



- bachelor research -

Information services provided for public transport in Rio de Janeiro in relation to the 2016 Olympic Games

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Preface

After several weeks of research at the company IFluxo this report is written, in order to give more insights, backgrounds and options in possible improvements on information services in Rio de Janeiro for the public transport operator. This research is the result of several weeks of research in Rio de Janeiro, but also the result of four years study Civil Engineering at University of Twente.

During the ten weeks in Rio de Janeiro an important guide and discussion partner was my supervisor Warner Vonk. His enthusiasm and always positive view helped me to investigate and develop two search strategies: the scientific approach of research and the hands-on (company) approach. Both gave me valuable insights and both were necessary to complete this research.

But learning and researching is one result of this internship. Valuable insights also came from the daily live in Rio de Janeiro. Without my friends Danyllo, Thiago, Laurene and Viviane this internship wouldn't have been such a big success and this report wouldn't have been written with this much pleasure.

Last I would like to thank for my supervisor in the Netherlands, Karst Geurs, for reading and providing critical notes during the process; my parents and Mirjam for their support all these years and the University of Twente in general for providing me the opportunity to go to Rio de Janeiro.

Enschede, 14 November 2010

Executive summary

Brazil is a rapidly increasing economic superpower, the increasing welfare results in higher car use and declining use of public transport. The city of Rio de Janeiro, host of the Olympic Games of 2016, is experiencing this decline in public transport share. To maintain their mobility, improvements of public transport have to be carried out. One of the current problems of public transport is the quality of travel information. It is suggested that improvements of the quality of travel information can contribute to the quality of public transport and retaining the use of public transport.

This research has built a framework of how the quality of travel information can be improved, by using the Olympic Games. The Olympic Games are the largest sporting event in the world and allow cities to make large investments in infrastructure and public transport, giving the opportunity to improve, among others, the quality of public transport.

This framework is built by reviewing literature about the subject of Olympic Games, public transport and travel information. Based on these literatures a generic framework, about the users need for travel information in the different stages of their trip, is built. This framework is adjusted to the case of Rio de Janeiro and is verified with two in-depth interviews.

Olympic Games

The Olympic Games require intensive preparations. Organising the Olympic Games can be divided in three timeframes: prior, during and after the Olympics. Each period has its own characteristics.

Most important aspect in the stage prior to the Olympic Games is to take into account the period after the Games, the legacy period. During the Olympic Games everything has to be flawless. Each day 1.5 million extra trips will be made by the three Olympic transport categories: Olympic Family, Olympic workforce and tourists. The Olympic Family will need a reliable private transport network, where as tourists and the Olympic workforce will be dependent on public transport. And next to the Olympic traffic the regular city traffic needs to keep on moving. After the Games only the legacy is left. To maximize the legacy it is important to make more investments in accelerating already existing long term plans, and make fewer investments in realising plans just for the Games.

The Olympic Committee has to ensure flawlessly organised Olympic Games. This responsibility makes them problem owner of all aspects, and hence for the quality of travel information.

Public Transport and travel information

Public Transport is necessary to maintain the mobility in a city. Many different people use public transport for travelling. To make tangible results the users of public transport are segmented in four categories:

- Regular user
- Occasional user
- Tourist, speaks local language
- Tourist, doesn't speak local language

Each group has its own characteristics, the regular user, for instance, is sensitive to the actual condition of service and reliability, whereas a tourist is sensitive to ease of use. Different needs are also found on the quality aspect 'travel information'. The regular user needs actual time/place related information and

information about distortions and irregularities. Occasional user needs information about basic route and time information but also about irregularities. Tourist needs basic information about route and time. Travelling by public transport exists of seven stages, from origin to ride to destination. On each stage information about the trip can be provided and different sources can be used.

The long term effects of improving travel information are unknown.

Developing countries

All recent Olympic Games and upcoming games are organised or got interest from one of the BRIC (Brazil, Russia, India and China) countries. All these countries have growing economies and having increasing mobility. The developing countries often need large improvements in infrastructure and they can use the Olympics to accelerate their long term plans of mobility using the investments made for the Olympics.

Public transport is in developing countries mostly by bus and has a relatively high modal share, but as the welfare is increasing, the bus share is declining. The quality of the public transport is also relatively low, compared to the developed countries. But general conclusions on developing countries are hard to make.

Framework

With the previous results a general framework about 'which information in which situation should be provided' is made. This framework divides the need for information in three directions: characteristics of the user, the timeframe of the Olympic Games and the stage of the trip.

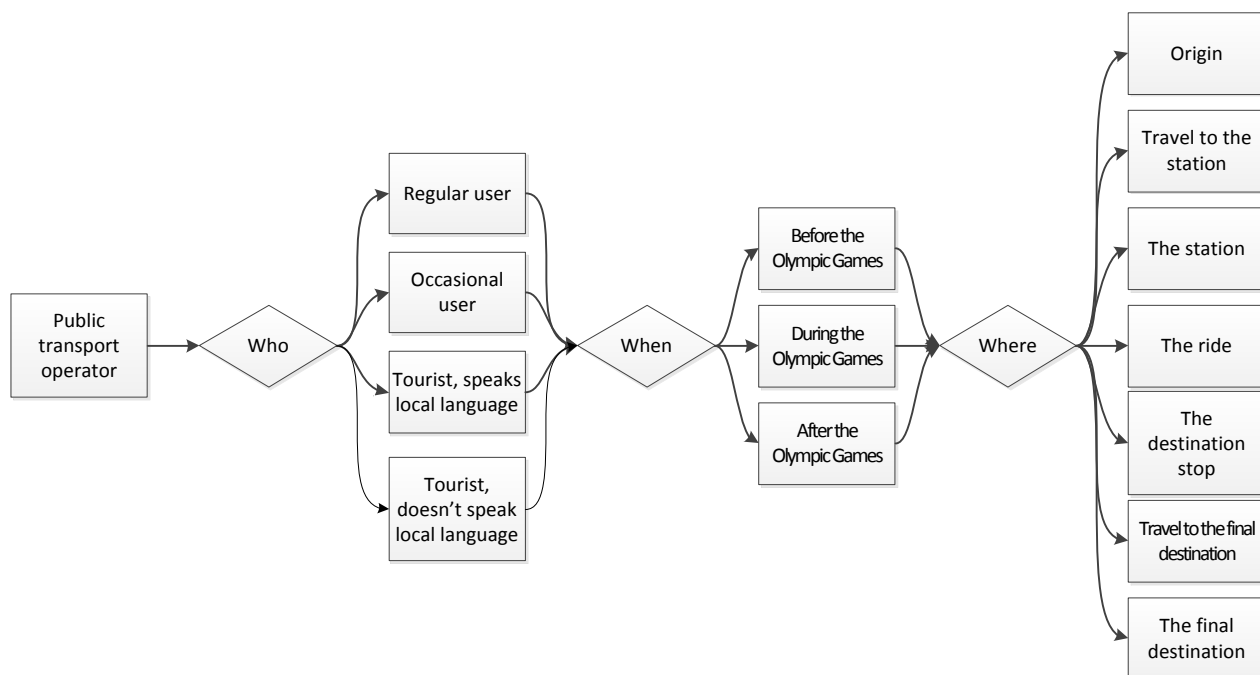


Figure 1: Different steps of information, when, where and for who.

The filled-in framework is added in Appendix B.

Rio de Janeiro

The previous framework is applied on the city Rio de Janeiro. Rio de Janeiro is host city of the Olympic Games of 2016. Public transport is mainly by bus; the bus is responsible for 71% of all daily trips. Recent declining bus passengers show the need for improving the system. Bus information in Rio de Janeiro is hardly provided and the transport is poorly accessible for tourists.

In two in-depth interviews with a public transport association and a specialist on transportation and mega events the framework is verified. They accorded to the need of improvements and saw too a useful guideline in this framework. Some remarks were given, first was that next to technical improvements also personal information is necessary. Second remark was the fact that using target groups is feasible for improving the service, but in practice only one information sign will be made. Remarkable was that the public transport operator don't consider providing information at the origin.

A good starting point for improving the travel information is with the developing of the new bus rapid transit lines.

Conclusion

Improvements of the quality of travel information in bus transport in the city of Rio de Janeiro are inevitable. Important is to provide the right information at the right place, customized to the need of the user. This must be done keeping in mind the practical aspects of implementation.

The Olympics are an excellent platform to accelerate the long term plans for improving transport. The Olympic Committee should initiate the improvements; the execution can be laid down at the associations for public transport operators.

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1. Introduction

Since the winning of the bidding for the Olympic Games¹ of 2016 the city of Rio de Janeiro has shown they want to be a city of world class. A city that is capable of hosting the largest sporting event in the world, the Olympic Games. In 2016 they have to show their capabilities, in sports, but also in organisation, construction and transportation. Public transport is a key factor to success in hosting the Games.

In Rio de Janeiro especially bus transport is very important. Nearly 7 million trips are daily made by bus. All these trips require information for users to make their travel decisions; some are easy, others are complicated and require more information. This research presents a theoretical framework to improve this information using the Olympic Games and applies this on the case of Rio de Janeiro.

1.1. Problem

The city of Rio de Janeiro has declining numbers of bus travellers. More and more people switch to private transport, due to the low quality of bus transport and increasing welfare of Brazil; resulting in decreasing mobility and accessibility.

The low quality of bus transport is partly due to the limited transport information. People have to rely on experience or information from people in the surrounding area. Formal information is hardly provided, making it hard to go by bus. The situation is unsatisfactory for large parts of the population according to the research of Vonk, et al. (2010).

The challenge is to improve this situation, to retain the users on the bus and maintain mobility of the city. One solution is presented, the arrival of the Olympic Games. With the winning of the bidding process they have committed themselves to organise a (almost) flawless Olympic Games. Withdrawing out of the Olympics would be a too great loss of their image; chaos and damaged Olympic Games are not an option. So it is necessary to improve on all aspects, one of the issues at stake is mobility. The Olympic Games bring large investments to the city and these investments can be used to accelerate improvements to the quality of the public transport and keep a good mobility (Andranovich, Burbank, & Heying, 2001).

1.2. Goal

This research provides a theoretical framework of the desired travel information for urban public transport in the three timeframes: before, during and after the Olympic Games. This framework is applied on the case study of Rio de Janeiro, host of the Olympic Games of 2016 resulting in specific conclusions and recommendations for the city.

1.3. Method

The research starts with creating a framework on travel information in relation to the Olympic Games. This is done by reviewing literature. The framework elaborates in three stages. First the impacts of Olympic Games on transport are studied. Secondly is zoomed in on urban public transport and thirdly is elaborated on one of the quality aspects of public transport: travel information. In combination with the influences of being a developing country and developing strategies the framework is build.

Secondly, the framework is verified and applied on the city of Rio de Janeiro. In this confrontation the differences between the framework and the Olympic Games of 2016 become clear. The confrontation is

¹ In general is meant with the organisation of the Olympic Games also the organisation of the Paralympic Games.

based on a contextual analysis and with two in-depth interviews with experts of public transportation and Olympic Games.

In the following diagram the steps and outline of this research is projected:

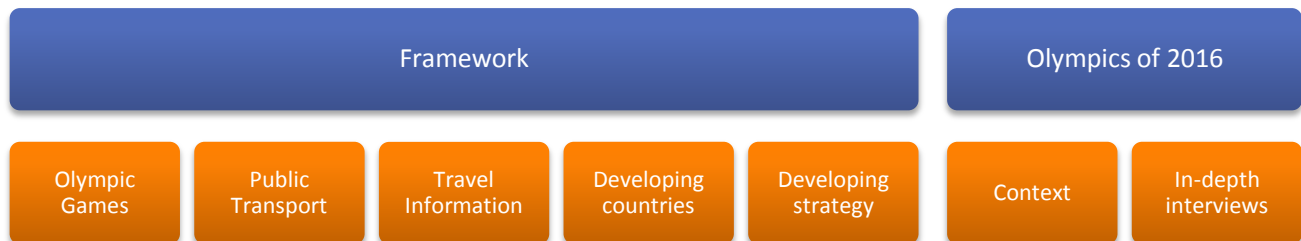


Figure 2: Research outline

The steps described above are executed by answering the following questions:

Central question 1: What is the role of information in public transport and how can improvements be made using the Olympic Games?

- What is the impact of Olympic Games on transportation?
- What is public transport, who uses it and how can it be influenced?
- What is public transport travel information and how is it used?
- What are the differences between developing countries and the developed countries, related to Olympic Games and public transport information?
- How can travel information be improved and who should bear the responsibility?

Central question 2: How can Rio de Janeiro improve its public transport information in relation to the Olympic Games?

- What are the Olympic Games of 2016 in relation to the public transport information in Rio de Janeiro?
- What is the opinion of experts on improving the public transport?

1.4. Outline

This research consists of 11 chapters. The chapters 2-6 elaborate on a framework based on central question 1. First will be given the impacts of Olympic Games on transportation (chapter 2), after this we will zoom in on urban public transport (chapter 3). From there the quality aspect travel information will be elaborated on (chapter 4). In chapter 5 the differences with developing countries will be explained. Chapter 6 develops a implementation strategy.

The framework is presented in chapter 7. Chapter 8 adjust and verifies the framework for the city of Rio de Janeiro.

The chapter 9-11 present conclusions, discussion of the results and makes some recommendations for further research and Rio de Janeiro

2. Olympic Games

Central question: What is the impact of Olympic Games on transportation?

The summer Olympic Games are the biggest sporting event in the world and ask for huge investments in infrastructure and venues. To successfully host the Olympic Games, a thought-out transportation plan has to be made. To transport tourists to the venues and hotels, but also to keep the city moving during the games. This chapter examines what the impact is of Olympic Games on transportation in the time stages before, during and after the games.

There are several studies about the effects of mega sporting events (like Olympic Games and World Cup Soccer). This study is focussed on the effects on public transport. Only summer Olympic Games are studied because of its much larger size compared to the winter Olympics. Olympic Winter Games sell around one million tickets; Olympic Summer Games sell about eight million tickets (Organising Committee for the XX Olympic Winter Games Torino 2006, 2008; Olympic Delivery Authority London 2012, 2009). Data of the most recent Olympic Games (Sydney 2000, Athens 2004, Beijing 2008² or London 2012) is used.

First general information about Olympic Games and organisation will be given, then second the influence on transport will be explained, in the third place we will learn the lessons from previous Olympic Games and fourth we will look to which provisions have to be made for the period of the Olympic Games. Finally a conclusion is drawn.

2.1. General information & Organisation

The Summer Olympic Games are organised every four years and the election as a hosting city takes place seven years in advance. The games go on normally for 17 days and take place in the European summer. During these 17 days several sporting events take place, surrounded by ceremonies and other events. But the attention for the Olympic Games goes beyond the 17 days; a city can count on 10-12 years of media coverage. From the pre- to post-Games period international media will follow the Games (Weed, 2008). Next to this the Games allow quick decisions and set out clear timelines to complete projects (Andranovich, Burbank, & Heying, 2001).

To organise a successful mega sporting event it is necessary to take in account the pre- and post-event period. Mega-events bring large media attention and give opportunities to invest in projects. But mega events, like the Olympic Games, only last a couple of days. Improvements and construction of venues and infrastructure are made for several years. This is why, if investments are made, most investments should be made for projects that are useable also after the event. From recent mega sporting events it becomes clear how important this legacy is. That is also the reason why more integral approaches have to be used (Shirai, 2009; Weed, 2008). In the period before the mega sporting event higher construction activity is noted, creating employment and impulses on local economies (Heurkens, 2008; UITP & ANTP, 2010).

Other effects of mega sporting events are (UITP & ANTP, 2010):

- The efficiency of the organisation of the city (or region) is demonstrated;
- The image of a city has been improved;

² The information about the Olympic Games of 2008 is very limited due to limited documents of the period prior to the Olympic Games of 2008 and evaluation reports are not yet available – the closed nature of the Republic of China is probably also of influence.

- Citizens of a city or region are more united.

2.1.1. Organisation

The period prior to and during the Games the Olympic Delivery Authority (ODA) bears the executive responsibility. This authority is a special organ from the Government and the National Olympic committee. They have been given special authority by Olympic laws and they bear full responsibility for the organisation of the Olympic Games. They make up the plans about roughly everything, from venue location to the selection of volunteers. For the transportation an extra committee is founded (Preuss, 2004).

It is the transportation committee's responsibility to make a sustainable and efficient flow of transport. They have to make sure that all the parties involved (different governmental institutions, Olympic Delivery Authority and the public transport operators) are cooperating and will implement the improvements needed for the Olympic Games. This responsibility makes them in fact problem owner for transport during the Olympic Games.

2.2. Transport stages of the Olympic Games

The Olympic Games require a very high capacity of the transport network. On peak days about 1 million trips extra are made next to the regular traffic. Recent Olympic Games don't allow private transport anymore to the venues. So the transportation for Olympic Games is fully dependent on the quality and capacity of public transport. No city had prior to the Olympic Games a sufficient public transport system to transport all visitors from and to the venues. This is why investments have to be made to improve the system of transportation on specific routes. It is, in general, not necessary to upgrade the complete network, while the Olympic Games only take place on specific places and main transportations will be between the venues, touristic locations and places to stay over (hotels, lodgings) (UITP & ANTP, 2010).

In my research on the transport of Olympic Games I identified three time-stages: the period before, during and after the Olympics. Prior to the Olympic Games long term plans are realised, giving the considerations of possible mobility growth after the Olympic Games due to increased tourism and economy. In the stage prior to the Olympic Games the preparation for the Olympics are also made. This has the following effects on transportation:

- Decreased capacity due to construction works
- Slight increase in demand due to construction employment
- Sometimes an increase in tourism is found prior to the Olympics (Weed, 2008)³.

Measures have to be taken to maintain the mobility. This should be mainly done by temporary measures and traffic management.

During the Olympic Games all the events take place and tourists come to the city, resulting in a large increase in demand. The transport system has to work flawless and construction works have to be finished. The period during the Olympic Games is especially elaborated in section 2.4.

After the Olympic Games the situation returns to 'normal', but with a possible increase in transportation due to more tourism and increase in size and welfare of the city⁴; resulting that a city has to turn in a permanent

³ Past Olympics show that it is possible to have more tourists in an Olympic city before and after the Olympic Games take place. (Weed, 2008).

better performance on transport. This is also the legacy period; permanent improvements will have to function normally without being oversized. Temporary measures will not be necessary, only in case of maintenance works.

In figure 3 the relation between time and demand-capacity is illustrated.

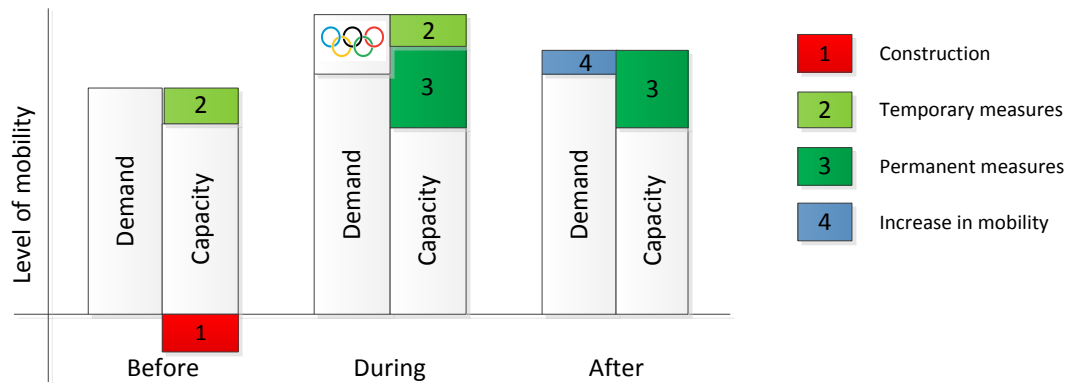


Figure 3: Relation between demand and capacity in relation to stages of Olympic Games (adapted from: Vonk, Hulleman, Berkum, 2009b)

2.3. Previous Olympic Games

Each Olympic Game has done an evaluation and much research has been done on the organisation and the legacy of Olympics. Recent Olympic studies show some important recommendations for upcoming Olympic Games. The most important ones on transportation will be noted here.

The importance of an integral approach, to take into account all the three periods, which means also the legacy period, is the most important lesson. Several Olympic Games have successfully used the Olympics in order to improve permanently the infrastructure without oversizing. The Games of 1992 (Barcelona) and 2008 (Beijing) are two success stories. The Olympic Games of 1992 had, with the organising of the Olympic Games, also as an objective to revitalize the complete city. They had taken into account the direct and indirect results of investments. For instance 42% of the investments were made by improving transportation; only a small part of the investments was used for organising the Olympic Games itself. This objective and being aware of the legacy period resulted in a booming economy in the period after the Games. The Games of 1992 still are a model for other mega events. So it is important to have a general idea about the optimal situation after the event and to know how the event can be used to make long-term improvements, that will last after the event (Brunet, 2005).

The Games of 2008 were also a successfully not in the least because plans of improving the infrastructure were already present. There are built for instance four new metro lines, delivered one year before the Games. And in the plans another 11 metro lines are planned and foreseen for the year 2015 (UITP & ANTP, 2010). This shows the need to make a transportation plan for a long term period and to use the Games to deliver projects on time.

⁴ The worldwide city population is still growing and increasing welfare results in a higher share of private transport. And after the Olympics it is possible to have growth rates up to 10% in tourists, but not all cities notice this result (Weed, 2008).

But there are less successful stories also known. The Olympic Games of 2000 (Sydney) had little thoughts about the post-Games use of the Olympic venues. This omission resulted in abandoned venues, oversized infrastructure and low economic profits (Weed, 2008; Cashman, 2006).

The Olympic Games of 2004 show two major failures. The first was the wrong legacy planning. The model and recommendations of Barcelona were used, but wrongly adapted to the local situation, which resulted in high expenses, dilapidated venues, and oversized infrastructure and not the economic growth fell behind as previously expectations thought. The second problem was the bad planning under which almost all projects laboured. Most projects were finished only months (or even weeks) before the Olympics, so there was too little time given or no time for margins for saturation. The oversized infrastructure and venues give however the opportunity for economic growth in the future (Gratton & Preuss, 2008; Weed, 2008).

Those examples show the need for adaption of the Olympic Games to the specific situation of the city and the country. This is also in line with the recommendations of the World Cup Soccer 2010. The ANTP (2009) has made a shortlist of items in transport planning:

- Use and optimise existing infrastructure;
- Unite the different involved organisations, creating an thoroughly thought-out plan;
- Information to the public. This is essential in image and use of systems, even more than high investments in techniques and capacity;
- Use the experiences of previous games, but also from local technicians and companies of the country itself.

Next to this one general recommendation is made every time: the integral approach of the period during and after the Olympics is essential in getting successful legacies to the city. The Olympic Games should be used to revitalise city aspects or bring long term projects forward. But large investments just for the 17 days need to be avoided (Heurkens, 2008; Essex & Chalkley, 1998; Weed, 2008; Zuylen, 2008).

2.4. Transportation during the event the Olympic Games

Two weeks before the Olympic Games the Olympic village will be opened, from then, until one week after the Olympic Games the transport system has to function at maximum performance. This is also the period that will be taken in account for this research.

To transport everyone smoothly from A to B a transport plan is made. The transportation plan of the Olympic Delivery Authority London 2012 (2009) is used for this research as a base.

This transport plan recognises four groups of travel during the Olympic Games.

- Olympic family (athletes, coaches, media, sporting officials and marketing partners)
- Olympic workforce (volunteers and professionals)
- Visitors of Olympic Games
- Background traffic (regular work or leisure traffic)

During the Games all groups are present and the city can have up to 1.5 million extra trips per day (Preuss, 2004). Each group will be explained below.

2.4.1. *Olympic family*

'Olympic Family' is the term used to describe all the people who play a part in making the Olympic and Paralympic Games happen. Generally, they will receive official accreditation during the Games. The Games Family is categorised into seven client groups. These are athletes and team officials, technical officials, press, broadcast, Olympic and Paralympic Family and marketing partners. These groups are essential to the Olympic Games and get the highest priority in travelling.

"They ... require fast, reliable and secure transport services between their accommodation and their destination. LOCOG will provide bespoke transport services appropriate to the needs of each client group." (Olympic Delivery Authority London 2012, 2009).

In previous Games there was a special Olympic Route Network (ORN) created, especially for the Olympic Family, to ensure this reliable network. This network was separated from regular traffic; or regular traffic was not allowed to use it.

The size of this group is currently estimated about 60.000 (Preuss, 2004); the Olympic Delivery Authority of London 2012 (2009) however estimates it already at 77.000 persons.

2.4.2. *Olympic workforce*

The Olympic Games are constructed mostly by professionals but during the Games it builds strongly on volunteers. These people guide the other groups to their destinations. They are essential in bringing high quality Olympic Games. In general this group will use the normal traffic modes to travel from and to the venues. In special situation private traffic is arranged. In Athens 2000 around 60 000 people volunteered, during Beijing 2008 this group existed of 1.7 million (100 000 for venues and 400 000 for the city) (BOCOG Beijing 2008, 2008). For London 2012 the size will be around 170.000 volunteers attracted (Olympic Delivery Authority London 2012, 2009).

2.4.3. *Visitors*

During the Olympic Games around 1.5 to 2 million people come to the organising city. Most people are from the country itself but a large part comes from the developed part of the world to encourage the athletes and enjoy the city. For the Olympic Games of London 2012 are around 7.7 million tickets available and at top days an extra 800 000 people will travel in London. An exact amount of trips cannot be given because of uncertainty in how many events a person will visit. The amount of trips will be mainly driven by the capacity of the venue or event. In past and future Olympic Games the following extra visitors are found:

Table 1: Number of extern attendees on Olympic Games (Preuss, 2004). *are estimates

Olympic Games	Out of city visitor (total)
1984 Los Angeles	770 000
1988 Seoul	240 000
1992 Barcelona	450 000
1996 Atlanta	968 000
2000 Sydney	475 000
2004 Athens	660 000*
2008 Beijing	660 000*

London 2012 has made estimations of the origin of the visitors using data of origins of visitors of previous Olympic Games. For the Olympics of 2012 it is expected that 33% comes from Great London, 42% from the United Kingdom and 25% from outside the United Kingdom (Olympic Delivery Authority London 2012, 2009)

Recent Olympic Games and also the upcoming Olympic Games of 2012 and 2016 will not allow visitors to use private transport to go to the sporting venues. Only public transport (free or with a valid ticket) is available to them. (Rio 2016, 2009).

Previous Olympics show that around 7% of the visitors have difficulties have to use public transport (Olympic Delivery Authority London 2012, 2009). For this group extra information or special transportation services has to be provided.

2.4.4. Background traffic

A city has to handle, besides the extra traffic due to the Olympic Games, its normal traffic. This is called the background traffic. It is equally important to keep a city moving during the Olympic Games. This is also one of the conditions for organising the Olympics. The normal background traffic differs a lot between the host cities.

Normally the background traffic is expected to be less during the Olympic Games because (Olympic Delivery Authority London 2012, 2009):

- People expect busier traffic, so they will travel on off-peak times or stay home;
- People are encouraged by the Olympic organisation to use public transport or not to travel.
- Previous Olympic Games saw a decrease of 20-50% in transportation in the city centres during the Olympic Games (Sydney 2000, Vancouver 2010).

2.4.5. Overview

In the following scheme all details are provided for the period during the Olympic Games:

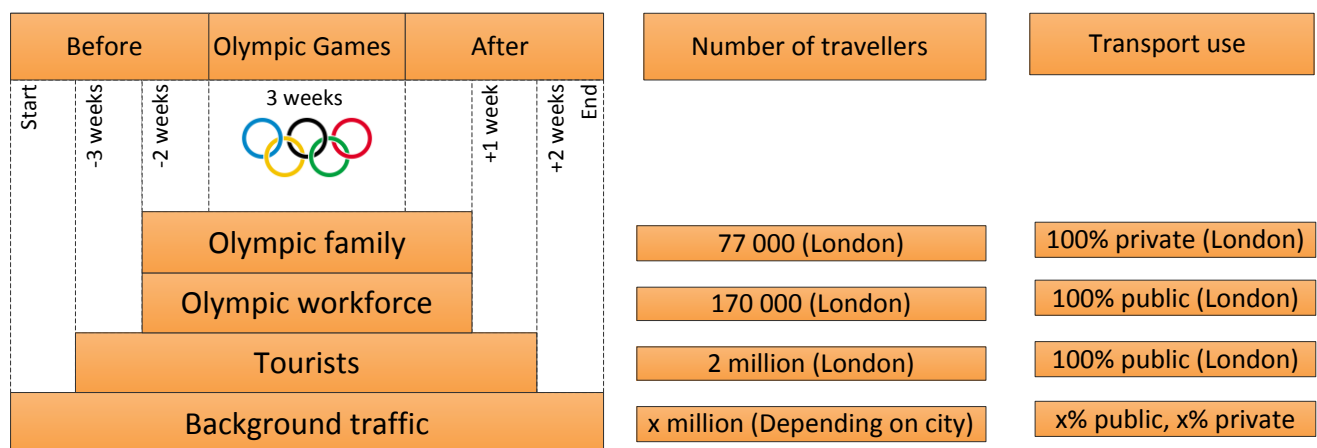


Figure 4: The relation between the different Olympic Groups and the stages of the Olympic Games

2.5. Conclusion

Organising successful Olympic Games is complex and requires intensive preparations in which three time periods have to be taken into account. The period before the Games has an increase in transportation and needs a detailed planning to have time for testing. During the Olympics 1.5 million extra trips will be made by the three Olympic transport categories: Olympic Family, Olympic workforce and tourists. The Olympic Family will need a reliable private transport network, where as tourists and the Olympic workforce will be dependent on public transport. And next to the Olympic traffic the regular city traffic will have to keep on moving. After the Games only the permanent investments will remain. It is to be expected that there will be an increase in transport and economy.

Previous Olympic Games show stories of success and failure and provide important lessons for upcoming games. The most important recommendations are: make an integral approach, adapted to the local situation of the city and to use the Games as an accelerator for existing long-term plans instead of creating new plans. When making the plans, use expertise from previous organisations but use also local expertise. And try to optimally use the current system, before creating infrastructure especially for the Olympics.

3. Public Transport

Central question: What is public transport, who uses it and how can it be influenced?

This chapter is zooming in on public transport. Public transport is one of the key parts in delivering the Olympic Games. All visitors will use public transport during the Olympic Games, but as shown before, the stage prior and after the Games is also of high importance. This is why first normal situation in public transport will be explained; in several aspects the link to the Olympics will be made.

Central question in this chapter is what do we mean by public transport, who uses public transport and how can it be influenced. To answer this question first a general idea of urban public transport will be given (§3.1), second the users of public transport will be highlighted (§3.2) and finally will be elaborated how public transport can be influenced (§3.3).

3.1. General information about public transport

Public transport is the collective name of all transport that is public, has a timetable and is driven along a fixed route for a fixed price. Public transport varies in form, from minivans to light-rail to high speed maglev trains. In this research only urban public transport is considered, because Olympic Games take only place in one city. There is no difference made between different forms of public transport. Examples of urban public transport are bus, light-rail, underground and sometimes heavy rail (train).

Travelling by public transport exists of different parts, from origin to station, the ride, from station to final destination. Between each part of the journey travellers have to switch from means of transport, for instance switching from travelling by foot to travelling bus or from bus to train. Three phases and four places of public transport have been identified:

1. The origin (e.g. home, work, shopping centre)
2. Travel to the station (e.g. travel from home to bus stop)
3. The station
4. The ride
5. The destination stop
6. Travel to the final destination (e.g. travel from bus stop to work or home)
7. The final destination (e.g. home, work, shopping centre)

On each part of the journey information can be provided.

3.1.1. Quality of public transport

Vonk, Berkum, Bodmer, & Hulleman (2009a) have researched the literature for the quality aspects of public transport. They came up with seven performance aspects and two supporting aspects. The supporting aspects support the performance attributes which leads to a certain image and perception of the public transport service. For instance: communication and information is one of the supporting aspects, it certainly influences the perception of the trip but does not directly contribute to make the trip. Each quality attribute can be influenced by involved parties.

Table 1: Quality attributes of public transport (source: Vonk, et al. 2009a)

Quality attributes	Definition
<i>Accessibility (availability in space of a mode)</i>	Easiness of access to the transport system and the activities

Quality attributes	Definition
<i>Frequency (availability in time of a mode)</i>	Index of occurrence of the transport service within the time interval
<i>Ease of use</i>	The degree to which travellers spend affective and cognitive effort on a journey by public transportation ⁵ .
<i>Travel time</i>	Period necessary to fulfil necessary activities for the displacement between an activity and another one.
<i>Comfort</i>	Material welfare referring to the service offered, in relation to the expectations of each one
<i>Price</i>	Value established by a political decision based on contractual definitions and/or skilful analysis
<i>Safety</i>	Confidence of the commuter that he will be protected against accidents that will affect his physiological or psychological integrity
<i>Reliability (supporting)</i>	Minimization of uncertainty of the commuter in relation to the effective service delivery according to pre-defined requirements.
<i>Communication & Information (supporting)</i>	Information that customer receives, through different communication media, about the transit company contributing to his perception of the service and company

3.2. Users of public transport

The urban client is the actor that uses the public transport service (i.e. paying customer), provided by the public transport operator (i.e. providing company). The urban client has one thing in common and that is they use the public transport service, but the needs and demands of the urban client are diversified. To recognize the differences and make services more effective, market segmentation is suggested (Weggemans & Schreuder, 2005).

Several ways of segmentation are suggested, Krizek (2007) has described the transit market in a unique way by dividing it into eight groups, based on their current habits and the potential of using the public transport. As shown before, improvements in information can lead to an increase in use of public transport. See the following diagram:

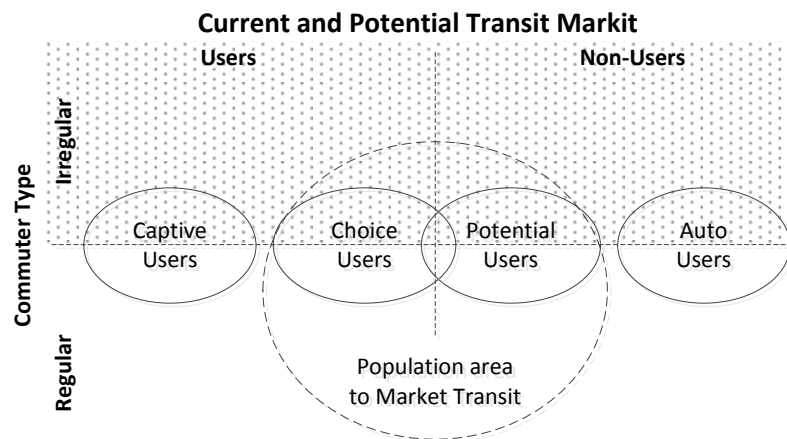


Figure 5: Segmenting the public transport market in 8 groups (source: Krizek & El-Geneidy, 2007)

⁵ “Low affective effort means feeling comfortable, experiencing pleasure and convenience accompanied by feeling secure and perceiving less stress. Low cognitive effort is defined by the system being easy to learn, providing high quality information and reliable services. Ease-of-Use is when it simply fits with people’s imagination of traveling. The effort that has to be spent matches the effort people are willing to spend for their journey” (Dziewan, 2008).

Captive public transport users and ‘population area to market transit’ are interesting for making improvements to information. Captive auto users are hardly a market for the public transport operator (Krizek, 2007) and private transport is excluded for travelling from and to the Olympic Venues, for these reasons captive auto users are excluded from this research.

The report of Weggemans and Schreuder (2005) shows similar criteria for segmenting users. They recognise situation specific differences also as a segmenting criterion. In the case of the Olympic Games it is supposed that speaking the language and knowing the local public transport system are specific criteria.

On the base of market potential and the segmenting theories above the following criteria are supposed:

- Captive or non-captive to public transport in the Olympic city
- Regular (over 2 times a month) or irregular user of public transport in the host city⁶
- Speaks local language
- Used to the public transport system of the host city.

Based on this five criteria four user profiles are made.

Table 2: Different user profiles

User profile	Person 1 (Regular user)	Person 2 (Occasional user)	Person 3 (Tourist, speaks local language.)	Person 4 (Tourist, doesn't speak local lang.)
Captive/non-captive	Captive	Non-captive	Captive	Captive
Regular/irregular user	Regular	Irregular	Irregular	Irregular
Speaks local language	Yes	Yes	Yes	No
Used to the public transport system	Yes	Yes	No	No

As shown it is assumed that ‘the regular user’ and ‘the occasional user’ don’t visit the Olympic Venues or if they do they are included in the group of ‘tourist, speaks local language’.

Below the four groups will be expounded, each with respect to their characteristics on Public Transport and the Olympic Games. In the framework in chapter 7 the users will also be related to travel information, travel information will be elaborated in chapter 4.

Person 1 (Regular user)

This user uses the public transport on a regular basis and is captive to the public transport. He is known to the system and speaks the local language. He is sensitive to quality aspects ‘service reliability’ and ‘state of service’ (Krizek, 2007).

In the categories of the Olympic Games he belongs to the group of background traffic. In the stage before the Olympic Games this group has to be informed about detours or other irregularities. During the Olympic Games it is important to influence his behaviour for travelling less to ensure a smooth traffic flow during the Olympics. After the Olympic Games this group will have the most profit of improvements made to the public transport system. Improvements are the most valuable on the quality aspect of reliability and state of

⁶ A regular user uses the system on a regular basis, given a specific route and timeframe. A user can be irregular for other trips; for instance on weekend trips or trips to unknown destinations. In this case the regular user has become an irregular user.

service information. In else this means information about the actual service, time information and distortions, and less information about basic map and route information.

Person 2 (Occasional user)

This user is non-captive and is for this reason a choice rider. He has the option to use public transport but can also use private transport for making trips. He is known to the public transport system but does not use it on a regular basis. He speaks the local language. This group belongs to the potential market of public transit and values almost all quality aspects, but mostly related to reliability and comfort (Krizek, 2007).

In the categories of the Olympic Games the group belongs to the group of background traffic. In the stage before the Olympic Games this group has to be informed about detours or other irregularities. During the Olympic Games it is important to influence his behaviour for travelling less or extra stimulated to use public transport to ensure a smooth traffic flow during the Olympics. After the Olympic Games this is a potential group to use more the public transport due to positive experiences and improvements made on the public transport system.

Person 3 (Tourist, speaks local language)

This user is captive to the public transport system; he has never used the system. He speaks the local language. This group is sensitive to the quality aspects: ease of use and information (Thompson, 2004).

In the categories of the Olympic Games the group belongs to the visitors. In the period before the Olympic Games they are not present, or only in smaller groups. During the Olympic Games they don't have any knowledge of the normal system so they need to have all the basic (and advanced) information about how to use the public transport system. After the Olympics more tourists will visit Rio de Janeiro, increasing the passenger totals of the public transport.

Person 4 (Tourist, doesn't speak local language)

This group is similar to 'person 3 (Tourist, speaks local language)', the same characteristics apply but there is one exception in accessibility to information. They can't use the information given in the local language and are limited in use of several information sources. In chapter 4 and 5 more detail will be given about travel information and the influence in developing countries.

3.3. Actors and influences

To improve information in public transport it is important to outline the relation between the urban client and the public transport operator.

Therefore firstly the most important actors and their relation will be outlined; In the second paragraph there will be especially elaborated on the public transport operator. In the final paragraph the relation between the urban client and the public transport operator will be deepened.

3.3.1. Actor outline

Many parties are involved in public transport. In general there are three main parties involved: the urban client, the public transport operator and the government. It differs per country how the relation between these parties is, if for instance more than one public transport operator exists or if there are unions. In this thesis the following model is assumed:

The public transport concessionaries provide, with advice and guidelines from the public advisory organs and the Federal Government, licences to the public transport operators, which makes it able to possess a

concession for operating a certain line. This line is operated by the public transport operator and used by the urban client. The Public Transport operator is often united in a transport consortium.

All these parties are in service of supplying public transport to the urban client. The urban client, sometimes represented by consumer organisation, demands certain services. The Olympic Games and other mega events can also be a demanding partner (for instance on quality or frequency).

In the following diagram the relation between all parties is presented. This research has further investigated the relation between urban client and Public transport operator; therefore they are coloured.

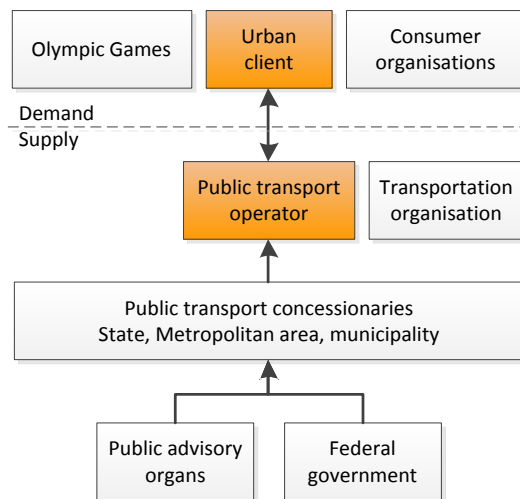


Figure 6: Relation between different stakeholders

3.3.2. *Public transport operator*

A public transport operator has several aspects which he takes into account for making his transport service. The aspects are the fixed assets (fleet, office), floating assets (fuel and tyres), overhead, personnel and regulations (i.e. fixed price, legislations). The fixed assets are dependent on size of the company and the floating assets are depending on personnel quality and driven kilometres. Overhead and personnel are depending on organisational structure. Regulations are externally determined.

These aspects combined result in a public transport service, characterised by the nine quality attributes.

3.3.3. *Relation urban client and public transport operator*

The relation between the urban client (demand) and public transport operator (supplier) is of high interest because of their direct relation.

The public transport operator has an input as stated above, resulting in the output of a public transport service (from a customer perspective), characterised by the nine quality attributes. These aspects result in a perception and image of the public transport service. The urban client decides, in combination with its personal situation, concerning personal characteristics (attitude, economics, profile, etc.), time and place, whether to use or not the public transport service. The outcome is a paid ticket price, a number of travellers on the vehicle, and a number of driven kilometres by the vehicles; for operators results this in revenue, for the urban client in a trip. Figure 6 shows a schematic representation of the above described relation.

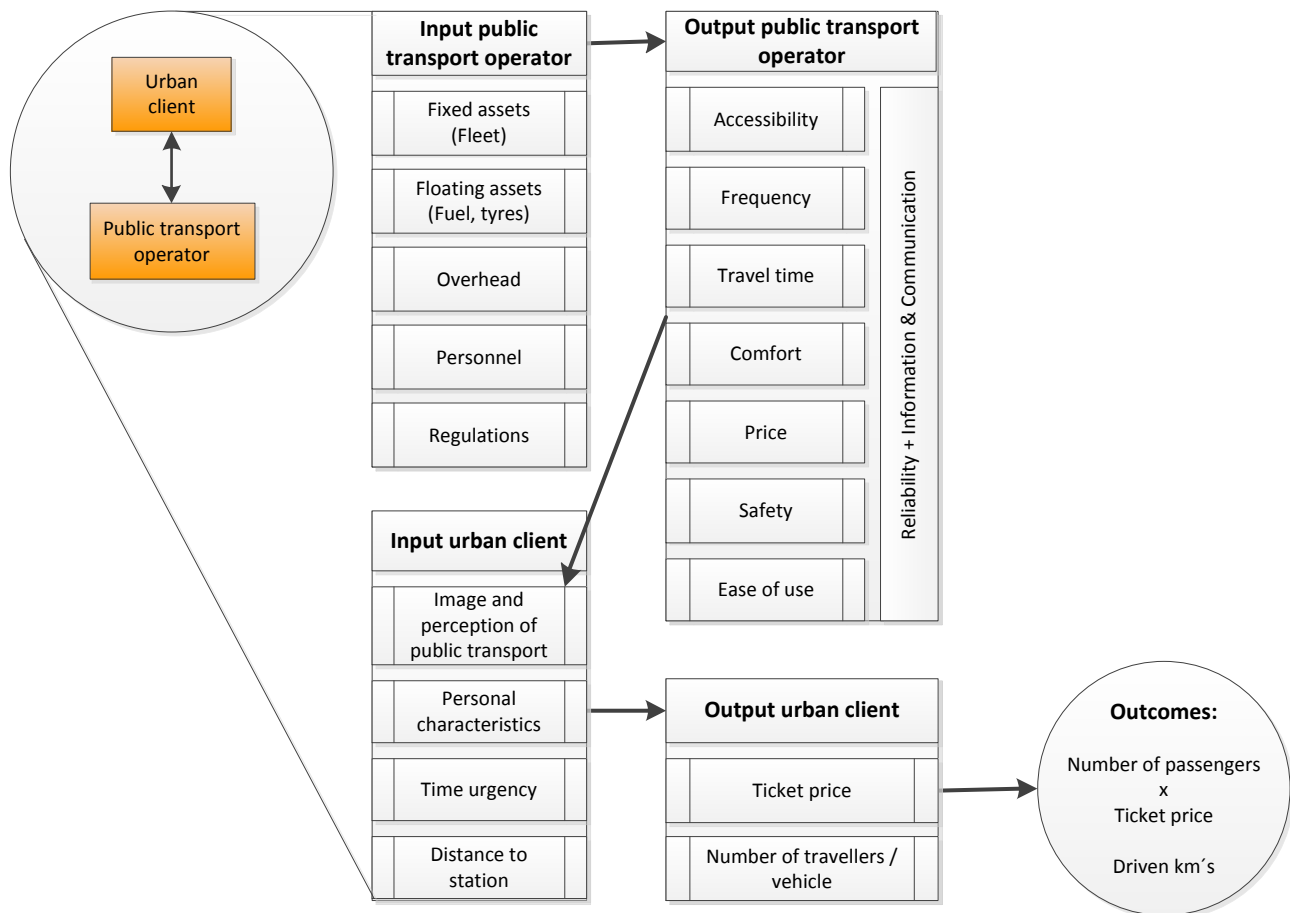


Figure 7: Relation between public transport operator and urban client stated in input and output

Each output aspect can be influenced by changing one of the input factors. A public transport operator can innovate the service in two ways: technics (influencing fixed and floating costs) and organisation (influencing overhead and personnel). Technical innovations are for instance providing real time travel information or introducing an entrance on buses for physically disabled. Organisational innovation is for instance the introduction of new policy requiring all drivers need to learn a common foreign language. Looked at why a public transport operator would innovate, three areas are identified (partly based on Ongkittikul, 2006):

- The innovation leads to lower costs or higher turnovers (i.e. economic profit)
- The innovation leads to a competitive advantage (e.g. improve due to a tender)
- The innovation is obligated from external areas (e.g. government).

From an urban client perspective the service of public transport can be influenced by:

- Changing the image and perception of the public transport operator (e.g. improve/inform about the quality aspects of the service)
- Economic stimulation (e.g. lower prices)
- Improving time urgency and distance to station (e.g. improve position of public transport over private transport)

3.4. Conclusion

Urban public transport is essential in delivering Olympic Games and the daily transportation in cities. The public transport operator is responsible for delivering the service; this service is used by the public (urban

client). The urban client values the service on nine quality attributes. These nine attributes result in an image and perception of the service.

To innovate and improve performance of public transport services it is essential to take along two points:

Firstly, *the* urban client doesn't exist. To make innovations work it is important to map out the needs and wishes of the different client groups. In relation to the Olympic Games four client groups are found, differentiated on the aspects of dependency (captive), regularity of use, control of the local language, and familiarity with the system.

Secondly, it is necessary to understand how innovations are developed. From a public transit perspective it has to lead to an economic profit, a competitive advantage, or it is obligated from government.

When implementing a service the following question should be asked:

- Who will use the service?
- What aspect will be improved?
- How can it be implemented?

4. Travel information

Central question: What is public transport travel information and how is it used?

Travel information is part of the quality attribute Communication & Information. This research limits to information related to make a journey – excluding marketing. Travel information range from basic time schedule to advanced personal real time travel information. It differs in time, place, type and technology. Especially the technology has become more interesting in the last years. The upcoming of mobile phones allow more personal travel information. The GPS and digital screens allow more information and in real-time on stops, stations or other places (Dziekan, 2008).

Providing travel information can have two goals. The first is to make the trip more convenient, by giving information about time, route, connecting services and surrounding areas. The second goal is to stimulate people to use public transport, mostly car drivers getting into public transport. For that the information has to make a comparison in quality and speed between car and public transport (Lyons & Harman, 2002; Chorus, 2007).

This chapter will start with giving a definition of information, following with a description of which information can be presented, how it can be presented, and how users process and value the information. In the last paragraph the effects of travel information are given.

4.1. General Information

Definition of information is, according to the Business Dictionary (2010): *“Raw data that (1) has been verified to be accurate and timely, (2) is specific and organized for a purpose, (3) is presented within a context that gives it meaning and relevance, and which (4) leads to increase in understanding and decrease in uncertainty.”*

This definition gives exactly the four aspects of using and giving the right information: the right information, in the right context, fulfilling a goal and resulting in a decrease in uncertainty or increase in understanding. Providing information has to accompany these four aspects. In the following three paragraphs all four aspects will be expounded. The aspect of accurate and timely with the right context is put together because both address the intrinsic quality aspect.

4.1.1. The right information in the right context

The quality of the information can be judged on four aspects according to Wang & Strong (1996):

- *Intrinsic: Accuracy, Objectivity, Believability, Reputation*
The information itself, is the information accurate and seems to be reliable.
- *Contextual: Relevancy, Value-Added, Timeliness, Completeness, Amount of information*
The context of the information provides the information a person wants to know at that moment.
- *Representational: Interpretability, Ease of understanding, Concise and Consistent representation*
Is the information provided also usable. Can a person understand the information and is it consistent with the other information provided.
- *Accessibility: Accessibility, Access security.*
Is the information accessible at the right place and right time.

These four aspects define the quality of the information.

4.1.2. Goals: announcing, motivating, educating, informing, supporting decision making

Information can be of high quality, as stated above, but has also to be communicated given a certain goal. There are five goals identified. Each goal has a different output.

Announcing: Promoting the service or aspects of the service;

Motivating: Attracting a service;

Educating: Making a change in behaviour;

Informing: Providing knowledge;

Supporting decision making: Clarify knowledge.

4.1.3. Value: decrease of uncertainty or increase of understanding

"The value of information lies solely in its ability to affect a behaviour, decision, or outcome. A piece of information is considered valueless if, after receiving it, things remain unchanged." (Business Dictionary, 2010)

The value of information lies in the fact that it can decrease the uncertainty, with the information a person can make a different (mostly better) choice or adjust its behaviour. When the effects of the choice are great or the change in the behaviour is big the information is more valuable. This is why information earlier in a project thought to be more valuable, because the room of choice is bigger.

4.2. Types of travel information

Travel information is firstly divided in what kind of information can be presented. Different research has been done by among others Rover (1999) and Graaf & de Hagoort (2000), they have researched what information a person could want about his trip. This has result in the following shortlist⁷:

- A. Necessity of reservation in advance;
- B. Location of boarding (e.g. bus stop, number of platform), including walking route;
- C. Location of transfer (including walking route);
- D. Location of alight;
- E. Time of boarding;
- F. Time of alighting;
- G. Accessibility of the vehicle;
- H. Safety of the route;
- I. Complete, most logical round trip with overall picture;
- J. Price of the trip, including validity and discounts;
- K. Actual distortions and deviations in respect to regular services.

This general list of travel information can also be diversified in location, for instance before the trip is made more information is needed (departure place and time, arrival time) than after the trip.

Chorus (2007) states that travellers want, next to time-related information, information about the 'soft' characteristics (e.g. comfort). Simpson (1994) has related the information to their importance. According to his research it is necessary to give first the basic time-place related information before giving more advanced (digital) information. Information about tariffs is important if there is no possibility for change. If the trip uses several modes of transport it is necessary to give information about the connecting transport, because

⁷ To this list often will be referred using the letters A-K.

this is one of the biggest barriers for using public transport. Chorus (2007) accords to the need of multimodal travel information, but states also that people prefer personal travel information.

The Dutch knowledge centre ‘Kennisplatform voor Verkeer en Vervoer’ (KPVV) (2006) has made a guideline which information that can and should be presented at bus stops to travellers. The following list is the result:

- Departure time
- Route information
- Information about tariffs and zones
- Dynamic information about the actual departure time
- Information about the surrounding area
- Information about how to file a complaint or suggestion
- A clearly visible phone number that can be called in case of emergency.

4.3. Sources of travel information

Multiple sources are possible for providing above information; often a combination of sources is used to provide travel information. Below, table 3, is a list of possible sources for providing information. The providing of information is classified in two ways, first in possibility of the given actuality, the second is in reliability.

For example, internet can give real-time information with a delay of just a few minutes, next to this the reliability is high due to the information often is provided by the transport company. People in surrounding area can give also real-time information (received from another source) but the reliability is lower because it is not provided by the transport company making it second handed information.

If it is possible to provide real time information (e.g. actual departure time), it is also possible to provide ‘delayed’ information (e.g. regular departure time).

In Chorus (2007) is stated that the degree to which information is used and the perception of the transport mode is updated is dependent to how the traveller perceives his reliability of his known information and the perceived reliability of the new information. Paulley, et al. (2006) makes a further notation by stating that information given by the official canals is less used and people more rely on own experiences or experiences from family and friends. So a difference in objective and perceived reliability can be found. Official travel information is often highly reliable but is perceived as relative unreliable, whereas unofficial travel information – experience, friends and family – is perceived as highly reliable.

Table 3: Sources of providing information in relation to actuality and reliability

Sources of retrieving information	Actuality/Delay			Reliability	
	Real-time	60min	1 day	High	Low
Leaflet			X	X	
Mobile internet	X			X	
Internet	X			X	
Phone	X			X	
Text message	X			X	
Friends		X			X
People in surrounding area	X				X
Professionals/employees	X			X	

Sources of retrieving information	Actuality/Delay			Reliability	
	Real-time	60min	1 day	High	Low
Analogue signs			X	X	
Digital signs	X			X	
Television/ Radio		X		X	
Announce	X			X	

4.4. Acquainting travel information

People treat the acquisition of travel information as a cost benefit analysis. The acquainted information has to lead to a bigger improvement in benefits than in costs (Chorus, 2007). For example: the time spend on searching information (cost) has to lead to a decrease in uncertainty in travel time (benefit). In general the literature states that the willingness to pay for travel information is very low. *“As public transport users mostly feel that they have already paid for information provision by buying a ticket.”* (Chorus, 2007).

Travel information is acquainted in two ways: active and passive. Active means people actively search for the information and use it or not. Passive acquisition of information means information that is presented to the traveller without asking. The traveller didn't actively searched for it. The newly found information is used to update his perception of the transport mode (Chorus, 2007).

Information can be acquainted before the trip is made and during the trip. The first decision is to make the trip and with which transport mode (pre-decisional information). If this decision is made, detailed information about, for example, departure platform and time is necessary (post-decisional information). Each acquainted information updates his or her perception of the transport mode and can make its decision different. This can be shown in the following diagram (Figure 8) (Chorus, 2007).

It should be stated that this is a theoretical model, in practice the pre-decisional information acquisition is passed without even paying attention due to habit. People have a certain preference which they retain and which is hard to change.

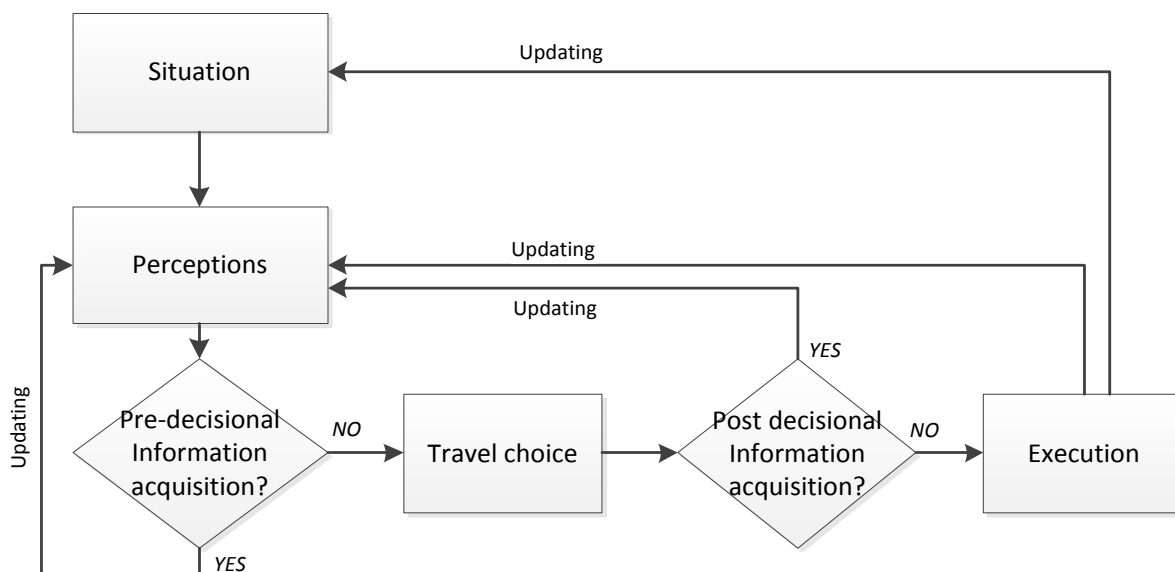


Figure 8: Iterative process of information acquisition and effect on perception and situation. Source: Chorus (2007)

4.5. Goal and quality of travel information

There are different criteria, as stated in paragraph 4.1 above, to which information can be judged. Hulleman, Jogems & Spittje (2004) adds two criteria specific for travel information. Firstly the information has to be adjusted to the capabilities of the audience to take on, process, and utilize. Second the information has to be adjusted to the needs of the audience (which information a user wants at what place). Lyons & Harman (2002) have translated these criteria into specific criteria for travel information: “travellers want reliable, clearly, unambiguous and comprehensible information that is accessible, complete and consistent, but most of all that is specific for his personal situation.”

On macro level it is possible to change travellers behaviour in relation to route, mode and departure time and place (Chorus, 2007); information has to be provided throughout the travel chain, but in the beginning the need and the possibilities are the greatest (Dziekan, 2008). On micro level, travel information updates the perception of the characteristic transport mode, in line with the iterative process of acquainting information of Chorus (2007). There is however no empirical research, to the authors’ knowledge, about travel behaviour and the changes due to improved information services⁸.

4.6. Users need for travel information

In line with the segmentation of the public transport market it is found that users value and need different information. In terms of regularity of travelling it is found that regular transit users are more sensitive to service reliability and the actual condition of service. Meanwhile irregular commuters tend to be more sensitive to basic information and availability of service (Krzek & El-Geneidy, 2007). Chorus (2007) found that the familiarity of the destination and the importance of the trip influence the induction of travel information. Time-arrival sensitive trips and unfamiliarity with the destination induces a higher willingness to acquire information. This is one of the reasons why business and commuter travellers (normally sensitive to the certainty of the arrival time) and leisure trips (unfamiliar with destination) gather more travel information – it should be noted that there is a difference in type of information they acquaint.

The value of information increases when information is more reliable, more relevant to the situation, trips have a high variety in conditions, and more travel alternatives are available (Chorus, 2007). Second to this information is more needed in the beginning of the journey, due to the bigger space of travel options (Dziekan, 2008). It is generally known that information provided in peoples own language is more useable, especially in complex situation and with time-pressure.

The research of Rover (1999) has converted the possible presented information into three classes of users: regular users, irregular users and tourists. A regular user that uses always the same route on the same time only wants information about actual distortions and deviations (K). Irregular users want also time, place, price, safety and accessibility information (A-K, excluding I). Where tourists also want a complete picture of the route map (A-K, including I).

4.7. Conclusion

Travel information is largely diversified by the needs and use of the transport service. The information needs to be in line with the need of the user.

⁸ The research of Chorus (2007) is based on simulations and stated preferences.

Regular users are sensitive to the actual condition of service and reliability, for this case they need information about actual arrival time and information about distortions and irregularities.

Occasional users can not completely rely on their experience, so they need to have basic travel information but also information about distortions and irregularities.

Tourists, speaking the local language, need information about the easiest route to their destination, they need to have basic time and place related information. Planned deviations are not interesting for them.

Tourist, not speaking the local language, need similar information as 'tourist, speaking the local language', but has more limitations on the use of sources.

To improve information services it is necessary to comply with the following rules:

- Give the right information for the target group – regular and irregular users need different type of information
- In the right way – tourists don't have all options of information available
- For the right goal – to attract or retain travellers. Users have a certain habit, but on long term it is maybe possible to change someone's habit.

5. Developing countries

Central question: What are the differences between developing countries and the developed countries, related to Olympic Games and public transport information?

In previous chapters mostly literature is used from developed countries. But recent and upcoming Olympic Games (2008: Beijing, Republic of China, 2014: Sochi, Russian Federation and 2016: Rio de Janeiro, Brazil) have taken or will take place in developing countries. Next to this public transportation is often different organised. In this chapter central is the question what the differences are in developing countries with the developed countries, related to Olympic Games and public transport information.

There should be noted that no exact definition is given of developing and developed country. In general is meant, in line with the United Nations (2010), with developed countries: Europe, Northern of America, Japan, Australia, and New Zealand. Developing countries are the other parts of the world.

Secondly the countries Brazil, Russia, India, and China are often referred as the BRIC countries. This group is an upcoming economic superpower. In total they populate 40% of the world population and a quarter of the total world land area; it is projected they gain combined a larger economy than the developed countries together (Wikipedia, 2010a). This group is taken as developing countries and in reference to the developed countries. Other, less developed, countries are not taken into account because of the low similarity and relevance to this research.

5.1. Olympic Games

All Olympics are organised by developed countries or one of the BRIC countries. Given the recent Olympic bidding processes, consequently one or more BRIC countries show interest in organising the Olympics.

- Brazil: 2004, 2012 and 2016 (organises)
- Russia: 2002, 2004, 2012 and 2014 (organises)
- India: none.
- China: 2000, 2008 (organised), 2010 and 2014.

In combination with the conclusions from chapter 2 it could be useful to organise Olympic Games, it can as said, accelerate plans and give years of international media attention. A country and a city can carry out long-term plans and have larger investments, which all are in the interest of the developing countries. There is only one large but, as it are developing countries large investments have to be made to accommodate all people, sports and transport. The Olympics of 2008 showed extreme high investments, officially comparable to the of Athens but critics show figures three to five times larger. The Olympics of 2008 had also a high political support for organising the Olympic Games, the country could show its capabilities in organising a mega event.

5.2. Public Transport and information

Zooming in on the public transport part of developing countries it is noticed that countries are more dependent on public transport due to the low car-ownership but shifts to more private transport is noted. Car use is increasing in all developing countries due to increase in income and welfare. This shifts results in lower traffic speeds in urban cities (Kutzbach, 2009).

In developing countries the public transport mainly exists of bus transport. In cities this is the case in Brazil and India; China and Russia have extended metro networks. The way bus system is used is highly dependent

on the city and country, in general the accessibility of the bus is low and disabled (approximately 10% of the population, 7% for the tourists of Olympic Games) are completely left out (Savill, Stone, Venter, & Maunder, 2003).

Another finding is that many developing countries don't use a timetable for urban public transport, making waiting times unreliable and low accessibility for people unfamiliar with the system.

The cities of Curitiba and Bogota have developed high quality bus transport systems, so called Bus rapid transit. These cities were highly successful because of an integral approach in which not only transportation is made but from a holistic vision in which next to transportation also spatial and green development is taken along.

On the subject of travel information in developing countries no general research is found.

6. Developing strategy

Central question: How can travel information be improved and who should bear the responsibility?

Improvements in transport information have to be implemented and be designed. This chapter outlines what steps should be followed to implement and design a new information service (paragraph 6.1). In the second paragraph is expounded which party should bear the responsibility for these improvements.

6.1. Steps to take

Based on the Dutch knowledgecenter 'Kennisplatform Verkeer en Vervoer' (2006) and Hulleman, Jogems, & Spittje (2004) the following list regarding the creation and implementation of information services:

1. Make clear what your goal is
2. Make a map of actors and define responsibilities
3. Manage and see how the financial aspects are
4. Create a planning
5. Think of the maintenance in terms of responsibility and flexibility (case of changes to the system)
6. Design the service
 - a. Collect the data
 - b. Design the model⁹
 - c. Develop the system
7. Implement
8. Test (feedback)
9. Implement on large scale

The usability of an information service is highly dependent on the quality of the design (Dziekan, 2008). Dziekan (2008) and Hulleman, Jogems, & Spittje (2004) give both a good idea about the points of interest in creating a design:

- Use clear symbols, clarify with text¹⁰
- Clear letter design
- Visualise maps as clear lines
- Think about colors, heights, distances, locations, lightning and order of information
- Be consequent in the information and the layout of information

These steps provide a basic idea to implement possible information services.

6.2. Responsibilities

The steps above should be executed by one of the parties involved in public transport. This is either the public transport operator, the concessionary (public transport authority) or a demanding party (Olympic Games or consumer organisations). But in any case, the public transport operator (or association) has to cooperate in providing data and, for instance, access to busses. In chapter 3.3 already became clear that the public transport operator will improve its service if it leads to lower costs or higher turnovers, leads to a competitive advantage or if it is obligated from external parties.

⁹ Dziekan (2008) has described in detail several design rules for travel information. It is recommended to take these guidelines along.

¹⁰ It is necessary to give at touristic locations the information in other languages also.

The theories stated that travel information has a limited effect on behaviour change (Chorus, 2007), not resulting in higher turnovers or lower costs. From that perspective it is suggested that individual public transport operators are not triggered to innovate from an economic perspective. The second way of improvement is by tender contracts. This is also not suggested because of the focus in tender contracts in developing countries is still on short term results and economic growth instead of quality improvements (Vonk, Personal communication, 2010). Only the third option remains open with the regulation from other (governmental) organisations.

Concluded can be that the concessionary (tender contracts) and the public transport operator will not start improving travel information. But a governmental organisation, as the Olympic Games, can give the impulse to start the improvements.

A second problem is faced; due to the complexity of public transport and the need for multimodal travel information, including connecting services, it is necessary to have a coordinating organisation for implementation. Therefore it seems feasible that not the individual operators but an association will be responsible for implementation.

7. Framework

The ideal situation presents an information system in which each user has full possibility of acquiring the right information at the right moment and he doesn't face any uncertainty or unreliability. From the perspective of the Public Transport operator the travel information is provided at the lowest costs resulting in the greatest increase in quality. From the Olympic Games also the external image and flawless road to the Games is essential.

The chapters 2-4 have resulted in a framework about which information should be presented to who. This is elaborated in the first paragraph. In paragraph 7.2 is more in detail given which information to the regular user should be presented. Paragraph 7.3 gives the conclusion for occasional users; paragraph 7.4 does this for tourists. The final paragraph gives information about the implementation process.

7.1. Overview

The theory earlier has stated the improvements diverse in several directions: the market is segmented in four market profiles (chapter 3) and the Olympic Games are divided in three time frames (chapter 2). Combining these two chapter and the characteristics of travel information (chapter 4) a profile for information need – from a user perspective - per person per time frame can be made. This is presented in the following table:

Table 4: Person characteristics in relation to time period and need for information

	Person characteristics	Before the OG	During the OG	After the OG
		<i>Building, deviations, improvements for OG, test stage</i>	<i>High traffic load, flawless system</i>	<i>Legacy period, 'normal situation'</i>
Regular user	<i>Sensitive to actual condition of service and irregularities</i>	Irregularities (EFK)	Irregularities due to OG (EFK)	Irregularities (EFK)
Occasional user	<i>Both, sensitive to actual condition of service and irregularities, but also to basic information</i>	Basics and irregularities (BCDEFGHJK)	Irregularities due to OG and basics (BCDEFGHJK)	Basics and irregularities (BCDEFGHJK)
Tourist (speaks local language)	<i>Needs basic information</i>		Basics (A-K)	Basics (A-K)
Tourist (doesn't speak local language)	<i>Needs basic information in common language or symbols</i>		Basics (A-K)	Basics (A-K) ¹¹

¹¹ The letters are responding to the list at paragraph 4.2, page 26 and are presented below:

- | | |
|---|--|
| A. Necessity of reservation in advance; | G. Accessibility of the vehicle; |
| B. Location of boarding (e.g. bus stop, number of platform), including walking route; | H. Safety of the route; |
| C. Location of transfer (including walking route); | I. Complete, most logical round trip with overall picture; |
| D. Location of alight; | J. Price of the trip, including validity and discounts; |
| E. Time of boarding; | K. Actual distortions and deviations in respect to regular services. |
| F. Time of alighting; | |

The user perspective implies that a user has the necessary information to make its trip. However, as demonstrated in chapter 2 the Olympic Games organisation has additional goals for providing travel information. They would like to have less trips been made during the Olympic Games, and if a trip has to be made it is preferably done by public transport. These goals go beyond the need for travel information and are therefore not taken into account. However, providing a more positive travel experience is taken into account.

Another discussion point is to what extent users will benefit from improvements. The regular user has lower needs for travel information and they are the most frequent users. Therefore improvements should be in the first place benefit the regular users. But, they also benefit from improvements in basic travel information. From that perspective improvements should be made in providing basic travel information, providing benefits for all users. To what extent the different needs should be recognised and especially information for regular users should be improved is subject for further research. In that research also the size of the groups and the potential benefit should be taken into account.

In appendix A is described in which stage the person has access to which source of travel information. For instance a regular user can use more sources than a tourist, not speaking the local language. Depending on the country and financial funding, it is possible to choose between 'basic' travel information and 'advanced' travel information. The difference is to what extent the public transport operator wants to comply with the needs of a user. With advanced information is meant the use of modern technologies and giving information by multiple (internet based) sources. The basic situation gives basic time/related information through only analogue signings. Advanced information complies perfectly with the needs of the user and uses multiple channels for providing information; it gives for example real-time information on a mobile phone. No research is conducted to the differences in complexity of implementation and costs of implementation and maintenance.

The complete framework is presented in appendix B. In this appendix the groups 'Tourist, doesn't speak local language' and 'Tourist, speaks local language' is combined, due to the small differences in need and personal characteristic. However, one large condition is made, information provided should be given in other languages (for instance: English, Spanish, Mandarin, or other relevant language) and use clear symbols. Otherwise this group is lost. This condition, as stated before, is sometimes even more important than providing high-tech information systems.

7.2. Improvements for regular user

The problem for regular users before the Olympic Games is the limited information about time and reliability, and given the upcoming major works on (road) transportation it is necessary to have information about these deviations (EFK). They have the possibility to access several types of information services (phone, computer, leaflets, personal assistance, local signs and mobile internet). Below is described the information needed for basic travel information. Thereafter is described the differences with advanced travel information.

It is recommended to introduce to introduce a basic phone service giving information about operating hours, frequency and especially information about planned deviations. Next to this give extra information on leaflets about deviations. Also prepare the users for the Olympic Games by active promoting the (legacy of) Olympic Games and the public transport, because they have to travel less during the Olympic Games – promoting travelling more by public transport instead of private transport is not necessary because they already are captive to Public Transport.

During the Olympic Games it is recommended to make sure people know the influence of the Olympic Games on the regular routes, for example the deviations and priority of the Olympic Route Network, they have to know the alternatives and be supported in not travelling. This can be done by giving extra information by the basic phone service, at the starting place give information by computer and spread leaflets throughout the city. Next to this give external incentives to travel less. During the Olympics travel special markings and leaflets on public transport stops give extra information about specific route deviations.

After the Olympic Games this group benefit from the improved information services, in the period after the Olympics they require almost the same information as in the period before the Olympic Games. Basic phone services operate with information about operating hours, frequency and planned deviations. At the starting place computer and leaflets are spread with the same information. During the complete trip information can be required by the phone service, direction and regulation signs. During the ride and at the destination stop extra attention has to be paid to appreciate people they take public transport.

In case more advanced media is used it is recommended to introduce a door-to-door service by phone, mobile internet and SMS. The basic information is also provided, where possible it is changed to digital screens giving real time travel time information – i.e. expected arrival times and actual distortion. A public-address system in the vehicle is introduced to give information about actual distortions.

7.3. Improvements for occasional user

Occasional users have nowadays the problem that very limited information is provided, leading to high uncertainties before and during the trip. Before the Olympic Games they have similar problems as the regular users: major road works influences the normal trips. Because of the irregular base they take public transport and given the Olympic Games information is needed about almost everything, except the system itself (BCDEFGHJK). They have the same possibility to access types of information services as regular users (phone, computer, leaflets, personal assistance, local signs and mobile internet).

It is recommended to introduce a basic phone service giving information about route, price, operating hours, frequency and information about planned deviations. Next to this give extra information on leaflets about deviations. Prepare the users for the Olympic Games by active promoting the (legacy of) Olympic Games and the Public Transport, because they have to travel less or use more the public transport (and no private transport) during the Olympic Games.

During the Olympic Games this group should use public transport on a regular basis. Give them incentives and appreciate people take public transport. Next to this they need to know the influence of the Olympic Games on the public transport system, for example the deviations and priority of the Olympic Route Network. This can be done by giving extra information by the basic phone service, at the starting place give information by computer and spread leaflets under people that live in the city. During the travel special markings and leaflets on stops give extra information about specific route deviations.

After the Olympic Games this group can belong to the regular users if they switch from private to public transport, due to a higher quality of public transport. In the period after the Olympics they require almost the same information as in the period before the Olympic Games. Basic phone services operate with information about route, price, operating hours, frequency and planned deviations. At the starting place computer and leaflets are spread with the same information. During the trip information can be required by the phone service, direction and regulation signs. During the ride and at the destination stop extra attention has to be paid to appreciate people they take public transport.

In case more advanced media is used it is recommended to introduce a door-to-door service by phone, mobile internet and SMS (PRTTI). The basic information is also provided, where possible it is changed to digital screens giving real time travel time information – i.e. expected arrival times, route map and actual distortions. In the vehicle public-address system and television screens are introduced to give information about upcoming stops and actual distortions.

7.4. Improvements for tourist

Tourist have nowadays the problem that very limited information is provided for travelling by public transport, leading to unattractive public transport and high uncertainties before and during the trip. Next to this is the problem they are not used to the transport system. Because of the unfamiliarity of the system they need information about basically everything, from route information to safety and accessibility (A-K). They have less access to types of information services as the others, they have to more rely on information provided on street signs or persons (phone, leaflets, personal assistance, local signs, and computer, in advanced also mobile internet).

Before the Olympic Games it is recommended to introduce and test different information services especially for the Olympic Games and the information. In the basic situation this means to introduce a basic phone service giving information about route, price, operating hours, frequency, accessibility and safety. Next to this give extra information on leaflets about basic information how the system works and the public transport in general. In basic they need all possible information as clearly as possible, they assumption has to be it doesn't have any knowledge about anything related to public transport.

During the Olympic Games they have to find their way smoothly through the public transport. It has to be clear where the venues are and how to get there. Information about the touristic location is also recommended. Information can be given by (special tourist) phone, internet and leaflets at hotels and venues, signs on streets and at stops, during the ride extra travel information can be provided. Next to this it is recommended to present service employees for personal questions. The information provided is similar to the information provided in advance of the Olympic Games, only adapted to differences due to the Olympic Games.

After the Olympic Games the public transport should be more accessible by giving information through computer, leaflets, phone services, signs and service employees about all basic travel information.

In case more advanced media is used it is recommended to introduce a door-to-door service by phone, mobile internet and SMS (PRTTI). The basic information is also provided, where possible it is changed to digital screens giving real time travel time information – i.e. expected arrival times, route map and actual distortions. In the vehicle public-address system and television screens are introduced to give information about upcoming stops and actual distortions.

7.5. Implementation strategy

The important result of the implementing strategy is that the Olympic Games or other governmental institute have to initiate the need for improvements, the execution should be done by one of the public transport associations, they have the information. The role between these authorities and the reciprocity between user and public transport operator is elaborated in paragraph 3.3.

When implementing a new service it is important to make clear what the goal is, for whom and in what budget.

8. Effect of the Olympic Games of 2016 for Rio de Janeiro

Central question: How can Rio de Janeiro improve its public transport information in relation to the Olympic Games?

The framework build in the previous chapters will be adopted on the city of Rio de Janeiro, host city of the Olympic Games of 2016. Several questions will be elaborated on. First, the context of Rio de Janeiro, including the Olympic Games of 2016 will be given. In the second paragraph the framework is verified with two experts. In the third paragraph the differences and necessary adjustments to the framework are drawn up. The final paragraph makes a brief example of the implementation process.

8.1. Context of Rio de Janeiro

The metropolitan city of Rio de Janeiro is one of the biggest cities in the world and the second city of Brazil, housing around 11.5 million inhabitants (IBGE, 2007). The recent economic growth resulting in increasing welfare and higher car ownership (Rio 2016, 2009) and declining public transport users (Duarte & Souza, 2006) is the city facing the challenge to bring the mobility to level. Next to this the city has to organise two major sporting events. The country hosts the World Cup Soccer of 2014 and the city hosts the Summer Olympics of 2016, both requiring an outstanding transport network.

But, these two events give the opportunity to improve the current situation and to accelerate current plans. In this case only is referred to the Olympic Games, the World Cup Soccer is not taken into account, but it is possible to use the results for the World Cup Soccer also.

This paragraph expounds first the background of the Olympic Games of 2016, second of public transport in the Rio de Janeiro and concluding with travel information in the city.

8.1.1. Olympic Games of 2016

This was Rio de Janeiro's third bid for hosting the Olympic Games, after failures for winning the bid to host the Olympics of 2004 and 2012, the bid of 2016 was won over the cities Chicago, Tokyo and Madrid (Wikipedia, 2010b). At the moment of writing the bid book is the only official document for the Olympic Games of 2016, this document is used next to existing studies on transportation in Brazil.

As in all recent Olympics all the Olympic visitors will have to travel by public transport, and the aim is also to have a decrease in private transport and increased use of public transport (or travel not at all) for background traffic (occasional and regular users).

The Games are concentrated around four central areas in Rio de Janeiro, each connected *'by a High Performance Transport Ring and dedicated Olympic Lanes, minimizing travel times. The venues include world-class existing facilities'* (Rio 2016, 2009). The connections will be made by building a new underground line and introducing several bus rapid transport lines. Over 5 billion US\$ will be invested bringing a permanent improvement for transport in the city. The new transport network is made to guarantee maximum travel times from and to the different Olympic venues. The public transport system will be transporting 0,5 million extra passengers on peak days during the Olympic Games, generating even more trips. The bus transport will be responsible of transporting 700 000 persons per hour in 2016¹². The BRT's will be possible to travel up to 72000 persons per hour per directions. Expected is that in a peak hour almost

¹² It is expected by Rio 2016 (2009) that there will be a decrease in bus transport due to intermodal traffic changes and extra investments in rail transport.

80.000 people want to leave Barra (Olympic village) at the same moment, in which the BRT has to take account for 96% of all the traffic. They form with the expansion and renewing of the railway services the centre key to the Olympic transport plan (Rio 2016, 2009).

The Olympic Traffic and Transport Division (OTTD) will be responsible for delivering this and is under direct state responsibility, and works in corporation with the ODA and city and federal governments. Two special agency's will be introduced ('OTTDS's Transport and Traffic Coordination Center' and 'Rio 2016's Games Transport Operations Center') will be responsible to ensure smooth traffic flows during the Olympic Games. They will use the improved existing city management centre and use a new 'Traffic and Transport Control Center' (CCO) (Rio 2016, 2009).

Next to this the Olympic Committee of 2016 has set its goal to provide real-time information to all spectators and local commuters by internet, radio and television. In-vehicle real-time travel information is not mentioned. Next to this they want to launch a special website and open information kiosks to facilitate all the daily planning of all people impacted by the Olympic and Paralympic Games (Rio 2016, 2009). There is not spoken about public transport information during the trip.

8.1.2. Public Transport

Transportation in Rio de Janeiro is characterised by four types of transportation: private car, taxi, bus or metro. From this the bus share is by far the largest, it is responsible for 71% of all the transport. This is why the case study is limited to bus transport, but most parts are also applicable to the metro and upcoming BRT systems.

The bus transport in the city is responsible for around 71% of all the transport, transporting daily 2.8 million people (Ônibus Rio, 2010; Fetranpor, 2009). The public transport authority gives concessions to the public transport operators, in total there are 47 companies having one or more concession to exploit a line. The 47 bus companies are united in the association 'Rio Ônibus', there exist nearby associations for different parts of the state Rio de Janeiro. They all are united in the federation 'Fetranpor'. Both associations represent the interests of the operators. This is in contrast to the representation of users. They are hardly represented by a consumer organisation.

The bus companies receive, in contrast with many European bus operators, no state subsidy. The only source of income is the travellers, making it deregulated market. The main goal setting for the bus operators is to make profit by travelling as many passengers at the lowest costs possible. Next to this the bus companies are keen on short term results and direct Return on Investment, this due to the recent history of hyperinflation (Vonk, et al., 2009a; Duarte & Souza, 2006). The public transport authority gives some basic regulations for bus transport (maximum prices, free access to elderly, disabled and students, accessibility for disabled, etc.).

The bus transport differs from high frequent traffic in the inner city (centre) to lower traffic in outer parts of the city. Buses don't drive on a timetable. The buses differ also in quality, the lowest quality are also with the lowest fee and don't have basic comfort standards as air conditioning. Higher quality buses range up to modern couches with comfortable seats and air conditioning and are often used for longer distances, but they also require higher fees. Fees are independent of distance or time and there exist no form of subscription or discounts. Almost all buses have a turnstile to secure the bus and count the number of passengers. Many buses have a driver and an extra conductor to decrease waiting time due to cash transactions. Recently a system of electronic payments is introduced (Sistema de Bilhetagem Eletrônica, SBE) and the system is increasing in popularity. This results in less money on board – increasing the safety – and

transactions are handled quicker (Ônibus Rio, 2010). Roads in Rio de Janeiro are of very low quality and show often holes and breaches in the road surface lowering the comfort during the trip.

Investments in marketing and service were low due to the thought that travellers mostly were captive. In recent years the growth of cars has been high, leading to a decrease in (captive) public transport users and making it harder to improve services (Duarte & Souza, 2006; Haarsman, 2009; Vonk, et al., 2009a).

In research of the NTU (n.d.), viewed by Haarsman (2009) it has been recognized that the public transport operator handles the fleet age, tariff and number of passengers per km as most important criteria (outputs) for its transport service. The quality aspects as stated in paragraph 3.1.1 is not used or at least it is not visible. In line with short term investments the floating assets (fuel and tyres) are of high importance. Long term planning (investment in better training of drivers) is rarely used – instead of this extra investments in motor engine prevention are made (personal communication, June 2010).

An important competitor for the bus companies are the minivans, next to the private cars. These minivans are illegal companies that drive around and serve as a minibus. They provide services that to places where, or at times when, normal buses don't drive. During the daytime they are often faster and so it's an important concurrent for the regular bus companies (Golub, Balassiano, Arau, & Ferreira, 2009). The study of Golub, et al. (2009) states also that the best way to decline the market share of illegal vans is to invest in regular public transport.

8.1.3. Travel information

The travel information in Rio de Janeiro is very limited. At home there exists the possibility of using several websites for travel information but these are not widely known (Nijenhuis, 2010). There also exists a book giving information about all bus routes. For travelling to bus stops there exists basic signs stating 'this is a bus stop', but these are not always present and sometimes hardly visible. In some cases also the passing route numbers are written on the bus stops. At busy bus stops, the bus stop also exists of a bus shelter, sometimes including basic information about routes – main stops information and line number only. In busy streets it happens that several bus stops are directly next to each other but without information which bus stops at which bus stop. Stopping a bus is done by raising a hand and drawing the drivers attention, without this buses drive by without stopping. Due to this and given the fact there is no timetable available, people have to be alert and are in high uncertainty about the state of the bus and the expected time of arrival (ETA), especially in low frequent areas (Nijenhuis, 2010).

Buses present in the front of the bus the bus line, final destination, main places passing, price and accessibility for disabled. In bus information is limited to the price and the regulations, sometimes stating the line number.

The result of this limited information provision or known systems, people are bounded to the information gain by experience or people in the surrounding area. Nearly all regular users know the main bus lines passing by and their route (Nijenhuis, 2010). For tourists, not speaking Portuguese another problem exists: most people living in the city, in particular elderly, don't speak English or another language than Portuguese.

8.2. Results of in-depth interviews

The framework presented in chapter 7 provides an idea of how improvements in travel information could be realised. To verify the framework two in-depth interviews are held. The first interview with Rafaela Romero¹³ has reviewed the impact of Olympic Games and the use of Olympic Games to accelerate existing long term plans. The second interview with Márcio Coelho Barbosa (superintendent of SETRERJ¹⁴) gave insights in the organisation of public transport in Rio de Janeiro and how innovations are implemented. Together they cover most part of the research. Central goal in the interviews was to verify the framework and how the framework should be adjusted to the situation of Rio de Janeiro.

Both interviews accord completely to the need for improvement on travel information and saw the framework as valuable for their work. The interviews made some additions or specific notes to the framework:

The most important result of the interviews was the discussion about systems versus people. As in the framework described, standalone systems cannot function, a system needs to be accompanied by professionals explaining and giving advice if needed. Márcio Coelho Barbosa accords completely to this need. In his day-to-day working environment many persons rely on technical systems instead of personal information. Within his region of Rio de Janeiro all bus drivers need to skill their English.

But in contrary of the need for information, his association is not providing any information before or after a trip is made, only is thought of information at stations and during the trip. Information about deviations or irregularities is not given. This is a flaw in the provision of information; a tangible solution was not reached.

Secondly he accords to the need of segmentation in information and accepts the different needs but realises that in practice only one sign will be made, giving more or less relevant information to all users.

In the interview with Rafaela Romero two aspects are discussed. The first aspect is the relation between the Olympic Games and mobility. Important conclusion is that in her opinion there is a growth in mobility for the Olympic Games as presented in paragraph 2.4. Secondly she added to the use of investments that an optimal relation has to be found in public and private investments. Her research found that in the case many public resources were used many permanent improvements were made; the relevance of this improvements is not discussed. In the case only private resources were used most money was used to organize the Games and no (or at least limited) permanent improvements were realized. This argues in favour for a mixed organization, wherein both, public and private, resources are used.

A notable example of her visit to the preparations for the World Cup of 2010 was the way a bus was stopped. In South Africa each neighbourhood has its own symbol. If a bus passes the person makes the symbol of the neighbourhood he wants to go to and the bus passes this neighbourhood it stops, if not, the bus will drive through and the person has to wait for the second bus. In this case only information about the symbols has to be provided. During her visit in South Africa it became also clear that speaking English or other relevant language is a necessity to manage all tourist traffic flows.

¹³ Rafaela Romero is transport specialist at Fetranspor, the federation for all bus association in the state Rio de Janeiro. She is currently researching the legacy of Olympic Games and has visit the preparations for the World Cup of 2010 in South Africa.

¹⁴ SETRERJ is the association of the 30 bus operators delivering the public transport in and between the cities of Niterói, São Gonçalo, Itaboraí, Tanguá and Maricá. In this area around 1.5 million people are transported daily by 3 000 buses.

8.3. Differences between framework and the city Rio de Janeiro

From theoretical perspective and the interviews it is possible to apply the framework developed. The theory of Rio de Janeiro and the two expert interviews approve the framework and no obstructions are found. In the theory and the interviews some differences between the framework and the case study of Rio de Janeiro are observed:

- The need for public transport information is similar to the framework, but there already exists websites providing travel information at home, this websites are simply not widely known, giving the need for marketing and promotion instead of developing new systems. On other stages of the trip the need for improvement is similar.
- The public transport operator is not providing information at the origin; no notion of initiative was found.
- The bus operators are completely dependent on incomes from passengers and are only focussed on short term results, giving long term investments a low feasibility. To overcome this problem it should be obligated by the government or subsidised from the associations or governmental institutes.
- The problem of a low percentage of people speaking a foreign language is large in the city of Rio de Janeiro, this has to be resolved to improve the accessibility for tourist not speaking Portuguese, but this problem is also of high importance for the two upcoming mega sporting events in the city. This remark should be taken along in designing the information systems.
- Solutions need not to be found solely in systems, but also in people. People rely more on professionals and people and surrounding areas then techniques.
- An integral approach in investments between public and private resources has to be found to organise great Olympics and have useful legacies.

8.4. Implementation in Rio de Janeiro

Rio de Janeiro has great opportunities to improve its public transport information. Some of the nine steps presented in chapter 6 of improving travel information are executed for the city of Rio de Janeiro.

1. The goal can be for instance to provide first basic travel information at bus stops at the new bus rapid transit lines (BRT): Transcarioca, Transolímpico and Transoeste.
2. The main actors involved in the development of these BRT's are the public transport operator and associations, the public transport authority, the user and the Olympic Games of 2016. The Olympic Games should address the problem of travel information and initiate solutions. Execution can be laid down at the public transport authority or an public transport association.
3. The financial responsibility is first at the Olympic Games or authority but can be passed on to the association or a third party (advertisement companies).
4. The planning is to have improved service by the beginning of 2016. Therefore the first tests have to be done in the upcoming 2 years and large scale implementation in 2014-2015.
5. Maintenance is the responsibility of either the public transport authority or the public transport association.
6. The design and implementation should be done in cooperation between the parties. This can be concretized later on.
7. Testing and evaluation is important and should be done in close cooperation with the users.

As shown in the above steps, no differentiation is made in users. The framework and the in-depth interview didn't agree on this point. There is chosen for a more practicable approach in which all users will benefit more or less from the improvements.

9. Conclusions

Central question: How can public transport operators in Rio de Janeiro improve the information services in public transport and what information should be provided with the use of the Olympic Games to overcome the problem.

Improving the information services in Rio de Janeiro is inevitable. The declining level of mobility due to lower declining number of bus passengers and higher welfare give the necessity of improving the quality of public transport in Rio de Janeiro. The coming of the Olympic Games of 2016 can be used to make this change and accelerate these plans. Central in this research was how public transport operators can improve this information services in public transport and what information should be provided, by making use of the coming Olympic Games.

First conclusion is that the public transport operators in Rio de Janeiro need to be triggered to improve its services. Currently the main interest is (short term) economic profit and results of improving travel information is only indirect visible in economic reports. Secondly is found that the Olympic Games can perform this trigger. The Olympic Games provide an excellent platform to initiate and accelerate projects due to the size, the international attention and the strict deadline; to provide a lasting legacy, special attention should be paid to long term projects. Important aspect is to adopt an integrated approach, involving all parties. The parties should be from public and private organisations to ensure a balanced result between legacy and organisation of the Games.

Second question in this research was what the role is of information in public transport and which information should be presented. There is no single answer to this question; to effectively improve the information, market segmentation is necessary. This research has made a first distinction in four target groups: regular users, occasional users, tourists speaking local language, and tourists not speaking the local language. Secondly there is difference in place – from origin to final destination seven stages can be identified. Thirdly the time period is different, during the Olympic Games different information is required than before or after the games.

If the public transport operator wants to improve a service, it has to decide for whom, where and when he will improve this service. This is visible in figure 9, page 46:

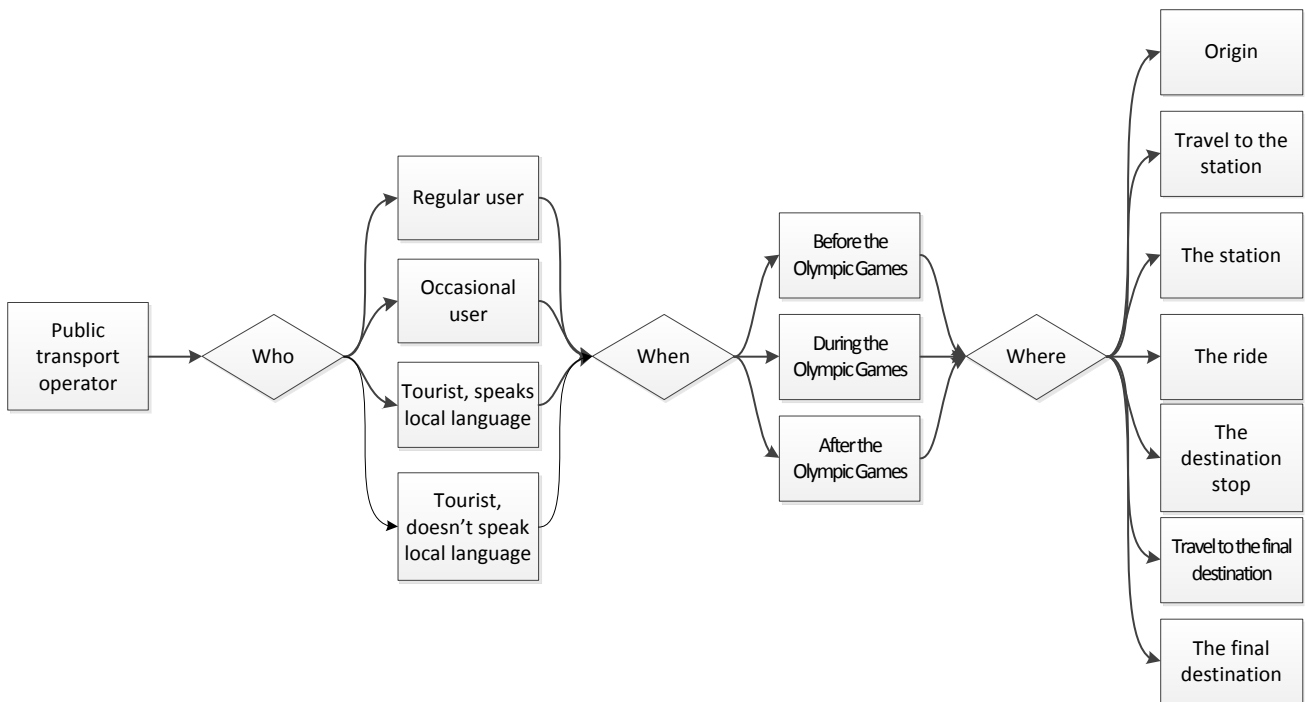


Figure 9: Different steps of information, when, where and for who.

Different characteristics for each service can be found. Users have different needs, the pre-Games, during the Games and post-Games period require different information and the sources available at the different stages are also different. A last decision to make is to what extent the operator wants to comply with the needs of the target group and what available financial resources there are; this results in the decision to provide 'advanced information', using modern technologies, or to provide 'basic information', using more simple and low cost systems. It should be noted that if advanced information is implemented also basic information should be provided.

The result of 'what information should be presented' is given in appendix B. But, the results in the framework are given from a systems perspective, introducing solely a new system is not sufficient, it is next to the system important to provide personal information. This gives the necessity to improve the language skills of for instance bus drivers.

10. Discussion

The conclusions of this research are mainly based on literature review. To develop the framework several choices are made, for instance in the segmentation of groups and distinction in basic and advanced travel information. However, if a complete different direction is chosen, other results and other conclusions possibly are drawn. This chapter discusses the method, results and conclusions of the research.

The first aspect is on the method itself. Questionable is if making a framework for travel information in general is useful to apply on a city; this due to the high differences between cultures, policies and public transport systems. Each country and each city has its own needs and profile. The framework requires, to be applied, adaptation to the local situation. It is possible that because of the given format target groups are overlooked or information services are not provided.

The second point is indeed the differentiation in target groups. The given four target groups are an example for the relation between a city with high public transport volumes and the coming of the Olympic Games. Perhaps, in other cases completely different target groups need to be applied, resulting in different needs and different ways of approaching.

The third point is if generic problems and measures can be given for Olympic Games. Each Olympic Games is unique, the differences are infinite, locations, culture, policies, techniques, visitors, stakes, etc. Many differences can be found and for each Olympic Games a specific plan has to be made.

Fourth aspect is the relation between urban client and public transport operator. In this research the nine quality attributes from the research of Vonk, et al. (2009a) are used, but as stated in their research, many other quality attributes can be used. The same applies for the way public transport operator is modelled.

Another aspect is the discussion about people's habit; to what extent users stay in their habit. In this research it is assumed that there exists a possibility in modal shift, however limited. But other theories state that this modal shift is hardly visible, and if it is visible it is doubted if this is due to improved information services.

Final aspect of discussion is the omission of cost/benefit for travel information. In this research only briefly a implementation strategy is presented. A cost/benefit analysis is essential before implementation. This can be done in future research and is one of the main recommendations.

11. Recommendations

The recommendations are divided in recommendations for further scientific research and for the city of Rio de Janeiro.

11.1. Recommendations for further research

This research provides a basic framework, but future research can be done to the following subjects:

In understanding how the behaviour of travellers is influenced by travel information, it is necessary to have data about the effects of travel information. To the authors knowledge only theoretical and model-based research is conducted, experimental research is not executed. Experimental research could give valuable insights in how the use of transport on long term is influenced by travel information.

Second it can be useful to expand the scope of this research to intercity Public Transport. This research is limited to urban public transport and users of intercity transport have probably different wishes and needs.

More research could be executed regarding the market segmentation of Rio de Janeiro. The size, demands and wishes of the target groups could be mapped out and a more detailed profile of the groups can be made. This gives the opportunity to fit more perfect to the needs of the target groups.

On the other hand, also more research can be conducted to the profiles of bus operators. In which way the bus operators can improve their service and why they would invest in travel information.

The current research provides a basic framework; to implement this framework has to be converted in real systems. In future research different systems could be compared and assessed, given the different needs of the target groups. This gives also insights in the cost/benefit relation.

11.2. Recommendations for Rio de Janeiro

Recommended in the case of Rio de Janeiro is to make a clear policy on travel information, including responsibilities for all parties involved. Currently several improvements are implemented but not from a holistic viewpoint. To create a sustainable legacy the future situation has to be thought-out well.

In line with the result of the interviews it is recommended to create a group wherein the public and private side is represented to create a sustainable legacy. In this committee the Olympic Delivery Authority should give the starting sign, stating the low quality of travel information. This start up can boost and create a permanent improvement to the situation in Rio de Janeiro.

A good starting point to improve information services is with the introduction of the bus rapid transit routes. These routes are essential to the Olympic Games transport plan and give great opportunities due to the fact it is completely new.

Another recommendation is to start providing basic information in the public domain on stations, this will increase the accessibility highly. In combination with the existing websites a basic information service is provided for the complete duration of the trip.

The development of the new bus rapid transit lines (BRT's) can be used as a starting point to improve the quality of public transport information.

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Appendices

In the appendices several explaining tables are given. The framework for which information to provide is also given.

A. Possible sources

Table 5: Possible sources from an operators perspective

Operator perspective	Actuality	The origin	Travel to the station	The station	The ride	The destination station	Travel to the final destination	The final destination
Mobile internet	High	x	x	x	x	x	x	x
Phone	High	x	x	x	x	x	x	x
SMS	High	x	x	x	x	x	x	x
Professionals	High				x			
Analogue signs	Low			x	x	x		
Digital signs	High			x	x	x		
Announce	High			x	x	x		
Internet	High	x						x
Television/ Radio	Low	x						x
Leaflet	Low	x		x	x	x		x

Table 6: Available sources for the regular user

Regular User	The origin	Travel to the station	The station	The ride	The destination station	Travel to the final destination	The final destination
Leaflet	x	x	x	x	x	x	x
Mobile internet	x	x	x	x	x	x	x
Internet	x						x
Phone	x	x	x	x	x	x	x
SMS	x	x	x	x	x	x	x
Friends	x	x	x	x	x	x	x
People in surrounding area	x	x	x	x	x	x	x
Professionals			x	x	x		
Analogue signs			x	x	x		
Digital signs			x	x	x		
Television/ Radio	x						x
Announce			x	x	x		

Table 7: Available sources for the occasional user

Occasional user	The origin	Travel to the station	The station	The ride	The destination stop	Travel to the final destination	The final destination
Leaflet	x	x	x	x	x	x	x
Mobile internet	x	x	x	x	x	x	x
Internet	x						x
Phone	x	x	x	x	x	x	x
SMS	x	x	x	x	x	x	x

Occasional user	The origin	Travel to the station	The station	The ride	The destination stop	Travel to the final destination	The final destination
Friends	x	x	x	x	x	x	x
People in surrounding area	x	x	x	x	x	x	x
Professionals			x	x	x		
Analogue signs			x	x	x		
Digital signs			x	x	x		
Television/ Radio	x						x
Announce			x	x	x		

Table 8: Available sources for the tourist, speaks local language

Tourist, speaks local language	The origin	Travel to the station	The station	The ride	The destination stop	Travel to the final destination	The final destination
Leaflet	x	x	x	x	x	x	x
Mobile internet							
Internet	x						x
Phone	x	x	x	x	x	x	x
SMS	x	x	x	x	x	x	x
Friends							
People in surrounding area	x	x	x	x	x	x	x
Professionals			x	x	x		
Analogue signs			x	x	x		
Digital signs			x	x	x		
Television/ Radio							
Announce							

Table 9: Available sources for the tourist, doesn't speak local language

Tourist, doesn't speak local language	The origin	Travel to the station	The station	The ride	The destination stop	Travel to the final destination	The final destination
Leaflet	x	x	x	x	x	x	x
Mobile internet							
Internet	x						x
Phone	x	x	x	x	x	x	x
SMS	x	x	x	x	x	x	x
Friends							
People in surrounding area							
Professionals			x	x	x		
Analogue signs			x	x	x		
Digital signs			x	x	x		
Television/ Radio							
Announce							

B. Framework








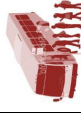


B.1 Legenda









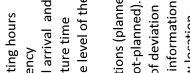

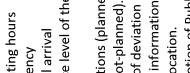

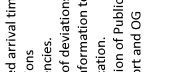

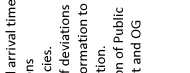



Symbol											
Name	Phone (mobile and fixed)	Computer	Leaflet	Analog route signs (easy to change locations)	Analog signs (permanent)	Analog signs (onboard)	Simple screen	Mobile application/ website	Text message	Sound system	High-tech digital screen







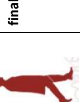








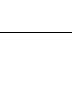
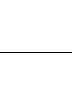
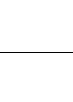
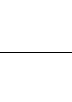







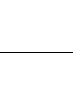

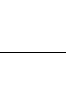

Regular user


























Basic







































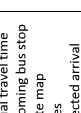



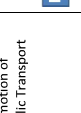







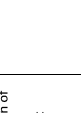

















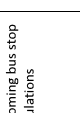







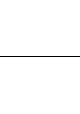









































Before the OG

<p>BASIC Regular user Before the OG <i>Characteristics: Sensitive to state and Irregularities</i> <i>Goal: -</i> <i>Information: Irregularities</i></p>					<p>Origin</p> <ul style="list-style-type: none"> - planned deviations - operating hours - frequency of the bus. 	<ul style="list-style-type: none"> - planned deviations - operating hours - frequency of the bus. 	<ul style="list-style-type: none"> - Planned deviations - operating hours - frequency of the bus. - Promotion of Public Transport - Promote OG and legacy of OG in general 	<ul style="list-style-type: none"> - planned deviations - operating hours - frequency of the bus. - Promotion of Public Transport - Promote OG and legacy of OG in general 	<p>Travel to the station</p> 	<ul style="list-style-type: none"> - planned deviations - operating hours - frequency of the bus. 	<ul style="list-style-type: none"> - case of planned deviations 	<ul style="list-style-type: none"> - 	<p>The station</p> 	<ul style="list-style-type: none"> - planned deviation - operating hours - frequency of the bus. 	<ul style="list-style-type: none"> - operating hours and frequency, regulations. 	<ul style="list-style-type: none"> - case of planned deviations - promotion of the OG in 	<p>The ride</p> 	<ul style="list-style-type: none"> - planned deviations - operating hours - frequency. 	<ul style="list-style-type: none"> - regulations 	<ul style="list-style-type: none"> - case of planned deviations - promotion of the OG in 	<p>The destination stop</p> 	<ul style="list-style-type: none"> - regulations and emergencies. 	<ul style="list-style-type: none"> - case of planned deviations - promotion of the OG in 	<ul style="list-style-type: none"> - case of planned deviations 	<p>The travel to the final destination</p> 	<ul style="list-style-type: none"> - case of planned deviations 			<p>The final destination</p> 	<ul style="list-style-type: none"> - Promoting the OG in general 		
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<p>ADVANCED Regular user Before the OG</p> <p><i>Characteristics: Sensitive to state and Irregularities</i></p> <p><i>Goal: - Information: Irregularities</i></p>	 <ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of PT - Promote OG and legacy of OG in general 			<p>Origin</p>	 <ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of PT - Promote OG and legacy of OG in general 			<p>Travel to the station</p>	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 			<p>The station</p>	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 			<p>The ride</p>	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - operating hours - frequency - Actual arrival and departure time - service level of the bus - deviations (planned and not-planned) - Case of deviation route information to new location. - Promotion of Public Transport and OG 			<p>The destination stop</p>	<ul style="list-style-type: none"> - expected arrival time - regulations - emergencies. - In case of deviations route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - expected arrival time - regulations - emergencies. - In case of deviations route information to new location. - Promotion of Public Transport and OG 			<p>The travel to the final destination</p>	<ul style="list-style-type: none"> - expected arrival time - regulations - emergencies. - In case of deviations route information to new location. - Promotion of Public Transport and OG 	<ul style="list-style-type: none"> - expected arrival time - regulations - emergencies. - In case of deviations route information to new location. - Promotion of Public Transport and OG 			<p>The final destination</p>	<ul style="list-style-type: none"> - Promotion of Public Transport and OG. 	<ul style="list-style-type: none"> - Promotion of Public Transport and OG 		
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<p>BASIC Occasional user During the OG</p> <p><i>Characteristics: Both, sensitive to state and irregularities but also to basic information</i></p> <p><i>Goal: Travel less or use public transport and basics (BCDEFGHIK)</i></p>									
									
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Map of surrounding area - Regulations - Emergencies 	<ul style="list-style-type: none"> - Planned deviations due to OG 	<ul style="list-style-type: none"> - Appreciate people take the bus - General information on OG 	
									
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Map of surrounding area - Regulations - Emergencies 	<ul style="list-style-type: none"> - Planned deviations due to OG 	<ul style="list-style-type: none"> - Appreciate people take PT 	
									
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Deviations due to the OG - General information of OG - Stimulate Public Transport 	<ul style="list-style-type: none"> - Map of surrounding area - Regulations - Emergencies 	<ul style="list-style-type: none"> - Planned deviations due to OG 	<ul style="list-style-type: none"> - Appreciate people use PT 	














<p>ADVANCED Occasional user During the OG</p> <p><i>Characteristics: Both, sensitive to state and irregularities but also to basic information</i> <i>Goal: Travel less or use public transport</i> <i>Information: Irregularities due to OG and basics (BCDEFGHIK)</i></p>	 <ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Route map - Maps of surrounding area - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Deviations (planned and not-planned). - Case of deviation route information to new location. - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Route map - Maps of surrounding area - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Deviations (planned and not-planned). - Case of deviation route information to new location. - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Deviations (planned and not-planned). - Case of deviation route information to new location. - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Route map - Maps of surrounding area - Real-time travel information - Deviations (planned and not-planned). - Case of deviation route information to new location. - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Route map - Maps of surrounding area - Real-time travel information - Deviations due to OG (planned and not-planned). - Case of deviation route information to new location. 		<p>The final destination</p> <ul style="list-style-type: none"> - Promotion of OG and Public Transport.
<ul style="list-style-type: none"> - Regular frequency - Operating hours - Route map - Price - Service level - Regulations - Emergencies 	 <ul style="list-style-type: none"> - Estimated time of arrival - Actual travel time - Information about route information to OG. - Appreciate people take the bus 	 <ul style="list-style-type: none"> - Planned deviations due to the OG - Promotion of Public Transport. 	 <ul style="list-style-type: none"> - Planned deviations due to OG - Promotion of Public Transport. - Deviations due to OG 	 <ul style="list-style-type: none"> - Planned deviations due to OG - Promotion of Public Transport. - Deviations due to OG 	 <ul style="list-style-type: none"> - Promotion of Public Transport - Marking of the ORN and temporary bus lanes - Map of surrounding area take the bus 	 <ul style="list-style-type: none"> - Promotion of Public Transport - Marking of the ORN and temporary bus lanes - Map of surrounding area 	<p>- Promotion of public transport</p>	
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency. - Deviations - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Planned deviations due to OG - Stimulate Public Transport 	 <ul style="list-style-type: none"> - Case of deviation due to the OG 	 <ul style="list-style-type: none"> - Case of deviation due to the OG 	 <ul style="list-style-type: none"> - Case of deviation due to the OG 	 <ul style="list-style-type: none"> - Case of deviation due to the OG 	 <ul style="list-style-type: none"> - Case of deviation due to the OG 	<p>- Case of deviations due to the OG</p>	
<ul style="list-style-type: none"> - Case of planned deviations due to OG 	 <ul style="list-style-type: none"> - Case of planned deviations due to OG 	 <ul style="list-style-type: none"> - Case of planned deviations due to OG 	 <ul style="list-style-type: none"> - Case of planned deviations due to OG 	 <ul style="list-style-type: none"> - Case of planned deviations due to OG 	 <ul style="list-style-type: none"> - Case of planned deviations due to OG 	 <ul style="list-style-type: none"> - Case of planned deviations due to OG 	<p>- Case of deviations due to the OG</p>	

<p>ADVANCED Occasional user After the OG</p> <p><i>Characteristics: Both, sensitive to state and irregularities but also to basic information</i> <i>Goal: Travel more by public transport</i> <i>Information: Basics and irregularities (BCDEFGHIK)</i></p>																				
	  	<ul style="list-style-type: none">- Route information- Price- Operating hours- Frequency- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport		  	<ul style="list-style-type: none">- Route information- Price- Operating hours- Frequency- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport		  	<ul style="list-style-type: none">- Route information- Price- Operating hours- Frequency- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport		  	<ul style="list-style-type: none">- Route information- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport		  	<ul style="list-style-type: none">- Route information- Maps of surrounding area- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport		  	<ul style="list-style-type: none">- Route information- Maps of surrounding area- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport		  	<ul style="list-style-type: none">- Total travel time- Promotion of Public Transport
	  	<ul style="list-style-type: none">- Route map- Price- Operating hours- Frequency- Real-time travel information- Service level of the bus- Deviations (planned and not-planned).- Case of deviation route information to new location.- Promotion of Public Transport	  	  	<ul style="list-style-type: none">- Regular frequency- Operating hours- Route map- Price- Service level- Regulations- Emergencies		  	<ul style="list-style-type: none">- Actual travel time- Upcoming bus stop- Route map- Prices- Expected arrival times- Service levels- Regulations- Deviations- Appreciate people take the bus		  	<ul style="list-style-type: none">- Route information- Upcoming bus stop information- Prices- Expected arrival times- Service levels- Regulations- Deviations- Appreciate people take the bus		  	<ul style="list-style-type: none">- Promotion of Public Transport		  	<ul style="list-style-type: none">- Case of planned deviations		  	<ul style="list-style-type: none">- Promotion of Public Transport
	  	<ul style="list-style-type: none">- Route- Price- Operating hours- Frequency- Deviations- Promote Public Transport	  	  	<ul style="list-style-type: none">- Estimated time of arrival of upcoming buses		  	<ul style="list-style-type: none">- Upcoming bus stop- Regulations		  	<ul style="list-style-type: none">- Case of planned deviations		  	<ul style="list-style-type: none">- Case of planned deviations		  	<ul style="list-style-type: none">- Appreciate people use PT.		  	<ul style="list-style-type: none">- Promotion of Public Transport
	  	<ul style="list-style-type: none">- Case of deviations	  	  	<ul style="list-style-type: none">- Planned deviations- Promotion of Public Transport.		  	<ul style="list-style-type: none">- Appreciate people take the bus		  	<ul style="list-style-type: none">- Case of planned deviations		  	<ul style="list-style-type: none">- Appreciate people use PT.		  	<ul style="list-style-type: none">- Appreciate people use PT.		  	<ul style="list-style-type: none">- Promotion of Public Transport

Tourist

Basic

Before the OG














												
Origin	Travel to the station	The station	The ride	The destination stop	The travel to the final destination	The final destination						
not present												

Characteristics: Needs basic information

Goal: -

Information: -

During the OG

												
Origin	Travel to the station	The station	The ride	The destination stop	The travel to the final destination	The final destination						
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route maps - Services - Regulations - Prices 	<ul style="list-style-type: none"> - Map of surrounding area (incl. touristic location and Olympic venues) - Regulations - Emergencies. 	<ul style="list-style-type: none"> - Map of surrounding area - ORN - Emergencies. 	<ul style="list-style-type: none"> - Returning 						
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Markings for bus stops 	<ul style="list-style-type: none"> - Operating hours - Frequency - Basic route map - Services in the bus - Regulations - Price and validity of ticket. - General information of OG - Special markings of ORN 	<ul style="list-style-type: none"> - Route maps - Services - Regulations - Prices 	<ul style="list-style-type: none"> - Map of surrounding area (incl. touristic location and Olympic venues) - Regulations - Emergencies. 	<ul style="list-style-type: none"> - Map of surrounding area - ORN - Emergencies. 	<ul style="list-style-type: none"> - Deviations due to OG 	<ul style="list-style-type: none"> - Deviations due to OG - Olympic events - Touristic locations 	<ul style="list-style-type: none"> - Deviations due to OG 	<ul style="list-style-type: none"> - Planned deviations due to OG 	<ul style="list-style-type: none"> - Walking routes to events and touristic locations. - Deviations due to OG 		
<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Accessibility - Safety - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route maps - Services - Regulations - Prices 	<ul style="list-style-type: none"> - Map of surrounding area (incl. touristic location and Olympic venues) - Regulations - Emergencies. 	<ul style="list-style-type: none"> - Map of surrounding area - ORN - Emergencies. 	<ul style="list-style-type: none"> - Deviations due to OG 	<ul style="list-style-type: none"> - Deviations due to OG - Olympic events - Touristic locations 	<ul style="list-style-type: none"> - Deviations due to OG 	<ul style="list-style-type: none"> - Planned deviations due to OG 	<ul style="list-style-type: none"> - Walking routes to events and touristic locations. - Deviations due to OG 		

Characteristics:











Needs basic information (in common language or symbols)

Goal: Positive experience with PT











Information: Basics (A-K)

Advanced

Before the OG

ADVANCED Tourist Before the OG										
Characteristics: Needs basic information Goal:- Information: -	not present	not present	not present	not present	not present					

During the OG

ADVANCED Tourist During the OG										
Characteristics: Needs basic information (in common language or symbols) Goal: Positive experience with PT Information: Basics (A-K)	<ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route map - Price - Operating hours - Frequency - Real-time travel information - Service level of the bus - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route map - Real-time travel information - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Route map - Real-time travel information - Accessibility - Safety - Deviations due to the OG (planned and not-planned) - Case of deviation route information to new location. - Transportation from an to Olympic venues and touristic locations - General event information 	<ul style="list-style-type: none"> - Promotion of OG and Public Transport. 		
	<ul style="list-style-type: none"> - Route - Price - Operating hours - Frequency - Real-time travel information - Accessibility - Safety - Videos about embarking/ disembarking - Deviations due to the OG - Transportation from an to Olympic venues and touristic locations - Latest information about OG 	<ul style="list-style-type: none"> - Estimated time of arrival - Actual travel time - Information about deviations due to OG - Latest information about OG 	<ul style="list-style-type: none"> - Regular frequency - Operating hours - Route map - Price - Service level - Accessibility - Regulations - Emergencies 	<ul style="list-style-type: none"> - Markings for bus stops - Maps of surrounding areas - Marking of the ORN and temporary bus lanes 	<ul style="list-style-type: none"> - Case of deviations due to the OG 	<ul style="list-style-type: none"> - Case of deviations due to the OG 	<ul style="list-style-type: none"> - Case of deviations due to the OG 	<ul style="list-style-type: none"> - Case of deviations due to the OG 	<ul style="list-style-type: none"> - Returning - Latest Olympic events/ results 	

