Bachelor Report

Cycling in Vila Aliança

Research about the needs of the cyclists in Vila Aliança

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Management summary

In Rio de Janeiro, Brazil, one out of five inhabitants live in the slums, called favelas in Portuguese. These people live in under poor conditions and face a lot of violence. On the one hand from drugs cartels that have the power over the slums, on the other hand from the police raiding the slums to arrest gang members. The NGO IBISS (Instituto Brasileiro de Inovações em Saúde Social) is active in many of Rio's favelas to support the inhabitants in the fields of healthcare, social inequality and human rights. Together with the Dutch NGO ICE (Interface for Cycling Expertise) students of the University of Twente already have done research about the use of the bicycle in the favelas of Rio de Janeiro.

In this research the focus was on the inhabitants of the favela Vila Aliança in the eastern part of Rio de Janeiro. Research has been done about the destinations of the cyclists, what the main routes are used by the cyclists and what the problems are that cyclists in Vila Aliança face. This because cycling could save the time and money on their daily trip to work. The research showed that the two train stations and surrounding shops are the main destinations in the research area. The routes people chose are the main streets, but most people use shortcuts through streets without car traffic for safety reasons. The main problems faced by cyclists in Vila Aliança are the high risk of theft and safety issues while on the road. For that reason it is important that near the Bangu train station investments are done in a guarded bicycle parking facility. To create more safety on the road bicycle lanes could create a designated place for cyclist on the road so that car drivers are more aware of the presence of cyclists. This would also create an important link to already existing networks of bicycle paths in the area.

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1. Introduction

1.1 Motivation

In 2006 two students of the Civil Engineering department of the University of Twente, Paul Allin and Jasper van der Hoek, conducted a research about bicycle mobility in the favelas of Rio de Janeiro. This research was done in cooperation with a NGO called IBISS which is active in the favelas (slums) of Rio de Janeiro. The areas their research focused on were three different favelas in the north and the west of Rio de Janeiro; Jardim America, Vigario Geral and Vila Aliança. In the research there were drawn several conclusions about the use of the of bicycle in these favelas. First of all the research showed that in Vila Aliança the use of bicycles is higher than in the other two areas Jardim America and Vigario Geral. Even though Vila Aliança is situated in one of the hottest parts of Rio de Janeiro. Other more general conclusions of the research were:

- That a substantial portion of the inhabitants already use a bicycle but that this only is used for cruising through the neighborhood and not as a mode of transport.
- The safety on the road is very low. Bicycles do not have their designated space on the road and drivers of motorized transport have little attention for cyclists and other forms of non-motorized traffic.
- There is a shortage of storage facilities at the destination points.
- The mindset of the people is that a bicycle is not a mode of transport but more a toy for children. But because of the higher use of bicycles in Vila Aliança the bicycle is here more accepted as a mode of transport.

With this first conclusions two other students investigated in 2006 the need for a bicycle storage facility in the favela of Jardim America. An arrangement, utilization and impact assessment plan were written for a guarded storage facility in the center of Jardim America. In this centre are a number of shops, sporting facilities and a health center located. This bicycle storage facility will be build at the location of an old garbage collecting point. At the moment of writing the garbage collecting point has been dismantled and is started with the buildup of the storage facility.

IBISS wants to increase the opportunities of the inhabitants of the slums in Rio de Janeiro. Together with I-CE, a Dutch NGO that promotes the use of the bicycle in developing countries, IBISS sees possibilities to increase the opportunities of the inhabitants by promoting the use of the bicycle. For that reason IBISS is interested in the possibilities to support the cyclists in Vila Aliança and there transport needs. To understand the needs of the cyclists in Vila Aliança this report will point out what the transport facilities are that are available for the inhabitants, what the main Origins and Destinations are in the area and the main routes between them and what view the inhabitants of Vila Aliança have about transportation by bicycle.

1.2 Background

1.2.1 Brazil

Brazil is the largest country in South America and borders with almost all countries in South America. It has a size of 8547 sq. km and a population of 180.655 million. It has big differences in landscape. In the north east the Amazon rainforest is situated which covers almost 20% of the country. In the west the cost line along the Atlantic Ocean is 7500 km long. Until 1822 Brazil was a colony of Portugal and the language spoken in Brazil still is Portuguese. Although it has mixed a bit with languages from the Indians originally inhabiting Brazil and the slaves brought in from Africa. The mixture in language shows reflects also the mixture of people. Instead of a lot of other former colonies where there was a strict separation between colonists and slave this was not the case in Brazil. Resulting in an extensive mix of races. From the independence in 1822 until 1952 Rio de Janeiro was the Capital of Brazil. In 1952 the capital and so the government and its institutions moved to Brasilia, a new build city in the middle of the country. Brazil is the world's ninth largest economy and its economy is even during the world crises still growing. The currency of Brazil is the Real (plural Reais) and it is indicated by the R$ symbol.

1.2.2 Rio de Janeiro

Rio de Janeiro is the second largest city of Brazil and has 7,3 million inhabitants. And in the metropolitan region of Rio de Janeiro live around 14 million people. The city is situated along the Guanabarra Bay and the Atlantic Ocean and squeezed into the valleys of the hills that surround the city. Rio de Janeiro is famous for its landscape, beaches and landmarks like the Christ redeemer statue and the Sugar Loaf mountain. But Rio de Janeiro is also known as one of the most violent city, mainly caused by drugs gangs that control the slums and the huge difference between rich and poor. The inhabitants of Rio de Janeiro are called Cariocas and they are like most Brazilians a joyful people. They show this through their music such as samba and off course during the carnival festivities.

Figure 1: View over Rio de Janeiro and the Christ Redeemer statue

1.2.3 Favelas

Rio the Janeiro is not only famous because of his beaches and the Christ statue, the city is also very well known because of it slums build on the hill sides. Because the slums are build on the hillsides they can be seen from everywhere in the city and this shows the sharp contrast between rich and poor. In Portuguese these slums are called favelas and they are collections of small houses constructed from simple materials and without basic facilities like electricity and running water . Originally the favelas were build on the hills near places where people could find work. Starting with building on the bottom of the hill and slightly building higher and higher. Because the enormous increase of people migrating to the city from poorer parts of Brazil in the seventies and actions taken by the government trying to clear some of the favelas on the hills people started to build new favelas on the outskirts of the city. These new favelas were build in flatter areas than the favelas in the city centre. In these new favelas the risk of landslides is smaller or non existing, but these new place were much further away from the city centre and the wealthy Zona Sul where most of the job opportunities are.

The favelas differ in appearance and size depending on their age and location. The older the favela is the more time the inhabitants had to improve their humble building. Nowadays most favelas exist of simple houses build from bricks and concrete and could even have several floors. Most of the improved favelas have running water and electricity and the main streets or alleys in these favelas are paved. But there are still favelas or parts of them where most houses consist of a few pieces of wood tied together and where the only roads are dirt roads. With the years the favelas started growing and now their size varies between a few hundred to half a million in the favela of Rochina. Which is one of the biggest slums in South America. In Rio de Janeiro one out of five inhabitants lives in a favela.

The view of the government towards the favelas, which has been one of denial, it is not strange that criminals and drug lords took power in this ‘safe havens’. In the favelas they formed a state within a state, with their own strict rules and without any control of the authorities. Most of the favelas in Rio de Janeiro are under control of drugs gangs . Three rivaling drug gangs operate in Rio de Janeiro: Commando Vermelho, Terceiro Commando Puro and Amigos dos Amigos. The main business of these gangs is drug trade and the processing of cocaine. From Rio de Janeiro a lot of cocaine is smuggled to the United States and Europe. The drug trade has a big impact on people living in the favela. Regular shoot-outs between traffickers and police and other criminals, as well as assorted illegal activities, lead to murder rates in excess of 40 per 100,000 inhabitants in the city of Rio and much higher rates in some Rio favelas. In the favela it is a normal sight to see young boys walking around with heavy guns, protecting the favela against any invasion from the police or rivaling gangs.

1.2.4 IBISS

The study was done for the Brazilian NGO IBISS. IBISS was founded in 1989 by Nanko van Buuren and Jan Dam as a way of ending the social exclusion of the inhabitants of the favelas and to increase their overall quality of life. IBISS wishes to contribute structurally and durably to the creation of a society in which everyone has access to public services, in which sickness and social inequality are fought and human rights are respected.

In 1989 Nanko van Buuren and Jan Dam were both already active within the “De Waal foundation” and decided that, when the “De Waal foundation” withdrew from Brazil, they would continue helping the poorest and socially most excluded inhabitants of Rio. The initial projects that IBISS started targeted those (mainly children) who were living on the streets, because, for whatever reason, they had no other place to go. After a while Nanko and Jan realized that, in order to really help these people, they needed to go up a level and try to prevent or solve the reasons why people were being forced to live on the streets. This brought them into the favelas where, during the past 15 years or so, IBISS has started, and is still running, over 50 projects. All of these projects originated from the same ideal, but vary in approach to the diverse problems.

The projects ranged in focus from improving the living conditions in the favelas, such as ensuring running water and sewage, to educating young potential leaders who could improve the community from within. What started as a two-man operation soon grew and now IBISS is one of the most influential ngo’s in Rio with over 300 employees, many of whom belong or belonged to the target group of IBISS. IBISS operates in 37 favelas and manages to walk the thin line between the government and the various drug cartels that unofficially run the favelas.

With the constant aim to improve further the quality of life for the slum inhabitants, Nanko thought that there might be a way to help the target group save money on public transport and increase their opportunities. This could be achieved if the people have access to cheaper or free transport.

1.2.4 I-CE

I-CE (interface for cycling expertise) is a Dutch NGO for low cost mobility and integrated cycling planning. I-CE is an interface for the Dutch cycling capabilities and does this by different programs such as low cost mobility initiatives and the bicycle partnership program. I-CE also initiated the Cycling Academic Network to support their goals by scientific research. To support local authorities, society organizations and other partners I-CE started the Bicycle Partnership Program. With this program they want to help these authorities in the development or increase of the use of the bicycle as a transport mode. The program understands that by promoting the bicycle use by improving cycle-inclusive urban planning, it is possible to make a significant contribution to the poverty reduction by increasing urban low cost mobility, augmenting road safety and thus contributing to a better air quality, a more sustainable environment and a higher quality of life. The program acts in developing countries of Latin America, Africa and Asia[1].

I-CE and IBISS are interested to combine their knowledge to fight poverty in the favelas of Rio de Janeiro. I-CE has already done some successful programs together with the municipality of Rio de Janeiro. Because IBISS has access to the favelas, where people have a lot of suspicion against authorities, this is for I-CE a way to reach the poor. For this research I-CE supported with technical knowhow about cycling.

[11] I-CE, 2009

2. Research design

In this chapter the design of the research will be formulated. After an identification of the problems the research questions are given. To conclude this chapter the research approach and the techniques that are used are given.

2.1 Problem identification

In the previous researches that have been done for IBISS Vila Aliança seemed one of the areas in Rio de Janeiro with a high use of bicycles. People here are more used to use a bicycle but still a lot of people just see the bicycle as a toy for children and not as means of transport. For that reason IBISS wants to know what they can do for the cyclist and how they could make more people cycling. IBISS is interested in cycling because a lot of the faveladors, inhabitants of the favelas, work in the city center and have to commute for an hour or more. Most of the times they use multiple busses or bus and train to get to their destination. Because you have to pay again for every bus one takes this is uneconomic. By using a bicycle these people can skip a bus trip on their daily journey to work and so safe money. To achieve that more people will use the bicycle IBISS is interested in building a bicycle storage facility as has been done in Jardim America. Because already a lot of inhabitants of the favela cycle they are also interested in what can be done to make cycling safer and so lower threshold to start cycling. For that reason the practical objective of the research will be:

Point out where new bicycle storage facilities should be placed based on the origins and destinations of trips made by the inhabitants of Villa Aliança in the research area and making recommendations about improvements of the infrastructure to benefit the cyclists .

2.2 Research questions

The research questions that have to be answered are:

1. What are the main origins and destinations in the research area?
2. What are the main routes in the research area?
3. What is the demand for a parking facility at the destinations?
4. What are the main problems the cyclists face?
5. What are the main benefits of cycling for the inhabitants of Vila Aliança?

2.3 Research approach

To answer the research questions the research has been divided into different steps. In the first step an inventory has been made of the research area, literature about cycling in developing countries and social data about the inhabitants of Vila Aliança. In the second step the information obtained in the first step has been used to hold an survey and to count the amount of cyclists on certain routes in the neighborhood. In the last two steps all information that has been obtained is analyzed and conclusions are drawn. Picture 1 gives a visualization of the steps that have been taken.

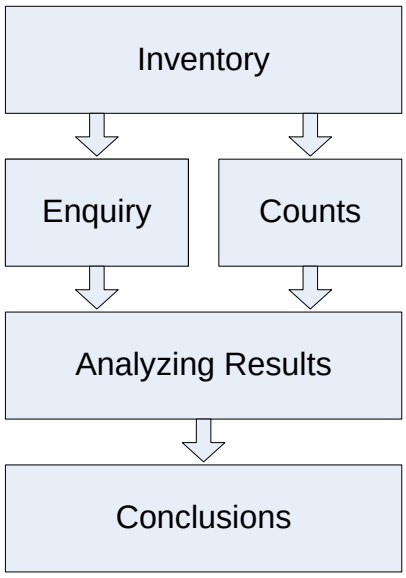

Figure 2: Research approach

2.4 Research techniques

To do the field research different techniques have been used to answer the research questions. Because the setting of the research is one with limited resources according to the I-CE Handbook should be strived for a suitable data collection that links questions and cost effective ways of obtaining them. This should be done by asking meaningful questions that can be answered by empirical, easily obtainable data. Quantitative data is used for scoring indicators. Qualitative data is useful for exploration and diagnosis and it can tell a story that cannot be deduced from objective measures. For this reason in the research quantitative as well qualitative methods are used.

To answer the research questions data is needed about the origins and destinations in the research area, why and how people travel and if they use a bicycle what problems they face. The methods that have been used to obtain this information are: observation, informal interviews, a survey, traffic counting and a focus group to get feedback on results found with the other tools. As has been pointed out these methods will generate qualitative as well quantitative data. The quantitative methods are use to express outcomes in numbers. The qualitative methods are used to deepen and verify the data gathered with the quantitative methods. Using qualitative approaches in a research has two key advantages: it encourages creativity and usually the results from these approaches tend to have a high level of realism. Flexibility is needed because the project area is not easy accessible for strangers and is for a large part under control of a drugs gang. For that reason close cooperation with IBISS employee is important to create trust in the neighborhood. The gang is very suspicious about

strangers in their neighborhood and for that reason it is hard to deduct surveys inside the favela. For that reason is chosen to deduct the surveys just outside the favela. But in the end of the research it was possible to also deduct some surveys around the local football field.

To get a good insight into the potential of a bicycle storage facility counting the current number of bicycles parked at a certain place is needed. Counting of cyclists is also important to get an indication of the routes that are used by cyclists and what the amount of cyclists is on the road. These numbers could also help to convince local authorities that a substantial part of the road users are cyclists. Because at the moment local authorities do not include the bicycle in their planning.

Most of the used techniques are described in the Handbook for Cycling-Inclusive Policy Development developed by I-CE and different partners. In appendix A the different techniques are explained a bit more.

As the main goal of the research is to find out what kind of facilities are needed. It is important to find out what the latent need is of parking spaces for bicycles and what the traffic situation is on the routes used by cyclists. Counting of bicycle parking places and parked and chained bicycles shows this latent need. To get an idea of the latent need parked bicycles have been counted in the areas near the two train stations. In these areas also a lot of shops are situated. Bicycle (repair) stores have been counted to give an indication what level of service there is for bicycle users and inhabitants of the research area

2.5 The research methods in practice

As has been pointed out in the Research Design different techniques have been used to obtain the data. These techniques are observation, informal interviews, counting, a survey and a focus group to verify the obtained results.

Observation and informal interviews have been done during many visits to Bangu and Vila Aliança. During the start of the research this has been done in cooperation with employees of IBISS that live and work in the project area. Later on this has also been done individually, because trust within the community was created. Most observations have been done by walking through the project area and talking with shop owners and inhabitants of the project area. The project area is also several times explored by bicycle to get an idea of what cyclist experience and to find out what the most logical routes are to reach popular destinations.

At some places along the route traffic has been counted to give an impression of the number of cyclists that actually use the road. And to compare different routes with each other. These counts have been done in sets of one hour of counting. The counting has been repeated to make sure the outcome is valid.

The survey has been done in the project area, outside and inside the favela. At first it seemed not possible to do the survey in the favela because of distrust by the drugs gang. For that reason people on the streets close to the favela and in the asfalto, the part of the neighborhood close to the favela, have been approached. Because people that live in the favela come here to do their groceries or go to school. In the end it was possible to do some interviews around the football field inside the favela. In total 64 people have filled in the survey. The survey can be seen in appendix B.

After the collection of the data a feedback group has been organized in cooperation with the employees of IBISS that are active in Vila Aliança. This has been done to show the community what the research was about and what the outcomes of the research were. For the research itself is was a check to see if the people that live in the project area agreed with the findings of the research. Besides the research that dealt with cycling in Rio de Janeiro a presentation has been given about cycling in the Netherlands. Many of the participants were very enthusiastic about this presentation and the use of the bicycle by the Dutch.

Figure 3: Presentation during the feedback session

3. Literature

In this chapter some general information about traveling in Rio de Janeiro, a model to analyze transport systems, and data about cycling in general will be presented. This information will give a view about what is known in literature and hand books and is useful in analyzing the transportation processes and systems in the project area and finding solutions.

3.1 Data on traveling in Rio de Janeiro

In the city of Rio de Janeiro daily 20 million trips are made[2]. Of these trips 33% is made by foot and 33% is made by bus. What makes the bus the most popular mode of public transport in Rio de Janeiro. Figures of the planning department of the city of Rio de Janeiro (PDTU) show that the traffic flows in the morning peak hours go from the suburbs into the city centre and in the evening peak hour they run the other way around.

Mode	Number of trips 1994 (%)	Number of trips 2004 (%)
Public Transport		
Subway	300.988 (2,28%)	355.404 (1,78%)
Train	412.140 (3,13%)	303.578 (1,52%)
Ferry	89.942 (0,68%)	82.091 (0,41%)
Bus	8.043.786 (61,2%)	6.583.742 (33,08%)
Van	-	
Individual Motorized		
Car & Taxi	1.514.421 (11,5%)	3.108.743 (15,61%)
Individual Not Motorized		
Bicycle	169.459 (1,28%)	645.510 (3,24%)
Walking	2.594.178 (0,43%)	462.210 (2,33%)
Others		
Total	**13.182.719 (100%)**	**19.915.954 (100%)**

Table 1: Number of trips per day – PDTU (2004)

Concerning the use of the bicycle there are 5 parts of the city where the use of the bicycle is significantly higher than in other parts of the city where the daily number of trips is under 5000. These 5 parts are: Santa Cruz (43.459 trips), Campo Grande (32.831 trips), Realengo (25.377 trips) and Bangu (24.787 trips)[3]. All these parts lay in the west of the city where building is less dense.

[2] PDTU 2004-Plano Direitor de Transporte Urbano da Regiao Metropolitana do Rio do Janeiro

[3] PDTU 2004-Plano Direitor de Transporte Urbano da Regiao Metropolitana do Rio do Janeiro

3.2 Transport system

In society there is a certain demand for traveling, people want to travel from A to B. This demand is caused the difference in value experienced by an individual between the place where he is and the place he wants to travel to. A and B could for example be home and work. Going to work has a higher value because in that place one could earn money. This is the demand or need to travel. On the other hand is there the supply of transport. This means that it is possible to travel from A to B with a certain mode, for example by car, on a certain road. In the model different markets can be distinguished that all influence each other. These markets are the travel market, transport market and the traffic market. Figure 2 shows these markets.

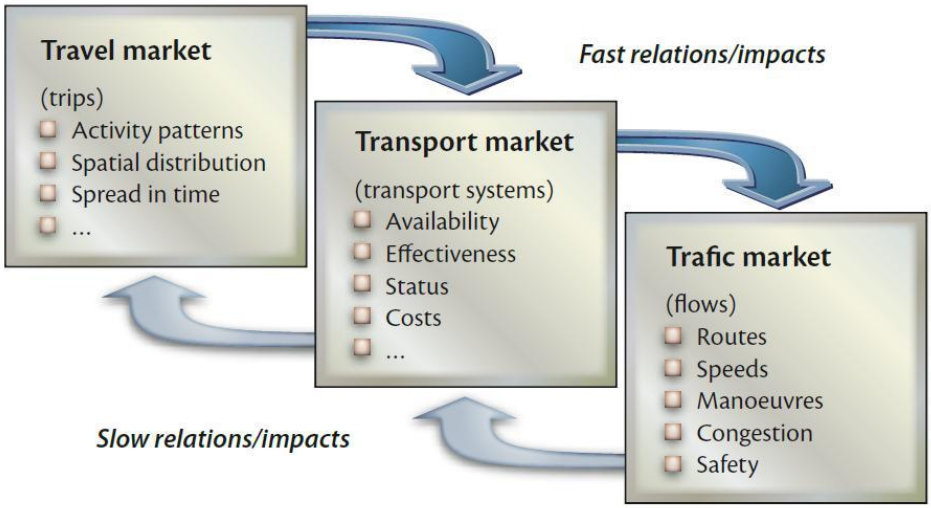

Figure 4: The three markets of the transport system.

Demand, the travel market, depends on the activity patterns of the people living in a certain area, the spatial distribution and the spread in time of these activities. The supply depends on the availability of modes in an area, the cost of these modes, the effectiveness, the efficiency and status of these modes. The demand and the supply come together in the traffic flows. For the flows aspects as the routes, speeds, congestion and safety are important.

To improve the transport system as a whole different interventions could be taken. Before interventions can be taken the area of interest has to be analyzed to get a clear view on the current situation.

3.3 Aspects of Bicycle use

The bicycle has a lot of benefits for the individual user and for the society as a whole. There are also some barriers that could prevent people from using the bicycle. In this paragraph the main benefits and barriers are pointed out. In the recommendations these benefits and barriers are used to make measures that stimulate the use of the bicycle.

3.3.1 Benefits of bicycle use

Improvement of access and mobility choices

Cycling is much faster than walking and is an easy way to get around, especially in congested cities. The bicycle offers great reliability because you are not depending on time schedules or established routes. When cycling replaces walking accessibility and mobility improve. Using a bicycle one can easily move three times as fast as on foot and thus travel three times as far in the same time. This increases the area one can reach enormously.

Exercise and health

Riding a bike on a daily basis is an exercise that improves the health of the cyclist. A study done by the University of Amsterdam shows that a regular cyclist that cycles at least three trips of 6 km per week has the same health as someone ten years younger that does not cycle. Cycling also helps fighting obesity because cycling at a moderate pace needs the energy of approximately 600 calories per hour. Besides burning a reasonable amount of energy cycling also has a lot of other positive effects on the health of the cyclists such as the stimulation of endorphins, hormones that stimulate the feeling of well being, keeps muscles in a good condition, improves the regulation of cholesterol and blood pressure and this is all reached by just a simple exercise.[4]

Cost saving

After the initial investment of purchasing the bicycle cycling is a almost free means of transport. Repairing is relatively cheap, and with using the bicycle one can save money otherwise be spent on public or individual transport. This money can be spend on other goods or possibilities what increases the possibilities and opportunities of the cyclist.

Fewer emissions

Bicycles do not generate any air pollution and hardly any noise. By increasing the use of bicycles and diminishing the use of cars the emission of greenhouse gasses will be reduced what will contribute to slowing down global warming. On a local scale cycling will contribute to cleaner air. Especially for people with bad respiratory conditions and people with asthma this is a positive effect.

Better use of public space

Bicycles use the space on the road in an efficient way. Cyclists require less than one third of the space of the road. To park a car it requires fifteen times as much space as a bicycle.

Improving social equity

In large developing cities most of the poor live on the outskirts in low income settlements, far away from the centers of employment. To reach these centers people have to face long travel times and the cost for these trips are a proper amount the of the monthly family income. This is a huge burden

[4] I-CE Handbook 2009

on the shoulders of the poor restricting their ability to participate in the work force, education and health care. The bicycle can play an important role in providing cheap and affordable transport for the poor.

Good combination with public transport
The bicycle is a very good means of transport to be used as a feeder transport for Public Transport such a bus and train. For many trips the destination is too far away to be reached by bicycle. In this cases the bicycle can be used to reach the bus stop or train station. This combination of bicycle and public transport can be a good alternative for the use of a private car. This because Public Transport on its own does not deliver a good door to door service, but in combination with the bicycle this problem is solved. To create a good connection between public transport and the bicycle it is important to have a good parking facility at the point where the transition is made from bicycle to Public Transport. This parking facility should not be too far away from the train station or bus stop.

3.3.2 Barriers to cycling

Poor road safety, insecurity and bicycle theft
When there are no facilities for cyclists they have to share the road with motorized traffic or cycle on the sidewalks. This can be dangerous and is unattractive. The cyclist is vulnerable between the fast moving traffic and on the sidewalk the cyclist gets in conflict with pedestrians and street vendors. Bicycle theft is also an important issue. Especially for poor people a bicycle is a large investment. If parking the bicycle is not safe the risk of theft becomes high. This is a powerful reason not to buy a bicycle or not to cycle.

Distance and physical limits
When distance become too long or the roads are too steep people will use other modes of transport, because in this cases cycling cost too much effort for them.

Climate and geography
When the weather is to hot cycling becomes unattractive. People do not want to arrive at their destination sweaty and wet.

Affordability and availability
Especially for poor people the initial cost of purchasing the bicycle can be a barrier. Also the availability of parts to repair a bicycle when broken can be a problem.

3.4 Main requirements for cycle friendly infrastructure

To improve the use of the bicycle an important part is the infrastructure on which the cyclist rides. Sometimes small improvements in the current infrastructure can make a large difference for cyclists. To see what are the most important requirements for cycle friendly infrastructure are the CROW has pointed out five aspects. In appendix E these 5 aspects are worked out.

To adapt infrastructure to cyclists it is important to keep the cyclist and its needs in mind when designing. The cyclist has some characteristics that make him different from other road users. These characteristics are:

- The bicycle is muscle powered. So energy loss should be at a minimum
- The bicycle requires balancing from its rider, so it needs enough space on the road
- Cyclists are vulnerable because there is no crumpling zone.
- Cyclist prefer a smooth surface because most bicycles do not have suspension.
- Cyclist ride in open air, so if possible protection against wind, rain and sun is needed.
- Cycling is a social activity and cyclist want to ride side by side. Especially for parents that escort their children.
- Cycling is a multitasking activity so designers should keep this in mind and avoid complex situations.

The 5 requirements for cycle friendly infrastructure are given in table 2:

Requirement	Definition	Criteria
Coherence:	To form a coherent network and offer connections to all origins and destinations of the cyclists	Possibility to find the infrastructure Consistency in the quality; Freedom in choice of routes; System is complete.
Directness	Offer the most direct route	Speed / level of the flow; Delay time Detour distance;
Safety	Guarantee maximum safety for the cyclists and other road users	Number of traffic victims; Chance to meet motorized traffic; Complexity of cycling; Pattern of complaints; Subjective safety.
Attractiveness	The route is adapted to the environment to make cycling as attractive as possible.	Pattern of complaints ; Illumination of the system; Social safety; Perception of the urban environment.
Comfort	The route facilitates a fast and comfortable traffic stream	Pavement Level of inclinations; Climate.

Table 2: requirements for cycle friendly infrastructure

3.5 Cycling in Rio de Janeiro

Rio de Janeiro states itself as the cycling city of Brazil. And indeed cyclists are not totally a strange phenomenon in the city. Spread over the city are more than 140 kilometers of cycle tracks and the bicycle is becoming more and more popular. In appendix D a map with all cycle tracks in Rio de Janeiro is provided. Despite of the many kilometers of cycle tracks the model share of the bicycle still is only 3%[5] in Rio de Janeiro. In this part will be pointed out the difference in cycling in the different areas in Rio de Janeiro. Most of the people that cycle in the South Zone, the richer part of the city do this for leisure purposes. There are perfect cycle tracks along the beaches of Copacabana and Ipanema where people cycle on nice bicycles and use the bicycle as a certain lifestyle. In the different neighborhoods are cycle tracks, but these tracks are not always connected to each other and the size and shape differs. Some are very good like the ones along the beaches, around Lagoa and in the Flamengo Park. Others are of bad quality or are painted on pavement so people walk on the cycle track or there are even terraces standing on the cycle track. As you can imagine these kind of cycle tracks are hardly used. In places where there are no or just bad cycle tracks cyclist use the road to cycle. The road system is mainly designed for cars and is in many places a one way system. Drivers are not really used to cyclists on the road, so cyclist have to 'fight' for their place on the road. This means that cyclists cycle on both sides of the road and also against the traffic flow. Unlike the Netherlands most cyclists prefer to cycle on the left side of the road of the road. This is because on the right of the road busses stop which conflicts with cycling.

Figure 5: Different kinds of cyclists in downtown Rio de Janeiro

[5] PDTU 2004 – Versao Preliminar

4. Data findings

This chapter goes into the conducted field research and the findings that were made in the research area. For the presentation of these findings the travel model presented in the previous chapter will be used. First an introduction about the area will be given. Next the travel market is described. This means the trips people in the research area make and how they are related to the spatial distribution, the activity patterns and the spread in time. Than the transport market will be analyzed. Which modes are available and what is the efficiency, status and costs of these modes. Finally we look at the flows in the neighborhood. Here important questions are what are the routes, speeds and safety in the neighborhood.

4.1 The research area

The project area is situated in Bangu. Bangu is a residential area in the western part of the city of Rio de Janeiro. Bangu is about a one hour drive from the center and can be reached by car or by bus over the motorway Avenida Brasil or by train to Campo Grande and Santa Cruz. In the whole Bangu area live 659.649 people and the area is with 77 inhabitants per hectare one of the least dense inhabited areas within the city of Rio de Janeiro .

Figure 6: Location of Bangu in Rio de Janeiro

In colonial times the area was an estate, Fazenda Bangu, founded by the Jesuits from Santa Cruz. In the end of the 19th century a textile factory was build on the estate by the English firm Morgan Snell and company near the just build railroad. This fabric brought a lot of employment to the area what started the region to urbanize. For a long time the factory was a stable factor in Bangu. But in the 1980's there was a decline in the production and eventually the factory closed in 1995. Since a few years the factory has been renovated and now houses a modern shopping mall. Bringing new employment and attracting visitors from the whole city.[6]

[6] Prefeitura da Cidade do Rio de Janeiro – Nota Technica 11: Bangu

The neighborhood of Bangu is a more residential area where most people live in houses. This unlike the centre and the south zone of the city where most people live in apartments. The neighborhood is cut in two by the railway track that runs from east to west.

The project area is limited by on the south site the railway line and on the north side Avenida Brasil, a large express way. From east till west the project area spreads from the Bangu train station until the train station of Senador Camará the distance between them is 2,5 km. In the area are situated the favela Vila Aliança, the asfalto of Vila Aliança and other residential buildings. The project area is shown in figure 3.

The centre of the neighborhood is the area around the Bangu train station. The train station is situated above the tracks as a bridge that connects both sides of the railway tracks. And on both sites of the railway tracks shops are located. The south site is the more richer part and the shops here are more luxurious. Here is also shopping Bangu, a shopping mall that is located in the old textile factory. On the north side are a big supermarket, different banks and a small bus station. From the bus station busses leave to the centre.

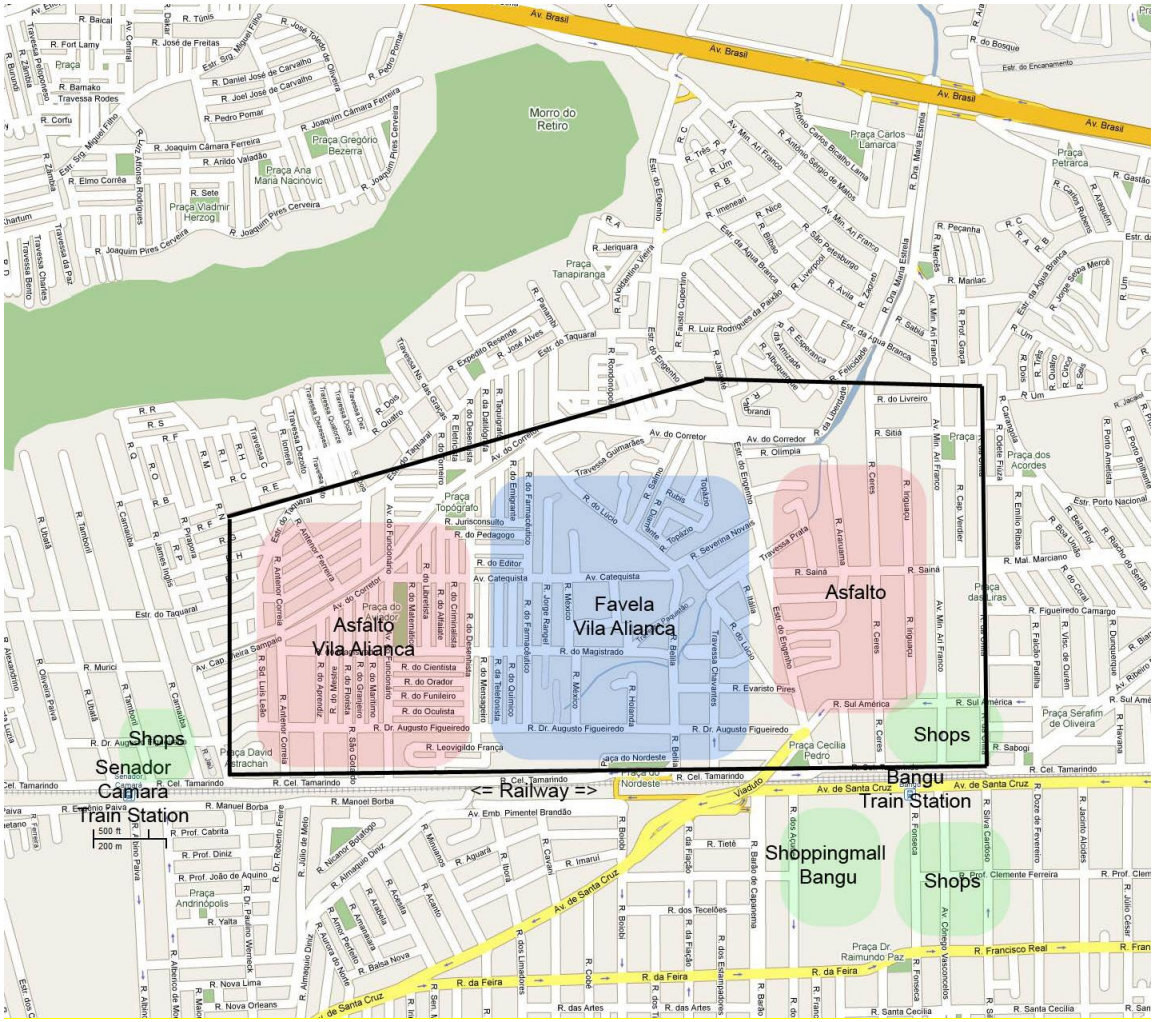

Figure 7: The research area

The Favela of Vila Aliança lies a bit west from the Bangu train station and north from the railway tracks. According to IBISS around 40.000 people live in Vila Aliança. The buildings in the favela are build from characteristic red bricks and most houses have running water and electricity. In the favela also a few small shops can be found where groceries are sold. Along the railway tracks is a part of the favela where housing conditions are very bad, here people live in small sheds made from pieces collected wooden plates. People in this part of the favela even have to cook on the street. The big difference between the asfalto and the favela is that the favela is under control of a drugs gang. The entrance roads of the favela are blocked with pieces of wood and debris. Also on the outside you can see the guards of the favela. These are young boys with walkie talkies that keep a close look on the streets to see who is going in and out the favela and to warn when police or a rivaling gangs come close. Inside the favela gang members walk around with machine guns to protected their drugs selling points and factories. Very often the police comes into the favela with special heavily armored cars to arrest gang members or confiscate drugs or special weapons. Most of the time this is accompanied with a lot of violence and at those times the situation in the favela is one of an urban war. Shootings can go on for hours, and most of the casualties are innocent children playing on the street at the moment the police arrives. In the period that this research was conducted two little children were killed by police fire in the favela.

4.2 Travel Market (Trips)

4.2.1 Activity patterns and spread in time

The most important activity patterns are traveling for work or education. Most people that live in Vila Aliança have to struggle to survive. Jobs they have are for short terms and for a low or minimum wage. A minimum wage is R$ 487,50[7] what is € 190,-. For most man jobs are located in the north west of Rio de Janeiro or in the city centre. In the north west of Rio de Janeiro the harbor and many factories are located. Also in Madureira, a part of Rio de Janeiro in the north of the city, a lot of factories are located. Also some men work on construction sites on different locations in Rio de Janeiro. The women that have jobs work in the city centre or the more wealthy neighborhoods along the coast. Here they have jobs in shops or cleaning of offices or houses. Not all women work, because they have to take care of their children. Most people leave between 6 and 7 o'clock in the morning and return in the evening around 7 and 8 o'clock at home. The journey they make to reach their jobs costs them between 1 and 2 hours. Most people do not work on the Saturday afternoon and on Sunday. In Brazil unemployment is around 8% but in the favelas this number is higher. There are no exact data about the unemployment in the favelas but according to staff of IBISS this number is around the 20%. Primary schools start at 9 o'clock in the morning and classes are finished at 4 o'clock in the afternoon. For teenagers it is very common to have a job during daytime and go to school in the evening. Because the schools offer classes for the younger children during daytime and for older children in the evening.

[7] portalbrasil

4.2.2 Spatial Distribution

Vila Aliança is situated along the railway track, that runs from the city centre to Santa Cruz, between two train stations. The Bangu station and the Senador Camará station. North of the area lies the Avenida Brasil, the express way that runs from the city centre to west of the city. Around the stations are commercial activities located. On the other side of the railway track is a newly build shopping mall, shopping Bangu, located. Between the train stations run two main roads. Along these roads all kind of small shops can be found such as bicycle repair shops, bars, beauty salons and grocery stores.

The project area consists of different parts of development. Near the station of Bangu there is a shopping street with a supermarket, different stores and different banks. Around this shopping area mainly normal detached houses, shops and small companies are situated. Going more west further away from the station the houses start to change and become more basic and are all build from the typical red bricks. This part is called the asfalto. The word asfalto means that instead of the favela this part of the neighborhood has paved roads. Moving more west the asfalto becomes the favela. Some parts of the favela look the same as the asfalto and like the houses in the asfalto al houses in the favela are build from the characteristic red bricks. In the favela are some small shops and there is a football field. There is no medical post in the favela. More to the west the favela ends and the asfalto goes on. Here on the border is also the main street of Vila Aliança. With a bar, small shops, including one for groceries, two bicycle repair shops, and an old samba school. In this samba school, that consists of a big square with a roof on it, IBISS organizes drumming classes for the children of the favela, but the location is also used for parties organized by the drugs gang. Close to the Senador Camará station the houses start to become better again. In the area are also some small parts with bigger and nicer houses. These parts have streets that are closed with a fence and have guards hired by the residents to protect their property.

Figure 8:

Images from the research area clockwise:

-Bangu train station and shopping street

-Street in the asfalto

-Senedor Camará train station

-Entrance to the favela

In the project area different services can be found. There are five schools. In appendix G the schools are shown on the map of the research area. Three of them are primary schools one is a high school and one is called collegio, this is a mixture between a high school and vocational. The primary schools mainly attract children that live in the project area. The collegio attracts students from whole Bangu and also from other neighborhoods, like Realengo and Campo Grande. Larger supermarkets can be found near the train stations of Bangu and Senedor Camará and there is one just north of the favela. Along the main roads all kinds of smaller shops can be found. The commercial activities in these shops are very broad and consist of: groceries, bars, internet cafés, garages, bicycle stores, beauty salons and hairdressers. For leisure there are several football fields in the project area, one is situated in the favela. Near the station of Senador Camará there is a gym. Like everywhere in Rio de Janeiro also in the project area are a lot of churches. Most of them are build by evangelical Christians and are situated in all kind of halls instead of the traditional cross shaped buildings.

4.3 Transport Market (Transport Systems)

4.3.1 Available modes

As has been pointed out in the part about the spatial distribution Vila Aliança is situated close to the railway and motorway to the city centre. And although it takes about an hour of traveling the city centre can be reached quite easily. In this paragraph different modes that are available to the inhabitants of Vila Aliança will be discussed.

Walking

Walking is an important mode of transport for the inhabitants of Vila Aliança. It is free and still a lot of destinations in the research area can be reached. In the survey 60% of the interviewees indicate that they go by foot to the train station. This walk cost them 20 minutes. The quality of the sidewalks in the neighborhood differs. Most of them are made of asphalt and are wide enough to provide enough space for pedestrians. These are mainly found near the two train stations and along the main routes. In other places the sidewalk is not more than dirt along the road.

Figure 9: Pedestrians on the sidewalk

Bus

Different bus lines run through Vila Aliança or run very close to it. Two lines run to the city centre and they both drive along the motorway Avenida Brasil. One is an express bus the other stops many times along the Avenida Brasil. The travel time from Vila Aliança to the city centre with the express

bus depends on the time of the day and vary between 40 minutes and 1 hour and 10 minutes. Close to the Bangu train station is a small bus station which is also the end of these lines. The price of the bus is fixed and is R$2,20. Among inhabitants of Vila Aliança the bus is a popular means of transport. Almost 50% of the interviewees indicates to use the bus on a regular basis. Another 40% indicates to use it now and then.

Figure 10: The bus from the city centre to Bangu and a bus driving through the neighborhood

Van

Vans are small busses that drive certain routes and try to fill the gap of where busses do not go. The status of these vans is unclear and it is not sure if they are legal or not. They also vary a lot in quality, some are pretty comfortable others are very unsafe. Most of the time the vans are packed with people and more than 20 people in these vans with thirteen seats is not uncommon. The price of a trip with a van is R$2,00, just under the price of a bus. But for longer trips the price could be higher. In Vila Aliança different Vans are active. A popular line is the line between Campo Grande and Vila Kennedy to neighborhoods close to Vila Aliança. There is also a van service between the station of Bangu and Vila Aliança to bring people with their groceries back home. In the survey 18% of the respondents indicates to use the van on a regular basis.

Figure 11: Vans in Vila Aliança and the center of Bangu

Train

Vila Aliança lies between two train stations and the distance between the centre of Vila Aliança and one of the stations is approximately 2 kilometer. The trains run to the city centre, Central do Brasil, and to Santa Cruz in the west of Rio de Janeiro. There are express trains that only stop at a few larger

stations and trains that stop at all stations. The exact lines can be seen in appendix C. The travel time between the station of Bangu and Central do Brasil is 50 minutes and trains run every 30 minutes. The price for the train is fixed and is R$2,20. During rush hours the trains can be very crowded and packed with people. At the end of a working day thousands of people try to enter the trains and try to conquer a place to sit. This can be pretty rough with a lot of pushing and people jumping through the windows of the train. The survey held among the residents of Vila Aliança shows that 12% of the interviewees uses the train on a regular basis.

Taxi and Motor Taxi

In Bangu and Vila Aliança taxis are active. But most inhabitants only use them for special occasions as they are too expensive for them. Instead of normal taxis a lot of motor taxis are present in the neighborhood. Motor taxis are just a motorbike with a driver on which you can hop on the back. For trips within the neighborhood the fare is R$2,00. As the neighborhood is not very large most trips only take a few minutes. If you compare the distance traveled with the price paid these trips are relatively expensive. In Vila Aliança are 7 motor taxi stands. These stands are places from where a group of motor taxis operate. These groups are organized and they share their profit. Sometimes they have a micro credit that made it possible to buy the motorbikes. 13% of the interviewees indicates to use the motor taxi now and then. For most people using a motor taxi it is also a status symbol, because on the back of the motor you are very visible.

Figure 12: Motor taxi and motor taxi stand

Car and motorbike

Around 20% of the interviewees indicates to have a car or a motorbike available. This means that they or a relative owns a car or a motorbike. Unlike the image of a motorbike in Europe, in Brazil it is also common for woman to drive a motorbike. Unlike some other hilly favelas with narrow alleys, it is possible to enter the favela of Vila Aliança by car. But compared to the favela the car ownership of people who live just outside the favela is higher.

Figure 13: A car in the asfalto of Vila Aliança

Bicycle

In Vila Aliança many people cycle and the bicycle is present on the street. According to the survey almost 75% of the families owns a bicycle. The reason why people in this part of the city are more used to the bicycle is that in the past they used the bicycle to go to their work in the nearby textile factory. Together with the high use of bicycles there are also a lot of bicycle shops and bike repairers in Bangu and Vila model is designed for women but is used by both men and women. The bicycle has thick tires what makes it more comfortable to cycle on a bad road surface. The prices for new bicycles are around R$ 400,- but a second hand bicycle is available from R$ 80,-. Repairs on the bicycle cost a few Reais. Repairing a flat tire for example costs R$2,-

Figure 14: Cyclists and a bicycle repair shop in Vila Aliança

4.4 Traffic Market (Flows)

4.4.1 Main Routes

The most important routes in the project area are from centre of Vila Aliança to the main roads that surround it. Through these main roads the two train stations can be reached. In figure 7 these routes are indicated with the green (Estrado do Taquaral), red (Estrado do Engenho) and light blue (Rua Dr. Augusto Figueiredo) lines. And from these main roads also the Avenida Brasil motorway can be reached. These main roads are made of asphalt and are about 7 meters wide. In Bangu especially around the train station of Bangu some streets are one way streets to regulate the traffic. These streets are indicated on the map with the blue (Rua Sul America) and orange (Rua Cel Tamarindo) line. In rush hours the roads around the train station can be a bit congested. To regulate the speed of the traffic everywhere in the project area speed bumps can be found. On quiet roads as well on the main roads. These speed bumps are made of concrete and are about 10 cm high.

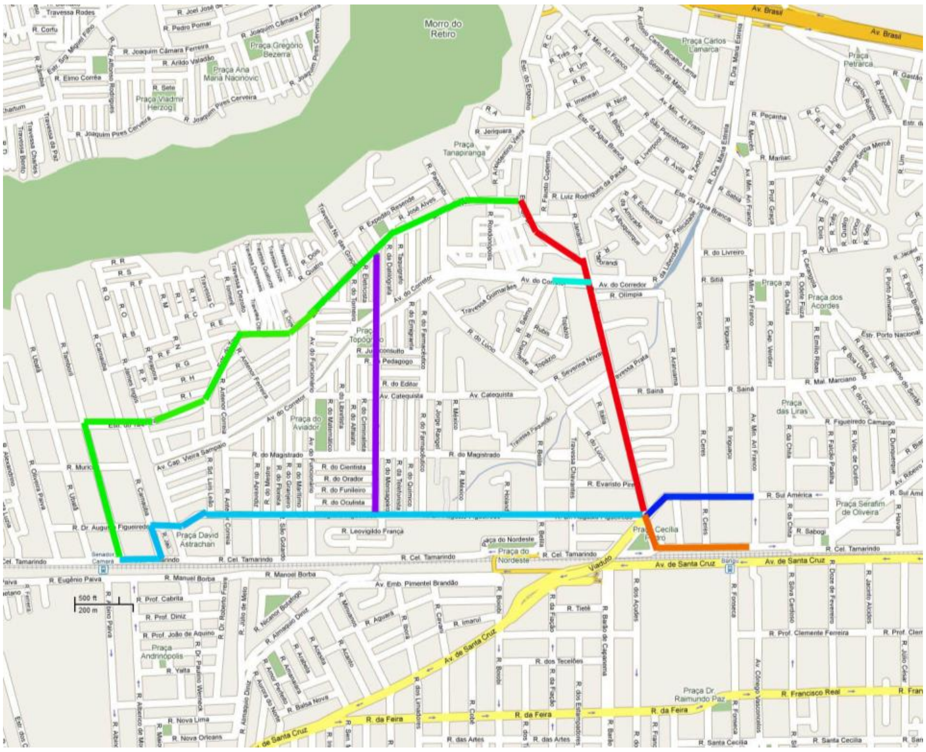

Figure 15: The main routes in the research area

4.4.2 Cycling Routes

To go to the train station of Bangu cyclists choose for direct and safe routes. Cyclists ignore the one way directions on most of the one way roads around the station of Bangu. Observation and counts also showed that cyclist choose a route along roads with hardly any car traffic instead of using the main roads with a lot of car traffic and heavy traffic. Counting shows that on some parts of the main routes to the station of Bangu only 40 cyclists per hour pass. On the quiet routes towards the station of Bangu pass 90 cyclists per hour.

Cyclists do not have their own assigned space on the road. As the roads are not very wide cyclists get easily in conflict with motorized traffic. Especially with lorries this is unsafe. In the survey 43% indicates to prefer cycling on the sidewalk instead of cycling on the road. One intersection in the area

has traffic lights. Beside this crossing there are some other crossings in the area where a stream of cyclists want to cross a busy road and comes in conflict with faster traffic. The interesting thing is that the inhabitants do not see these crossings as dangerous. In their eyes these crossings are only dangerous when police wants to enter the favela and gets in an armed conflict with gang members.

Figure 16: Crossing with traffic lights

4.4.3 Social Safety

People do not feel unsecure when it is dark. The survey shows that 80% of the interviewees would cycle when it is dark. In Rio de Janeiro sunset is between 6 and 8 o'clock depending on the season. Lightning on the bicycle is very uncommon, but some bicycles have reflectors. People worry more about conflicts between the police and the drugs gang because they feel that as insecurity.

4.4.4 Parking

People in Vila Aliança indicate that bicycle theft is a large problem. This means bicycle theft outside the favela. Inside the favela there is the strict law from the drugs gang which does not tolerate theft in the favela, because the gang does not want problems that could attract the police. When people do not obey this law the gang will make sure that the responsible get punished. But at places like the train stations and in front of stores the chance of bicycle theft is high according to the interviewees. It is also very common to use an old bicycle to go to one of the train stations because of the chance of theft. In the survey 80% of the people indicate that they do this. Although the high chance of theft still a lot of people use the bicycle to travel to the station of Bangu and the surrounding shops. Counting shows that on the north side of the station at daytime on average 200 bicycles are parked. These bicycles are chained to the many poles of the sunroof. About 200 meter from the station there is a small place where bicycles can parked in someone's garage. To enter this place the user first has to ring a bell what makes it very user unfriendly. According to the owner he has space for 20 bicycles and he charges R$2,00.


Figure 17: Parked bicycles at the Bangu train station.

The situation at the Senador Camará train station is a bit similar to the around the station of Bangu. But this station is a bit smaller and around this station are only a few shops. Counting here shows an average of 70 bicycles parked. The difference with the situation at the Bangu station is that that here the bicycles are parked in an concentrated area. Also social security here is higher, because in front of the place where the bicycles are parked a motor taxi post is situated. Here are until the beginning of the evening people present that have an eye on the parked bicycles.


Figure 18: Parked bicycles at the Senador Camará train station.

4. Conclusions and recommendations

In this chapter the conclusions of this report will be presented. First the research questions will be answered followed by the conclusion concerning the research problem. In the second paragraph the conclusions will be discussed followed by some recommendations.

5.1 Answers on the research questions

RQ 1: *What are the main origins and destinations in the research area?*

The whole research area exist of residential areas and can thus be seen as a origin. To make it more precise we can distinguish four exact origins. These are the residential area around the train station of Bangu, the favela of Vila Aliança, the asfalto west from the favela and the residential area north of the favela. The main destinations in the research area are the train stations of Bangu and Senador Camará, Shopping Bangu, the mall on the other side of the railway tracks, and the schools in the research area.

RQ 2: *What are the main routes in the research area?*

The main routes in the research area are from the residential areas to the main routes and from there to the train stations. Figure 7 shows these routes. Cyclists also use smaller roads with less motorized traffic to avoid dangerous situations. Figure 10 shows, indicated by the black arrows, the road that has a dead end for cars and is used by cyclist to have a safe alternative for the main road indicated by the red lines. The cyclists use the road indicated by the yellow lines to continue their route to the station of Bangu.

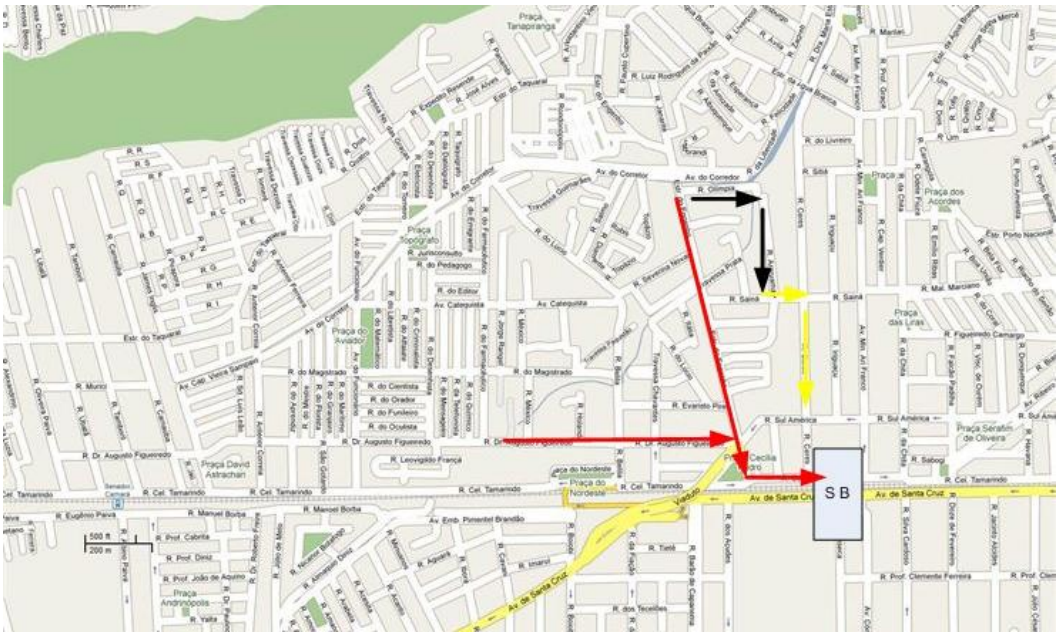

Figure 19: Alternative routes for cyclists.

RQ 3: *What is the demand for a guarded parking facility at the destinations?*

The demand for a guarded parking facility on the north side of the Bangu train station is between 100 and 150 bicycles. At the moment on average 200 bicycles are parked in front of the station. In the survey 50% of the interviewees indicates that they are willing to pay for a guarded storage facility. The survey also shows that many people are afraid that there bicycle will get stolen when they park it at one of the train stations. This creates a demand for guarded parking of bicycles. Other guarded parking facilities such as the ones in Santa Cruz show that it can be very successful and profitable. For most users in Santa Cruz it does not seem a problem that the facility is about 200 meter away from the train station.

RQ 4: *What are the main problems the cyclists face?*

The main problems cyclists face are road safety, bad road surface, bicycle theft and a lack of places to park their bicycle at the train stations.
Bad road safety is caused by the fact that cyclists have to cycle between faster traffic and they do not have a designated space on the road. Most drivers do not respect cyclist on the road what makes that they start to cycle on the sidewalk. This partly causes the complaints about the bad road quality. Most roads are not in a very bad condition and even in the favela most roads are paved. But when cyclists have to cycle on the side walk this are mainly muddy places what makes cycling uncomfortable.
Another problem is the lack of places to park a bicycle at the train stations. At the Bangu train station this is an urgent problem. During daytime the available bicycle racks are full and people chain their bicycle to the pools of the sunroof. This makes that the whole shopping area is full with bicycles. This also makes it attractive for thieves to steal the bicycles. In the whole neighborhood of Bangu this is a serious problem.

RQ5. *What are the main benefits of cycling for the inhabitants of Vila Aliança?*

The largest benefit is that the inhabitants of Vila Aliança can cycle in 5 minutes to the train station instead of walking 20 minutes. Because most people depend on the bus or train to travel to their work and Vila Aliança has good bus and train connections, it is for most inhabitants not possible to skip a bus with cycling. The main benefit is thus saving travel time. A way to save money on a trip is to use the bicycle instead of the motor taxi or van. But most people only use the motor taxi in special occasions.

5.2 Overall conclusion

5.2.1 Parking Facilities

The most important point of attraction in the research area is the train station of Bangu and the shops around it. Most inhabitants of Vila Aliança come here to do their shopping and if they take the train most of them do that at this train station. Here is also a large potential demand visible. Already more than 200 bicycles are parked here every day and this in combination with the high risk of theft of the bicycle creates a demand for a guarded bicycle facility. The risk of theft is also an important reason not to cycle for many people so taking this risk away will improve the use of the bicycle. For that reason starting a guarded parking facility at the Bangu train station will be a good solution for the inhabitants of Vila Aliança.

The difficult part however is where to situate this guarded parking facility. At this moment cyclists can park their bicycles in front of the station and the shops, so a facility to far away from the station and the shops will not be attractive. For that reason the storage facility should be in the shopping street close to the train station. The only suitable place is in the unused corner in front of the Guanabara supermarket. Starting a guarded parking facility here should be done in cooperation with the supermarket. A good example of this kind of cooperation is the Bangu Shopping mall on the other side of the railway tracks. Here a free guarded bicycle storage facility is provided for the visitors of the shopping mall. Pictures of this bicycle storage facility are in appendix H. The parking facility should be a simple facility with a small fence behind which the bicycles can parked, this because there is no enough space to build an indoor facility.

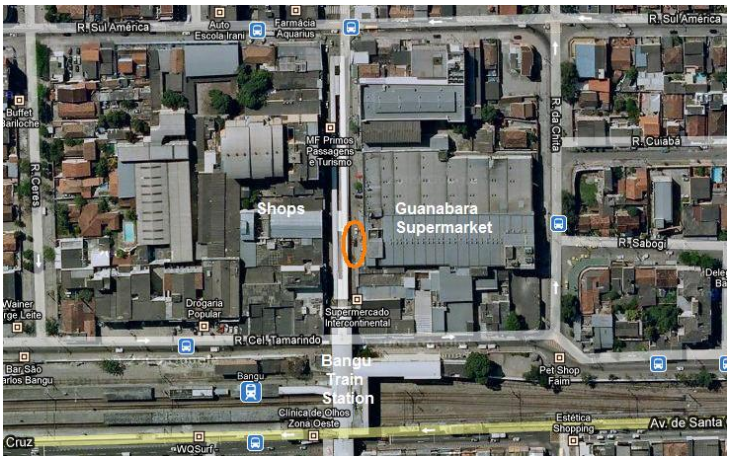

Figure 20: The unused corner in front of the supermarket indicated on the map by the red circle.

Besides a guarded parking facility at the train station of Bangu the parking facility at the station of Senador Camara should be improved. In the current bicycle racks it is hard to chain your bicycle to a fixed point. For that reason people chain their bicycles to the railing of the crossing over the railway tracks to prevent that their bicycle gets stolen. In the Netherlands there bicycle racks on the market where it is easier to chain your bicycle to the bicycle rack. But as Brazilians do not use the same bicycles as in the Netherlands it would be advisable to do some further research about the design of this kind of bicycle rack. These bicycle racks could also be placed near destinations such as football fields and near shops and bars.

5.2.2 Cycle lanes and completeness of the cycle network

To make sure that not only at the destinations problems are solved for the cyclists also along the routes barriers for cycling should be taken away. The main barrier here is the insecurity for cyclists while on the road. Cyclist do not have a designated space on the road and are sometimes forced to cycle on the sidewalk. To change this situation on the main routes bicycle lanes could be created. This makes drivers of cars aware of the space of cyclists on the road and shows the presence of bicycles. In the one way streets the cycle lanes can be used to create space for the cyclists where they can cycle against the current. Examples of these cycle lanes are show in Appendix I.

Creating bicycle lanes also could complete the network of bicycle paths that already exists in Bangu. In the area east from the Bangu train station are already large parts with cycle tracks. In Campo Grande the part of Rio de Janeiro west from Bangu also large parts with cycle tracks exist. Creating bicycle lanes in Vila Aliança is not only good for people that just want to make small trips in Vila Aliança but also makes the total cycle network more coherent. A coherent network creates the possibility to cycle further and reach for example destinations, like work, that otherwise seemed too far away. This creates new opportunities for the inhabitants of Vila Aliança and they can save money they otherwise spend on public transport.

Figure 21: A cycle path in the western part of Bangu

Not only the cycle lanes could show road users the place of cyclists on the road but also on crossings that are used by a lot of cyclists signs on the road could be made. These signs could form a path of white squares showing that cyclist cross the road at that point. A crossing that is eligible for these kind of signs is the crossing of Estrada do Engenho with Rua do Corredor. In picture 7 this is where the red and the turquoise lines cross. At this crossing a lot of cyclists that use the quiet roads have to cross the busy Estrada do Engenho to enter the favela.

Creating bicycle lanes is not something IBISS could do. But with the contacts they have and together with I-CE and the municipality a project could be initiated to improve the roads and give the cyclists their space on the road.

References

Allin, P & Van der Hoek, J. *Internship report on the possibilities for the bicycle in Rio de Janeiro*, 2006.

Grosvenor, T. *Qualitative Research in the Transport Sector*, 2000.

I-CE *Cycling-Inclusive Policy Document: A Handbook, 2009*

Prefeitura da Cidade do Rio de Janeiro – Nota Technica 11: Bangu

Prefeitura Transportes *Plano Diretor de Transportes da Cidades do Rio de Janeiro, 2004.*

www.cycling.nl

www.ibiss.info

http://www.rio.rj.gov.br/

http://www.portalbrasil.net/salariominimo_riodejaneiro_2009.htm

Bachelor Report

Cycling in Vila Aliança

Appendices

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Appendix A - Research Techniques

Observation

Observation is a qualitative technique and has been used to get an idea of the main origins and destinations in the research area. Obtaining a lot of data on origins and destinations is mainly important in larger cities. In small cities and smaller areas such as the research area there are only a few origins and destinations and routes. According to the I-CE Cycling Handbook an analysis of OD flows is not necessary in such a case. In this case the OD's can be listed through site visits and through OD mapping. This is less accurate but gives in small area a sufficient idea of the origins, destinations and routes. Because the main origins are the residential areas and in the case of this research the favela and the main destinations are shops and places where shops are concentrated, train stations and bus stops.

Informal conversational interview

An informal conversational interview is an interview in which the interviewee does not know that he is been interviewed. The interviewer just starts a conversation and asks in this conversation about certain topics he is interested in. In the case of this research that means that shop owners, staff of the NGO and other important people in the research area are being ask about certain topics concerning traveling and using the bicycle. Rubin and Babbie (1993) say that you can use this method the best when you want to maximize your understandings of what you are observing and would like to hold a focus-group within this case. The good thing about these kind of interviews is that the interviewee is at ease and can speak openly. There is not the pressure of a formal interview what could withhold the interviewee of giving answers that are maybe socially not wanted. In the research this kind of interviews have been used to get an idea of the research area and what is going on. Together with the information obtained from the observations the information from these interviews had been used as an input to design the survey and determine where counts have to be done.

Survey

Surveys are used to obtain different kinds of information. This could be travel motives, reasons for mode choice, origins and destinations, characteristics of road users and much more. There are different kind of surveys and the main surveys used in transport research are household surveys, road side surveys, and internet surveys. In this research the choice has been made to use road side surveys. In the kind of area like a favela it is not possible to have a household survey. The area is controlled by a drugs gang and for this reason it is not possible to distribute a lot of surveys in the research area. And also people will be fearful filling in the surveys. For that reason is chosen to have a roadside survey. Roadside surveys are less comprehensive than household surveys. The roadside survey is handed out at a certain location. In this research the survey has been handed out at different locations in the research area to get good sample of surveys. Important for the road side survey is that it does not contain too many questions, because as you are interviewing people during their daily routines they do not have a lot of time. To get enough surveys it is very important that it does not take too much time to fill in. According to the ICE HANDBOOK the five main topics that usually occur in surveys on bike use are: income, ownership and availability, trip making, desired trip making and constraints on bicycle use.

Traffic counting

Counting traffic can be done in different ways. The I-CE Handbook states: “This can take the form of screen line counting in one or both directions and stream counting at intersections. In stream counting at intersections, for every leg of the intersection, the streams in different directions are counted. One drawback is that, in busy intersections, it can be quite difficult for one person to count the different streams from one leg, so more persons per leg are necessary.” That is why according to the I-CE Handbook screen line counts are easier but a drawback is that they also result in less information. For this research the traffic counts are used to get an idea of the number of cyclists on the main routes. In a next phase these numbers can be used to convince the local authorities that there are proper amount of cyclists using the roads. Because in most cases local authorities have no idea about cyclist and the number of cyclists on the road. For that reason screen line counts in two directions have been done. The best period to do traffic counts is during peak hours. The I-CE Handbook says about counting periods: “As for counting periods, it is good practice to use peak periods on ordinary weekdays and to repeat counts for at least one other week in the same period of the year. Counting in peak periods produces a fair idea of peak cycle demand.” During the research counting has been done during the beginning of the afternoon, as this is during daytime a peak period.

Facility counts

To have some data on the completeness of bicycle infrastructure in the research area different facilities have been counted.

Appendix B - Conducted Survey

PESQUISA SOBRE TRANSPORTE NO BAIRRO

O perfil do visitante

1. Sexo: Masculino ☐ Feminino ☐
2. Sua idade: 0-20 ☐ 20-30 ☐ 30-40 ☐ 40-50 ☐ 50-60 ☐ 60 e + ☐ NR ☐
3. No total, quantos pessoas moram em sua residência:
   Moro: só ☐ 2 ☐ 3 a 4 ☐ 5 e mais ☐
4. Onde você morra? Qual bairro:

Algumas questões sobre seu transporte

5. Quais veículos estão disponíveis para você?

Veículos	Você tem?	Quantas vezes por semana você usa?
Automóvel		
Motocicleta		
Bicicleta		

6. Qual transporte você usa?

Veículos	Você usa?	Quantas vezes por semana você usa?
Ônibus		
Van		
Moto táxi		
Trem		
Metrô		
Outros		

7. Quantas conduções você uso pra ir pro trabalho/escola?

8. Qual e o destino de suas viagens?

Destinos	*Você vai pra:*	*Quantas vezes por semana?*
Estação Bangu		
Lojas perto de Estação Bangu		
Estação Senedor Camerá		
Lojas perto de Estação Senedor Camerá		
Lojas aqui na comunidade		
Shopping Bangu		
Trabalho/Escola aqui no bairro		
Trabalho/Escola fora o bairro		
Outros		

Algumas questões sobre o trem

9. Quando você usa o trem, qual estação você mais usa?

Bangu ☐ Senador Camará ☐ Outra ☐

10. Você vai ate a estação de trem:

A Pé ☐
De Bicicleta ☐
De Moto-taxi ☐
De Ônibus ☐
De Van ☐
Outros ☐

Algumas questões sobre a bicicleta

11. Porque você usaria a bicicleta e porque você não usaria a bicicleta? Classifca as razões com **1** (*não importante*), **2** (*pouco importante*), **3** (*importante*), **4** (*muito importante*).

Usar bicicleta	**Classificação**	**Não usar bicicleta**	**Classificação**
Saudável		Risco de furto	
Rápido		Chuva	
Barata		Vou suar muito	
Fácil		*Pouco seguranca no trânsito*	

12. Classifica os principais problemas para ciclistas no bairro com:

1 (não é problema)	2 (pouco problema)	3 (problema)	4 (grande problema)

Problemas	**Classificação**
Falta de estacionamento	
Quebra molas	
Risco de Furto	
Pouco seguranca no trânsito	
Buracos na Rua	

Algumas questões sobre o transito e bicicleta

10. Se eu tiver que pagar 1 Real para guardar minha bicicleta, eu prefiro parar em outro lugar. sim □ não □
11. Se eu vou ate a estação de trem de bicicleta, não tem lugar para guardar minha bicicleta. sim □ não □
12. Eu vou ate a estação de trem com uma bicicleta velha porque se eu for com uma nova vão roubar sim □ não □
13. Eu prefiro andar de bicicleta na calcada sim □ não □
14. Eu ando de bicicleta a noite sim □ não □
15. Quando eu paro perto da estação de trem em Bangu, tem grandes chances de minha bicicleta ser roubada sim □ não □
16. Quando eu paro perto da estação de trem em Senador Camará, tem grandes chances de minha bicicleta ser roubada sim □ não □
17. Os motoristas respeitam os ciclistas quando eles estão andando de bicicleta na rua sim □ não □
18. Aqui no bairro os carros andam muito rápido, e por isso não é seguro andar de bicicleta sim □ não □
19. Quebra-molas não são bons para quem anda de bicicleta sim □ não □
20. Tem muitos cruzamentos perigosos aqui no bairro sim □ não □
21. Um cruzamento com sinal é seguro para se atravessar de bicicleta sim □ não □
22. O tipo de material da rua nao é bom pra andar de bicicleta sim □ não □

Translation of the survey about transport in the neighborhood

Profile

. 1. Sex: Male □ Female □

. 2. Age: 0-20 □ 20-30 □ 30-40 □ 40-50 □ 50-60 □ 60 e + □ NR □

. 3. How many people live in your family:
I live: alone □ 2 □ 3 a 4 □ 5 and more □

. 4. Where do you live? Which neighborhood:

Some questions about you transport

5. Which modes are available for you?

Vehicles	You have?	How many times per week do you use it?
Car		
Motorbike		
Bicycle		

6. What types of transport do you use?

Modes	You use?	How many times per week?
Bus		
Van		
Motor taxi		
Train		
Metro		
Others		

7.

8. What is the destination of your trip?

Destination	*You go to:*	*How many times per week?*
Bangu train station		
Stores at the Bangu train station		
Senedor Camerá train station		
Stores at the Senedor Camerá station		
Stores in the neighbprhood		
Shopping mall Bangu		
Work/ School in the neighborhood		
Work / School outside the neighborhood		
Other		

Some questions about the train

9. When you use the train which station do you use?

Bangu □ Senador Camará □ Other □

10. How do you go to the train station:

Walking □
Bicycle □
Motor-taxi □
Bus □
Van □
Other □

Some questions about the bicycle

11Why to use or not use the bicycle

1 (*not important*), **2** (*little important*), **3** (*important*), **4** (*very important*).

Using the bicycle	**Classification**	**Not using the bicycle**	**Classification**
Healthy		Risk of theft	
Fast		Rain	
Cheap		Sweating	
Easy		Little safety on the road	

12. Rank the problems for cyclists in the neighborhood:

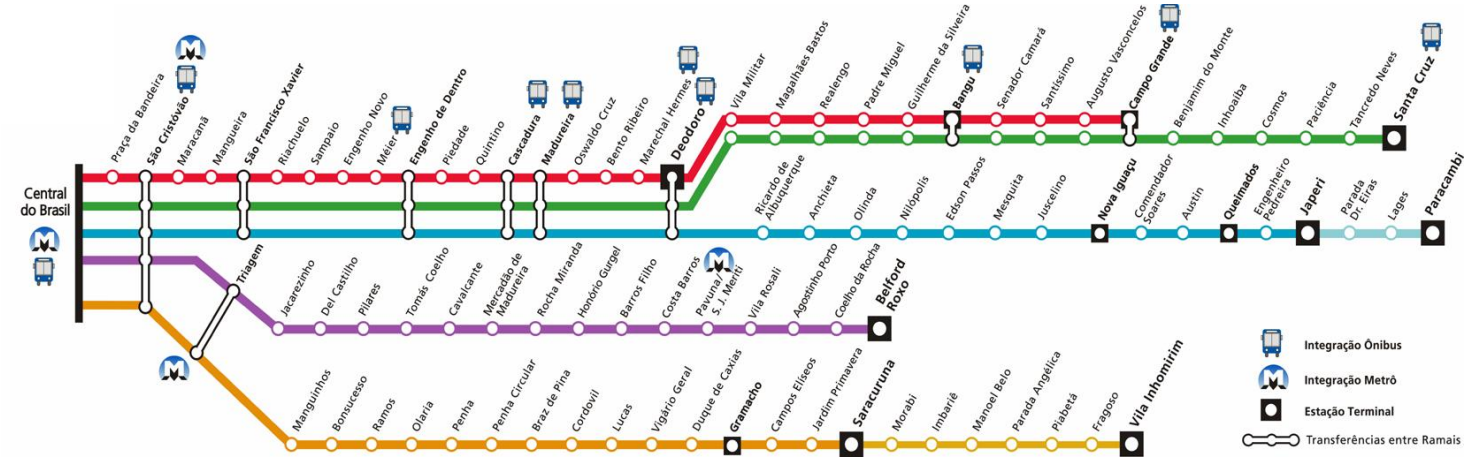
1 (not a problem)	2 (small problem)	3 (problem)	4 (big problem)

Problem	**Classification**
Lack of parking space	
Sleeping policeman	
Risk of theft	
Little safety on the road	
Bad road surface	

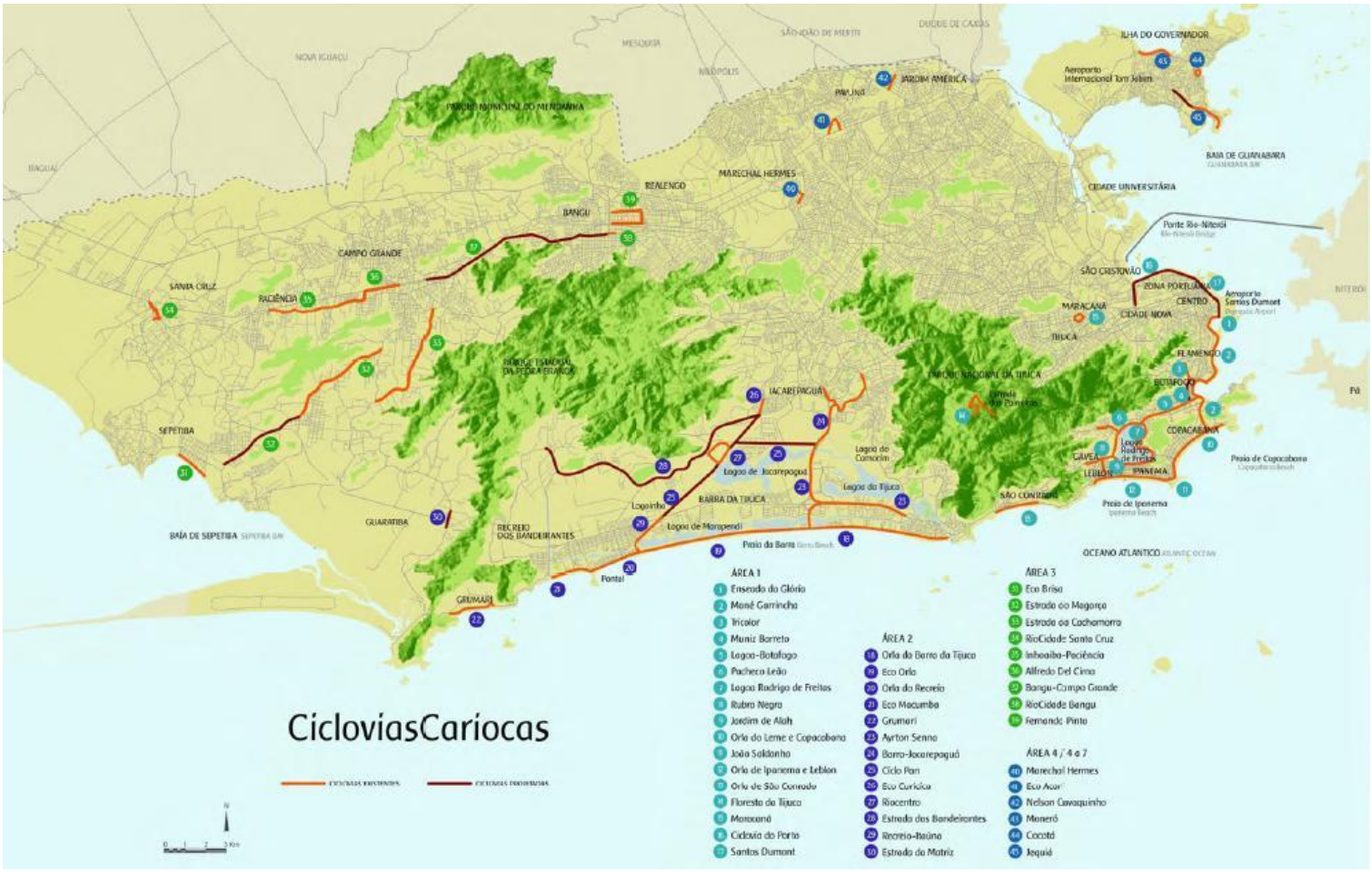
Some questions about traffic and the bicycle to answer with yes or no

23. When I have to pay 1 Real to park my bicycle, I prefer to park on an other place.
24. When I go to the train station by bicycle there is no place to park my bicycle.
25. I go to the trainstation with an old bicycle because a new one will get stolen.
26. I prefer to cycle on the sidewalk.
27. I cycle in the dark.
28. When I park my bicycle at the Bangu train station there is a large chance that my bicycle will get stolen.
29. When I park my bicycle at the Senedor Camara train station there is a large chance that my bicycle will get stolen.
30. Car drivers respect cyclists when they cycle on the road.
31. Here in the neighborhood cars drive very fast, that is why it is not safe to cycle.
32. Speed bumbs are bad for cyclists.
33. There are a lot of dangerous crossings in the neighborhood.
34. A crossing with traffic lights is safe to pass by bicycle.
35. The road surface is not good to cycle.

Appendix C - Train Lines in Rio de Janeiro



Appendix D – Cycle routes in Rio de Janeiro



Appendix E – The 5 requirements for cycle friendly infrastructure

Coherence

It is important that all cycling infrastructure together forms a whole. So the network provides connections between all origins and all destinations and especially the important ones. Coherence also means that there should be good connections with other means of transport such as bus and train. With good integration it is possible to make a whole journey from origin to destination.

Directness

Directness means that cyclists can use the most direct routes and that detours keep to a minimum. The bicycle is most used for short trips and cyclist now the area well. So if they can choose between a short route or a longer route with cycling infrastructure they still choose for the shortest route. Cyclist also do not search very long for a parking spot but most of the time just park at their destination.

Safety

As cyclists are vulnerable in traffic the safety requirement should guarantee safety for cyclists and other road users. In design it is important to keep encounters between fast moving traffic an cyclists at a minimum and separate them in time and space.

Comfort

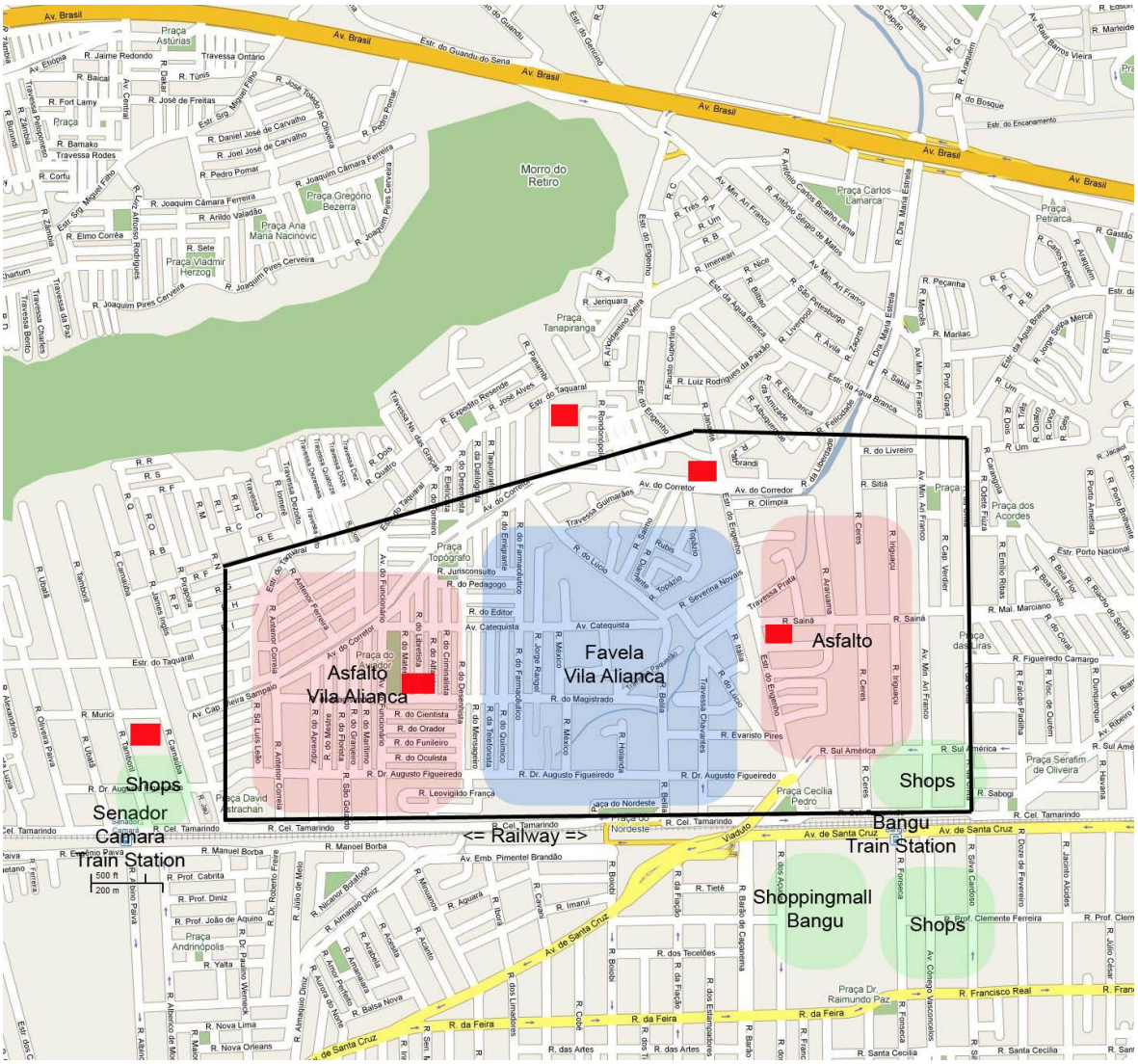
As cycling costs physical effort so delay caused by shortcomings of the infrastructure makes cycling less attractive. Riding on a road with bad surface discourages cycling. It is thus important to have a smooth surface and minimize the chance of stopping and other nuisance caused by other traffic or weather.

Attractiveness

Attractiveness means that the cycle infrastructure fits well in its surroundings. Attractiveness also includes the criterion social safety, which is clearly associated with surrounding design and context. People feel safe in busy places.

Appendix F - Brazilian Bike Caloi Poti

Appendix G – Schools in the project area



The schools are indicated by the red squares on the map.

Appendix H - Example of the bicycle storage facility at Shopping Bangu

Appendix I - Examples of cycle lanes

Before After