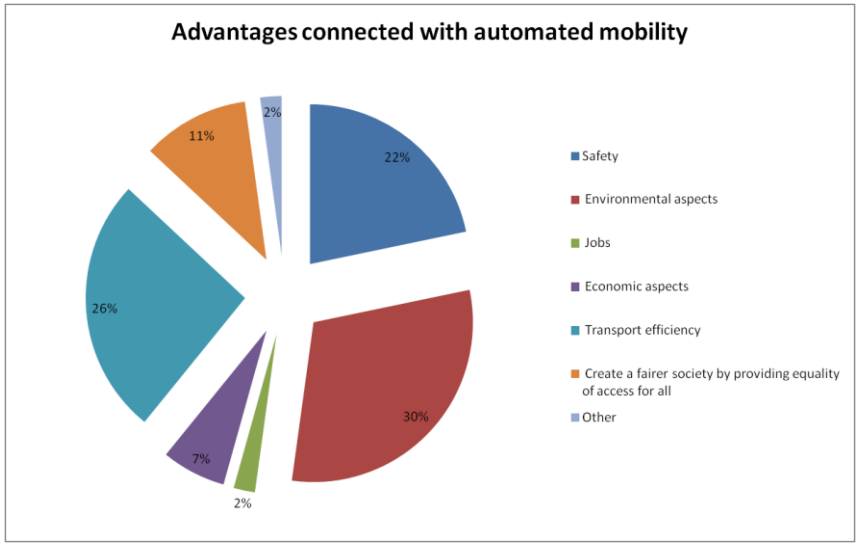


Figure 7.2 Advantages connected with automated mobility

On one side an interviewed showed concern about the absence of the human control, but on the other side additional points of strength came out from the interviews:

- the modularization of this mode of transport
- the adaptability of automated vehicles within the public transport system
- the absence of noise and pollution (if connected with e-technology)
- the fine transport interconnection
-

Respondents also gave a positive feedback in connection with the demonstrator delivered in La Rochelle appreciating the path chosen, the free service and the smooth transport interconnection.

To the question "**In a future scenario do you think automated vehicles will be mostly used as**" an high percentage of participants responded public transport, taxis and other on-demand services, car sharing and freight transport. Only two persons considered the use of automated vehicles for private owned vehicles.

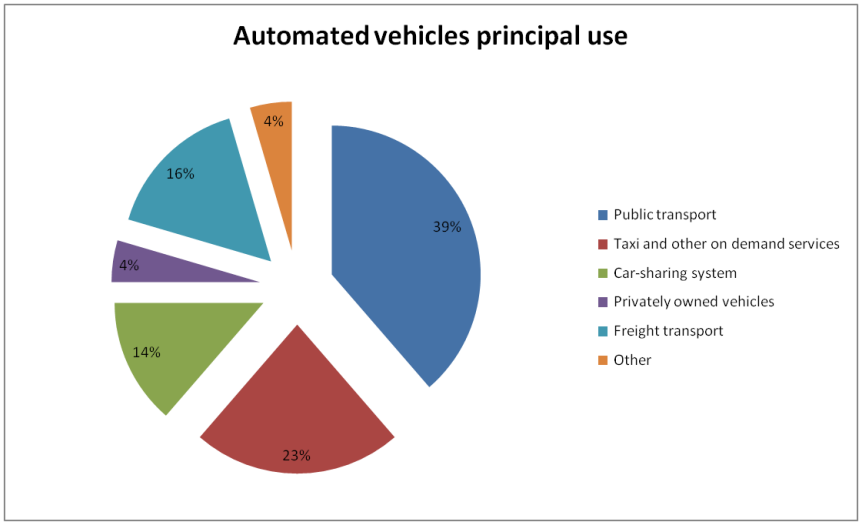


Figure 7.3 Automated vehicles principal use

Thanks to its flexibility and security some respondents suggested to use them for small deliveries and for an high level (luxury) service for those who not use public transport. A negative opinion came from a respondent that hopes these vehicles will never have a wide implementation.

Participants gave also their opinion on how automated vehicles should **interact with other modes of transport on roads.** The majority prefers a total segregation with dedicated lines and an high number of respondents agree with the possibility of having automated mobility on low speeds roads, with pedestrians and cyclists.

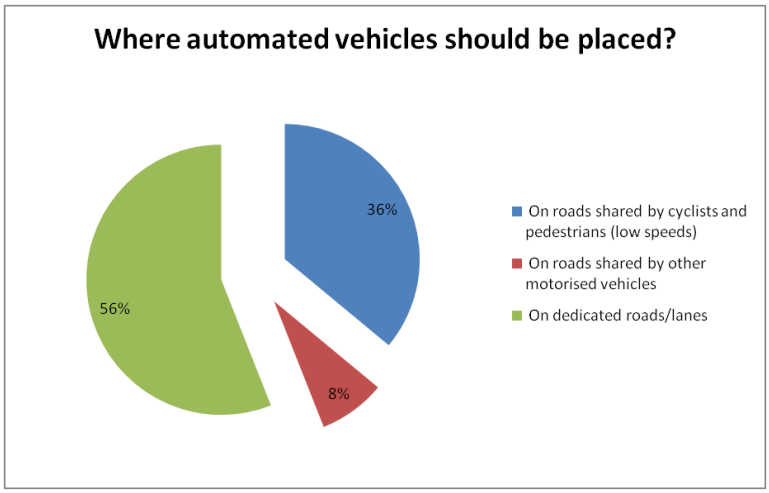


Figure 7.4 Opinion on where automated vehicles should be placed

For the **impacts section of the survey** we obtained three types of answers depending on the field of expertise of stakeholders

To the question "**if you are a PRIVATE ACTOR** (transport operator or service company) or a **MANUFACTURER** what do you think public authorities and urban planning operators should do to enable a wide spread implementation of automated

mobility?" 9 participants responded. The most commons answers are to be proactive and to include automated vehicles discussion in SUMP process.

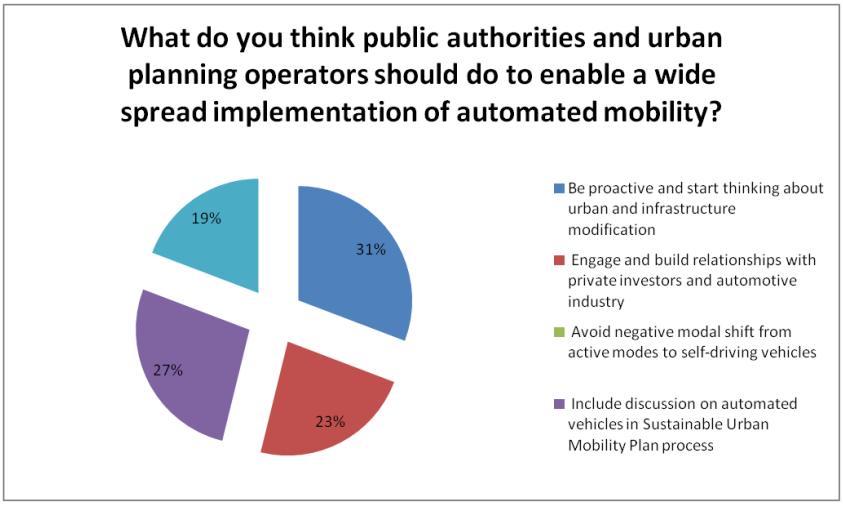


Figure 7.5 Opinion on what public authorities and urban planning operators should do to enable a wired spread implementation of automated mobility

To the question "**If you are from a PUBLIC AUTHORITY BODY** what do you think the private sector and automotive industry should do to enable wide spread implementation of automated mobility?" 8 participants answered. The need of investment from the private sector is one of the welcoming actions. The other enabling mechanism that cities ask for is to think more about selling a service instead of selling cars. Another comment received is on the importance of working on a road space optimization to reserve a place suitable for automated vehicles.

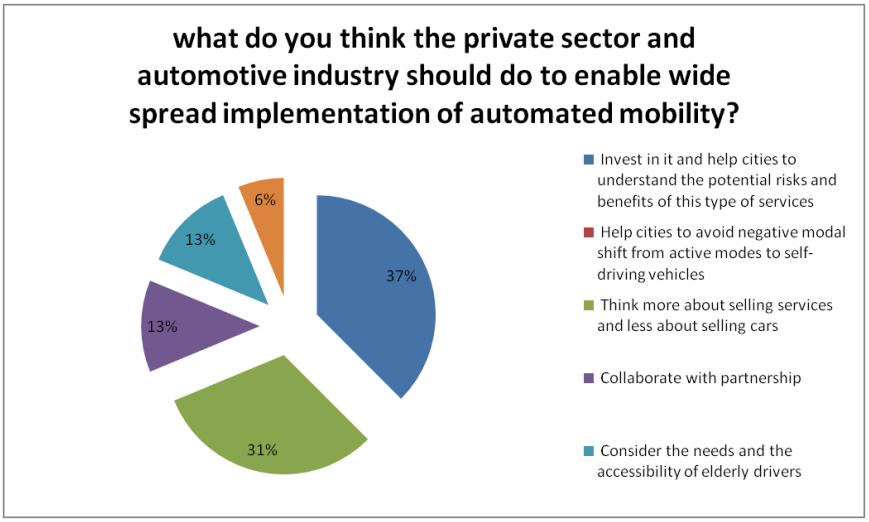


Figure 7.6 Opinion on what private sector and automotive industry should do to enable a wired spread implementation of automated mobility

Two participants from the **freight field** responded to the last question "what do you think private sector and public authorities should do to enable wide spread implementation of automated mobility?" Both of them agreed with the statement "think about automated vehicles as a mixed mode for passengers and goods delivery" and considered as winning

points the integration of long distance delivery with urban distribution and the study of new business models.

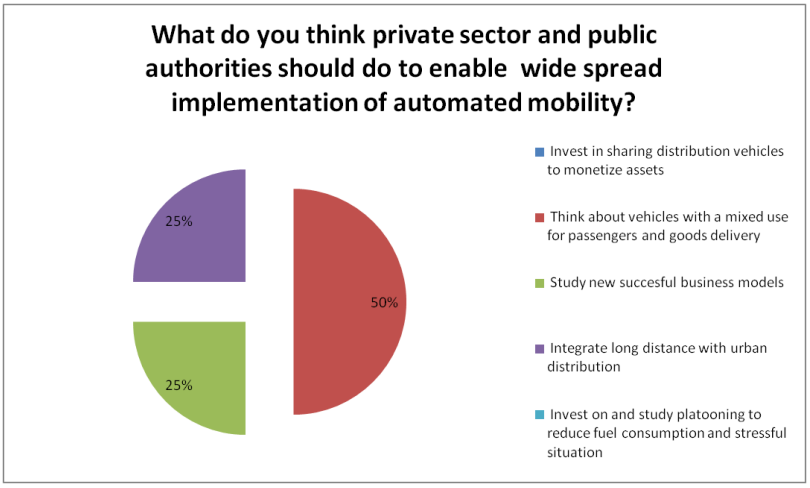


Figure 7.7 Opinion on what private sector and public authorities should do to enable a wired spread implementation of automated mobility

Participants have been asked to give their agreement or not to a **list of statements concerning automated mobility**, private vehicles and collective vehicles. The majority of them agreed with an increase of safety, comfort and convenience and the creation of new jobs. An high percentage of them (more than 50%) disagreed with the assumption of a modal shift from soft modes to self-driving cars.

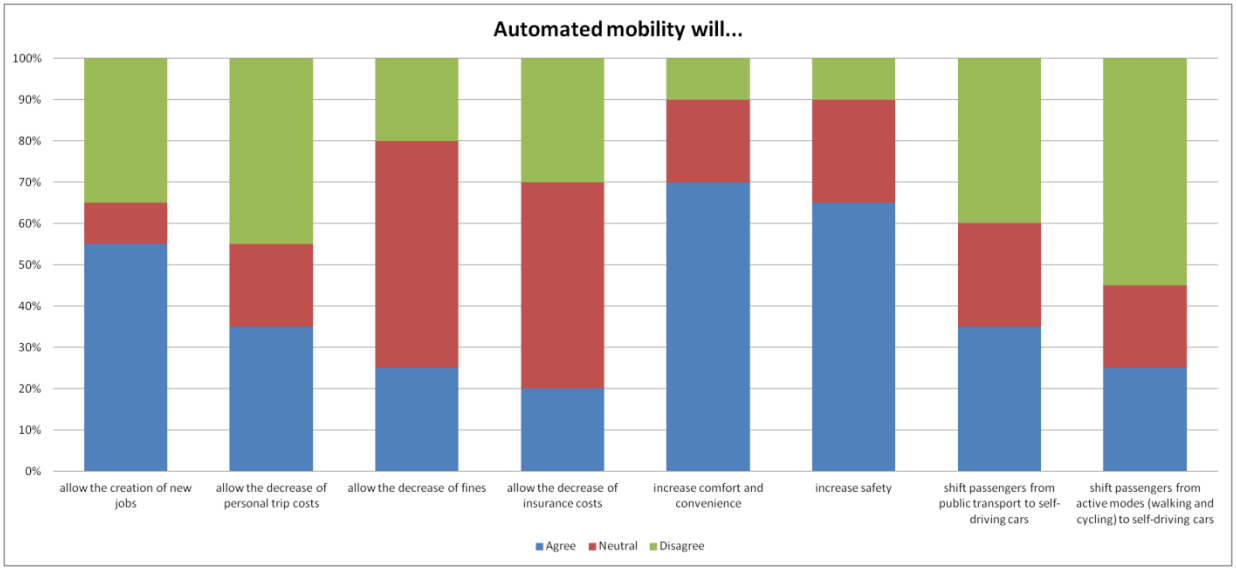


Figure 7.8 Statements on automated mobility

Concerning **differences between private and collective self-driving cars** 70% of participants agreed that collective automated cars will have a positive impacts on energy emission and 55% of them agreed that these cars will allow land saving. The

majority of them also disagreed that private automated cars will have negative impacts on energy emission and land consumption.

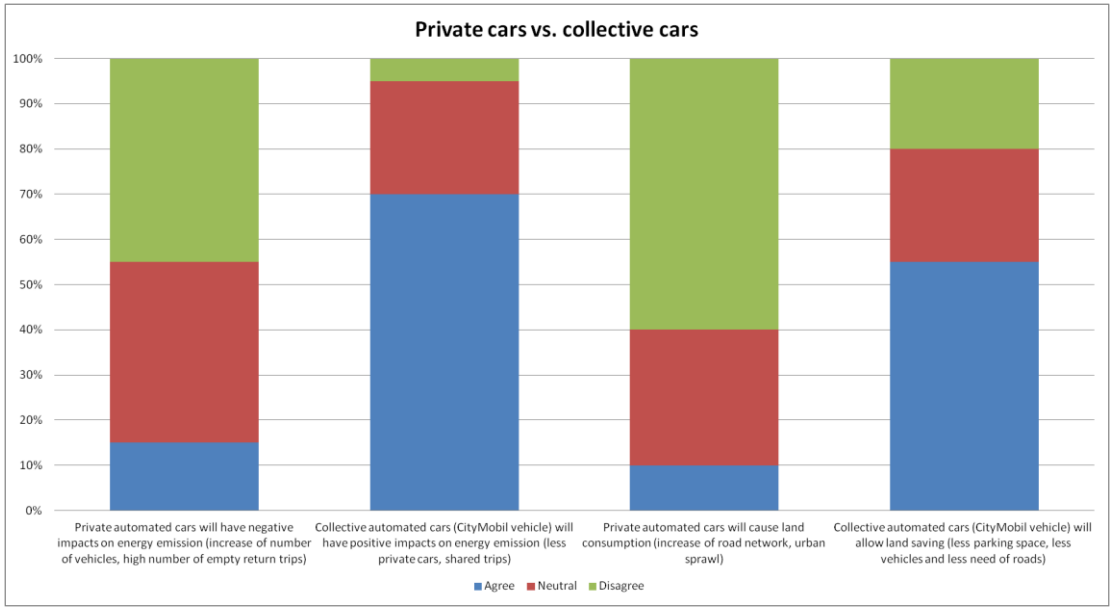
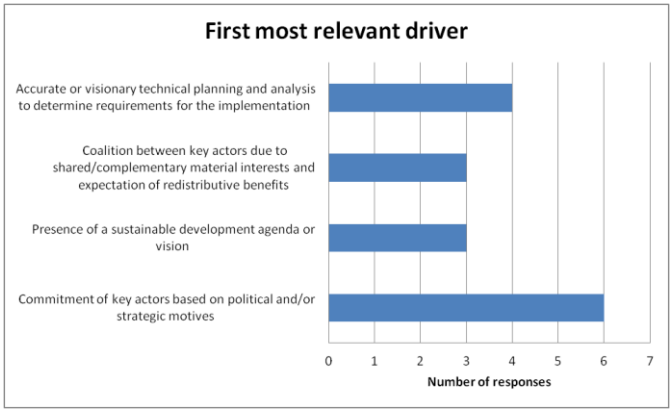


Figure 7.9 Comparison between private and collective automated vehicles

In the **section Drivers and Barriers** respondents have been asked to rank the three most relevant drivers and barriers. Analysing the answers received the three most important drivers are:

- Commitment of key actors based on political and/or strategic motives;
- Accurate or visionary technical planning and analysis to determine requirements for the implementation;
- Presence of a sustainable development agenda or vision.



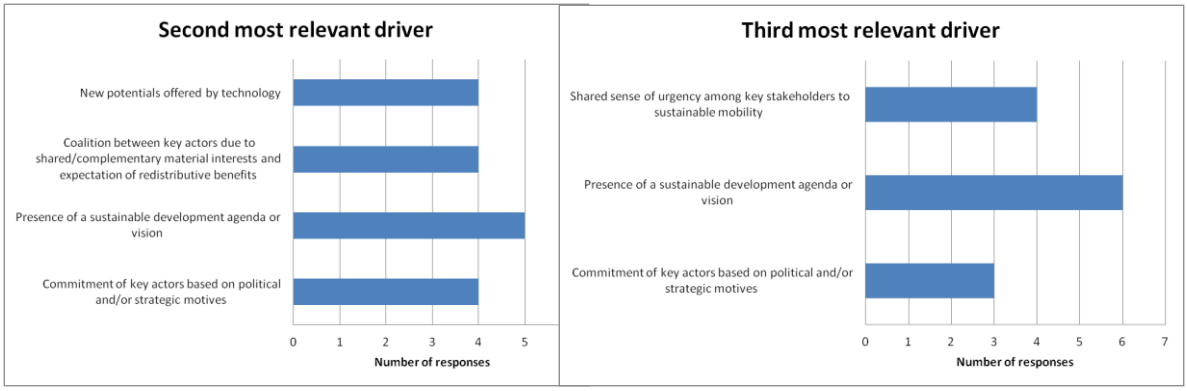


Figure 7.10 The three most important drivers

The most important barriers ranked by respondents are:

- Analysis of and proposals to change impeding rules, structures, legislation etc. ;
- Different views and interests about the sustainable development of the cities;
- Involvement of key stakeholders.

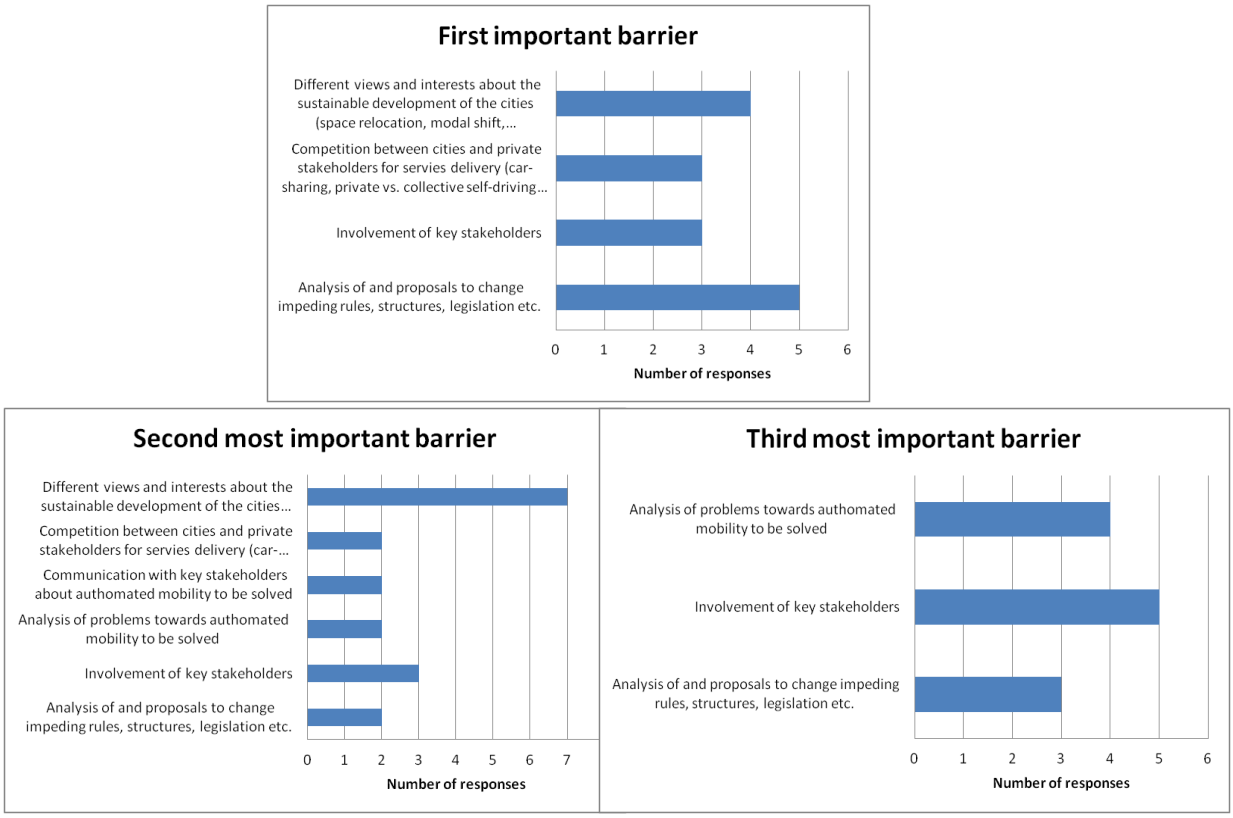


Figure 7.11 – The three most important barriers

In the **willingness to pay** section participants have been invited to answer to different questions in relation to their role in the city.

On one side 8 respondents from local transport authorities, urban planning authorities, public transport service operators, goods deliver service operators answered what is

their willingness to pay in case of ticket on-board and in case of a subscription. The totality in the first case and a great majority in the second one agreed to pay the same ticket price or subscription they are paying now.

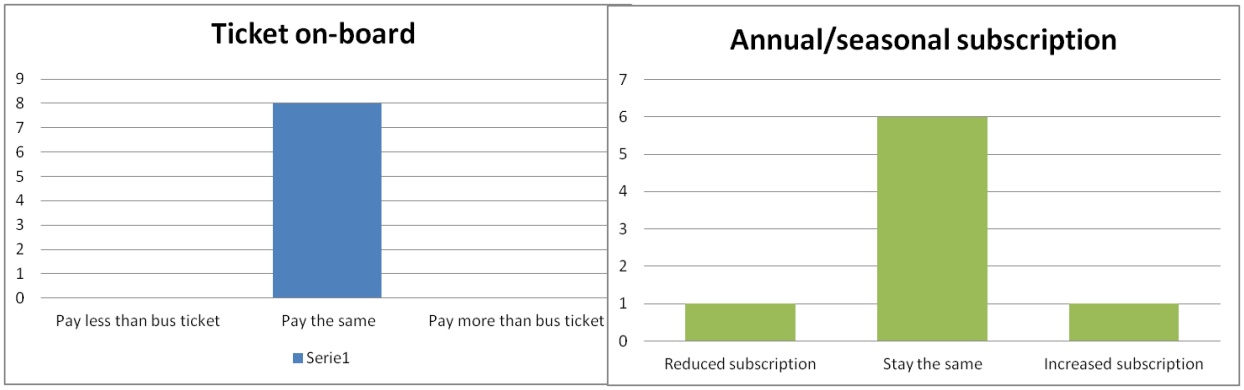


Figure 7.12 – Willingness to pay

On the other side 12 participants from business owners, private organizations, travel bureau answered to the questions on their contribution to a public automated vehicles service. In addition to an annual fee for the service maintenance or a ticket's refund for users, respondents proposed to involve small enterprises, to finance the service with local taxes and/or with income from the parking payment.

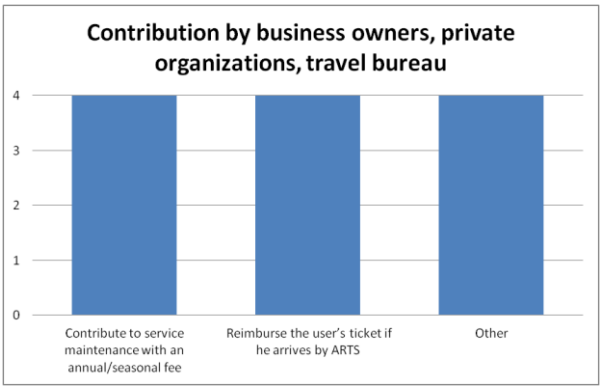


Figure 7.13 – Willingness for private contributions

The last question concerned the priority of activities in the future research and development of automated vehicles.
The prioritization of activities from stakeholders ranked the three most important actions:

- Large scales field operational tests to collect empirical evidence of changes in modal choice behavior;
- Vehicle tests and evaluation under various traffic/road/weather conditions to ensure safety;
- Assessment of social, economic and environment impacts of wider implementation of automated vehicles.

7.5 Summary

The objective of the stakeholders survey are:

- assess stakeholders awareness and acceptance of the automated road transport system.
- investigate the expected impacts in relation with the role of each stakeholder, and potential drivers and barriers connected with a spread implementation of automated mobility.

The stakeholders survey carried out in La Rochelle was based on face-to-face interviews using a structured questionnaire. The targeted people were stakeholders selected by La Rochelle through an accurate process to ensure the best possible coverage of all relevant stakeholders categories: local transport authorities, urban planning authorities, passengers transport operators, manufacturers and freight operators.

Concerning knowledge and attitudes towards automated vehicles 95% of participants gave their positive opinion regarding automated vehicles. Stakeholders answered also that automated vehicles can be an advantage mainly for safety, environment and transport efficiency.

Stakeholders considered automated vehicles in a future scenario a useful technology for public transport, taxis and other on-demand services, car sharing and freight transport. The majority of them also think that automated vehicles should not interact with other modes preferring a total segregation with dedicated lines, or low speeds roads, with pedestrians and cyclists.

The most enabling actions for a wide spread implementation of automated mobility are:

- Public authorities and urban planning operators should be proactive and to include automated vehicles discussion in SUMP process;
- Private sector and automotive should invest in this technology and think more about selling a service instead of selling cars;
- Public authorities and private sector should think about automated vehicles as a mixed mode for passengers and goods delivery.

For the majority of stakeholders automated vehicles will impact positively safety, comfort and convenience and on the creation of new jobs while they don’t consider the possibility of a modal shift from soft modes to self-driving cars.

Respondents think that collective automated cars will have a positive impacts on energy emission and will allow land saving. On the other hand they disagreed that private automated cars will have negative impacts on energy emission and land consumption.

The three most important drivers stressed are the commitment of key actors, an accurate or visionary technical planning and analysis to determine requirements for the implementation, and the presence of a sustainable development agenda or vision.

The most important barriers ranked by respondents are the analysis of and proposals to change impeding rules, structures, legislation etc, the different views and interests about the sustainable development of the cities and the involvement of key stakeholders.

In relation to that the priority for the research and development of automated vehicles in the future are: 1) large scales field operational tests to collect empirical evidence of changes in modal choice behavior, 2) vehicle tests and evaluation under various traffic/road/weather conditions to ensure safety, and 3) assessment of social, economic and environment impacts of wider implementation of automated vehicles.

8 Conclusion

A public transport service was successfully demonstrated in La Rochelle with six automated mini buses running on a route linking Aquarium to Technoforum (1.9km). During the three and half month demonstration, a total of 14,661 people have tried automated vehicles.

ARTS operation and performance

Currently, few results are reported on automated buses to provide public transport services on public roads without segregation of traffic. The demonstration of ARTS vehicles in La Rochelle proved that it is possible to provide public transport service by operating automated buses in urban areas. It is challenging to run automated vehicles on public roads with other road users around such as cyclists and pedestrians. The step-by-step approach (3 phases) adopted was proved to be appropriate. The first two phases allowed the system to adapt to the reality of the environment, which paved the way for the implementation of operating ARTS on the whole route (phase 3). Although improvable, the ARTS demonstration proved to be rather satisfactory from the point of view of increasing awareness and understanding of automation technology for transport.

An analysis of vehicle performance shows that automated vehicles are able to control their speeds and accelerations/decelerations more accurately and consistently than human driven vehicles. Users of automated vehicles are expected to benefit from such improvements. Firstly, accurate and consistent speed control would mean less likely to exceed the speed limits, which will reduce accident rate and accident severity. Secondly, accurate and consistent acceleration/ deceleration control would mean less likely to apply excessive accelerations and decelerations for starting-up and braking, which will have positive impacts on reducing fuel consumption and pollutant emissions. Thirdly, accurate and consistent accelerations/deceleration control would mean smooth vehicle movement which will increase riding comfort to users.

Ex-post survey of users

For most of the users, the experimentation in La Rochelle was an interesting demonstration of automated vehicles which generated substantial curiosity among the users. Curiosity was the main purpose of the trip for the users. Approximately half of the users became aware of the ARTS demonstration by chance. It is therefore suggested that the visibility of the demonstration area had an impact on the frequentation of the service.

More than half of the respondents declared a relatively high level of satisfaction opinions of being good or very good when all criteria are combined. The criterion of comfort requires particular attention for future experiments as it is the most poorly rated. Other criteria needing attention are on-board waiting time and jerkiness. This level of satisfaction was also high thanks to the appreciated information work carried out by the operators on-

board vehicles. Indeed the operators were well prepared and in most of the situations were in a position to answer user questions related to the automated vehicles. Traveling using ARTS had social impacts: the quality and simplicity of the exchanges on-board vehicles are not reported in the evaluation questionnaires, but they highly contributed to the success of the demonstration among the users – though the vehicles were not always fully technically satisfactory. The users were happy to exchange ideas with the operators on ARTS and sometimes the travel using ARTS turn out to be a concentrated workshop on this new technology.

Globally, the users would be willing to use the ARTS in the future. More than a half of users would be ready to use the ARTS without operators, especially the users of 34-54 year old. Approximately a third of respondents would be only willing to use the ARTS in the presence of a human operator, especially the users more than 64 year old. For future experiments, it might be necessary to better understand their concerns and how to address them.

At the end of demonstration, some users living in the demonstration area (and using very regularly the system for 80% of them) were sad because they acquired some travel habits with the ARTS. In the future, they will be happy to use a permanent ARTS service.

The occurrence of incidents at a rate of 13% requires attention particularly assuming that the reduction of minor incidents could be easily achieved. Approximately a third of respondents were only willing to use the ARTS in the presence of a human operator. For future experiments, it might be necessary to better understand their concerns and how to address them.

Stated preference survey

The comparison results need to be interpreted by taking into account differences between the two samples: ex-ante a sample of potential users, ex-post a sample of actual users. In the ex-ante case we assess the preferences of individuals who have not experienced the ARTS, while in the ex-post case we assess the preferences after experience: it is remarkable that in both cases we have obtained the same result in terms of relatively higher preference for ARTS when the two competing systems have identical travel time and fare attributes. The preference detected is an average of the different individuals of the samples; in both the ex-ante and the ex-post case we have found that preference share increases with age; this is another interesting result which makes a case for automation in an ageing society.

A wider public survey

In general, public attitudes were positive towards implementation of automated vehicles in urban areas. For automated buses, the most attractive benefit would be lower bus fares because of no driver costs. Majority of the people would prefer automated buses if both automated and conventional buses were available on a route. Passenger security would be one of most concerned issues for automated buses especially during night time services. For the automated mini buses demonstrated, the most supportive role would be to complement public transport as feeders/distributors. The public had positive attitudes

towards other applications of automated vehicles in urban areas. A majority of the people surveyed would consider using automated cars if they became available. Of the people who considered using automated cars, about three quarters would like to own an automated car, and about one quarter to share automated cars through services such as car-sharing, car-pooling, or 'taxi' like services. It seemed that there were some misconceptions about the benefits of automated vehicles, especially the safety benefits. Safer than human driven vehicles is one of the major driving forces for the development of automated vehicles and would be a prerequisite for implementation of automated vehicles on public roads. Automated vehicles should be safer than human driven vehicles because of removing human errors. From the survey, only a quarter of the respondents believe automated vehicles would be safer than human driven vehicles. This could be results of low levels of awareness or/and understanding of the self-driving technology. In La Rochelle, demonstration of the automated mini buses was good for increasing awareness and demonstration of automated vehicle concept. However, the vehicles were operated in low speed and with little interaction with other motorised traffic, which were not enough to convince the public what automated vehicles can do in real conditions, especially the safety benefits. This implied that further research and development activities are needed in the future to test automated vehicles in different road/weather/traffic conditions, and to monitor how people's attitudes with the awareness/understanding of automated vehicles.

Stakeholder survey

Interviewing stakeholders relevant points have been raised with a general positive and open view on automated mobility. These vehicles are considered a useful technology for public transport, taxis and other on-demand services, car sharing and freight transport with positive impacts on safety, comfort and convenience and on the creation of new jobs. On the other hand there are many concerns connected with the interaction between automated vehicles and other modes preferring a total segregation with dedicated lines, or low speeds roads, with pedestrians and cyclists. Considering a future scenario there is a need of interaction between the different private and public actors working on a common and sustainable agenda and paying attention both to technical and economic aspects: operational tests to evaluate impacts on safety and modal choice behavior and assessment of social, economic and environment impacts.

Reference

Alessandrini A., Alfonsi R., Delle Site P., Stam D. (2014), Users' preferences towards automated road public transport: results from European surveys. 17th Meeting of the EURO Working Group on Transportation, EWGT2014, 2-4 July 2014, Sevilla, Spain. Transportation Research Procedia 3 (2014) 139 – 144.

Alessandrini A., Delle Site P., Gatta V., Marcucci E., Zhang Q. (2015) Stated preference logit analysis of users' attitudes towards conventional and automated buses. CREI Working Papers No 2/2015. http://host.uniroma3.it/centri/crei/workingpapers.html

CityMobil2 (2014), Report on the Stated Preferences surveys in the twelve cities. WP14 - Common study evaluation and selection for phase 2.

Annex A: Ex-post evaluation survey for users

Questionnaires à l'attention des utilisateurs de véhicules sans chauffeur à La Rochelle.

Bonjour, nous souhaiterions recueillir votre avis sur l'expérimentation de véhicules sans chauffeur. Cela prendra **6 à 10 minutes**.
Grâce à vos réponses, les partenaires du projet **Citymobil2** pourront:
- mieux connaitre **les comportements des utilisateurs** du véhicule sans chauffeur
- évaluer **la perception des utilisateurs** en matière de qualité, de sécurité, de performance du véhicule
- apporter **des recommandations** aux constructeurs du véhicule pour améliorer le confort, la sécurité du véhicule.

Toute suggestion pour améliorer l'expérimentation est la bienvenue !

NOM de l'enquêteur:

La météo au moment de l'enquête :

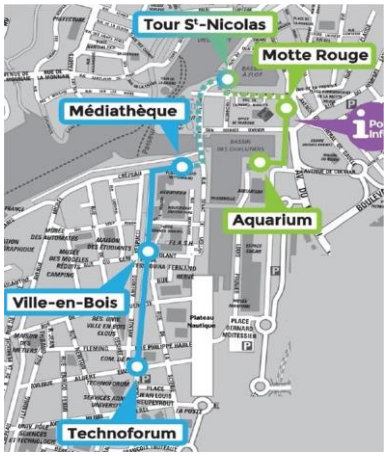
- ☐ Dégagé / Ensoleillé
- ☐ Partiellement ensoleillé
- ☐ Couvert
- ☐ Pluvieux

Indiquez la direction empruntée

- ☐ Vers l'Aquarium
- ☐ Vers le Technoforum

Indiquez l'arrêt actuel

- ☐ 1: Aquarium
- ☐ 2: Motte Rouge
- ☐ 3: Tour St Nicolas
- ☐ 4: Médiathèque
- ☐ 5: Ville en bois
- ☐ 6: Technoforum



Section B - Question filtre

Question filtre

Q1. Combien de fois avez-vous utilisé le service depuis sa mise en place ? (en comptant ce trajet)?

- ○ Une seule fois
- ○ Deux fois
- ○ Entre trois et cinq fois
- ○ Plus de cinq fois

Q2. Avez-vous déjà répondu à ce questionnaire précédemment ?

- ○ Oui
- ○ Non

Part 1 – Questions concernant l'expérience avec ARTS

Connaissance du service

Comment avez-vous eu connaissance de cette démonstration? (plusieurs choix possibles)

- ☐ Par la presse ou les média régionaux
- ☐ Par la Communauté d'Agglomération, la Ville de La Rochelle
- ☐ Par le bouche à oreille
- ☐ Par hasard
- ☐ En voyant fonctionner les véhicules (en tant que non-usager)
- ☐ Autre

Si autre, indiquer brièvement par quel moyen :

Trajet

A quelle station êtes-vous monté?

1: Aquarium	○
2: Motte Rouge	○
3: Tour St Nicolas	○
4: Médiathèque	○
5: Ville en bois	○
6: Technoforum	○

Quel est l'objet de votre déplacement (plusieurs choix possibles)?

La curiosité, la découverte du véhicule sans chauffeur	☐
Le travail	☐
Les études	☐
Les courses, le shopping	☐
Un motif médical (aller chez le médecin)	☐
Les loisirs	☐
Des formalités administratives	☐
L'accompagnement d'un enfant	☐
Le retour à mon domicile	☐
Autre	☐
Si autre, indiquez brièvement l'objet de votre déplacement :	

Combien de fois par semaine effectuez-vous ce déplacement ?

Cinq fois ou plus par semaine	○
Entre deux et quatre fois par semaine	○
Moins fréquemment	○

Comment êtes-vous arrivé à votre station de départ (plusieurs choix sont possibles) ?

En voiture (en tant que conducteur)	☐
En voiture (en tant que passager)	☐
En bus	☐
En train	☐
A pied	☐
En vélo	☐
En moto/scooter	☐
Autre	☐
Si autre, indiquez brièvement quel mode :	

Par quel(s) moyen(s) vous rendez-vous de cette station à votre destination finale (plusieurs choix sont possibles) ?

En voiture (en tant que conducteur)	☐
En voiture (en tant que passager)	☐
En bus	☐
En train	☐
A pied	☐
En vélo	☐
En moto/scooter	☐
Autre (préciser)	☐
Si autre, indiquez brièvement quel mode :	

Quel est votre mode de transport habituel pour ce trajet ?

En voiture (en tant que conducteur)	☐
En voiture (en tant que passager)	☐
En bus	☐
En train	☐
A pied	☐
En vélo	☐
En moto/scooter	☐
Autre	☐
Si autre, indiquez brièvement quel mode :	

Avez-vous des bagages (plusieurs choix sont possibles)?

Non	☐
Oui, une valise	☐
Oui, un sac à dos	☐
Oui, une poussette	☐
Oui, un/des sacs de course	☐
Autre	☐
Si autre, précisez le type de bagages:	

Aviez-vous déjà eu l'occasion d'utiliser un véhicule sans chauffeur lors de la première démonstration à La Rochelle, en 2011?

Oui	◯
Non	◯

Niveau de Satisfaction

J'aimerais avoir votre niveau de satisfaction concernant le service des véhicules sans chauffeur. Est-ce que vous êtes satisfait…?

	Pas du tout satisfait	Peu satisfait	Indifferent	Satisfait	Très satisfait
De l'utilité du service	○	○	○	○	○
Du niveau d'intégration du service avec les autres modes de transport	○	○	○	○	○
Du temps d'attente aux stations et du temps à bord du véhicle	○	○	○	○	○
Du confort (disponibilité des places assises, des poignées de maintien à bord, de la visibilité depuis le véhicule…)	○	○	○	○	○
Du nombre d'arrêts entre les stations et les feux de signalisation	○	○	○	○	○
De la fréquence des secousses	○	○	○	○	○
De l'information disponible	○	○	○	○	○

Au cours de votre trajet, un incident/une panne s'est-il produit ?

Oui	◯
No	◯
Si oui, indiquez brièvement quel type de panne	

Quelle est votre perception de la sécurité à bord du véhicule sans chauffeur par rapport à un bus classique (risque d'accident/collision avec les piétons, cyclistes, véhicules aux carrefours)?

Beaucoup moins protégé	◯
Moins protégé	◯
Ni plus, ni moins protégé	◯
Plus protégé	◯
Beaucoup plus protégé	◯

Seriez-vous prêt à l'avenir à utiliser à nouveau ce service de véhicules sans chauffeur ?

Non	◯
Oui, avec ou sans opérateur de service à bord du bus	◯
Oui, seulement si un opérateur est présent à bord du bus	◯
Je ne sais pas	◯

Part 2 – Renseignements personnels

Genre

Sexe

Homme	◯
Femme	◯

Age

Votre âge ?

<18	◯
18-24	◯
25-34	◯
35-44	◯
45-54	◯
55-64	◯
65-74	◯
>74	◯

Education

Quel est votre niveau d'études ?

Ecole primaire	◯
Collège	◯
Lycée	◯
Licence / Master	◯
Doctorat	◯
Je préfère ne pas le dire	◯

Occupation

Quelle est votre situation professionnelle ?

Etudiant (e)	◯
Salarié (e)	◯
(Auto-)Entrepreneur, profession libérale, commerçant (e)	◯
Retraité (e)	◯
Femme/homme au foyer	◯
Sans emploi	◯
Je préfère ne pas le dire	◯

Nationalité

Dans quelle commune habitez-vous ?

La Rochelle	◯
CDA La Rochelle (préciser)	◯
Hors CDA (préciser)	◯
Préciser	

Handicap

Souffrez-vous d'un handicap (déficience visuelle, fauteuil roulant…) ?

Non	◯
Déficience visuelle	◯
Fauteuil roulant	◯
Autre	◯
Si autre, préciser	
L'accessibilité à la station et au véhicule vous semble-t-elle… ?	
Très difficile	◯
Difficile	◯
Assez facile	◯
Facile	◯
Très facile	◯

Merci pour votre participation!

Annex B: Ex-post stated preference survey

CITIES DEMONSTRATING AUTOMATED ROAD PASSENGER TRANSPORT

Questionnaires à l'attention des utilisateurs de véhicules sans chauffeur à La Rochelle

Bonjour, nous souhaiterions recueillir votre avis sur l'expérimentation de véhicules sans chauffeur. Cela prendra 6 à 10 minutes.

Grâce à vos réponses, les partenaires du projet Citymobil2 pourront:

- mieux connaitre les comportements des utilisateurs du véhicule sans chauffeur
- évaluer la perception des utilisateurs en matière de qualité, de sécurité, de performance du véhicule
- apporter des recommandations aux constructeurs du véhicule pour améliorer le confort, la sécurité du véhicule.

Toute suggestion pour améliorer l'expérimentation est la bienvenue !

Section A - Renseignements préliminaires

NOM de l'enquêteur

La météo au moment de l'enquête:

- ☐ Dégagé / Ensoleillé
- ☐ Partiellement ensoleillé
- ☐ Couvert
- ☐ Pluvieux

Indiquez la direction empruntée

- ☐ Vers l'Aquarium
- ☐ Vers le Technoforum

Indiquez l'arrêt actuel

- ☐ 1: Aquarium
- ☐ 2: Motte Rouge
- ☐ 3: Tour St Nicolas
- ☐ 4: Médiathèque
- ☐ 5: Ville en bois
- ☐ 6: Technoforum

Section B - Question filtre

Question filtre

Q1. Combien de fois avez-vous utilisé le service depuis sa mise en place ? (en comptant ce trajet)?

Une seule fois	◯
Deux fois	◯
Entre trois et cinq fois	◯
Plus de cinq fois	◯

Q2. Avez-vous déjà répondu à ce questionnaire précédemment ?

Oui	◯
Non	◯

Section C - Consentement à payer

Q3.Quel prix seriez-vous prêt à payer pour le service actuel de transport public ?

- Moins que pour le service traditionnel de transport public (0,8€) ○
- Le même prix que pour le service traditionnel de transport public (1,3€) ○
- Plus que le service traditionnel de transport public (1,8€) ○
- Plus que le service traditionnel de transport public (2,30€) ○
- Moins que pour le service traditionnel de transport public (0,8€) ○

Q4.Quel prix seriez-vous prêt à payer pour le service de véhicules sans chauffeur ?

- Moins que pour le service traditionnel de transport public (0,8€) ○
- Le même prix que pour le service traditionnel de transport public (1,3€) ○
- Plus que le service traditionnel de transport public (1,8€) ○
- Plus que le service traditionnel de transport public (2,30€) ○
- Moins que pour le service traditionnel de transport public (0,8€) ○

Section D - Utilisation future

Q5.Pensez-vous que le service de véhicules sans chauffeur est utile ?

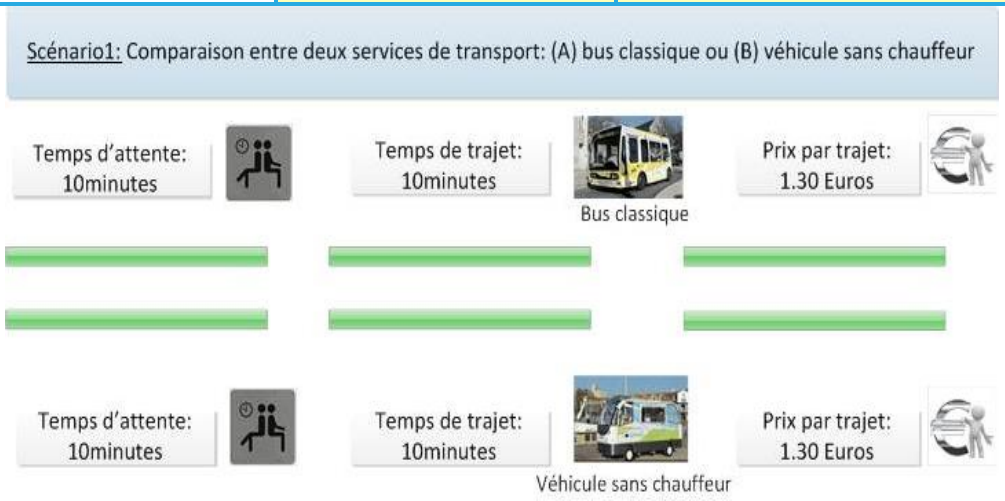
- Non ☐
- Oui, sur le trajet actuel de la démonstration ☐
- Oui, sur d'autres trajets que le trajet actuel ☐
- Je ne sais pas ☐

Section E - Préférences déclarées

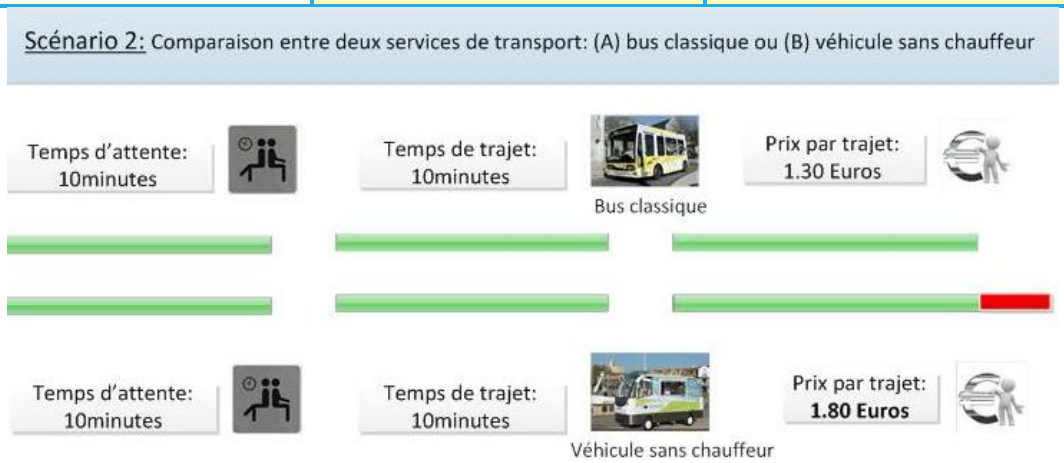
Q6.Combien de temps a duré votre trajet au bord du véhicule sans chauffeur?

- Moins de 5 minutes ○
- Entre 5 minutes et 10 minutes ○
- Entre 11 minutes et 15 minutes ○
- Entre 16 minutes et 20 minutes ○
- Plus de 20 minutes ○
- Moins de 5 minutes ○

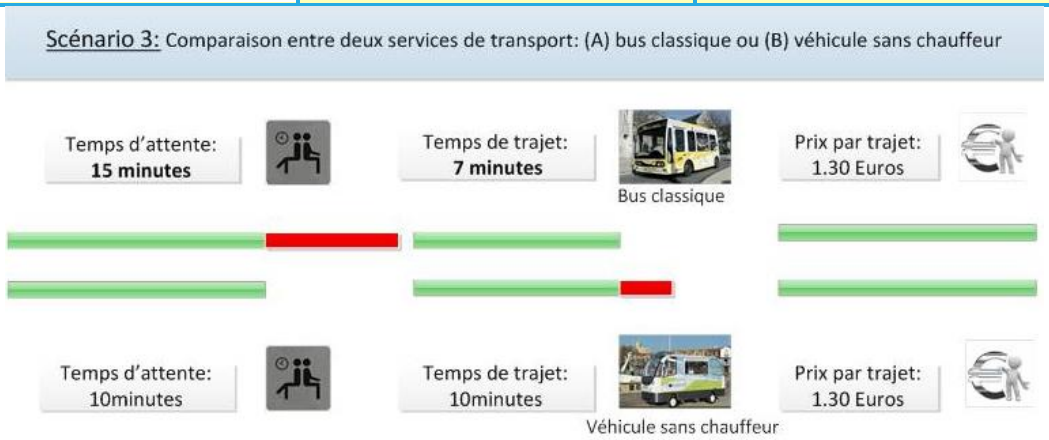
Scenario 1:	Si un service de transport public est mis en place sur le trajet de la démonstration identique au service existant (le même prix du ticket, le même temps d'attente à la station et le même temps de trajet)	
	Service de véhicule sans chauffeur	Service de bus classique
Q7.Quel service préféreriez-vous?	○	○



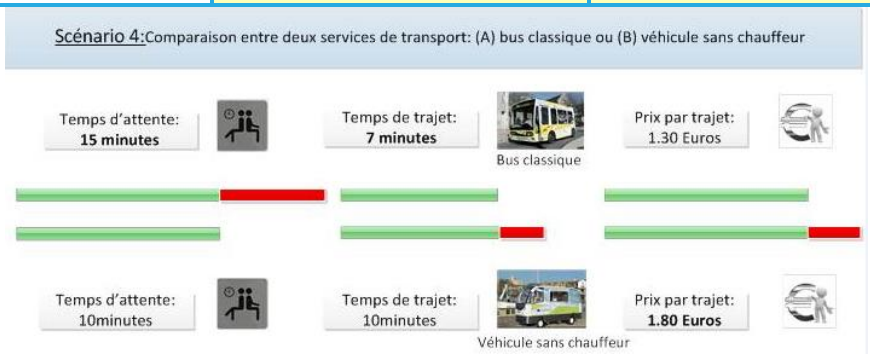
Scenario 2:	Si un service de transport public est mis en place sur le trajet de la démonstration avec le même niveau de service (le temps d'attente à la station et le temps de trajet) qu'un transport public existant, mais le prix du ticket pour le service de véhicule sans chauffeur et supérieur au bus classique	
	Service de véhicule sans chauffeur	Service de bus classique
Q8.Quel service préféreriez-vous?	○	○



Scenario 3:	Si un service de transport public est mis en place sur le trajet de la démonstration avec le prix du ticket identique au service existant, mais le même temps d'attente à la station est 2 fois supérieur pour le bus classique, le temps de trajet en bus est 20% inférieur au temps de trajet en véhicule sans chauffeur	
	Service de véhicule sans chauffeur	Service de bus classique
Q9.Quel service préfére-riez-vous?	◯	◯



Scenario 4:	Si un service de transport public est mis en place sur le trajet de la démonstration avec le prix du ticket en peu plus élevé pour le véhicule sans chauffeur, mais le même temps d'attente à la station est 2 fois supérieur pour le bus classique, le temps de trajet en bus est 20% inférieur au temps de trajet en véhicule sans chauffeur	
	Service de véhicule sans chauffeur	Service de bus classique
Q10. Quel service préfére-riez-vous?	◯	◯



Section E – Renseignements personnels

Sexe

Q11. Vous etes:

Un homme	◯
Une femme	◯

Age

Q12. Votre âge?

< 18	◯
18-24	◯
25-34	◯
35-44	◯
45-54	◯
55-64	◯
65-74	◯
> 74	◯

Education

Q13. Quel est votre niveau d'études?

Ecole primaire	◯
Collège	◯
Lycée	◯
Licence / Master	◯
Doctorat	◯

Occupation

Q14. Quelle est votre situation professionnelle?

- ○ Etudiant (e)
- ○ Salarié (e)
- ○ (Auto-)Entrepreneur, profession libérale, commerçant(e)
- ○ Retraité (e)
- ○ Femme/homme au foyer
- ○ Sans emploi
- ○ Je préfère ne pas le dire

Commune

Q15. Dans quelle commune habitez-vous ?

- ○ La Rochelle
- ○ CDA La Rochelle
- ○ Hors CDA

Q16. Si vous habitez hors La Rochelle, indiquer la commune (préciser en particulier, si la personne est étrangère, dans quel pays elle réside)

Handicap

Q17. Souffrez-vous d'un handicap (déficience visuelle, fauteuil roulant…) ?

- ○ None
- ○ Déficience visuelle
- ○ Fauteuil roulant
- ○ Autre
- ○ Si autre, précisez

Merci pour votre participation!

Annex C: Questionnaire To A Wider Public

CityMobil2

CITIES DEMONSTRATING AUTOMATED ROAD PASSENGER TRANSPORT

Que pensez-vous du véhicule automatisé sans chauffeur CityMobil2?

Cher participant,

La Communauté d'Agglomération, la Ville de La Rochelle, l'EIGSI (école d'ingénieurs) et Proxiway sont partenaires du projet européen CityMobil2 – projet impliquant 45 partenaires à travers l'Europe. Le projet porte sur l'étude et la démonstration des systèmes de transport automatisés (c'est-à-dire sans chauffeur) dans un environnement urbain.

La Rochelle a été choisie dans le cadre du projet pour mettre en œuvre une démonstration de véhicules automatisés de grande ampleur. Ainsi, entre le 17 décembre 2014 et le 25 avril 2015, les véhicules automatisés du constructeur français Robosoft ont circulé dans l'espace urbain. Près de 15 000 voyages auront été réalisés à bord des 6 véhicules.

Les partenaires du projet souhaitent maintenant évaluer les impacts de cette démonstration, notamment en termes de sensibilisation de la population.

C'est pourquoi nous invitons chacun (utilisateur ou non-utilisateur du système) à nous faire part de son avis. Toutes vos réponses resteront anonymes!

Grâce à votre participation, les partenaires du projet Citymobil2 pourront:

- mieux évaluer les besoins en matière de transports automatisés sans chauffeur;

- apporter des recommandations aux constructeurs du véhicule pour les améliorer en fonction des attentes;

- apporter des éléments de réflexion aux décideurs de villes européennes en vue d'éventuels futurs déploiements.

Un grand merci pour votre contribution!

Un véhicule automatisé est défini ici comme un véhicule capable de se repérer seul sur un réseau routier, de détecter les obstacles environnants et de se rendre d'un point A à un point B sans intervention humaine.

Un Système de Transport Routier Automatisé (ARTS en anglais) – comme celui qui a été l'objet de la démonstration à La Rochelle est une application adaptée au Transport Public (avec des arrêts fixes ou variable et un parcours défini).

Les principales composantes du système dont le véhicule, l'infrastructure, les télécommunications et un système de supervision de flotte/un centre de contrôle de l'exploitation.

Q1. Vous êtes:

☐ Une femme
☐ Un homme

Q2. Votre âge?

☐ <18 ☐18-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64
☐ 65-74 ☐ >74

Q3. Quelle est votre situation professionnelle?

☐ Étudiant (e)
☐ Salarié (e)
☐ (Auto-)Entrepreneur, profession libérale, commerçant (e)
☐ Sans emploi
☐ Femme/homme au foyer
☐ Retraité (e)
☐ Autre (préciser): _____

Q4. Quel est votre niveau d'études ?

☐ École primaire
☐ Collège
☐ Lycée
☐ Licence / Master
☐ Doctorat
☐ Autre (préciser): _____

Q5. Dans quelle commune habitez-vous?

☐ La Rochelle
☐Autre (préciser): _____

Q6. A quelle distance de votre domicile se situe l'arrêt/la station de transport public le plus proche?

☐ <300m
☐ 300-500m
☐ >500m

Q7. Quels sont vos modes de transports les plus courants pour aller au travail, à l'école ou pour vos loisirs? (Plusieurs choix possibles)

☐ Bus
☐ Train
☐ Voiture (en tant que conducteur)
☐ Voiture (en tant que passager)
☐ Moto/scooter
☐ Vélo
☐ A pied
☐ Autre (préciser): _____

Q8. De manière générale, vous préféreriez conduire/être à bord de: (Choisir une seule réponse)

☐ Un véhicule classique, sans aucun système d'aide à la conduite
☐ Un véhicule équipé de certains systèmes d'aide à la conduite en matière de direction, de vitesse et de freinage (le conducteur reste responsable et peut prendre le contrôle du véhicule à tout moment)
☐ Un véhicule entièrement automatisé (sans intervention possible/ responsabilité des usagers à bord)
☐ Je ne sais pas

Q9. Avez-vous eu l'occasion d'utiliser l'un des "systèmes automatisés" suivants? (Plusieurs choix possibles)

☐ Régulateur de vitesse (maintient une vitesse constante définie par le conducteur)
☐ Régulateur de vitesse adaptatif (régulation automatique de la vitesse pour éviter d'être trop près du véhicule de devant)
☐ Aide au stationnement
☐ Assistant de conduite dans les ralentissements (adaptation de la vitesse)
☐ Véhicules entièrement automatisés (comme les véhicules de la démonstration CityMobil2)
☐ Aucun
☐ Autre (spécifier): _____

Q10. Aviez-vous entendu parler de véhicules automatisés avant ce questionnaire?

☐ Oui

☐ Non

Q11. Selon vous, quels sont les bénéfices à attendre des véhicules automatisés? (Une seule réponse par ligne)

	Tout à fait d'accord	Plutôt d'accord	Pas vraiment d'accord	Pas du tout d'accord	Pas d'avis
Une réduction des accidents	☐	☐	☐	☐	☐
Une réduction de la congestion (des bouchons)	☐	☐	☐	☐	☐
Une navigation facilitée sur les routes	☐	☐	☐	☐	☐
Des mouvements de véhicules plus fluides	☐	☐	☐	☐	☐
Une réduction de la consommation du carburant	☐	☐	☐	☐	☐
Une réduction de la pollution	☐	☐	☐	☐	☐
Une réduction des accidents	☐	☐	☐	☐	☐
Une réduction de la congestion (des bouchons)	☐	☐	☐	☐	☐

Q12. D'après vous, les véhicules automatisés seront:

☐ Plus sûrs que les véhicules conduits manuellement
☐ Aussi sûrs que les véhicules conduits manuellement
☐ Moins sûrs que les véhicules conduits manuellement

Q13. Avez-vous pris un bus sans chauffeur lors de la démonstration CityMobil2 à La Rochelle?

☐ Oui
☐ Non (Aller à la Question Q15)

Q14. Comment avez-vous eu connaissance de ces bus sans chauffeur? (Plusieurs choix possibles)

☐ Par la presse ou les média nationaux (radio, télévision)
☐Par la Communauté d'Agglomération, la Ville de La Rochelle
☐ Par la bouche à oreille
☐ En voyant fonctionné les véhicules (en tant que non-usager)
☐ En utilisant le service
☐ Autre (préciser): _____

Q15. Combien de fois avez-vous utilisé le bus automatisé, sans chauffeur, à La Rochelle?

☐ Une seule fois
☐ Entre deux et quatre fois
☐ Plus de cinq fois
☐ Aucune

Q16. Les atouts supposés des bus sans chauffeur suivants sont-ils selon vous intéressants ? (Une seule réponse par ligne)

	Très intéressant	Moyennement intéressant	Peu intéressant	Pas du tout intéressant
Une navigation facilite dans un réseau de routes complexe dans les zones urbaines	☐	☐	☐	☐
Un coût du ticket moins élevé	☐	☐	☐	☐
Une augmentation de la fréquence de passage des bus	☐	☐	☐	☐
La possibilité de prendre contrôle du véhicule à distance (par un système de caméras reliées un poste de contrôle centralisé)	☐	☐	☐	☐
Une flexibilité de service en répondant aussi bien aux demandes individuelles que collectives	☐	☐	☐	☐
Une conduite plus sûre grâce à l'absence de l'erreur humaine	☐	☐	☐	☐

Q17. Parmi les sujets suivants liés à l'utilisation de bus automatisés, quels sont ceux qui vous préoccupent le plus ? (Une seule réponse par ligne)

	Très Préoccupé	Plutôt Préoccupé	Un peu Préoccupé	Pas un Problème
La sécurité à bord durant la journée	☐	☐	☐	☐
La sécurité à bord durant la nuit	☐	☐	☐	☐
Absence d'opérateur à bord	☐	☐	☐	☐
Un espace limité pour les bagages	☐	☐	☐	☐
Un espace limité pour les personnes à mobilité réduite	☐	☐	☐	☐

Q18. A votre avis, quel peut être le rôle à l'avenir dans le transport public des bus sans chauffeur (Plusieurs réponses possibles)

☐ Offrir un service complémentaire aux services de transports existants
☐ Remplacer les bus conventionnels sur les routes existantes
☐ Fournir un service de nuit
☐ Fournir un service de transport dans des zones touristiques
☐ Aucune utilisation possible dans les transports publics
☐ Autre (Préciser): _____

Q19. Les bus automatisés pourraient générer des économies liées à l'absence des conducteurs et améliorer la qualité du service de transports publics. Lequel des points suivants souhaiteriez-vous voir amélioré en priorité? (Une seule réponse possible)

☐ Réduire le prix du ticket
☐ Augmenter la fréquence des bus
☐ Augmenter la couverture du réseau de bus (lignes supplémentaires,..)
☐ Autre (Préciser): _____

Q20. Avoir un opérateur à bord du véhicule permettrait d'améliorer la qualité de service des bus automatisés (en matière de sécurité par exemple), mais augmenterait aussi le coût du service. Comment souhaiteriez-vous que les bus automatisés soient exploités? (Une seule réponse possible)

☐ Avec un opérateur systématiquement à bord
☐ Avec la présence d'un opérateur à bord pour les services de nuit
☐ Sans aucun opérateur à bord
☐ Autre (Préciser): _____

Q21. Si des bus automatisés et des bus classiques étaient disponibles sur un même itinéraire (même taille, même fréquence, même temps de trajet et même prix), lequel préféreriez-vous? (Une seule réponse possible)

☐ Bus automatisé avec un opérateur à bord
☐ Bus automatisé sans opérateur à bord
☐ Bus classique

Q22. Aujourd'hui les voitures personnelles peuvent être équipées avec de systèmes automatisés. Etes-vous réceptif/sensible aux améliorations suivantes liées à l'utilisation des systèmes automatisés? (Une seule réponse par ligne)

	Très sensible	Moyennement sensible	Peu sensible	Pas du tout sensible
Plus de sécurité dans le contrôle du véhicule	☐	☐	☐	☐

avec l'élimination des erreurs humaines				
Pas besoin de dépenser du temps et de l'argent pour apprendre à conduire	☐	☐	☐	☐
Permet au "conducteur" de faire autre chose pendant son déplacement	☐	☐	☐	☐
Une meilleure mobilité pour les personnes à mobilité réduite, personnes âgées	☐	☐	☐	☐
Une navigation automatique sur le réseau routier	☐	☐	☐	☐
Une réduction de la consommation du carburant et des émissions	☐	☐	☐	☐
Un coût de stationnement réduit (pas besoin d'une place de parking à proximité)	☐	☐	☐	☐
Une baisse des frais d'assurance	☐	☐	☐	☐

Q23. Parmi les sujets suivants concernant l'utilisation de véhicules automatisés, quels sont ceux qui vous préoccupent le plus? (Une seule réponse par ligne)

	Forte Préoccupation	Moyenne Préoccupation	Petite Préoccupation	Aucune Préoccupation
Défaillance du matériel ou du système	☐	☐	☐	☐
Logiciel/base de données pas mis à jour à temps	☐	☐	☐	☐
Hausse du coût d'achat de véhicule	☐	☐	☐	☐
Risque de piratage du véhicule	☐	☐	☐	☐
Risque de divulgation de mes données personnelles sans mon consentement	☐	☐	☐	☐
Responsabilité légale en cas d'accident	☐	☐	☐	☐

Q24. Les atouts supposés des bus sans chauffeur suivants sont-ils selon vous intéressants pour un système de taxi? (Une seule réponse par ligne)

	Très Intéressant	Moyennement Intéressant	Peu Intéressant	Pas du tout Intéressant
Tarif réduit	☐	☐	☐	☐
Confidentialité accrue	☐	☐	☐	☐
Plus d'espace pour les passagers	☐	☐	☐	☐

Q25. Si des taxis automatisés étaient disponibles, utiliseriez-vous plus souvent le service de taxi?

☐ Oui
☐ Non

Q26. Les atouts supposés des véhicules automatisés suivants sont-ils selon vous intéressants pour un système d'auto-partage comme Yélomobile?* (Une seule réponse par ligne)

"L'autopartage est un système dans lequel une société, une agence publique, une coopérative, une association, ou même un groupe d'individus de manière informelle, met à la disposition de « clients » ou membres du service un ou plusieurs véhicules. Plutôt que de disposer d'une voiture personnelle qui reste l'essentiel de son temps au garage ou sur une place de stationnement, l'utilisateur d'un service d'autopartage dispose d'une voiture qu'il ne finance que pour la durée de son besoin. Le reste du temps, la voiture est utilisée par d'autres membres".

	Très intéressant	Moyennement intéressant	Peu intéressant	Pas du tout intéressant

Avoir plus d'espace pour les passagers	☐	☐	☐	☐
Pouvoir appeler une voiture automatisée à distance	☐	☐	☐	☐
Pouvoir rendre une voiture automatisée à l'endroit désiré	☐	☐	☐	☐

Q27. Les atouts supposés des véhicules automatisés suivants sont-ils selon vous intéressants pour un système de covoiturage? (Une seule réponse par ligne**)**
"Le covoiturage est l'utilisation conjointe et organisée d'un véhicule, par un "conducteur" non professionnel et un ou plusieurs tiers passagers, dans le but d'effectuer un trajet commun".

	Très intéressant	Moyennement intéressant	Peu intéressant	Pas du tout intéressant
Pas besoin de conducteur	☐	☐	☐	☐
Coût de trajet réduit	☐	☐	☐	☐
Avoir plus d'espace pour les passagers	☐	☐	☐	☐
Voyager avec un inconnu dans la voiture	☐	☐	☐	☐

Q28. Si un jour des voitures automatisées deviennent disponibles sur le marché, comment les utiliseriez-vous?* (Une seule réponse possible)

☐ J'achèterais une voiture automatisée pour mon usage personnel
☐J'utiliserais des voitures automatisées dans un système d'autopartage, de taxi ou de covoiturage
☐ Je n'utiliserais pas de voiture automatisée
☐ Autre : (Préciser): _____

Merci de partager tout autre commentaire sur l'expérimentation Citymobil2 de la Rochelle.

Annex D: Stakeholders Survey

CityMobil2

CITIES DEMONSTRATING AUTOMATED ROAD PASSENGER TRANSPORT

Questionnaire pour les parties prenantes sur les connaissances et attitudes vis-à-vis des véhicules automatisés

Cher participant,

Merci de participer à cette enquête. Elle fait partie intégrante du travail entrepris dans le cadre du projet européen de recherche CityMobil2 dont le but est d'étudier les impacts potentiels des **Systèmes de Transports Routiers Automatisés** grâce à des démonstrations d'ampleur dans les villes.

L'objectif principal de cette enquête est d'évaluer le degré de sensibilisation et d'acceptation par les parties prenantes des véhicules automatisés et leurs applications. Votre contribution est importante et très appréciée. Ce questionnaire est entièrement anonyme et les informations collectées ne seront utilisées que dans le cadre de ce projet.

Un véhicule automatisé est défini ici comme un véhicule capable de se repérer seul sur un réseau routier, de détecter les obstacles environnants et de se rendre d'un point A à un point B sans intervention humaine.

Un **Système de Transport Routier Automatisé (ARTS** en anglais) – comme celui qui a été l'objet de la démonstration à La Rochelle est une application adaptée au Transport Public (avec des arrêts fixes ou variable et un parcours défini).

Les principales composantes du système sont le véhicule, l'infrastructure, les télécommunications et un système de supervision de flotte/un centre de contrôle de l'exploitation.

INFORMATIONS PERSONELLES

Q1. Eléments de contact
Nom: _____
Prénom: _____
E-mail : _____
Ville: _____
Jour de l'entretien: _____

Q2. Quel est votre rôle/ position?

☐ Autorité organisatrice de transport (AOT)

☐ Décideur public, urbaniste

☐ Opérateur de transport

☐ Constructeur

☐ Opérateur de transport de marchandises

☐ Autre: _____

CONNAISSANCE GENERALE ET ATTITUDES VIS-A-VIS DES VEHICULES AUTOMATISES

Q3. Quelle est votre opinion générale sur les véhicules automatisés? (Choisissez une seule réponse)

☐ Très positive

☐ Positive

☐ Neutre

☐ Négative

☐ Très négative

Pouvez-vous donner davantage de détail à votre réponse?

Q4. A votre avis, les véhicules automatisés peuvent avoir un impact positif sur (Plusieurs réponses sont possibles):

☐ La sécurité routière

☐ L'environnement (bruit, pollution, impact visuel, etc.)

☐ L'emploi

☐ L'économie

☐ L'efficacité du transport

☐ La création d'une société plus équitable en offrant un accès au transport pour tous

☐ Autre: _____

Pouvez-vous donner davantage de détail à votre réponse?

Q5. Dans le futur, pensez-vous que les véhicules automatisés seront utilisés en tant que :

☐ Véhicules de transport public

☐ Taxi et autre transport à la demande

☐ Véhicules en temps partagé (*car-sharing*-type Yélomobile, Autolib')

☐ Voitures personnelles

☐ Véhicules de transport de marchandises

☐ Autre: _____

Pouvez- vous donner davantage de détail à votre réponse ?

Q6. Parmi les scénarios d'utilisation des véhicules automatisés suivants, lequel a votre préférence ?

☐ Sur des routes partagées avec les piétons et les cyclistes, à vitesse réduite

☐ Sur des routes partagées avec d'autres véhicules motorisés

☐ Sur des routes et/ou des couloirs dédiés aux véhicules automatisés (interdit à tout autre véhicule)

IMPACTS DES VEHICULES AUTOMATISES DANS VOTRE DOMAINE D'EXPERTISE

Q7. Répondez à la question correspondant à votre rôle.
A) <u>Si vous êtes un ACTEUR PRIVE ou un CONSTRUCTEUR,</u> que doivent selon vous mettre en place les autorités publiques et les planificateurs urbains pour faciliter une généralisation de la mobilité automatisée?

☐ Être proactif et anticiper l'évolution de la ville et les modifications nécessaires de l'infrastructure

☐ Initier et construire des relations avec les investisseurs privés et l'industrie automobile

☐ Éviter un report modal négatif des modes doux/actifs (vélo, marche) vers les véhicules automatisés

☐ Inclure la question des véhicules automatisés dans le Plan de Déplacement Urbain

☐ Repenser à l'utilisation des places/espaces de stationnement pour de meilleurs usages

☐Autre:
_____

B) <u>Si vous êtes un organisme/une autorité PUBLIQUE</u> : que doivent faire le secteur privé et l'industrie automobile pour faciliter une généralisation de la mobilité automatisée?

☐ Investir/ s'investir et aider les villes à appréhender les risques et les avantages potentiels de ce type de services

☐ Éviter un report modal négatif des modes doux/actifs (vélo, marche) vers les véhicules automatisés

☐ Pensez davantage à offrir des services de transport qu'à vendre des voitures

☐ Collaborer, agir en partenariat

☐ Prendre en compte les besoins et l'accessibilité des conducteurs/personnes âgés

☐Autre:_____

C) <u>Si vous êtes un OPERATEUR DE TRANSPORT DE MARCHANDISES</u>: que doivent faire le secteur privé et l'industrie automobile pour permettre une généralisation de la mobilité automatisée ?

☐ Investir dans le partage des véhicules de distribution pour monétiser les actifs

☐ Penser à une utilisation mixte des véhicules à la fois pour les personnes et pour les livraisons de marchandises

☐ Étudier de nouveaux modèles économiques fiables

☐ Mieux lier transport de longue distance et distribution urbaine

☐ Étudier et investir dans des technologies de « platooning » (pelotons de véhicules) pour réduire la consommation de carburant et les situations de stress

☐
Autre:_____
_

Q8. Dans quelle mesure êtes-vous en accord /en désaccord avec les affirmations suivantes? (Une seule réponse par ligne)

	Pas du tout d'accord	Pas vraiment d'accord	Pas d'avis	Plutôt d'accord	Tout à fait d'accord
La mobilité automatisée va contribuer à créer de nouveaux emplois	☐	☐	☐	☐	☐
La mobilité automatisée va contribuer à diminuer les coûts de transport personnel	☐	☐	☐	☐	☐
La mobilité automatisée va contribuer à la diminution des infractions/des contraventions	☐	☐	☐	☐	☐
La mobilité automatisée va contribuer à réduire les coûts d'assurances	☐	☐	☐	☐	☐
La mobilité automatisée va rendre le transport plus confortable et plus pratique	☐	☐	☐	☐	☐
La mobilité automatisée va améliorer la sécurité routière	☐	☐	☐	☐	☐
La mobilité automatisée va générer un transfert de passagers du transport public vers les	☐	☐	☐	☐	☐

voitures automatisées					
La mobilité automatisée va générer un transfert de passagers des modes doux/actifs (marche, vélo) vers les voitures automatisées	☐	☐	☐	☐	☐
Les voitures privées automatisées vont avoir un impact négatif sur les émissions (augmentation du nombre de véhicules et un nombre élevé de trajets à vide)	☐	☐	☐	☐	☐
Les véhicules automatisés de transport collectif (ex. CityMobil2) vont avoir un impact positif sur la consommation de l'énergie (moins de voitures personnelles, plus de voyages en commun)	☐	☐	☐	☐	☐
Les voitures privées automatisées vont générer une consommation d'espace accrue (augmentation du réseau routier et étalement urbain)	☐	☐	☐	☐	☐
Les véhicules automatisés de transport collectif (ex. CityMobil2) vont permettre de libérer de l'espace urbain (moins d'espace réservé au stationnement, moins de véhicules, moins de besoin en routes)	☐	☐	☐	☐	☐

LEVIERS ET FREINS

Q9. A votre avis, quels sont les <u>principaux leviers pertinents</u> pour une généralisation de la mobilité automatisée? Choisissez les TROIS principaux leviers et ORDONNEZ-les par ordre de pertinence (1= la plus pertinente)

☐ Un engagement des acteurs-clés basé sur des motifs politiques et/ou stratégiques

☐ L'existence d'une stratégie de développement durable

☐ Un sentiment partagé par les principales parties prenantes d'une urgence en matière de mobilité durable

☐ Une entente entre les acteurs clés en raison d'intérêts matériels communs et de bénéfices financiers attendus

☐ Une planification technique précise ou visionnaire permettant de déterminer les exigences de mise en œuvre de la mobilité automatisée

☐ De nouveaux potentiels grâce à la technologie

☐ Autre:_____

Q10. A votre avis, quels sont les principaux <u>freins</u> à une généralisation de la mobilité automatisée? Choisissez les TROIS principaux freins et ORDONNEZ-les par ordre de pertinence (1= la plus pertinente).

☐ Une absence de propositions pour changer les règles, les structures, la législation

☐ Un manque d'implication des principales parties prenantes

☐ Des difficultés à trouver des solutions adaptées pour résoudre des problèmes liés à la mobilité automatisée

☐ Des problèmes de communication entre les principales parties prenantes

☐ Une concurrence entre villes et acteurs privés pour fournir des services de transport (véhicules en temps partagé, véhicules automatisés de transport collectif/ véhicules automatisés privés ...)

☐ Des points de vue différents et des intérêts divergents en matière de développement durable des villes (réorganisation de l'espace, report modal, accessibilité, sécurité ...)*

☐ Autre:_____

PRIX À PAYER

Q11. Votre opinion concernant le prix à payer pour un tel service

A. **Si vous êtes** ***une autorité locale organisatrice de transport, une agence de planification urbaine, un opérateur de transport public, un opérateur de service de livraison de marchandises***: en supposant que les systèmes de transports automatisés offrent un service de transport fluide, intégré et sécurisé, quel prix serait prêt à payer les utilisateurs pour bénéficier d'un tel service?

OPTION 1: Le prix unitaire du ticket:
☐ Moins qu'un ticket de bus
☐ Le même prix qu'un ticket de bus
☐ Plus que le prix d'un ticket de bus

OPTION 2: Le prix de abonnement mensuel/annuel:
☐ Un abonnement à prix réduit
☐ Un abonnement à un prix identique à celui du bus
☐ Un abonnement à prix majoré

B. **Si vous êtes** ***un chef d'entreprise, un commerçant, une organisation privée*****:** en supposant que les systèmes de transports automatisés offrent un nouveau service de transport pour les utilisateurs, votre volonté de contribuer financièrement à ce service (pour un bénéfice économique indirect) serait de**:**

☐ Contribuer à l'entretien du service à travers une cotisation annuelle / saisonnière
☐ Rembourser le ticket de l'utilisateur s'il arrive par véhicule automatisé avec le système de transport automatisé
☐ Autre: _____
☐ Aucune de ces propositions. Spécifier pourquoi?
_____

Q12. Selon vous, sur quels aspects devraient prioritairement se pencher les futurs projets de recherche et de développement sur les véhicules automatisés ? Choisissez les TROIS principaux aspects et ORDONNEZ-les par ordre d'importance (1= le plus important)

☐ Diffuser les résultats de la démonstration actuelle
☐ Faire davantage de démonstrations de véhicules automatisés pour sensibiliser la population et faire en sorte que les véhicules automatisés soient mieux acceptés
☐ Continuer les tests de véhicules automatisés et évaluer les résultats dans différentes conditions de circulation, types de routes, conditions météorologiques
☐ Mettre en œuvre des essais opérationnels de grande échelle pour recueillir des preuves de changements de comportement (changement de mode de transport)
☐ Évaluer les impacts sociaux, économiques et environnementaux de la mise en œuvre à

une échelle plus large de véhicules automatisés
☐ Analyser les impacts financiers (direct et indirects (par une évaluation coût-bénéfices) de la mise en œuvre de systèmes de transport automatisé

Merci d'avoir compléter ce questionnaire!