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## Results of a new approach in making survey on P.T. – new bus rapid transit service in Nantes

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### Abstract

It has been 30 years since Greater Nantes reprioritized its transport policies based on a radial public transport network and constructed a Tramway. Today, Greater Nantes is developing a new BRT system, called 'Chronobus'. Chronobus enables Nantes' public transport network to function across a new mesh network with a controlled investment (70 M€). Until now, household travel and operator surveys have not provided comprehensive information about the public's local transport needs and perceptions. With this in mind, Greater Nantes conducted a large-scale innovative survey in 2014 to determine how users make their travel choices considering a wide range of social factors. The survey was targeted at small geographic areas to determine the effectiveness for residents on a fine scale. The objectives of this article are: (1) to describe the innovative survey carried out within Greater Nantes and to outline the diversity of the results; (2) to outline the potential use for local authorities to conduct similar surveys in order to better understand the dynamics of urban mobility in their jurisdictions. The survey includes both quantitative (around 8,000 answers) and qualitative features (30 semi-structured interviews; two focus groups) and are aimed at both Chronobus users and non-users. This article emphasizes four main topics: the willingness to walk to a Chronobus service (rather than to a classic bus service); the consideration of Chronobus and other transport criteria in choice of residential dwelling location; the use of Chronobus as a tool for urban renewal and for opening up isolated and disadvantaged areas; and the perception of Chronobus users and non-users of its impacts on the other transport modes and local life. This innovative study is not only an evaluation tool, but a social barometer that provides useful information to local authorities to supplement other current household and operator surveys. The article shows that similar surveys can be seen as a useful tool for opening up dialogue with local populations on mobility topics.

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**Keywords:** evaluation tool; BRT; innovative survey; perception of users and non users; high-level service; residential choice; willingness to walk

## 1. Background and objectives of the study

This article describes a new type of survey conducted to evaluate a Bus Rapid Transit (BRT) program in France and the observed range of interesting results about willingness to walk to a BRT system, residential choice, urban renewal and BRT impacts in local areas. These results are compared to the findings of other mobility surveys. Greater Nantes is composed of 24 cities and accounts for nearly 600 000 inhabitants. Greater Nantes is located in the West of France and has run a Light Rail Transit system (LRT) since 1985 and a BRT system since 2006. Both systems are operated by the same operator, SEMITAN. It has been 30 years since Greater Nantes reprioritized its transport policies based on radial public transport network and constructed the Tramway. Today, Greater Nantes is developing a new BRT system, called Chronobus. It enables public transport in Greater Nantes to operate on a mesh transport network with a controlled investment of 70 M€. The main characteristics of the network include:

- Seven lines of 70 km total (four lines commissioned in 2012 and three lines in 2013)
- Fast lanes (15–21 km/h of commercial speed)
- Extensive operating hours (5am to midnight)
- High frequency (5–8 minutes each ways during peak hours)
- High punctuality rate (85–95%)
- Permanent service all year long

These high-level service attributes are achieved through different arrangements by local area: dedicated lanes in congested areas, low traffic areas, traffic lights priority, bus stops used as tools to regulate traffic, and parking reorganization. The Chronobus network also takes into account pedestrian and cycling infrastructure to encourage the use of alternative modes and to limit the appeal of car based travel. Extensive dialogue was undertaken with citizens to explain the project (more than 70 public meetings). The flexibility of the Chronobus program enables an adaptation of the project to local needs. This new transport policy orientation was established under budget and urban constraints and accomplished through the population's gradual attitude changes toward mobility. The initial forecast demand of 70 000 passengers a day for the seven lines has since been exceeded; with the service gaining an observed patronage of more than 80 000 users a day. Fig. 1 displays a Chronobus sharing public space with cars and bikes.



Fig. 1. A Chronobus working on the Greater Nantes network (source: Nantes Métropole).

Until now, household travel and operator surveys have not provided comprehensive information about the public's local transport needs and perceptions. With this in mind, Greater Nantes conducted a large-scale innovative survey in 2014 to determine how users make their travel choices considering a wide range of social factors (residential choices, accessibility benefits, and district attractiveness). Highlights from the survey include:

- A wider view of mobility (expanding the number of trips assessed, not only day-before trips as in the household travel survey and expanding the scope to include more than one transport mode as in the operator survey)
- Designed for and targeted at smaller geographic areas to determine the specific effectiveness of public transport for residents: 11 areas were assessed for the study along three lines of the Chronobus network (C5, C6 and C7)
- Qualitative data measurements of the population's perception of mobility to anticipate changes in mobility habits

The objective of this article is to describe the innovative survey carried out within Greater Nantes and outline the diversity of the results. The originality of the survey lies in the following elements:

- It was conducted on a district level and targeted at users and non-users of the Chronobus services.
- Both quantitative and qualitative data were measured: nearly 8,000 responses were collected – two focus groups of six people each were formed, and 30 face-to-face interviews were conducted.

Topics covered include the quality of current Chronobus services and the impact of Chronobus in 11 different districts of Greater Nantes. As the Chronobus service is not necessarily the same in every part of the city, asking people their opinion of the Chronobus in different locations enabled to make valid relative assessments of perceptions. The article also aims to demonstrate that both qualitative and quantitative data are necessary to understand thoroughly travelers' behaviors and habits. Finally, throughout the study, we establish how this type of survey would be beneficial for other local authorities in assessing mobility systems in their jurisdictions. Overall, the article's main objective is to outline how this type of survey can help in gaining a deeper understanding of the dynamics of urban mobility.

## 2. Methodology

The survey was conducted through a partnership with local stakeholders to gain insight into locals' perception of Chronobus services. It happened between April and June 2014, the year after the opening of the Chronobus lines C5, C6 and C7 (Lines C1 to C4 have been operating since 2012). The survey needed to be carried out promptly during this period to ensure that the previous transport situation (before Chronobus) was still fresh in residents' memories. Stakeholder engagement meetings with each of the 11 districts' authorities were held to understand the expectations and priorities of each. After gathering and analyzing the information collected in the 11 areas, especially from the consultation meeting proceedings organized by Nantes Métropole (2010) and from the literature (TRL Report, 2004 and Bernardino and Fourcade, 2013) and, examining the Chronobus impacts, the survey questionnaire was developed. Some key points assessed in the survey were:

- The willingness to walk to Chronobus rather than a classic bus: does the high level of service provided attract users and encourage them to use the public transport system? What is a reasonable walking time to Chronobus? Is walking an obstacle for non-users?
- How does a BRT impact residential choices for households? How different is it within the different areas?
- How has Greater Nantes used Chronobus as a tool for urban renewal and for opening up isolated and disadvantaged areas of the city? What about the perception of accessibility to jobs and amenities?
- The perception of users and non-users of the program in local areas: how does Chronobus impact the other transport modes? (Cars, bikes, pedestrians ...)? What about the local life? (Noise, impacts on local shops...)

The survey was designed to be answered online or face-to-face and on average took around ten minutes to complete. The survey allowed respondents to express their opinions (including an open-ended question) about Chronobus and the public transport network on offer in Nantes. Responses were collected either online if the respondent was previously informed via the bus displays, local press, flyers...; or face-to-face with on-field surveyors.

Respondents could access the survey online at [www.enqueteChronobus.fr](http://www.enqueteChronobus.fr) or through scanning a QR code with their smartphone. Six on-field surveyors were commissioned full time in charge of connected tablets on site – during two months, five days a week. In addition to the quantitative survey, two focus group of six people each and 30 face-to-face semi-structured interviews were carried out.

### 3. Main results

This survey enables local authorities to understand the perceptions of people who live near and benefit from the Chronobus program (users and non-users). 7783 questionnaire responses were filled; 1790 (23%) via direct internet access to the questionnaire and 5993 (77%) through on-field surveyors equipped with tablets. At least 450 questionnaires were completed for each district with targeting of approximately 50% Chronobus users and 50% non-users (from 453 and up to 843 per area). The sample was designed to take in a wide demographic age, sex, professional status, and household composition categories.

It was observed by on-field surveyors that respondents were generally glad to have the opportunity to participate in the survey. They welcome the fact that this was an opportunity to communicate about transport issues in Greater Nantes. As a result, respondents expect Greater Nantes authorities to provide concrete feedbacks on the survey results and hope that the local government will take their suggestions and opinions on-board.

#### 3.1. The willingness to walk to Chronobus

According to the household travel survey (2014), the average walking time to reach a Chronobus stop is around 4 minutes. The scope of this result includes the 718 inhabitants of Greater Nantes who responded to the household travel survey and who use at least one of the seven Chronobus lines. From the focus group and the semi-structured interviews of the Chronobus survey, it seems that a reasonable walking time to access Chronobus is somewhere between 5 and 10 minutes. For Chronobus users that responded to the survey (3445 persons), 25% walked more than 10 minutes to reach Chronobus. 43% of respondents said they were willing to walk more to reach Chronobus than a classic bus stop which suggests that approximately one user out of two thinks that high quality of service justifies walking longer. However, the willingness to walk differs across the districts depending on local features. People are willing to walk more to Chronobus in areas where it is the only high level of public transport.

The lines C5 and C7 operate as key arterial routes and replace some original bus lines, which had more local service features. Consequently, some old users of those bus routes bemoan the fact that the previous bus service operated a stop ‘next door’ whereas now they have to walk 10 minutes or more to reach the BRT service. This shows that a high level of service is not always enough to justify a less accessible system and further highlights that walking time to access the bus network appears to be a crucial factor in the modal choice process. If walking is considered ‘too long’, many people surveyed reported a preference for using their private car. Analyzing the survey results on the willingness to walk by demographic profile also yielded interesting conclusions. The results suggest that people with reduced mobility were more sensitive to walking time to reach Chronobus services. Some respondents expressed opinions that providing more stops would be an improvement, despite the impact that more stops would have on the speed of the service. Across all respondents, the results of the Chronobus survey showed a willingness to accept slightly higher walking times – between 5–10 minutes – than stated walk time from the household travel survey (4 minutes). Several factors can explain this:

- The Chronobus survey only focused on three of the BRT lines among the seven. Consequently, as each line is designed differently; the willingness to walk may differ as well.
- Methodology to determine the walking time is different. The household travel survey asks users to estimate their actual walking time. The Chronobus survey asks if respondents walk more or less than 10 minutes to reach a Chronobus service and the qualitative focus groups and semi-structured face-to-face interviews allow a deeper understanding and a valuation of the walking time.

The household travel survey and the Chronobus survey identify that one of the main barriers to public transport use (in particular Chronobus use) is the distance of the service from respondents’ dwelling locations, which implicitly

means that walking times are perceived as too long. The qualitative analysis also revealed that some respondents would like the locations of the Chronobus stops to be different or more advantageous to their living location. Indeed, some respondents believed that stops were too far away from stop locations (particularly when walking time exceeded 10 minutes) while others noted that stops were actually too close. The survey opens the discussions with local authorities to understand where best to locate Chronobus stops. This shows that the survey can serve as an interface between local authorities and populations.

### 3.2. How mobility criteria, especially Chronobus, are taken into account in making the residential choice?

Choosing where to reside is usually made after considering criteria range of variables associated with residential location. According to the household travel survey (2014), the key attributes considered in choosing where to live in Greater Nantes are displayed in Table 1 below (from a sample of 2029 survey answers):

Table 1. First and second factors for making residential choices (source: Household travel survey, 2014).

| Factors                                                | % of people who chose it as the first factor | % of people who chose it as the second factor |
|--------------------------------------------------------|----------------------------------------------|-----------------------------------------------|
| The proximity of workplace                             | 28%                                          | 2%                                            |
| The proximity of shops, schools                        | 16%                                          | 6%                                            |
| The size and comfort of accommodation                  | 14%                                          | 17%                                           |
| The environment                                        | 7%                                           | 7%                                            |
| The possibility to live in an individual accommodation | 6%                                           | 0%                                            |
| The quality of public transport service                | 6%                                           | 12%                                           |
| The price                                              | 5%                                           | 16%                                           |
| Living in the city center                              | 3%                                           | 19%                                           |
| Owning the accommodation                               | 3%                                           | 6%                                            |

Table 1 shows that the quality of public transport service provision is considered to be the first or second most important attribute in choosing where to live. Fig. 2 gives the results of the Chronobus survey regarding residential mobility. The household travel survey reveals that the quality of a public transport service is taken into account by residents when choosing where to live. The Chronobus survey goes further by asking the 605 residents of the sample who recently moved within Greater Nantes if they consider the following transport criteria in their residential choice: Chronobus proximity, public transport (PT) proximity, the possibility to walk and the possibility to cycle. Fig. 2 suggests that transport public service offerings are an important factor in determining residential location choice. 80% of respondents thought that public transport proximity was essential when choosing their place of residence (even when it was not the first or second most important attribute according to the household travel survey).

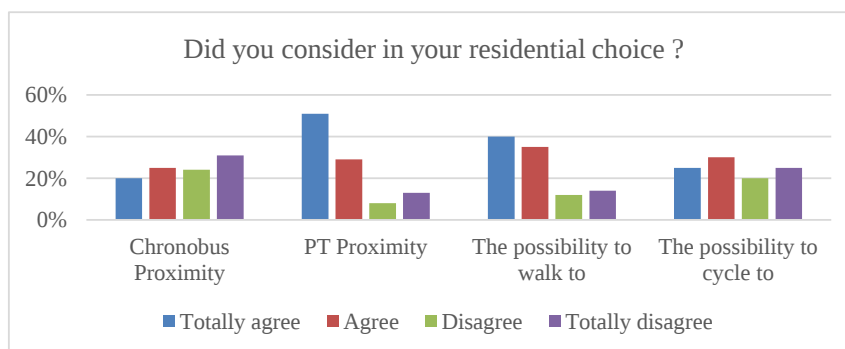


Fig. 2. Determinants of residential choice (sample size – 605. Source: Chronobus Survey, 2014).

Surprisingly, out of these 80% of respondents, users were regular and also occasional Chronobus travelers. This highlights that public transport was considered to be an important daily mode of transport as well as an occasional one if the need to use public transport is required. Chronobus service proximity was considered to be a crucial factor in dwelling location by 45% of the sample. The Chronobus survey allows further analysis of Chronobus users and non-users inside this sample segment.

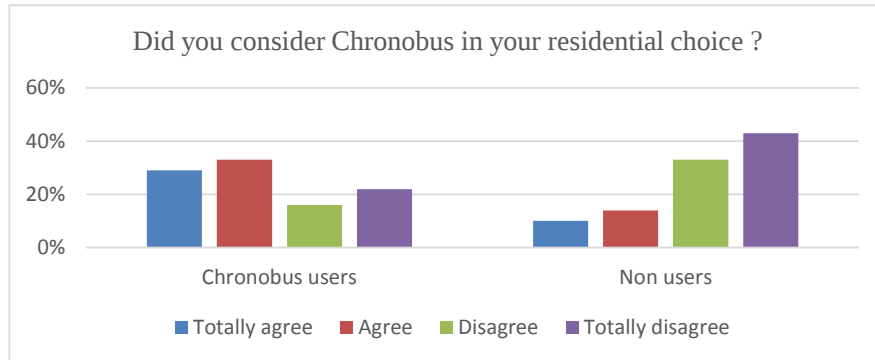


Fig. 3. Distinction between users and non-users in the residential choice criteria (sample size – 605: 343 users/262 non-users. Source: Chronobus survey, 2014).

Unexpectedly, Fig. 3 demonstrated that some Chronobus users did not consider the service's proximity when they chose their residential location whereas some non-users did. The face-to-face interviews were able to highlight how some people like to know they have an alternative transport mode nearby – even if they use private transport on a daily basis, they have another mode available if necessary.

The local approach allows us to compare the consideration of Chronobus in the residential choice for three different districts of Greater Nantes located on the Chronobus line C7. Area A is located at the terminus of the line and has an intermodal connection with the Tramway. Area B is located in the eastern part of Greater Nantes where Chronobus is the main public transport service. Area C is located in the eastern part of Greater Nantes – Chronobus is the main bus line in the area but the region is also connected to the city center of Nantes by train during peak hours.

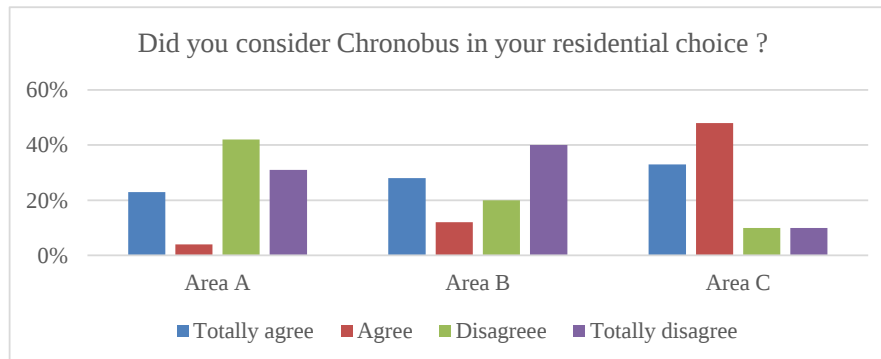


Fig. 4. The impact of Chronobus in residential choice in 3 different areas (sample size Area A – 475; Area B – 792; Area C – 731. Source: Chronobus Survey, 2014).

Fig. 4 shows that people in areas mainly served by Chronobus (B and C) are more likely to consider Chronobus in their dwelling location choice than people in areas where public transport services on offer are greater (like ready access to the Tramway). The train service during peak hours does not appear to compete with Chronobus in Area C. One likely reason is that people value the flexibility of Chronobus over the train as the Chronobus service operates throughout the whole day. The train service is mainly used by commuters. These results highlight how localized scale surveys allow a better understanding of district specific perceptions and priorities in public transport service offerings.

The Chronobus survey has enabled a deeper understanding of the correlation between BRT and choice of dwelling location, supplementing the household travel survey analyses highlighting the correlation between any public transport offerings and residential location attributes.

### 3.3. Chronobus as a tool for urban renewal

The Chronobus program has also provided the opportunity to rethink transport and urban planning issues in certain areas of the city, particularly in several disadvantaged districts. Offering better access plays a key positive social role in many aspects of life of these areas. Indeed, Chronobus has enabled improvement in access to jobs, services and amenities. This is the case with Area D, a high priority district for the city and positive urban planning policies, which had no connection to the south of Nantes by a high quality public transport service before Chronobus. Since the Chronobus program began, positive changes have taken place such as new flat constructions, and the creation of new retail establishments and new pedestrian and cycling organizations. The survey allows us to gauge the opinions and perceptions of Area D residents and visitors who know the district well enough (sample size: 665). Fig. 5 and Fig. 6 display the views of Area D's respondents and respondents from the total sample (sample size: 7088) on the contribution of Chronobus to: (1) being able to reach more parts of the city in a reasonable travel time; (2) get easily to work/universities/high schools.

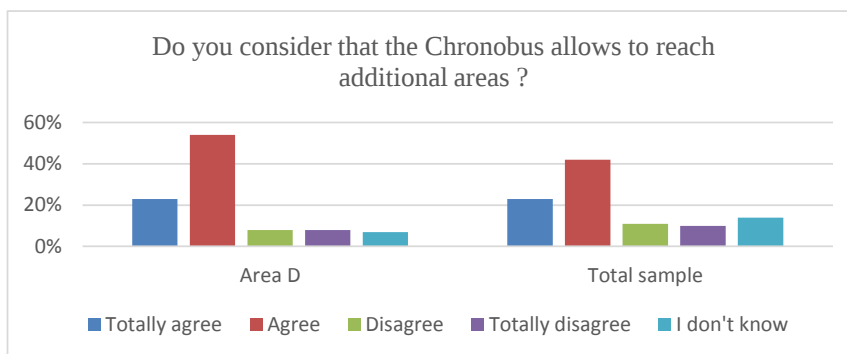


Fig. 5. The perception of Chronobus impacts on opening up the area D and general view (source: Chronobus Survey, 2014).

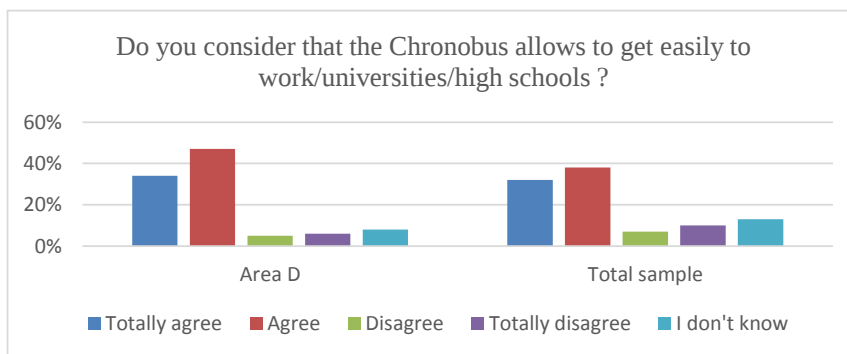


Fig. 6. The perception of Chronobus on access to workplace/universities/high schools from Area D and general view (source: Chronobus Survey, 2014).

The results show that residents of Area D perceived a positive change and believe that there has been greater ability to access the rest of the city, jobs and amenities with the introduction of Chronobus. The findings are also noted in the whole sample to a slightly lesser extent. Furthermore, the survey reveals that people have positive view on the improvements in general since the introduction of Chronobus. Perceived enhancements have been seen in how more people are moving into the area, new flats and new shops have developed, and new environmentally sustainable transport modes are being adopted. Overall, Chronobus was introduced into disadvantaged areas as part of a wider urban renewal program, which has been shown to have had wide ranging beneficial social impacts on the districts. The public has come to associate the Chronobus program with the urban renewal program – and the general sentiment is that ‘Chronobus and its components help the district’. This illustrates the relevance of analyzing transport and urbanism issues together. These views were observed during semi-structured interviews in the Chronobus survey (2014). Understanding these social perceptions of public transport services is something that is not carried out in the operator SEMITAN survey (2014) and in the household travel survey undertaken by Nantes Métropole (2014) and is therefore another positive contribution from the Chronobus survey.

### 3.4. The perception of users and non-users of Chronobus in local areas

Both the quantitative and qualitative parts of the Chronobus survey identify the issue that space is contested between the different transport mode users on roads and footpaths. For instance, some changes to cycling lanes since the Chronobus program were questioned by respondents. The Chronobus allowed Greater Nantes to rethink the cycling network alongside Chronobus routes. The cycling routes vary by local area: sometimes cyclists need to share road space with cars, other times with buses in bus lanes, and occasionally on the sidewalk with pedestrians. As a result, some cyclists are confused about the consistency and continuity of the network. Some pedestrians are unsure about cyclists on the sidewalk, and why pedestrian crossings are impacted by Chronobus operations. Added to that there is also concern among car users about not being allowed to overtake Chronobus in certain locations. The survey helped identify respondents’ opinions of the impact of Chronobus on the ease of their typical trip making.

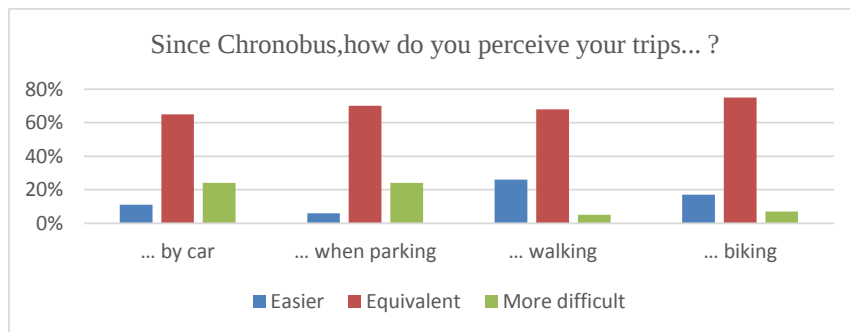


Fig. 7. The perception of travelling in the local areas since Chronobus (sample size – 7088. Source: Chronobus Survey, 2014).

Fig. 7 displays the perception of people of the transport plan after Chronobus and shows that, after Chronobus, things remain more or less the same for most respondents. Nevertheless, travelling by car and parking seem to be more difficult, whilst green modes appear to be somewhat easier. These perceptions are consistent with the transport policy objectives about increasing the use of sustainable travel modes identified in the urban mobility plan of Greater Nantes (2011). In spite of some disapproval on the whole, Chronobus users’ and non-users’ views were not so different which seems to suggest that even people who do not use the service can see its social advantages. Because the survey has yielded results from different districts, local authorities are able to understand issues specific to their area and can use the results to improve some of the local transport features where issues have been identified with regard to cycling lanes, pedestrian paths, and crossroads schemes. In addition to the Chronobus impacts on the other transport modes, the survey also measured perceptions in changes in local urban amenities and community. Respondents had a good opinion of the Chronobus program: in that ‘it brings new life to the district’ (63%), ‘it enhances the image of the

district' (71%), 'it helps to bring new residents' (67%) and 'there has been an increase in new shops' (57%), and that 'it increases the property values' (56%). On the negative side, 21% of the respondents said that 'the area is noisier since Chronobus'.

#### 4. Summary of the findings – perspectives

##### 4.1. The Chronobus survey type as an innovative way to collect additional information to understand mobility

To conclude, the Chronobus survey and the other surveys are complementary. While the household travel survey brings to light the global travel habits of residents, the operator survey analyses the perception of users toward the quality of services, surveys like the Chronobus survey provide additional information on transport perceptions taking into account wide social factors and demographics.

The Chronobus survey enabled understanding of a great variety of results, including:

- The willingness to walk to Chronobus is higher than to access ordinary buses. 43% of interviewees were willing to walk more to reach Chronobus. This suggests that a higher level of service justifies a longer walking time. However, some users (particularly those with reduced mobility) lament the change – because their previous bus stop was 'just next door'. Another finding was that users are willing to walk more to Chronobus in districts where it represents the only high level of transport service. The reasonable walking time to Chronobus seems to be around 5 to 10 minutes according to the face-to-face interviews (against 4 minutes in the household travel survey). The qualitative aspects of the survey provided an important added-value to the quantitative results.
- The consideration of a nearby BRT in the choice of residential location, as well as the possibility to travel by walking or cycling, were analyzed. 40% of the respondents who recently moved residence in Greater Nantes considered Chronobus proximity in choosing their new residential location, whether they use it or not. This figure increases in the districts where Chronobus is the main high level of service public transport offered in the area.
- Chronobus is highly valued in the disadvantaged districts. The public has come to associate the Chronobus program with the urban renewal program. This demonstrates the relevance of analyzing transport and urbanism issues together.
- The different techniques employed in the Chronobus survey make apparent that public space is still disputed and often confusing for the different transport modes: pedestrians, cyclists, public transport users, and motorists. Users and non-users have similar views of changes in local district due to the introduction of Chronobus services. Even if they do not use it, non-users appreciate the positive social changes brought by Chronobus. The survey highlights the positive opinions of residents regarding the Chronobus. Overall, they consider it as an improvement in bringing more people and more commercial activity to the district, and as an opportunity to rethink pedestrian, cycling and car transport planning. Moreover, the survey identifies the perceived positive impact on real estate prices, and on the community amenities and social enhancement, but also some social costs like the rise in noise in the districts (an issue not tackled in the operator or household surveys).
- The open-ended question also reveals wide ranging residents' concerns, like the belief that there is a need for more public transport to serve outlying areas and areas of high employment (most of the network currently converges in the city center). In addition, the qualitative parts of the survey can be used differently; they are also valuable in identifying topics that were not volunteered. People did talk about multiple subjects, which we analyzed, but additionally, it is interesting to interpret the topics not mentioned by the respondents. For instance, the fact that people did not cite motorbikes or scooter issues and only a handful of respondents discussed car parking issues may suggest that these issues were not seen to be important in the context of the Chronobus, or in people's opinions on the transport network generally.

##### 4.2. Potential improvements for responding to public demand and for mobility surveys

This innovative study is not only an evaluation tool, but a social barometer that provides useful information to local authorities to supplement current household and operator surveys. Indeed, the Chronobus survey type can be seen as

a valuable tool for dialogue with local population on mobility topics. Respondents felt empowered by the survey and expect feedback and action from Greater Nantes authorities on issues identified in the survey. The survey is therefore a good tool for local governments to understand residents' priorities and opinions on transport issues, and also a valuable one for local residents to voice their opinions on issues not often openly discussed due to their technical nature.

The Greater Nantes transport network faces ever increasing demand from new and existing users. However, expansion of the system has slowed in recent years as financial and spatial limitations have reduced investment in other transport improvements. To successfully manage the transport network, innovative and collaborative solutions are increasingly needed. The survey showed that respondents highly value the public transport service and that respondents themselves were often full of projects and ideas to enhance the transport system in their community.

The Chronobus survey approach is a valuable tool which could be utilized in other regions and on other transport modes. It shows that collaboration could just be the start. Respondents who participated in the semi-structured interviews and focus groups could be further involved in more detailed discussions and interviews (panel data techniques). Indeed, the Chronobus survey conveys a "picture" of the social aspects of mobility in 2014. The Chronobus survey could also be conducted on a regular basis (every two years or so). Researching public transport users and non-users perception through Chronobus style surveys and also combining results with numerical transport data on wider transport metrics, would offer a deeper analysis of mobility. This type of study would be complementary to existing traditional surveys, providing a valuable resource for understanding not just user satisfaction or performance of transport systems but the views of users themselves.

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