Bicycle mobility in Rio de Janeiro

Bicycle storage facilities to improve bicycle mobility in Jardim América & Vigário Geral

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Preface

You are going to read our final report which describes our activities and the outcomes of our Bachelor Assignment in Rio de Janeiro, Brazil, commonly referred to as Rio. The objective of this assignment was to make an integral plan for bicycle storage facilities that will be mainly used by the inhabitants of favelas (slums) in the areas Jardim América and Vigário Geral.
We conducted this research for the company IBISS in Rio and as the final assignment for our Bachelor Civil Engineering at the University Twente, Enschede.

At first we had a critical attitude towards the non-motorised transport (NMT) issue. After all, in the Netherlands cycling is very normal. We had talks with Paul en Jasper, who had already done research in Rio, and several experts in the field of NMT. This changed our whole perspective of cycling and, in particular, how it can be used to combat poverty.
Through Rob Hulleman we came in contact with Nanko van Buuren and the assignment was discussed. In the mean time, it was agreed that Bas Tutert and Rob Hulleman could advise us as supervisors. Bas Tutert is partly working at the University and is an expert on transport, Rob Hulleman works for I-CE and is an expert on bicycle mobility in developing countries.

We want to thank our supervisors Nanko, Bas and Rob for their advice and guidance. Nanko always helped us and advised us really well. He also was very clear about what IBISS wished to achieve. And not only professionally, but in free time as well, we have enjoyed quite some Brazilian beers together. Bas has been an important source of information when we had some questions. But most of all he has supplied us with a lot of literature on NMT. During Rob's stay in Brazil, he had some revealing criticisms, for which we thank him. Also Warner Vonk took an interest in our project - we also want to thank him. He not only had some useful contacts, but also had some tips on how to have a great time in Rio. Both Rob and Warner have been working on setting up a Bicycle Partnership Programme that I-CE is working on. We hope that this will be a success in Rio and can be continued throughout Brazil. Martin Stienstra was very helpful supporting the cultural aspects of our stay in Brazil. Claudia Tavares, who works in city hall, helped us a lot and she would always make some time for us. Paulinho, Sandro, Farinha and Victor were very helpful in guiding us through the favelas. They did not only gave us very useful information but, maybe even more important, always knew how to make fun while working.
And also, to all the people that we have forgotten in this preface, thank you very much.

March 2007,

Rio de Janeiro / Enschede,

Kees Kant and Erik Sambell

Management summary

In the northern favelas Jardim América and Vigário Geral in Rio de Janeiro the standard of living is low and NGO's such as IBISS are looking for ways to make a positive structural change for the people in the favelas. One of these ways is promoting bicycle mobility. By using the bicycle, people can avoid using the bus or other forms of transport that cost money. In practice people can reach a bigger area for the same amount of money. This creates job opportunities and lowers costs of living.

Previous research has demonstrated that despite the use of bicycles being low at this moment, there are real opportunities for bicycle mobility in the area. It was recommended by Paul Allin and Jasper van der Hoek that the construction of bicycle storage facilities would stimulate their use. Paul and Jasper are students at the University Twente who have already done some research on bicycle mobility in Rio de Janeiro.

Following this recommendation, this report outlines an integral plan for bicycle storage facilities (BSF) in the area: an arrangement plan, a utilization plan and an impact assessment plan. The implementation of these plans will become a pilot project, which will serve as a learning experience for similar projects in Rio de Janeiro. Therefore it is also important that the pilot project is evaluated one year after implementation, as described in the impact assessment plan. The utilization plan describes by whom the facilities will be exploited and maintained.

In our research we encountered the mindset Brazilian people have about cycling. Cycling is still not considered as a fully accepted alternative for public transport or the car as it is in the Netherlands. However, there is a positive development but this should be stimulated by creating bicycle facilities.

The most suitable locations for a pilot project are Praça Jardim and along the Dutra highway.
The first BSF will be built inside a central building at Praça Jardim, the centre of Jardim América. The starting capacity will be 100 places which could be expanded to a maximum of 318 places. The capacity and turnover make paid guards possible. There is also space for a repair shop - this is an extra service for users of the facility.
The BSF will be under the control of IBISS and they will construct it with materials that are bought as much as possible inside the research area. The department of employment and justice will finance this BSF during the starting period. After a while the income will be generated by asking a fee of R$ 0,50 for storing a bicycle and a share of the revenue from the repair shop.
The impact of this BSF can be measured in two ways; counting bicycles and interviewing people. In the first year employees of the BSF will conduct these during the first week of each month (counts) or every three months (interviews).

The second BSF will be built at both sides of the bridge over the Dutra. The starting capacity will be 16 places at the side of Jardim América and 10 places at the side of Parque Colombia. The total capacity could be expanded to a maximum of 78 places.
Because of the smaller capacity and turnover this location is not designed as a guarded bicycle facility. Only if the BSF turns out to be a success in the future this facility can be changed into a guarded one. The business that is set up at Praça Jardim than can take control of this BSF as well.
The BSF will be constructed by IBISS with materials that are bought as much as possible inside the research area and the government will finance this as well.
The impact of this BSF can be measured in only one way; counting bicycles. During the first year employees from the BSF at Praça Jardim will count the stored bicycles during the first week of each month.

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1. Background

To create an understanding of favelas, this phenomenon is explained in the first paragraph. Next the company IBISS, for which we worked, is described. The last paragraph is about the situation in our research area, and the opportunities for cycling for the inhabitants.

1.1. Favelas

Rio de Janeiro is one of the biggest cities in Brazil: almost 12 million inhabitants. It is estimated that 6 million are living in favelas: Brazilian for slum. A favela is made up of self-made houses; sewerage or any formal planning is often missing.

Originally favelas were built on the mountainsides near to places with job opportunities. For example, a lot of favelas are located on the mountainside along Copacabana and Ipanema, touristy neighbourhoods located along the beach. But through the years Rio de Janeiro attracted more and more people looking for work. The favelas grew fast, and expanded north to flat areas. Many inhabitants of favelas were forced to live far away from areas with jobs.

When a favela ages, the standard of living usually improves. This is because the inhabitants spend a part of their income on improving their houses. Many old favelas have running water and electricity. Since a few years the government is slowly improving favelas trough the 'favela-bairro' project. This project aims to turn favelas into bairros (normal neighbourhoods). This is done by hardening roads, improving houses and constructing sewerage and electricity networks.

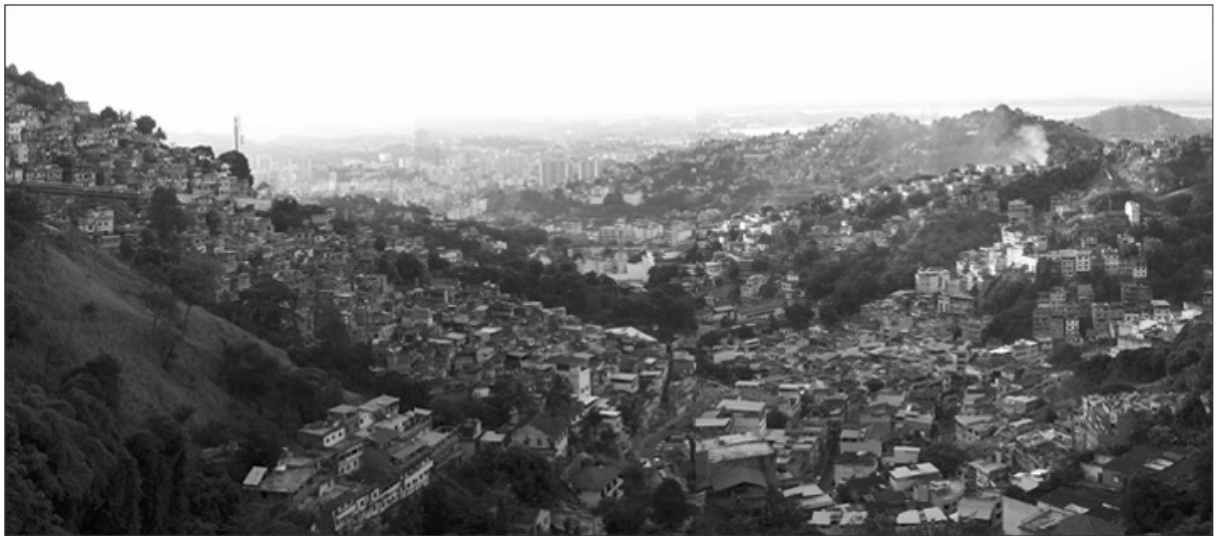

Figure 1. Favela (favelafaces.org)

The most favelas started in the 1970s. Because the government neglected the favelas, drug gangs used the favelas to stay hidden. Slowly the gangs seized power over favelas and created their own societies, complete with an organisation and laws. These favelas, excluded from normal society, really are safe havens for the drug lords and their organizations. The inhabitants suffer from this situation in multiple ways. Government services do not have access, bystanders get shot in shootings between the gang and the police and youth is recruited to work for the gangs.

To keep on operating, the leaders create their own laws – 'lei da favela' – and breaches of these laws are severely punished. A shot in the hand or foot is a common punishment, the most severe is execution. The reason behind this strict system is keeping the police away. A stolen van is a perfect reason for the police to attack a favela, so naturally drug gangs want to prevent this from happening. As a consequence crime is a rarity within these strictly ruled favelas.

Three drug gangs operate in Rio: Commando Vermelho, Terceiro Commando Puro and Amigos dos Amigos. Also militias operate in favelas; this group consists of former or corrupt police officers. Some

of them also originate from the army. The militias do not trade in drugs, but collect money by extorting favela inhabitants.
All the time there is an all out war for more power within and between the four enemies for territory, arms and drug trade. Also every day the military police is executing attacks on drug gang controlled favelas. Approximately 6000 people die yearly as a result of this conflict, which can be described as a civil war.[1] For comparison, in Baghdad 11.264 people died in the period march 2003 – march 2005 [2], that is almost 6000 dead in one year.

1.2. IBISS

IBISS is short for Instituto Brasileiro de Inovações em Saúde Social (IBISS). Translated Brazilian Institute for Innovation to Improve a Healthy Society. [3] IBISS was founded in 1989 by Nanko van Buuren who still is the Executive Director. The work of IBISS aims at making an end to the process of social en societal expulsion. IBISS wants to structurally and sustainable contribute to a society in which everyone has access to public services, in which diseases and social inequality are being confronted and human rights respected.

IBISS is always trying to find new methods to fight poverty. That is why IBISS sets up pilot projects to develop new challenging working methods. The results of these pilots contribute to new policy. IBISS puts a lot effort into convincing local governments to take over these projects in the long term, substantively and financially.
At the moment the 56 projects of IBISS run in more than 30 favelas These are projects in the field of street work, shelter homes, district bounded projects, neighbourhood constructing work, specific groups, preventive healthcare, disabled care programmes, framework shaping & further training and finally human rights & interest assistance. The projects are recognizable by their initiating and renewing character.
To make the development of these new working methods possible and to stimulate the application of these methods IBISS has set up their own training centre. Social workers and informal leaders in the projects and neighbourhoods are given framework shaping programs here.
A short description of the several areas of work is given in Annex B.

The NGO is working with a small staff and a total of 432 employees working directly for or within IBISS projects. 302 of those employees have a contract involving alternative penalties, 'Soldados nunca Mais' and 'Pais Trabalhando'. 'Soldados nunca Mais' is a project that helps young men leaving the drug scene by offering alternative ways of earning a living and respect. 'Pais Trabalhando' is a project which offers jobs – for example at court-houses – for parents that neglected their children.

1.3. Research Area

Jardim América and Vigário Geral are two favelas in the north of Rio de Janeiro. Jardim América consists of several neighbourhoods differencing in age. The old part, in the centre, is called the asfalto. This name refers to the asphalt roads through the neighbourhood. The newer parts are located on the edges to the north and to the west. These parts are typical favelas and the living conditions are really poor. Drug gang Commando Vermelho has some power here.
Also Vigário Geral is divided in an asfalto and a favela, separated by a railway track. The asfalto is commonly named Vigário and is very hilly. The favela is one of the favelas that participated in the favela bairro project. This has resulted in improved conditions for the inhabitants on various aspects, especially housing, health and infrastructure. Because it is isolated – only one entrance for motor vehicles – and the rule of Commando Vermelho is strict here, it is still a favela.

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[1] Guardian, *Power battle sparks street war in Brazil's City of God*, February 11th 2007.
[2] Oxford Research Group, *Iraq Body Count; A dossier of civilian casualties 2003-2005*, July 2005.
[3] Steunfonds IBISS [ibiss.info], *Over IBISS: Missie*, 2006.

To illustrate the difference between the asfalto and favela area some pictures are included In Annex N.

Despite the improving conditions in these neighbourhoods, the inhabitants still do not have a lot of money. The money they earn, is spend for a large part on food, housing and transport. The last spending is the reason of this investigation. Most inhabitants use several forms of public transport when travelling to their work; train, busses and vans (kombis). Often they have to use a combination of these different modes of transport to reach their destination.
In Rio de Janeiro the transport system is different than in the Netherlands. In Rio de Janeiro you pay for a ride instead of a certain distance. This results in a set price for the train, bus and kombi. Therefore it costs more money when you have to use multiple forms of transport. An opportunity to reduce these costs is to substitute a part of the trip by bicycle. After all, after buying a bicycle, the only costs are reparations on the bicycle now and then.

From September 2005 till February 2006 the possibilities of the bicycle were investigated by Paul Allin and Jasper van der Hoek. According to their report[4] a substantial portion of the population already owns a bicycle, but very few use it as a form of transport. The bicycle is mainly used as a way to parade through the neighbourhood, despite the fact people can save a significant part of their income. There are a number of problems that prevent people from using the bicycle as a form of transport:

1. Poor road safety

In Rio the Janeiro bicycles mostly do not have their own designated space. Furthermore motorised transport does not pay attention to non-motorised transport. Therefore it can be very dangerous to cycle.

2. Shortage of storage facilities

There are hardly any facilities to store ones bicycle. Only in front of busy shops there are racks placed. A negative consequence of this is theft. Inside a favela like Vigário Geral or Terra Encantada, theft is not present, because of the strict social control. But outside or on the edges of the favela, there are very few places where it is safe to park a bicycle. A second consequence is that bicycles have more chance on breaking or being vandalised when not stored in an orderly fashion.

3. Mindset

In most of Rio de Janeiro and in Jardim América and Vigário Geral too, the bicycle is not really seen as a mode of transport. Besides that, the style of living is one of taking it easy. As a result, people prefer to take the kombi or bus. The bicycle is mostly used for recreation or to show off.

Two neighbourhoods in Rio de Janeiro with a lot of bicycle mobility are Bangú and Santa Cruz. The bicycle is very popular there as a mode of transport. In these neighbourhoods there are a lot of facilities for cyclists as well. More about these neighbourhoods in Annex L.
This is more or less the desired situation for our research area. A situation in which the bicycle is being fully recognized as a way of transport for the middle-long distances and where it is safe to cycle around the neighbourhood and to store your bicycle at your (sub-) destination.
By achieving this situation people can save money by avoiding the use of busses and kombis and save time by use the bicycle in stead of walking. The increased mobility ensures an expanded range which gives people access to more jobs. Also the living conditions of the inhabitants will improve in various ways. First of all there will be less motorized traffic needed which makes the air less polluted and the streets safer for non-motorized transport. Secondly cycling is an healthy exercise.

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

2. Research project

To reach the desired situation, a pilot project should be executed. From this pilot project lessons can be learned to set up a bigger project. In this way measures can be tried out. The obstacles for bicycle mobility – formulated in the previous chapter – are discussed in the framework. Next the objective and the research questions to reach this objective are formulated. In the last chapter these questions are answered.

2.1. Framework

To improve bicycle mobility in the area, there are three obstacles: poor road safety, shortage of bicycle storage facilities and the mindset.
The most important problem is the shortage. At the edges of the favelas and in the asfaltos generally there is no strict social control to prevent theft or vandalism. A potential BSF has to be guarded to prevent theft.
The poor road safety is also an issue, but this only becomes relevant when bicycle mobility increases as a result of bicycle storage facilities.
The mindset on itself will not be investigated. It is assumed that the installation of BSFs will have a positive effect on the mindset.

2.2. Objective

The objective is to make an Arrangement Plan, Utilization Plan and an Impact Assessment Plan for future bicycle storage facilities, in the research area, which have to concur with the yet to be developed Programme of Requirements.

In the objective there are some words used that are important for the project. Therefore a list with definitions from these and other frequently used words is given in the glossary of terms.
Next to this objective the research model has been formalized. This has been used to formulate the research questions. The model is shown in the Annex A.

2.3. Research Questions

To reach the objective, research questions are formulated.

RQ 1. *What is the relevant data on bicycle mobility in the research area?*

RQ 2. *How can locations in the research area be arranged on the basis of the Programme of Requirements?*

RQ 3. *How can the bicycle storage facilities be utilized?*

RQ 4. *How can the impact of the pilot project be measured?*

3. Data collection

This chapter will elaborate on the collected data in the research area that is needed for the three plans. First the research area is being analysed by pointing out the supply (3.1) and demand (3.2). After that, the zones with the greatest opportunities for a BSF will be described more in detail (3.3) and some important statistical information on these zones is pointed out (3.4). Then the supply routes of these zones will be discussed (3.5). And finally the several journey purposes of the inhabitants that travel to, from or within these zones are pointed out (3.6)

The map below shows the research area. The several neighbourhoods have been outlined as well as some vital information about threats and opportunities for bicycle mobility.

Figure 2. Threats and opportunities in the research area.

3.1. Supply

There are several facilities in the research area that are good for bicycle mobility. But there are some factors that hinder bicycle mobility as well. These facilities and factors are discussed in this paragraph.

The most important factor in the research area that hinders bicycle mobility is the two hilly areas. These areas consist of several ridges that are hard to cycle over. When visiting this area we have seen no bicycles at all, almost everybody is walking here. Not even the kombi's drive up these hills and most busses avoid them too.

In the east of the research area there is the favela Vigário Geral that is controlled by the drug gang Commando Vermelho. Parade de Lucas, a neighbourhood south of Vigário Geral is controlled by one of the competing drug gangs, Terceiro Commando. In between these two neighbourhoods, there is a strip called the Gaza strip. These drug gangs get into gun fights on a regular basis at this strip. At times the police also get involved. Therefore cycling is not safe around this area. Because the other borders of Vigário Geral are a railway and a river/swamp, the only possible area to cycle to is in the neighbourhood itself or to the train station.

An unsafe situation occurs in the favelas in the north(west) too when the militias enter. Militias are groups of former soldiers and policemen that are fighting against the drug gangs. These fights are accompanied by a lot of violence and gunfights which makes cycling impossible at times.

Finally the condition of the roads in some parts of the research area is quite bad. The asphalt is in pretty good condition, but when entering the favelas in the north and the northwest the dirt roads

begin. In good weather this is not a problem, but after (heavy) rain it is. This probably is one of the reasons that most bicycles in the research area are ATB's.
Two important facilities for bicycle mobility are already present in the research area. First of all there is a bicycle path crossing Jardim América from north to south and backwards. At first this path was not really used by cyclists but only by joggers, mostly because it goes from nowhere to nowhere. But nowadays the path is used by more cyclists every day.
Secondly there are already quite a few bicycle shops in the research area present. These shops vary in size and service, but most of them repair and sell bicycles for a reasonable price (starting at R$ 60,- for a second hand bicycle). Also the positioning of most of these bicycle shops is pretty positive, as a lot of these are located along an important supply route towards important attraction points in the area.

3.2. Demand

First of all, a positive fact is that a lot of people already own a bicycle, especially a lot of young people in Jardim América and Vigário Geral. When going to the research area we could see them riding their bicycles around. When talking with people in these areas, we found out that a lot of young people indeed own a bicycle. Families often have more than one bicycle and bicycles are often shared among all members.
Secondly there are some zones in the research area that attract a lot of people. The first is the train station Vigário Geral in the east. This station is located along the railway between the stations Central do Brasil and Saracuruna and serves as a transport hub for people from the surrounding neighbourhoods (see Annex M). During rush hour trains pass here every 15 minutes. Many people can walk to the station; others use a kombi or bus.
The second zone is the main square of Jardim América (Praça Jardim). On this square there is a newly constructed health centre, a supermarket, a soccer field and several other shops and bars. Close to this square are a school, a church and a bicycle shop. Obviously this square attracts a lot of people from the whole of Jardim América and Vigário Geral. Especially the supermarket is a big attractor. The new health centre attracts less people but this is expected to rise because it is the first health centre in the neighbourhood. Also the soccer field is a big attraction, because of the games that are played here. The school and the church are interesting as well, because of their regular attraction on the surrounding area. At last there is a building next to the health centre that is used by the Comlurb at the moment. The Comlurb is the Brazilian garbage collecting service. They have to move to another location because Brazilian law states that they are not allowed to be located next to a health centre.
The third zone is the highway BR 116 (Via Dutra) that can be found in the south west part of the research area. There are three bus stops along this highway which have attraction on cyclists that we numbered 1 to 3 from west to east. At the three locations there is the possibility to cross the Dutra, by either a bridge or a tunnel. At the moment these people go to these bus stops by bus or kombi. Some of them who live close enough go their walking. Instead these people could cycle to save money or time.

3.3. Chosen zones

On the basis of data collection and conversations with Nanko, Sandro and Farinha a selection was made of the several zones discussed. Because of the limited time for the assignment, we chose two zones with the best chances to succeed as a pilot project. These chosen zones have been investigated further. The information on the other zones is admitted in Annex F.

The first zone that will be investigated further is Praça Jardim (figure 3). There is a lot of mobility seven days a week. The promising thing about this square is that the crowd is diverse. People from the surrounding area come to buy their groceries, see a soccer game or go the church. Children from all Jardim América go to school and people from all Jardim América and Vigário Geral go to the new health centre. Something that underlines the importance of this square for the neighbourhood is the number of kombis and busses that pass it. A list of these busses and a map of their routes is given in Annex C. People from within the neighbourhood now using the bus, could switch to the bicycle. Some more detailed information about the square is pointed out below.

The health centre of Jardim América has opened in September 2006. In the time we were there not all services were operating yet. The health centre wants to pay attention to the vital problems first by offering basic services before offering the complete program. A list of services that are offered already and a specification on the 3273 visitors that were assisted in October 2006 is given in Annex D. According to Solange Signaini, a social assistant who works here, these 3273 visitors can be equally divided over the days the health centre was open this month. Thus the number of visitors for one day is about 149. The health centre is open from Monday till Friday from 7 am till 5 pm.

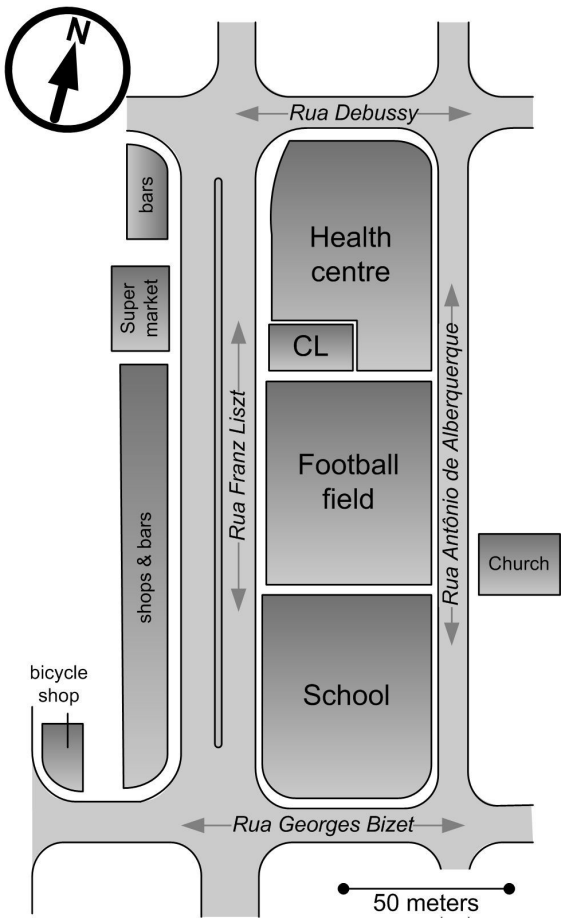

Figure 3. Location Praça Jardim.

The name of the church is Asembleja de Deus Jardim América. According to Alvaro Innociencio, the secretary of the church, the most visited meetings are on Sundays. In the morning there are 200 people visiting and in the evening all members, approximately 500 people, visit the church. There are meetings during the week too, on Tuesdays and Thursdays in the evening. But less people visit these meetings; respectively about 150 and 50 people.

The supermarket Multi Market has about 2000 clients every day, according to the manager Benicio Braz. The supermarket is open everyday from 8 am till 8 pm. The manager also mentioned that the peak moment is the last hour the supermarket is open, from 7 till 8 pm. The results of interviews held here is given in Annex D.

The name of the school is Escola Municipal Zélia Braune. The school offers basic education to about 1000 students. In the night there is education for adults, approximately 75 students. Because of this combination, the school is open from 8 am till 5 pm and from 7 till 11 pm. The school has done a survey amongst the students. These results are included in Annex D.

The soccer field is located at Praça Jardim as well. There are some other soccer fields in the research area as well, but this one is most important for Jardim América. They have an own team as well as the other neighbourhoods and compete with them in weekly games. At the end of the season cup games are taken place here too. Games are played in the weekends and on weekly nights trainings take place. Games attract a lot of people as soccer is a really important part of their life. But trainings are not visited on a regular basis. The amount of people that come to watch a game varies from 50 till more than 100, depending on the importance of the game.

In table 1 important outcomes of interviews and the survey at the school are presented. The big difference in the percentages of the school is caused by the possibility for these students to use the bus for free. There were no conducted interviews at the church or the soccer field. The data from table 1 and conversations with inhabitants and employees of IBISS gave us a good impression of the ownership and the use of bicycles. The general impression is a ownership percentage of approximately 50% and use of approximately 25%. But this last percentage is probably lower for the church because the members live nearby. In the research area we have seen a lot of churches and only one health centre and a few supermarkets of this size.

	Ownership (%)	Use (%)
Health centre	56	20
Supermarket	63	35
School	45	4

Table 1. Bicycle ownership and use at Praça Jardim.

The second zone that will be investigated further is location 1 along the Dutra (figure 4). There are two bridges at this location, one for general use and one for pedestrians and cyclists. In this report the bridge for general use is referred to as the bridge, and the other as the pedestrian bridge. This location has the most users of the three locations according to our counts. The total amount of people getting on the bus is about 187 people in the morning and getting off the bus in the evening 268. This difference can be explained by two reasons. The first is that this zone offers a lot of work in the evening too, so many people arrive there as well. The second is that this bus stop offers more social safety when it is getting dark in the evening, which makes it interesting to get off the bus here. Inhabitants of Jardim América prefer to get of the bus here instead of location 3 along the Dutra because there they have to use a tunnel to cross the Dutra homeward. The number of people however depends on the weather conditions and in general is already low. Therefore and because of the first reason for the difference we use the number of 187 people.

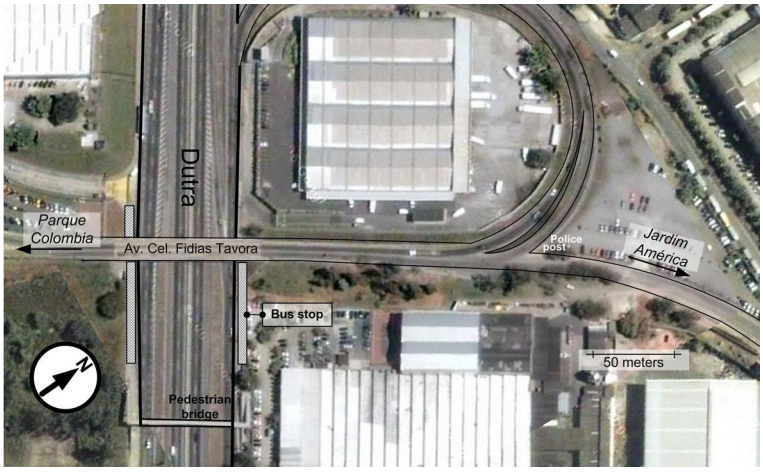

Figure 4. Location Dutra.

Conversations with people at the bus stop showed that two thirds of the people live in the neighbourhood on the south side of the Dutra, Parque Colúmbia. Again two thirds of those who live in Parque Colúmbia can walk to their house within 10 minutes. The rest, 42 people in total, plus the people from Jardim América, 62 people in total, are interesting for the bicycle storage. At the moment most almost all these people use a kombi or walk home. Only a handful of people use the bicycle.

3.4. Statistics

For calculating the capacity some statistics have to be known. Therefore counts have been conducted at both locations.

3.4.1. Praça Jardim

The several attractions at Praça Jardim have been investigated for their attraction to cyclists. We have investigated the present and potential demand in this zone. In Annex D an overview of all the surveys can be found. In table 2 the cycle demand for each attraction is shown at their peak moment.

	Peak moment	Present	Potential	Total
School	Mon – Fri, 8 am – 5 pm	42	96	138
Health centre	Mon – Fri, 8:30 – 9:30 am	9	14	23
Supermarket	Mon – Fri, 7 – 8 pm	88	64	152
Church	Sunday, 6 – 8 pm	20	40	60
Football field	Fri, 8 – 10 pm	10	40	50
Stored bicycles	Wed, 11 – 12 am	26	-	26

Table 2. Cycle demand at Praça Jardim.

These numbers cannot simply be summed up. These demands are not all for the same period of time. The students from school for example will come in the morning and leave at the end of the afternoon. The visitors of the health centre and the supermarket visit the Praça during the whole day. And the visitors of the church or the football field come in the weekends and at evenings during the week. Calculations show that the busiest hour is from Monday till Friday between 08.30 and 09.30 am. At this time the present demand is 80 places. The potential extra demand is 175 places. This potential extra demand consists of the people who already own a bicycle but do not use it and responded that they would use it if there was a BSF. It is to be seen whether this outcome can be translated to the future use of the BSF.

3.4.2. Dutra

In paragraph 2.2 the number of potential users for a BSF at this location already is calculated. From Parque Colombia there were 42 people and from Jardim América there were 62 people interested in a BSF. These 104 people divided over Parque Colombia and Jardim América at a ratio of respectively 3 to 2, are not expected to use a bicycle as a mode of transport at once. Although a lot of people already have a bicycle, most of them use it just for exercise. However, when going to this location during rush hours in the morning and evening, there is quite some cycling over and under the two bridges. During morning rush hour there were around 20 people cycling at the Dutra and another 20 people used the two bridges to get to the other side. Sightings of bicycle mobility one year ago in the area report less cyclists. This gives us the idea and the encouragement that the bicycle is being used as a mode of transport more and more. However, parked bicycles and cyclists are less seen that in, for example, Praça Jardim.

Conversations showed that 50% of the respondents already have a bicycle and 40% of the respondents said to use a BSF. Because of the experimental character of this planned BSF, expectations should be tempered. Therefore the total present demand is reduced from 42 to 21. The potential extra demand can be calculated by using the remaining 21 and the other remaining respondents that already have a bicycle. Therefore the potential extra demand is 52. A table with the average counting values is given in Annex E.

3.4.3. Summary

In table 3 the cycle demand for both locations is clarified on more time.

Location	Present demand	Potential demand	Total demand
Praça Jardim	80	175	255
Dutra	21	31	52

Table 3. Cycle demand at both locations.

3.5. Supply routes

Supply routes are the routes that (potential) cyclists use to reach the chosen zones. The supply routes at both locations have been tested on potential obstacles.

3.5.1. Praça Jardim

Praça Jardim lies in the central part of Jardim América and does not really have supply routes. People come to this square from all of the research area and use the road that fits them the best. We have been looking at the roads in the direct environment and these are good enough for bicycle traffic. There is enough space, not a lot of traffic and very few lorries.

3.5.2. Dutra

There is one major supply route that goes all the way from Furquem Mendes to the Dutra location (figure 1). This route passes Furquem Mendes, Dique, Terra Encantada, Gringolandia and Ficap. The people that live here have the least money within the research area and therefore will benefit from improvements in living conditions the most. The route consists of a long road that is partly asphalted and partly dirt. When making plans for a BSF at this location, it is advisable to look at the current traffic situation close to the Dutra, because the intersection with the access route for the highway could be a problem for bicycles. If the BSF turns out to be a success, there is the possibility for creating a bicycle path along this supply route. More on this in chapter 4. Already there are some bicycle shops located along this route which of course is a positive thing.

3.6. Journey purposes

The journey purposes are important for the determination of the turnover. When you know how long people will store their bicycle at the BSF the occupation degree can be determined. This is important for the determination of the required capacity. But it is also important to know where the inhabitants are moving to now to be able to say something about the future situation. Inhabitants that do not have a job or have a job inside the research area, might consider a (better paid) job somewhere further away from home when transport becomes cheaper or faster.

3.6.1. Praça Jardim

The people at Praça Jardim were of course already at their journey purpose. They were visiting the health centre, church or football game or buying their groceries or going to school. One of the questions asked them was where they were coming from and a lot of respondents lived in Jardim América. This was already expected, but some lived in the neighbouring Duque de Caxias.

3.6.2. Dutra

The people at the bus stops who were asked for their journey purposes all went to or returned from work. This probably is because we have been questioning people during or around rush hour. Almost every interviewed person said to be working in the Centro region in the south. According to Nanko van Buuren there is a transfer station for goods being build in Nova Iguaçu in the north. These two areas can be found on a map in Annex M. A lot of people from the research area work there already and when the transfer station is ready even more people will go working there. Remarkably none of the respondents at the bus stops was working in Nova Iguaçu. Maybe the people that work there use a different bus stop, a different kind of transport or travel at a different time. Anyway the realization of a BSF could change the situation for these people and those willing to work there in the future, in such a way that they will be able to use this bus stop.

4. Arrangement Plan

The arrangement plan is a plan for the bicycle storage facilities and adjustments to supply routes . The plan for each BSF include the location, capacity, storage, social safety and desires. The requirements for these aspects are included in Annex G.

4.1. Location Praça Jardim

This storage is meant for all the people cycling to the various facilities at and around Praça Jardim. The capacity of 100 bicycles makes a guarded storage possible.

4.1.1. Location

The space is now occupied by the Comlurb (garbage collecting service) but this service will move to another location. The space is 14.5 meters wide and 24 meters deep; this corresponds to 348 square meters. This surface can be divided in three spaces: an open but covered space (I), an open space (II), and a building (III).

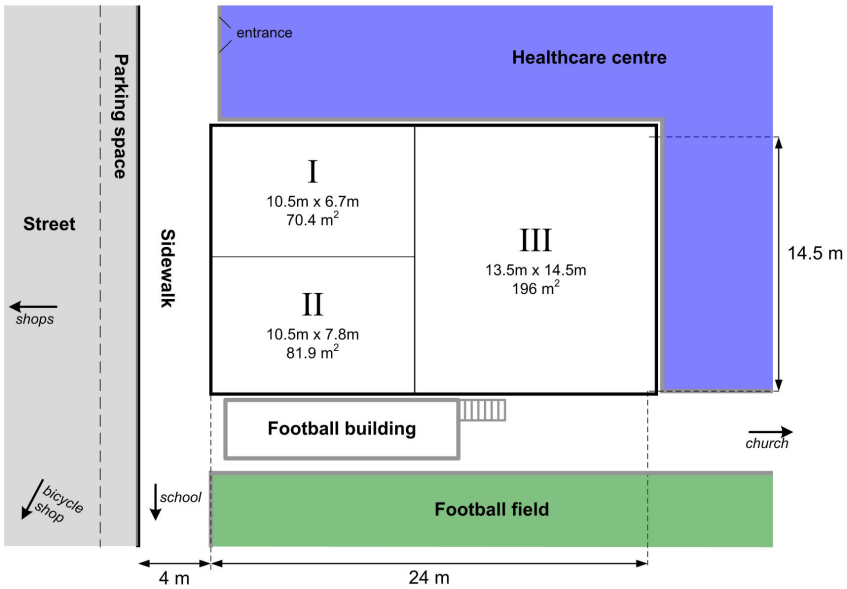

Figure 5. Overview Comlurb.

Two large doors form the entrance at space II. This space is open and does not have a constructed floor, it's just dirt. Space I has a concrete flour and a simple corrugated roof which leans on six pillars. Space III consists of a building and a small alley on the right side. Seen at the front, this building has a working place on the left side and it's administration on the right side.
The storage can also be reached by using the alley along the football field. This can be used as a shortcut by visitors of the church or football matches.

4.1.2. Capacity

The present demand is set on 80 (chapter 3). Because of the 80% rule (Annex G) the capacity for this bicycle storage facility is 100 places. Our expectation is that starting with this number of places will be sufficient for the first couple of months. The potential extra demand is set on 175 (chapter 3). Because of the 80% rule there has to be space for another 218 bicycles. In the long-term this capacity could be needed and in theory this space is available. But because of the bicycle shop, extra space needs to be utilized, there are three options.

- The school could place bicycle racks within their own walls for students.
- There is space in the alley and on the sidewalk for storage.
- The 80% rule could be left aside, so the capacity is used more effectively.

4.1.3. Storage

Two different racks will be used. The first one is a high/low system where bicycles will be placed vertically. The bicycle will be hanged by their front wheel. This type is for sale, but it is a better option to construct it. This is explained in the Utilization Plan (chapter 5).
The second, less used, type is a high/low type where bicycles can be placed horizontally. This storage type needs more space, but creates a better overview of the storage and bicycles can be stored here if the bicycle is not suitable to be hanged vertically.
Examples of both types are displayed in figure 6 and 7 below. [5]

Figure 6. Vertical bicycle rack.

Figure 7. Vertical bicycle rack.

To motivate use, the facility will have an open character. The desk in space I is bordering the sidewalk and the entrance next to it is 3 meters wide. It also offers space for motorcycle storage. Only employees can enter space II, this is utilized for bicycle storage, having space for 72 bicycles: 24 horizontally and 48 vertically. The large doors are replaced by a solid look-through fence, increasing the open character. Spaces I and II are largely separated by a fence to secure the bicycles. Also people may not walk further than the desk because of the motorcycles. Space III is used to raise to capacity to the necessary 100 spots. There is 175 m² floor space left, this is multi functional: it can be used for expanding the capacity, a workplace for a bicycle repairer and administration.

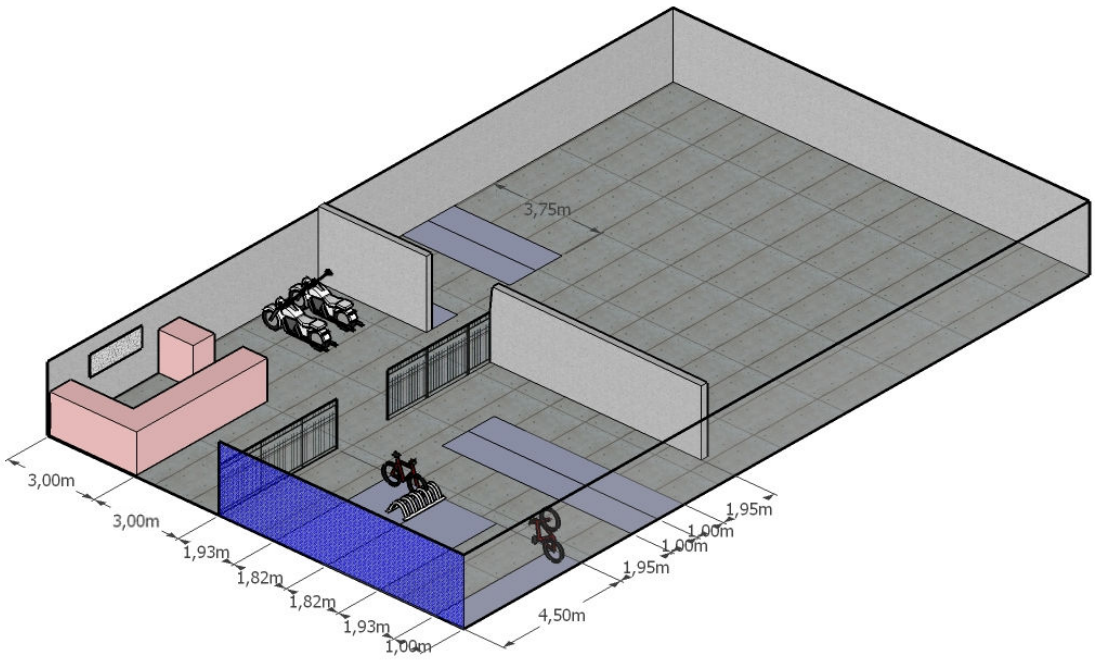

Figure 8. 3D sketch BSF Praça Jardim.

[5] Cicloparking [cicloparking.hpgvip.ig.com.br], 2006.

Combined with a smaller desk area, the repair shop can also function on the space reserved for the motorbikes. This has as an advantage for the repairer: he is more involved in the storage.
Every bicycle is placed in a high/low position and requires a width of 37.5 cm.[6] Horizontally placed bicycles require a length of 1.82 meter and vertically placed bicycles a length of 1 meter. The walkways are 1.93 meter wide.
The entrance is 3 meters wide. This is wide enough for people passing each other, occurring in busy hours. There is also enough space for people to wait for their bicycle and for people walking in with a motorbike to store it.

4.1.4. Social safety

At night there won't be sufficient lighting around the storage. Therefore enough lighting has to be applied at the front of the storage and in the side-alley.

4.1.5. Desires

It is desired that the side-alley will be adjusted. At this point it is just sand and dirt and for most people not an option to use during or after rain. Therefore this path needs hardening, we suggest concrete hardening. It is important that rain will be drained in a good fashion, preventing pools in the alley.

4.2. Location Dutra

At both sides of the bridge a part of the BSF is planned. Both facilities are mainly purposed for people who park their bicycles and after that take a bus to work. Secondly it is meant for people who work at a factory close to the parking. Thirdly it will function as an example for companies: near-by companies will be stimulated to install a parking for their employees. Because the amount of expected stored bicycles is too low, this location will not be guarded. Only the discussed bicycle storage facility will be placed on both sides of the Dutra. The one on the side of Parque Columbia is close to a company with guards and the one on the side of Jardim América is close to a police post. These two objects will not physically guard the bicycle storages, but most likely serve as a natural deterrent against thieves and vandals.

4.2.1. Capacity

The present demand is set on 21 (chapter 3). Because of the 80% rule (Annex G) there has to be space for 26 bicycles. When this BSF turns out to be a success there is more than enough space for the expected potential extra demand of 52 places, based on the potential extra demand of 41 (chapter 3).
The ratio of the demand between Jardim América and Parque Colombia is 3 to 2 (chapter 3). Dividing the 26 spots with this ratio requires the Jardim América side to have 16 spots and the Parque Colombia side 10 spots.

4.2.2. Storage

The rack of choice is the type SMAC 2 (figure 9). This type is used a lot by the city hall. We already saw this type close to Praça Jardim and they are already installed along the Copacabana and Ipanema beaches (pictures in Annex K). This type is so popular in unguarded situations because of its durability: it is impossible to break or bend it with only human force. And because it is already so popular, people easily recognize it as a bicycle rack. We discussed this option with Claudia Tavares and she advised this type to us as well. She is working on bicycle mobility in Rio de Janeiro for city hall.

On the side of Parque Colombia, ten bicycle spots will be realized. Users lock their bicycle at this facility and afterwards cross the road to either walk down the stairs or to take a bus or go to work.

[6] Stichting FietsParKeur, *Normstellend document fietsparkeersystemen*, 2004.

One could ask: why not build it at the other side of the road, which would prevent users from crossing. Unfortunately there is no space available on this side. If the facility turns out to be a success, a crossing is a possibility.

On the side of Jardim América 16 spots will be created. Users lock their bicycle and afterwards either walk to the stairs to take a bus or to their work. The users from Jardim América can cross before the police post and use a safe route past the company (next to the storage) and afterwards the sideway to reach the facility. In the future there is a possibility to construct a bicycle path on the south side of the road straight to Jardim América. In this way the busy intersection at the police post is avoided. This bicycle path would create a better connection with Ficap, Gringolandia, Dique and Terra Encantada; the poorer areas of Jardim América.

Figure 9. Type SMAC 2.

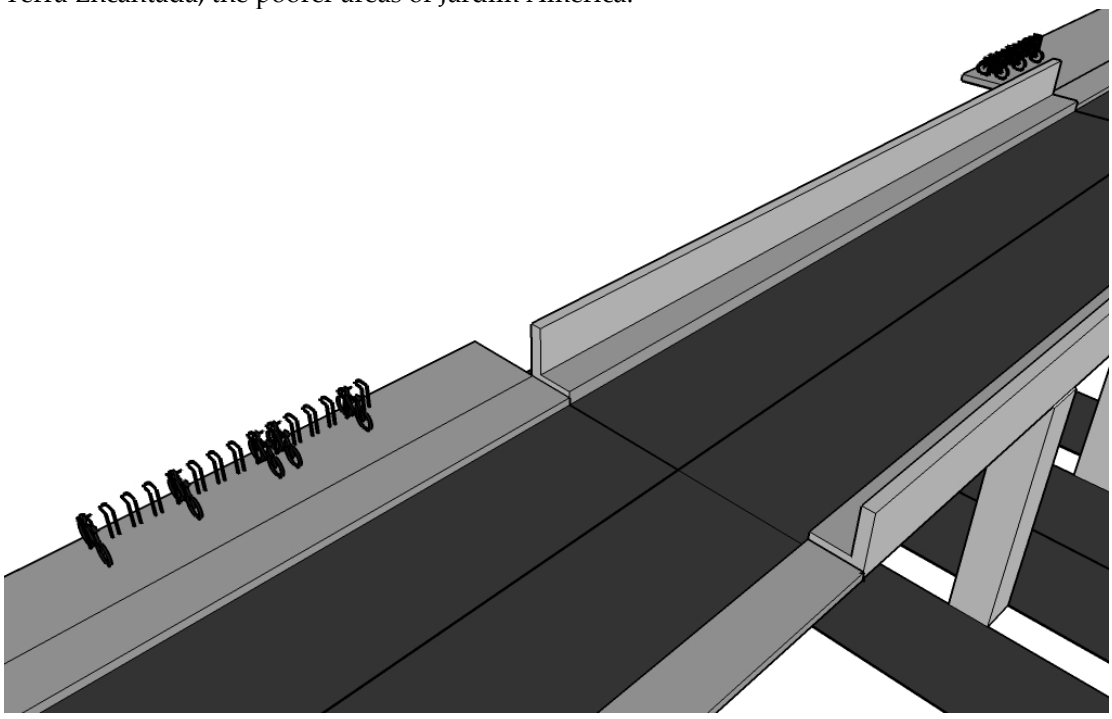

Figure 10. Overview BSF location Dutra (down is direction Jardim América).

Figure 11 shows the dimensions for a part of the facility.

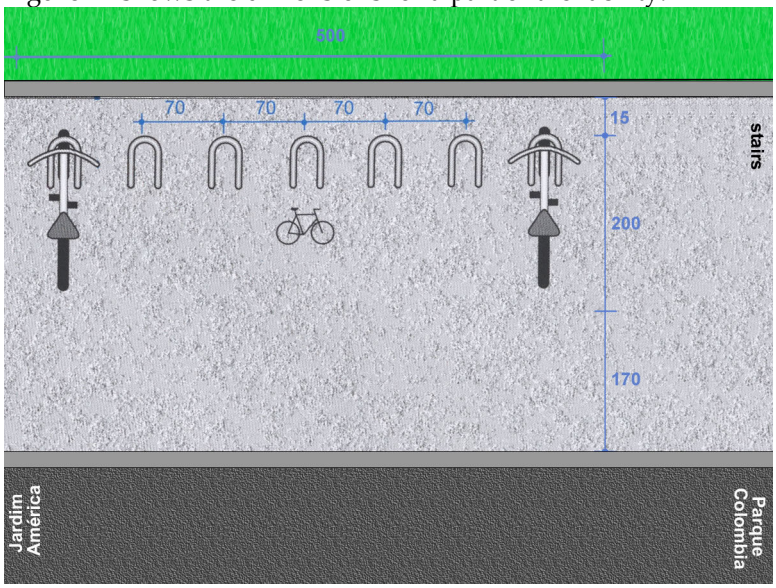

Figure 11. Dimensions (in cm) BSF location Dutra.

To two meters from the sidewalk the piece of ground is on the same level as the sidewalk. After this, there is a small slope and the ground is flat again (figure 12). Obviously, for building the facility, there is some ground needed to flatten the piece of ground.

Figure 12. Situation on the side of Jardim América.

However, there is an obstacle. There is a long fence separating the sidewalk from the company (also visible in figure 11). IBISS would have to negotiate with this company to back up the fence at least 3 meters, so there will be space for the BSF. It is questionable if it is legal to have your fence bordering the sidewalk, so probably IBISS can force the measure with the help of the local government.
In the unlikely event that it will not be possible to construct the bicycle spots on the desired side, there is an alternative. The spots could be constructed on the other side. This alternative is described in Annex I.

4.2.3. Social safety

To improve safety of the storages, lightning should be put up. People will feel safer locking or getting their bike when it is dusk or dark. Besides that, there is less chance of vandalism or theft.

4.2.4. Desires

It is desired that the road through Terra Encantada will be improved. Cyclists are using this road already but it is a bumpy ride. A new asphalt layer would improve the situation dramatically.

5. Utilization Plan

This chapter will outline the construction, establishing and exploitation for both the guarded bicycle storage at Praça Jardim (6.2) and the bicycle storage at the Dutra (6.3). Each of the two bicycle storages will be discussed separately. But first the planning for the implementation of the plans is given (6.1).

5.1. Planning

Nanko van Buuren is already discussing the plans for both locations with some persons involved. These persons are among others the manager of the Comlurb and the financial director and lawyer of IBISS. Therefore implementation of the Arrangement Plan can start any moment. This is dependable on the timescale for permits. It is advisable to start implementing the plans for location Dutra first since these can be implemented quicker. After that the plans for Praça Jardim can be realized.

It will be the best scenario if the plans for both locations will be integrated into one business. This is because there is no real business starting up at the Dutra location yet. In the future however this may change and by integrating the plans both locations already into one business plan, the plans will be more successful.

5.2. Location Praça Jardim

5.2.1. Construction

Before the construction of the guarded bicycle facility can start the Comlurb has to move and the building has to be stripped. As mentioned already in chapter 3, the Comlurb legally is not allowed to be located this close to a health centre.
The stripping and the construction of the guarded bicycle facility will be done by IBISS. For the construction materials like iron, wood and cement are needed. These materials can be bought at several companies within the neighbourhood. In this way the money is spent inside the neighbourhood, which is good for the local economy. With these materials, the desk can be made, as well as the walls, fences and floor. The vertical racks can be made by IBISS as well as this will save money and create job opportunities. This is not very difficult as we have seen at the bicycle storage in Santa Cruz, where they have made these racks themselves too.
The financial support for the construction will come from the department of employment. Projects like 'soldados nunca mais' of IBISS can apply successfully for allowances. This is a project that helps people get out of a drug gang into the 'normal' world. People that are in this project will do the construction work.

5.2.2. Establishing

As mentioned in the Arrangement Plan, this storage facility will be guarded. We expect that two persons guarding the facility will be enough. Important is that there is always at least one person at the entrance of the BSF. Since the cyclists can deliver their bicycles at the desk which is located in the front there always has to be someone there. Also because of safety the only persons that are allowed to enter are the employees. A third person can work in the repair shop. During rush hour and other busy moments, this third person can assist the other two to ensure there is always someone present at the desk. These three jobs will be filled in by persons that participate in the 'soldados nunca mais' project of IBISS. Because the bicycle storage will be open from 7 am until 11 pm, there will be two shifts. This means a total of 6 employees and thus 6 extra places in the 'soldados nunca mais' project.
As mentioned in the Arrangement Plan too, this storage facility will have space for a repair shop. The materials for this shop can be bought in the neighbourhood at one of the various bicycle shops. The two persons that are going to work at this shop will have to be trained for the job. This training can be done at one of the various bicycle shops as well.

In the beginning the salaries of the guards will be paid by the department of justice and the salaries of the repairers will be paid by the department of employment. All six employees will be part of the 'soldados nunca mais' project. This way IBISS has overall control of the project and business in the starting period.
To pay for the materials of the repair shop and to set up a business and support this the first year IBISS will apply for micro credit. Because we do not have sufficient knowledge of this financial option we are not able to say ourselves whether this is possible. Nanko van Buuren however assured us that this will very likely be successful.

5.2.3. Exploitation

Because the government will not continue paying the salaries of the employees forever and the micro credit will have to be paid back in time too, income will be generated by asking a fee. The questionnaires revealed that people are willing to pay for a guarded bicycle storage, but some said maximally wanting to pay R$ 0,50 (€ 0,18) each time. The fee could be raised in time to R$ 0,70. In the long term the coupon system (see Annex L about Bangú and Santa Cruz) is a good idea for this storage facility, this will be good for customer relations. Also a share of the revenue from the repair shop will be used to generate income.
The employees are the only people that really enter the building since the cyclists can deliver their bicycles at the desk which is located in the front. This way they are responsible not only for the bicycles but for maintaining the BSF as well. Any form of vandalism is not expected because this is not really present in Brazil at guarded places.

5.3. Location Dutra

5.3.1. Construction

Before the construction of the bicycle storage at the Dutra can start, negotiations with the company that is now using the space are necessary. Nanko van Buuren told us that he will participate in these negotiations and convinced us that this will not be a problem. Legally they are not allowed to use this strip, because it is to close to the road.
Firstly, the ground is on a slope and thus needs to be flattened (figure 11). The floors will then be made of concrete. This can also be bought inside the neighbourhood. As mentioned already in chapter 4, Claudia Tavares, an employee of the secretary of municipal urbanism, said the racks can be delivered by city hall and are perfectly fitted for this location.
As already mentioned before, this location will start with a small amount of 26 spots. When the BSF turns out to be a success there is space for more racks on both sides of the Dutra. If bicycle mobility in the neighbourhood really is going to grow, there is even space for a bicycle path on the supply route to this location. But this is just an idea for the future as we do not expect this to be necessary in the short term.
The financial support for the construction will come from the department of employment again.

5.3.2. Establishing

This location will at first not be guarded which means there is no personnel needed and thus no financial plan for salaries. Only maybe in the future when the BSF turns out to be a success and more bicycles can be stored. This is preferred of course, since this is good for job opportunities as well.

5.3.3. Exploitation

Important goal of the BSF at this location is to see whether people will start using their bicycles more to go to this bus stop. But also to act as an example for the surrounding companies to stimulate bicycle mobility.
In the future, when the BSF is growing and guards are affordable, an admission fee of R$ 0,50 is applicable here too. In the mean time employees from the BSF at location Praça Jardim can visit this location now and than. This way they can see whether this BSF is being used and at the same time

take a look at the maintenance aspect. The aspect of maintenance is important for this location because practically all day there is no physical protection. It is particularly open for vandalism. This has been one of the most important reasons for choosing the type of bicycle racks as was pointed out in chapter 4 already. This one is strongly build and anchored in concrete and therefore very hard to damage.

6. Impact Assessment Plan

The goal is to assess the impact of each BSF and adjustments to roads on the use of bicycles. It is also important to discover points of improvements.

In order to assess there have to be several measurements before and after implementation. These measurements are called the baseline measurements and the post measurements. In this chapter the baseline measurements are given. The post measurements have to be conducted in the same way to have a decent comparison and should be conducted each day of the first week of each month during the first year after implementation of a BSF. This way the development of the bicycle mobility is measured.
To have a reliable assessment, there are a few requirements for the measurements:

- Normal weather conditions: dry, no extreme temperatures and no hard winds.
- There are no road works or by-passes that disrupt regular traffic.
- There are no special events or happenings in the research area.

Next to measurements it is important to point out desired improvements to roads, intersections or the BSF's itself. This will be achieved by interviewing users of the BSF's and other cyclists. And of course feedback from the people working at the BSF at Praça Jardim will be essential. Because they are the ones that will be monitoring the use of the BSF.

6.1. Location Praça Jardim

The baseline measurement for the BSF at Praça Jardim consists of two kinds of measurements. The first one involved counting bicycles. There are a few small facilities to park bicycles at this location, so there is a distinction between parked and free-standing bicycles. All the bicycles that were parked in the streets around the block (with the school, football field and healthcare centre) and on the four intersections around the block were counted twice because this gives a more reliable image of the situation[7].

	Count 1	Count 2
Parked bicycles	9	6
Free-standing bicycles	18	11

Table 4. Baseline measurement bicycles at location Praça Jardim.

The second measurement involved interviewing people at the healthcare centre, school and the supermarket Multi Market. Two important questions: Do you have a bike and did you use it to arrive here?

	Healthcare centre	School	Supermarket
Visitors on one day	150	1000	2000
Valid interviews	45	402	50
Respondents who own a bike	25	180	32
Respondents who arrived by bike	9	17	18

Table 5. Baseline measurement bicycle mobility at location Praça Jardim.

The post measurements for Praça Jardim will be executed by the employees from the BSF. They will measure the parked and free-standing bicycles each day of the first week of each month during the first year after implementation of the BSF. They will conduct the same interviews and surveys as have

[7] CROW, *Leidraad fietsparkeren*, 2001.

been used for the baseline measurement as well. This has got to be done once every three months during the first year after implementation of the BSF.

6.2. Location Dutra

The baseline measurement for the BSF near the Dutra consists of one kind of measurement involving counting bicycles. There are no facilities to park your bicycle at this location at this point of time, so that is why there were only free-standing bicycles counted. All the bicycles that were parked close to the bridge, on the bridge, between the bridge and the police post or close to the police post were taken into account. Again there have been two counts to give a more reliable image of the situation.

	Count 1	**Count 2**
Free-standing bicycles	6	1

Table 6. Baseline measurement bicycles at location Dutra.

The post measurements for the Dutra will be executed by the employees from the BSF at Praça Jardim. They will count the parked and free-standing bicycles once each day of the first week of each month during the first year after implementation of the BSF.

During our visits to this location we had occasional conversations with guards from companies in the surrounding area. From these conversations we learned that approximately 10% of the employees of companies with a BSF cycle to work,. Approximately 0.5 % of the employees that work at a company without a BSF cycles to work. We do not know whether the employees started cycling after the construction of a BSF or whether the BSF's were constructed because there were employees cycling to their work. But it is at least an interesting thing to investigate further.

7. Conclusions

In chapter 2 there have been given four research questions which had to be answered in this report in order to reach the following objective:

The objective is to make an Arrangement Plan, Utilization Plan and an Impact Assessment Plan for future bicycle storage facilities, in the research area, which have to concur with the yet to be developed Programme of Requirements.

In this chapter we will draw conclusions on each of the research questions (7.1). After that an overall conclusion will be drawn (7.2).

7.1. Research questions

RQ 5. *What is the relevant data on bicycle mobility in the research area?*
There are two suitable locations within the research for constructing a bicycle storage facility (BSF) in this pilot project. The first is Praça Jardim and the second is the Dutra.

At Praça Jardim there are several attractions like a new health centre, a supermarket, a school, a football field and a church. The present and potential extra demand at the peak moment, Monday till Friday between 08.30 and 09.30 am, is respectively 80 and 175 bicycles.

At the Dutra there is a bus stop at both sides of the road. This road can be crossed by pedestrians: they can use the pedestrian bridge or the normal bridge. Inhabitants from Jardim América as well as from Parque Colombia get on the bus here to go to work. The present and potential extra demand is respectively 21 and 31 bicycles.

RQ 6. *How can locations in the research area be arranged on the basis of the Programme of Requirements?*
This BSF at Praça Jardim will be built inside a central building at Praça Jardim where the Comlurb (garbage collecting service) is located at this moment. After they have left the BSF can be constructed as has been explained in the Arrangement Plan. The starting capacity will be 100 places which could be expanded till a maximum of 318 places.

The BSF at the Dutra will be built at both sides of the bridge over the Dutra. After the location is cleared from the discussed fence and the ground floor is flattened the construction can start. The starting capacity will be 16 places at the side of Jardim América and 10 places at the side of Parque Colombia. The total capacity could be expanded till a maximum of 78 places.

RQ 7. *How can the bicycle storage facilities be utilized?*
Because the turnover at Praça Jardim is high enough this BSF has been designed as a guarded bicycle facility. There will be 6 employees divided in two teams working in two shifts. In each shift there will be a bicycle repairer who is working in a repair shop.
The BSF will be under the control of IBISS and they will construct this BSF with materials that are bought as much as possible inside the research area. The departments of employment and justice will finance this BSF during the starting period. After a while income should be generated by asking a fee of R$ 0,50 for storing a bicycle. Also a share of the revenue from the repair shop will be used to generate income.

The turnover at the Dutra location is too low to support a guarded bicycle facility. Only if the BSF turns out to be a success in the future will this facility can be changed into a guarded one. Once this happens it is thinkable that it will become a part of the Praça Jardim business.

This BSF will be constructed by IBISS as well with materials that are bought as much as possible inside the research area again. The government will finance the construction of this BSF as well. When this BSF is changed into a guarded BSF in the future the same fee of R$ 0,50 can be asked to generate income.

RQ 8. *How can the impact of the pilot project be measured?*
The impact of the BSF at Praça Jardim can be measured in two ways. First by counting bicycles inside and outside the BSF each day of the first week of each month during the first year after implementation. Secondly the visitors of the health centre and supermarket, as well as the students from the school will be asked for their bicycle ownership and use. This will be done ones every three months during the first year after implementation. These measurements will be done by the employees from the BSF itself.

The impact of the BSF at the Dutra can be measured in only one way. The bicycles at the BSF can be counted again once each day of the first week of each month during the first year after implementation of this BSF. This will be done by the same employees that perform the counts at Praça Jardim.

The results of these measurements will be compared with the baseline measurement. In this way it is possible to see possible changes in bicycle mobility as a consequence of the two BSF's.

7.2. Overall conclusion

To tackle the problems of poor road safety and theft in the research area the Arrangement, Utilization and Impact Assessment Plans for the two selected locations should be executed. This will contribute to an increased bicycle mobility for the inhabitants. In this way they will save time and/or money by avoiding a walk or the use of a bus or kombi. This saving can be used for access to a bigger area which gives them better opportunities for a job. Also the business that is started at Praça Jardim will create some new jobs.

Glossary of terms

Arrangement Plan
Plan for bicycle storage facilities (location, type, capacity, rates and safety measures) and adjustments to supply routes.

Bicycle mobility
The usage of a bicycle as a way of transport.

Bicycle storage facility (BSF)
Construction meant to store one or more bicycles in or against it and thereby giving the bicycle(s) enough support.

Hang system
BSF where a (part of the) bicycle is hung.

High/low system (H/L System)
BSF where high and low storage places switch.

Impact Assessment Plan
Plan to evaluate the impact of the realized Arrangement Plan on bicycle mobility in the research area.

Programme of Requirements
Requirements for the BSFs and Supply routes.

Research area
The favela Vigário Geral and the area that is enclosed by the Dutra highway (BR116), the Linha Vermelha (Via Presidente João Goulart), the railway and Avenida Brasil.

Supply route
Route that leads to a BSF and is used by many cyclists.

Utilization Plan
Plan for the utilization and maintenance of the bicycle storage facilities.

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