



University of Groningen

A transport equity analysis of a 2016 Olympic Games Legacy Project: Bus Rapid Transit in the city of Rio de Janeiro, Brazil

Bachelor Thesis

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Abstract

Mega events can have many benefits for the host city and its residents that may last for long after the end of the event. This study analyses the consequences of a mega sport event on transport equity. The case study is the Olympic Games in Rio de Janeiro in 2016, with a Bus Rapid Transit system as one of its Legacy Projects. Since its goal was to improve the mobility of the urban poor, this study focuses on vertical equity. Residents' perceptions were studied during five in-depth semi-structured interviews. The findings suggest that at the start of the implementations, the BRTs offered many benefits to its users, especially with regards to travel time, user safety and accessibility, thereby adding to transport equity. However, a few years after the Games, the condition of the stations and buses has deteriorated in such a way that most positive effects have disappeared, making place for negative effects. Both previous research and data from the interviews suggest that political interests and short-term planning have played a role in this. Future research should continue investigating how the situation evolves in the future, specifically after the current COVID-19 pandemic. In addition, a solution has to be found for residents who depend on Bus Rapid Transit in their daily mobility.

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1. Introduction

When Rio de Janeiro won the bid to host the 2016 Olympic Games, mayor Eduardo Paes promised his citizens to invest five times the money that would go to sport facilities, on public works to improve the quality of life in Rio. Around the same time, 4,120 families were evicted from their communities in order to build the new sport facilities, with an additional 2,486 families being threatened by this (Bin, 2017). This contrast shows how some parts of society may benefit from the hosting of a mega event in their city, whereas others may experience major disadvantages because of it, resulting in social injustice.

Mega events, such as the Olympic Games, can be seen as a way for big cities to not only improve their international relations and show their identity to the world, but these events can also help to solve problems of urban degradation, transport problems and environmental issues (Kissoudi, 2010). Even long after the event, benefits may continue. However, the effects may not always be positive, resulting in a negative perception of the host city and its government by local populations and the rest of the world, as was the case of the Olympic Games of 2004 in Athens (Kissoudi, 2010). For the organization of a mega event, concerns about a city's ability to host the event arise that usually relate to security, infrastructure and time-management (Curi et al., 2011). To show to the world they are capable of the organization, socio-spatial interventions are made in the city. An example is the construction of a big wall in the city of Rio de Janeiro for the Pan American Games of 2007 that divided the lives of the higher and lower socio-economic classes. This was done in order to protect the 'Games space' from violence on the other side of the wall, but also to exclude that side of the wall from being represented in the media (Curi et al., 2011). Giulianotti et al. (2015) have researched socio-spatial politics of exclusion with regards to mobility and access to social spaces during the Olympic Games of 2012 in London. The socio-spatial distribution of the Olympic sites, of public access to the events and the mobility strategies related to the securing of the event spaces all resulted in a form of social exclusion. They concluded that the measures safeguarded the interests of Olympic visitors and spectators and marginalized parts of the local population.

In fact, different scholars have criticized sports mega events as they often only benefit small parts of society, resulting in capitalist accumulation at the expense of social welfare, in addition to strengthening social and economic hierarchies and segregation, placing certain interests over others (Millington & Darnell, 2014). However, Misener & Mason (2006) claim that (mega) sport events can also contribute to community development in the form of social capital, including community networks and social inclusion. Instead of focusing on economic development and tourism, which has been researched in abundance according to them, they call for more research on the social impacts of sports events. This does not only provide the academic world with more depth into the impacts of sport events on cities, but it can also empower cities to create proposals for sport events that lead to real social change and political action. Within the literature on mega sport events legacies, transport is considered to be relatively understudied (Ferranti et al., 2020).

By making use of resident perceptions, this study adds to the limited academic resident perception studies specifically related to mega events and their social dimensions. These are crucial for understanding all stakeholders in the project, and for being able to make future improvements on participation of all stakeholders in the hosting of a mega event for it to be successful (Ritchie et al., 2009). In this way, locals' needs and wishes can be integrated into multi-level cooperation, increasing inclusion and participation in society. This does not only lead to an increase in the quality of the event, but also in public acceptance and trust, both necessities for a sustainable project (Németh, 2016).

The focus of this study is on the Olympic Games of 2016 in the city of Rio de Janeiro. It tried to find out whether one of its Legacy Projects, a Bus Rapid Transit (BRT) system, is actually contributing to social justice and is reaching its goal of improving mobility for the urban poor in the North and West zones of Rio after the Games. BRT systems use high-capacity vehicles that have their own lanes, with frequent service (Johnson, 2014). With regards to studies on BRT systems, there is an underrepresentation of user impacts, especially on different impacts across user groups (Venter et al., 2018). As the cities BRT systems are often implemented in usually have high levels of inequality, this leads to a significant research gap. By interviewing exclusively BRT users on the impacts of BRT on their and other BRT users' lives, this research tries to take a step in filling this gap.

The main research question of this research is: *"How does the Bus Rapid Transit system that was constructed as a Legacy Project of the 2016 Olympics contribute to transportation equity in the city of Rio de Janeiro?"* To be able to answer this question, the following sub-questions are asked:

1. What can be considered direct and indirect impacts of the start of the implementation of the BRT system on lower and higher socio-economic population groups in the city of Rio de Janeiro?
2. What can be considered direct and indirect impacts of the BRT system as it is today on lower and higher socio-economic population groups in the city of Rio de Janeiro?

A qualitative analysis of in-depth interviews was used to conduct this investigation.

In this study, the impacts of the urban transport infrastructure project BRT on the mobility of the urban poor are discussed in line with the concept of transportation or transport equity. These and other related theories and concepts are explained in the theoretical framework, together with a conceptual model. Expectations are formed and discussed based on this framework. After this, the methodology sections explains the choice of a case study approach, the case study selection, the data collection and analysis and the ethical considerations. The results are divided into three subsections: direct impacts, indirect impacts and changes in direct and indirect impacts over time. The discussion summarizes the findings and places them in the context of the framework. Finally, the research questions are answered in the conclusion, in addition to future research recommendations and a reflection on the research process.

2. Theoretical framework

According to Lucas and Jones (2012), transportation systems have been widely discussed in terms of economic and environmental sustainability, but the shift of attention to social impacts, including the concept of transportation equity, is still fairly recent. Litman (2006) states that equity, also called justice or fairness, is about the distribution of impacts, both benefits and costs. He further distinguishes between horizontal equity, concerned with the equal distribution of impacts, and vertical equity, concerned with the distribution of impacts based on people's abilities and needs. The division can be made by income and social class, or by mobility need and ability (e.g. people with disabilities or other special needs). According to Litman, transport planning decisions can have various equity impacts, including the quality of available transportation for people, costs of transport facilities like user fees and effects on the attractiveness of an area. Because of these various types of equity and ways to measure the impacts, analysing transportation equity can be difficult. To ease this process, this study solely focuses on vertical equity with regard to income and social class, using Litman's definition that transport projects can be considered equitable if they favour lower socio-economic groups, thereby balancing overall inequities. As the main research question of this paper is to investigate the impacts of BRT on the mobility of Rio's urban poor and to find out whether it has

added to social justice in Rio de Janeiro, this form of equity is deemed most suitable for this research. The BRT system in Rio is thus considered equitable in this study if it has provided more benefits regarding the mobility of lower socio-economic groups than that of higher socio-economic groups.

Conceptual model

Venter et al. (2018) wrote a research paper on the empirical evidence on the equity impacts of Bus Rapid Transit systems in the Global South. A conceptual model was developed based on these concepts, displayed in Figure 1. They specifically look at direct impacts, including travel time, travel cost and road user safety, dealing with BRT's main objectives of speed and efficiency gains. In addition, they explore indirect social impacts to users, including accessibility and employment impacts. As lower income groups are more likely to be bus than car users, they benefit more from direct positive impacts than higher income groups who are less likely to take the bus (Venter et al., 2018). Positive impacts thus mean the BRT adds to vertical transport equity. In the model, positive impacts are represented by the green lines, the bigger the line the greater the impact. If the impacts on lower socio-economic groups are indeed positive and greater than those on higher socio-economic groups, there will be a positive effect on transport equity in the city (represented by the green arrow in the model).

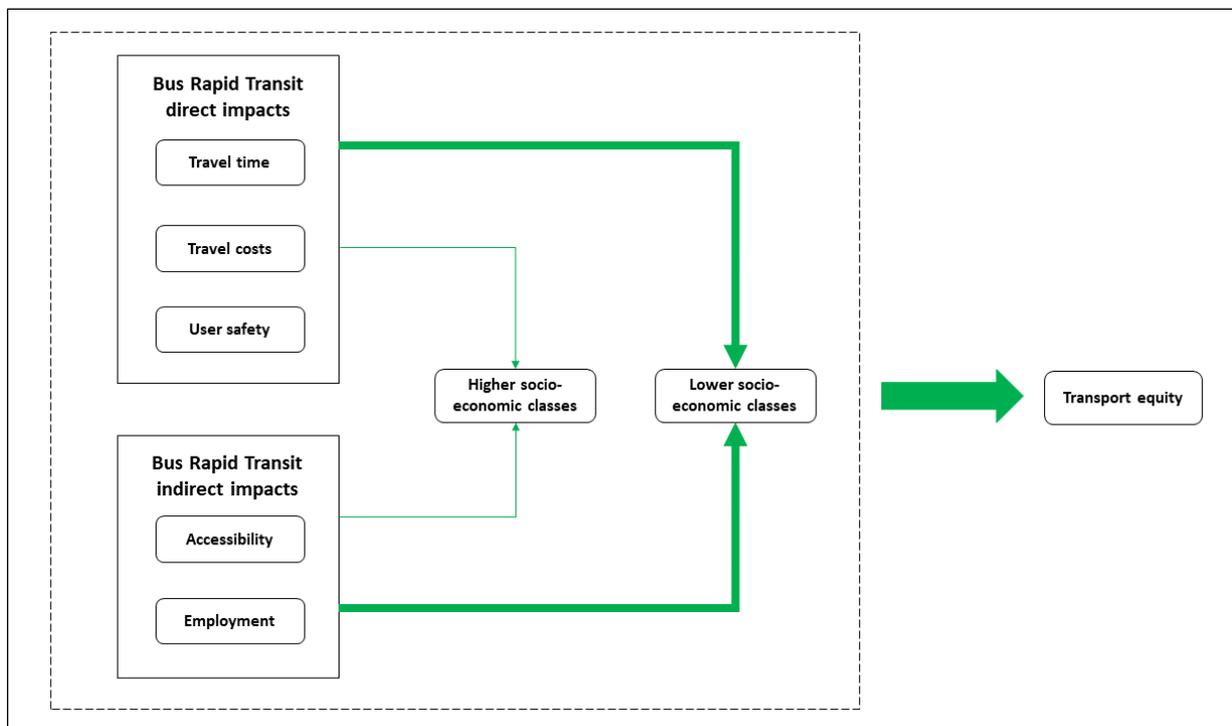


Figure 1: Conceptual model on how Bus Rapid Transit can contribute to transport equity

Expectations of direct impacts

In comparison to normal buses, BRT buses gain in average speed by making use of exclusive infrastructure and advanced technologies (Deng and Nelson, 2013; Hidalgo and Gutiérrez, 2013). Private vehicle speeds often also benefit from the removal of buses from mixed traffic lanes, however average bus speeds tend to improve to a greater extent (Cervero, 2013; Cervero and Kang, 2011). Users of the BRT in Rio are therefore expected to experience a decrease in travel time, meaning a contribution to transport equity. With regards to the impact of travel costs, a ticket for the BRT is the same price as that of a normal bus in Rio de Janeiro (Brown, 2018). Other modes of public transport are somewhat more expensive, including the subway, the train and the metro. However,

the largest percentage of BRT users are found to be previous public transport users along the same routes (Malik et al., 2021; Mahadevia & Joshi, 2013). If we assume this to be equally true for BRT users in Rio de Janeiro, where the BRT system mainly replaces normal buses, most users continue to pay the same price with the implementation of the BRT system. The impact of travel costs in this specific case study may therefore be limited.

Concerning road user safety impacts, multiple studies have shown that BRT implementation can result in less traffic accidents (Bocarejo et al., 2012; Duduta et al., 2012; Hidalgo et al., 2013). This suggests an improvement in overall road user safety, for both users and non-users. However, safety is also an important matter inside the buses and at the bus stations in a city with high crime rates. Therefore, this research takes both safety issues into account. In contrast to normal buses, fare collection happens off-board for BRTs, meaning you can only enter the station with a ticket (Ferranti et al., 2020). This is expected to lead to an increase in safety for its users.

Expectations of indirect impacts

Looking at indirect impacts, previous research has already shown that residents' ability to access opportunities in the urban area can be greatly impacted by BRT, through better connectivity and lower travel times (Cervero, 2013). Not only do more people have access to public transport, but users are also able to visit more locations via the BRT system. This includes an expansion of job opportunities for the urban poor, which can have great impacts on their lives. Related to this are employment impacts, especially for low-income workers, as jobs are created in the construction, operation and maintenance of BRT systems (Venter et al., 2018). Both indirect impacts of BRT are thus expected to contribute to transport equity in the city of Rio de Janeiro.

3. Methodology

Case study description

For this research, I chose to do a case study approach to gain a deeper understanding of the real life impacts of mega-events-related infrastructure projects on transport equity. Spatially, this resulted in

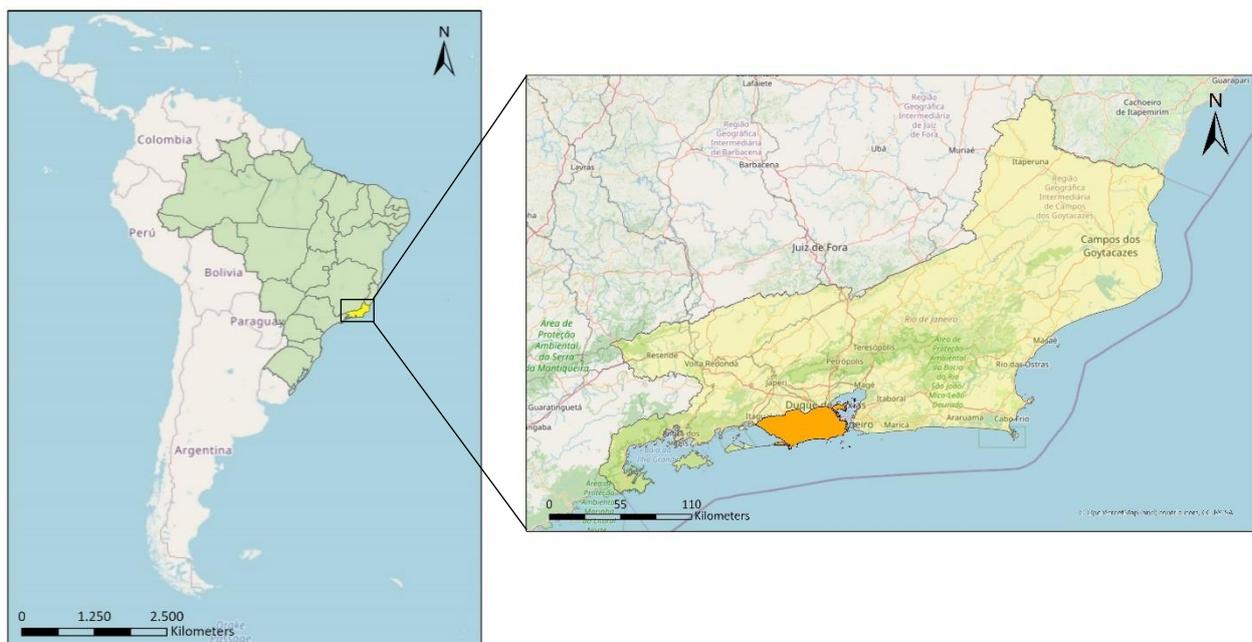


Figure 2: The city of Rio de Janeiro in relation to the state of Rio de Janeiro and Brazil

an explorative overview of experiences regarding one specific case, instead of arbitrary experiences that are hard to compare. Furthermore, it enables the comparison of experiences over time, showing the change or persistency of impacts, thereby giving a more accurate view of the actual consequences on people's lives. The case study approach thus adds to the credibility and accuracy of the research.

The specific case study is the Bus Rapid Transit system that was one of the Legacy Projects of the Olympic Games of 2016. The system was implemented in the city of Rio de Janeiro, located in the state of Rio de Janeiro in Brazil (Figure 2). Rio's mayor Eduardo Paes argued that the Games were to be seen as a means to accelerate urbanization projects necessary for the city (Parkin & Steiker-Ginzberg, 2014). This included the BRT lines that would improve the mobility of the urban poor in the North and West zones of Rio. However, although socially excluded population groups are often important for the promotional narrative used to increase public support for the hosting of a mega event, they rarely experience benefits from it (Coakley & Souza, 2013). By investigating whether the BRT system in Rio de Janeiro has succeeded in its ambitions, this case study offers more insights into the actual rather than the promised impacts of mega events on population groups. As Rio de Janeiro is a city with great economic disparities, the question of transport equity is of significant interest here.

The BRT system was a big part of Rio's proposal in its bid for hosting the Olympics, and it received 35% of the total investments in transportation projects as it was considered to be the best solution for meeting the demands for public transport during the Olympics (Kassens-Noor, 2013). It is viewed as a world-class transport system, favoured for its relatively short construction time and low construction costs, allowing implementation within an event's timeframe (Ferranti et al., 2020). The BRT lines that were proposed for the city of Rio de Janeiro are depicted in Figure 3, showing the TransOeste which started in 2012, 58 kilometers long with the highest amount of passengers per day (192,610 passengers in 2019), the TransCarioca from 2014, 39 kilometers long with a daily demand of

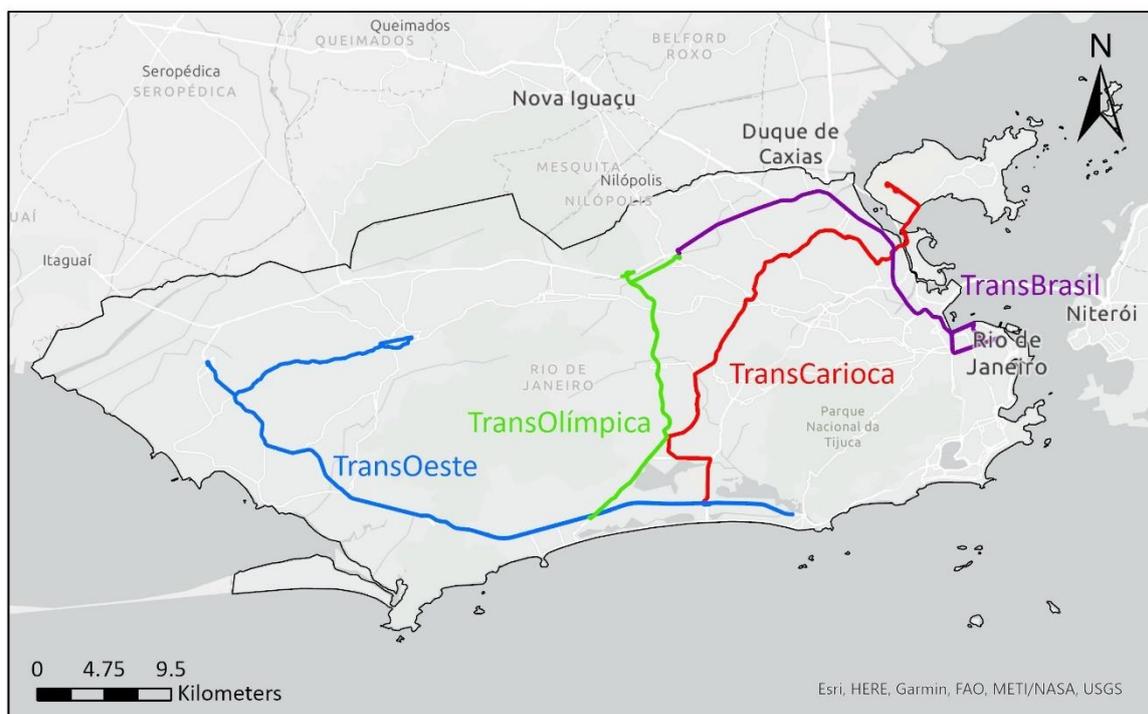


Figure 3: A map of the proposed four Bus Rapid Transit lines in Rio de Janeiro as Legacy Project of the 2016 Olympics

146,377 people and the TransOímpica implemented in 2016, 26 kilometers long with 38,879 users per day (BRTData, 2021). The TransBrasil corridor was part of the proposal, but has not been built to this day and was therefore left out of this case study.

Data collection and analysis

To be able to answer my research questions, I used qualitative in-depth interviews to find out what real effects of the BRT are in place in the city of Rio according to locals. In-depth interviews provided me with the option to ask my interviewees about their experiences, thoughts and feelings. This was preferred over a quantitative survey, as my goal was not to find out statistical details, but rather to get to know what feelings are there and how these changed over time. During the interviews it became clear this is only possible when you either have a conversation with local residents or visit the city yourself. The interviewees were therefore selected to be local citizens instead of people working for the government or for the BRT companies. Seeing as visiting the study location was not possible because of COVID-19, the search for participants took place online. The interviewee requirements are listed below:

- Has lived in Rio de Janeiro before, during and after the Olympic Games of 2016
- Has experience with the Bus Rapid Transit system in Rio
- Is able to communicate in English

The language requirement was chosen to ensure good communication and understanding of the interview questions. Contact details of local residents were gathered via the help of personal contacts. Family members, friends, students and professors were asked if they might know people suitable for this research, resulting in an accessibility sample. A standardised message was then sent to the suggested persons explaining the details of the research study and the interviews. The eventually selected interviewees were all suggested by different personal contacts, in order to minimize a sampling bias. Furthermore, attention was paid to a geographical spread of participants by asking them about their location of residence, to ensure the collection of information on all three BRT lines.

A total of five interviewees were selected based on the beforementioned criteria. It should be acknowledged that this is a small set of interviews, however the goal was not to provide an overview of all opinions of the residents of Rio, but rather to explore thoughts and feelings and create an impression of personal experiences. The interviews took place via videocalls, enabling the sharing of body language, and taking between half an hour to an hour. During the interviews, I made use of a semi-structured interview guide (Appendix A), separated in three parts based on experiences with public transport and the BRT system before the Olympics, during the Olympics and now. Rather than using a standardized interview guide, this allowed for probing questions on their specific answers and personal experiences, while keeping an overarching framework to be able to compare the results. In advance of the interviews, the interviewees were asked to read through and sign an informed consent form (Appendix B). In addition, the questions were in some cases shared beforehand as some participants stated they were not used to speaking English every day. In addition to clear wording of the question, the language problem was managed in this way. At the start of each interview, the consent form was discussed shortly with room for questions, and after that the interview was audio recorded to enable the transcription of the data later. After the interviews were transcribed, they were analysed with the help of a deductive coding tree (Appendix C) that was developed based on the theoretical framework.

Ethical considerations

Regarding research ethics, efforts were made to uphold the highest level possible for the investigation. To ensure the confidentiality of the participants of the interviews, their anonymity was guaranteed, giving them a participant ID rather than using their names. Contact details of the interviewer were available for later questions or remarks. Additionally, participants were made aware of the option to withdraw their information at any given stage of the research if they wished to do so. By asking the participants explicitly open questions about their experiences, they were free to share the amount and type of information they wished to share, without feeling pressured to answer in a certain direction. They agreed to the use of their information from the interviews for educational purposes, namely my bachelor thesis. The interviews all took place on personal devices without the presence of other people, and were recorded via a mobile phone application and then saved on a personal computer. There was no provision of incentives to the participants, however gratitude was shown for their time and effort. With regards to dissemination of the results, the participants could state their preferences of receiving a copy of the research paper. As the identities of the interviewees were not shared between each other, the chance of any discomfort as a consequence of that was minimized.

4. Results

Table 1: Description of the interviewees and their familiarity with BRT

Participant ID	Gender	Age	Neighbourhood of residence during and after the Olympics	BRT line most familiar with	Personal BRT usage
P1	Male	28	Botafogo, Catete, Copacabana (South Zone)	TransCarioca	Occasionally for recreational purposes
P2	Female	26	Copacabana (South Zone)	TransOlimpica	Occasionally for recreational purposes
P3	Male	24	Recreio dos Bandeirantes (West Zone)	TransOeste	Daily for work
P4	Female	57	Vista Alegre (North Zone)	TransCarioca	Daily for work, recreational purposes
P5	Female	30	Engenho Novo (North Zone), Copacabana (South Zone)	TransOeste	Occasionally for recreational purposes

The conducted interviews provided many insights about the experiences and feelings of local residents of Rio de Janeiro regarding the BRT system. An overview of the characteristics of the participants can be found in Table 1. The sample consisted of both males and females, which can result in different perceptions of safety using BRT, as women are found to be more likely to feel unsafe in public transport than men (Ouali et al., 2020). Four of the participants were in the age category of 20-30, with one other of 57 years old. Due to a limited number of available participants, uniformity in age was not considered as one of the most important requirements. There is a variation in neighbourhoods of residence around the time of the Olympics and the BRT line they are most familiar with, leading to insights about the three different BRT lines. Personal BRT usage consisted of

use for recreational purposes, including meeting friends and going to events, and daily use of the BRT to commute to work.

An overview of the sentiments captured during the interviews is provided in Table 2. Here, a [+] represents the mentioning of a positive effect, whereas a [-] stands for a negative situation. When the situation would change over time, a [>] is used to symbolize this. The symbol [+/-] serves to show a neutral effect. When the concept was not mentioned by the interviewee, the cell is empty.

Table 2: Overview of direct and indirect impacts as noticed by the interviewees

Participant ID	Travel time	Travel costs	User safety	Accessibility	Employment
P1	+		+/-	+/-	
P2	+/-	+/-	-	+	
P3	+		+ > -	+	
P4	+ > -		-		
P5	+/-		-	+	

Direct impacts: travel time, travel costs and user safety

Starting with direct impacts, the common view was that travel time increased during the constructions, which had an effect on the lives of people as they spend a bigger part of their day on commuting. For one participant, this was a terrible time. Another interviewee stated that this was mainly a problem for car users, as the constructions were blocking the roads, whereas someone else said mainly poorer people experienced disadvantages from this as the BRT system were built in their neighbourhoods. As the construction took a lot of time, these impacts stayed for a while. When the BRT was finally implemented, most people experienced a real decrease in travel time, especially when comparing it to the time the same distance would take on a normal bus. This was stated by multiple interviewees as having a positive impact on their lives. Although it was mentioned that the bad punctuality of the BRT can be a problem, this was the same for normal buses. One interviewee thought that the travel time for car users would also have been decreased, as the buses were removed from the normal roads. Only one person talked about the role of travel costs, stating that transportation in Rio is expensive either way, so people have no cheaper option than BRT. To really serve lower socio-economic groups, this person believes the BRT system should be made freely available for them. With regards to user safety, the BRT system was praised at the start. The fact that BRT have their own stations was seen as a positive characteristic, in contrast to normal buses which only have a stand on the street. One interviewee explained that in Brazil, there is a lot of violence and robberies. Not only do the new BRT stations with doors mean you have to get a ticket before you can get inside, each BRT station also has its own security guard, someone who sells the tickets, so the safety for users really increased.

Indirect impacts: accessibility, employment

Looking at indirect impacts, an improvement in accessibility was mentioned a lot. As was explained, most job opportunities are concentrated in the city centre, which was hard to reach for people living far away before the BRT was implemented, sometimes having to use three or four different buses in order to get there. Not only does the BRT in this way save a lot of time for people, at the same time it increases accessibility for them. One person discussed how before BRT, sometimes people would be

turned down for a job because they would take too long to arrive. By connecting people to other transportation modes, for example the metro, it has connected the city better. This also resulted in gains for other socio-economic groups:

It brought innovation for all the economic groups in here, because the worker could get to their job faster and safer. And the CEO of the company could get his workers coming in safety, in the proper time (P3).

However, someone stated the system is not as broadly covered as it should be, and that it should be expanded further. The South Zone was said to be left out, however that already has various other public transportation options and small streets, so the BRT would be more of a problem than a solution. Lower socio-economic groups were thought to benefit most from BRT, because of the places it now covers and because they are considered to be its main users. BRT employment options were not noticed by the interviewees as having an effect.

Changes in direct and indirect impacts over time

From the information from the interviews, it can be said a lot has changed since the beginning of BRT in Rio de Janeiro. Many of the stations are said to be in a bad state and sometimes even abandoned, especially in poorer areas. Some lines stopped working, in addition to no more maintenance of the stations. This causes people to have longer travel times, having a negative influence on their lives. As many normal buses disappeared, they are now left with zero options. One interviewee talked about how this leaves a feeling of sadness, disappointment and anger among the residents, leading to an increase in violence in the city. The stations transform into local dangerous places, principally in poorer areas where people feel the government has forgotten about them. People who do use the BRT feel exposed to dangerous people, illustrated by this quote:

It's terrible everywhere, it's not good. Because you cannot walk through comfortable, you cannot go self-confident. You are always scared about people. If you say hello, you don't know what they think about. So this violence is not good. For no one (P4).

This sentiment was shared by other interviewees:

All the stations are broken, you cannot take one station freely, if it doesn't have the security or somebody with you to go there on the station, you cannot stay there alone (P3),

while someone else would often take an uber instead of the BRT because of safety issues. A friend of hers used to take the BRT stopped doing this because of the same reasons after she had a baby. This has to do with another safety problem, namely the fact that the buses are too crowded, which became an even bigger problem during the current pandemic. People are required to wear face masks, but at the same time are packed in a bus. Especially poorer people are affected by this, as they often have no other choice but to go to work. According to P2, this is something everyone talks about, even the media. P5 agrees and states this is the fault of the government, as they built the BRT without thinking about the number of people who would use it, resulting in inhumane conditions. In addition, you have to wait until several buses have arrived as the first ones are often too full, and when you enter it is still too crowded. Together with the bad quality of the buses, this can lead to accidents on the road:

So all of the buses are full and when you take a full bus of the BRT, it's really really complicated. There was an accident like four weeks ago I think, the BRT hit a car and the BRT fell over. This accident was pretty bad because the BRT was full and it is connected with two

parts. It's like the BRT are two cars connected together by sort of a fabric thing. So this middle part, that connection between them, it's real fragile right now because the BRTs are so used, so you cannot stay there for much longer because it gets really scary when you get there (P3).

Another consequence of the lack of maintenance is that people forcibly break into the glass doors of the stations, resulting in homeless people living in the stations. One person witnessed stations being put on fire in order for the homeless people to stay warm. In addition, he also saw a part of a station catch fire, which may have been the result of an electrical failure. An interviewee explained that the security that first increased safety at the stations, later became ineffective as the workers are not armed and have little authority. With regards to accessibility, the BRT did connect the city in a spatial way, however one interviewee stated it has in fact diverted people socially. According to P3, higher socio-economic groups started to complain when more and more people arrived at 'their' beaches, suggesting they brought along an increase in robbery. The BRT was thus said to be bad for 'their' areas, by connecting to the poor parts of the city to them. Furthermore, it was said the government used the Olympics to promote their lives, and a big part of the population, especially the poorest people, were left behind in the name of this progress. In addition, the interviewees felt the interests of the Olympics were placed higher than that of the local population:

It's completely different, it's another atmosphere, the whole goals of the city are different, and everything is made looking forward to that event, and how to attend it and how to place the people and the athletes and make their experience as great as possible (P1).

5. Discussion

The findings of this research suggest that although the BRT first did have positive impacts on the lives of its users, specifically with regards to travel time, user safety and accessibility, these impacts have now disappeared mostly, making place for negative effects. During the constructions, travel time increased for both users and non-users, meaning society as a whole experienced disadvantage from this. The interviewees gave contrasting answers on who was mainly impacted by this, so no conclusions are drawn from this. However, the information of the interviews made clear that after the constructions, travel time first decreased greatly for its users, enabling them to arrive much faster at their destinations. Car users were also said to benefit from BRT having its own roads, in line with previous research (Cervero, 2013; Cervero and Kang, 2011). However, as these studies have found bus users gain more in travel time, this can be said to contribute to transport equity. In addition, BRT users were able to reach more parts of the city which increased their opportunities. Although it was mentioned that employers also benefit from this, the increase in accessibility impacts the lives of lower socio-economic groups more. Due to added security at the BRT stations, their safety was also enhanced. As travel costs neither had a positive or negative effect on its users, and as BRT employment was not explicitly mentioned, these two factors are deemed to have a less important effect and therefore not affect transport equity significantly. Based on the three positive impacts, the BRT would be likely to positively impact their mobility and quality of life, thus contributing to transport equity.

However, the interviews all showed the same pattern in that the BRT currently is in such a bad condition that the progress in travel time and user safety no longer apply. In fact, travel time has in some cases increased due to defect stations and overcrowding. This also leads to dangerous situations, both inside the buses and on the stations. During the current pandemic, these developments only worsened. The positive effects on transport equity thus mostly vanished. The

reasons behind this align with previous research, which found that Rio's BRTs were designed and implemented on an ad hoc basis for political gains, without paying attention to travel patterns and travel demand estimations, hindering more equitable urban development (Kassens-Noor et al., 2016).

6. Conclusion

In this study, the direct and indirect impacts of the Bus Rapid Transit system, implemented as part of the Legacy Projects of the 2016 Olympic Games, on transportation equity in the city of Rio de Janeiro were examined. The focus of the research was on vertical equity, and on finding out whether BRT improved the mobility and quality of life for lower socio-economic groups. This was done using interviews with five residents of Rio de Janeiro, that provided insights into their local experiences, feelings and opinions regarding BRT. As a consequence, many residents were left unheard, however the goal of this research was to explore local feelings and experiences with regards to the BRT system and how they have changed over time, giving a preliminary impression of the mobility impacts on different population groups in Rio de Janeiro.

As the interviews demonstrated a shared view, I conclude it is safe to say that the BRT system was unsuccessful in fulfilling its promise of serving the needs of the lower socio-economic groups in the city, thereby failing to contribute to transportation equity in the long-term. This is in contrast with the start of the BRT implementation, when BRT seemed to bring positive effects on the lives of its users as expected based on previous research. BRT increased the accessibility of lower socio-economic groups, especially to the city centre, thereby expanding their job opportunities. In addition, there were gains in user safety and travel time. As lower socio-economic groups, its main users, benefited most from this, the infrastructure project could be considered equitable. However, the lack of maintenance and attention to poorer areas resulted in a reversion of the positive impacts. This led to safety problems and feelings of disappointment, with as consequence an increase in violence and tensions between lower and higher socio-economic population groups. In its current state, the BRT system can be considered to have a negative rather than a positive impact on transport equity. Political interests and short-term planning played a role in this, conforming to previous findings in the city of Rio de Janeiro.

Given that the current pandemic worsened the circumstances, it is important to see if the situation will improve after the pandemic. Future researchers should therefore consider investigating how the situation evolves in the coming years. Regardless, the results of this study point to the need for a solution for the group of BRT users that have no other transport option. If more stations become unusable, this will seriously harm the mobility of more residents. Therefore, another future research recommendation is looking into developments behind the scenes, namely how the needs of local residents can be better incorporated in governmental decision-making in Brazil and other Latin-American countries, for example by citizen participation.

Reflection on the research process

Looking critically at the research process, some strengths and weaknesses present themselves. With the use of residents' perceptions, this research has added to the limited residents' perception studies with regards to the social dimensions of mega events and to user impacts of BRT in academic literature. However, I remain conscious of the fact that the city of Rio de Janeiro has millions of residents, and many people make use of the BRT. The interviewees all had access to a computer and were able to speak English, which is already a selected group of people. In addition, multiple interviewees stated that it was difficult to understand the situation without having visited the city.

However, by listening to a pattern in the data and not trying to make explicit conclusions about the whole population, I have tried to mitigate this limitation.

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Appendices

Appendix A: Interview guide

What is your age?

What period of your life did you live in Rio de Janeiro?

In which area(s) have you resided?

In which area/ neighbourhood did you reside during the Olympic Games of 2016?

What were your experiences with public transport before the Olympics-related investments?

Did you use it often and did it feel accessible to you?

How did you experience the constructions of and the changes made to the BRTS during the preparations and organization of the Olympics?

Did you experience hinder in your mobility? And did that hinder impact your life significantly?

Which of the TransOlímpica, TransOeste, TransCarioca are you most familiar with?

Did you feel the interests of tourist and athletes were placed higher than that of the local population? How come?

What were your feelings when you heard about the BRT system? Were you excited or doubtful?

Do you now experience the BTS systems as valuable for you? For others? For the city? Why?

Do you feel it has improved public transport used in relation to other modes of transport, such as car use?

Do you think the BTS investments eventually brought benefits for all population groups or benefited some socio-economic groups more than others? In what way?

Is there anything you would like to add?

Then I would like to thank you very much for your time and effort. As you know, you can always contact me if you have further questions or remarks.

Appendix B: Informed consent form



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 groningen**

Informed consent

Human Geography & Urban and Regional Planning

Consent form for the research project ‘The Impact of the 2016 Olympics in Rio and its Bus Rapid Transit System on Transportation Injustice’.

I was informed about the topic of this research. I was able to ask questions and my questions were answered to my satisfaction. I had enough time to decide to participate in the research.

My participation is completely voluntary. I can withdraw from the research at any time, without having to give a reason.

I give my permission for using the interview data for the following purposes: *bachelor’s thesis and presentation*.

I agree to participate in this interview.

Name and signature of research participant. Date.

I declare that I have informed the research participant about the research. I will notify the participant about matters that could influence his/her participation in the research.

Name and signature of researcher. Date.

Appendix C: Coding tree

