THE IMPORTANCE AND CHALLENGES OF LOW COST MOBILITY MODES FOR SUSTAINED SOCIOECONOMIC AND ENVIRONMENTAL DEVELOPMENT IN CITIES OF AFRICA

Belew Dagnew Bogale
The importance and challenges of low cost mobility modes for sustained socioeconomic and environmental development in cities of Africa: Comparative analysis of bicycle transport in Bahir Dar and Hawassa cities in Ethiopia

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Abstract

Bicycle transport is one of non-mortised transport which uses human energy. It has no emission, and noise, it requires very small parking space, it is cheap to own and operate, offer door to door service, keeps the rider in a good health, and safe when it is segregated from fast traffic. This study presents bicycle transportation in Ethiopian secondary cities, the case of Bahir Dar and Hawassa. The dominant mode rather than walking in these cities is bicycle transportation. The research of both cities is done based on secondary and primary data of 408 bicycle riders. The findings witnessed that the topography, weather condition and the present city size of both cities is comfortable for bicycle transportation. But until now much recognition and management is not given to this mode in Ethiopia. Absence of adequate bicycle infrastructure facilities, fear of traffic accidents due to unsafe traffic situation, bicycle theft, lack of financial ability to own a bicycle, outdoor insecurity, poor quality of pavement of roads, lack of integration of bicycle facilities in transport planning, etc are some of the main impediments of cycling and bicycle transportation development identified in this study. The bicycle sector is a source of livelihood for many people. For sustainable bicycle transportation, policy makers and transport professionals have to take this sector in to account.

Keywords: bicycling, benefits, challenges, affordability, management, sustainability
1. Introduction

1.1 Background of the Study

Transportation is the factor of socio-economic development worldwide. It is classified as motorized and non motorized transport (NMT). Among NMT modes, bicycling has proved its virtue in many developed and developing countries. In fact, it is the only means of personal transport within reach of the low-income groups of the population. The range of cycling is between 10 and 15 kms per hour, as opposed to walking which ranges at an average between 5 and 6 kms per hour. According to Grava (2003), the introduction of bicycling has long history (since 1816). Its role differs widely over time and between cities. In the northern countries, bicycling was used primarily as a means of transport to work and shopping. In recent years, however, it has been used increasingly for commuting and provide couriers services in major cities; whereas, in the third world societies, use of and attitudes to bicycles differ widely, in accordance with economic conditions, the terrain and cultural values (Simon David, 1996).

Cycling in big cities of Africa, for instance, in CBDs of Nairobi and Dar es Salaam as explained by Longen and Temblete(2001), is discouraging, but more encouraging along collector roads, through speed humps and raised pedestrian crossings. In other side, cycling in medium size cities is viable can be an attractive mode of urban travel. Examples are given to Morogoro and Eldoret. In Ethiopian medium/secondary cities (like Nazret, Bahir Dar, Hawassa, Dire Dawa), where geographical setting at the gentle slope, level of urbanization and their traffic is increasing, bicycle mode could be popular transport. This study attempts to review the extent of development, management and challenge of bicycle transport in cities of Africa in particular emphasis to Bahir Dar and Hawassa cities in Ethiopia. They are secondary cities from two regions Amhara and SNNPR(Southern Nations Nationalities Peoples Region). This research has also tried to show comparisons between both cities

1.2 Description of the Study Area

As illustrated on the map Hawassa is located at $07^\circ03'N 36^\circ029'E$. It is located 275km to South of Addis Ababa. It has a total of 688km road in 2011 of which 57km asphalt, 200km all whether (Gravel), 241km dry whether road,18km Cobblestone and 172km red ash roads. It has 50 sq.km area classified into seven sub cities.

Bahir Dar is also located $11^\circ36'N 37^\circ23'E$ Coordinates. It is 578km to NNW of Addis Ababa. It has a total of 331km road of which 44km asphalt, 77km all whether/Gravel, 174km dry whether road, 10km cobblestone and 27km walk way. It has 165 sq.km area classified into eight sub cities.
Bahir Dar and Hawawssa Cities are relatively located at the gentle slope of 1836 and 1697 m.a.s.l. with the population size of 191,000 and 213,000 respectively. They are also centers for tourist attraction and their population growth is more than 4.5% per annum.

1.3 Problem Statement

The smooth running of bicycle transport in most cities of developing countries like Ethiopia is influenced by: low infrastructural, institutional, financial and professional capacities; low awareness, low considerations by the concerned bodies, slow adaption of modern technology and best practices, lack of efficient policy, rules and regulations.

These major bottlenecks have constrained the development of safe and convenient bicycle transportation and compounded the city’s mobility problems. The study has assessed the magnitude of the above problems; identified the causes of the problems and forwarded remedial and possible solutions and recommendations to alleviate these problems. This would assist policy makers to identify the major decision attributes that would speed up the successful management of bicycle transport system.

1.4 Objective of the Study

The main objective of the study is to make a thorough analysis about bicycle transport management of secondary cities in Ethiopia specifically comparing Bahir Dar and Hawassa cities. Specific objectives are:

i. To identify advantages and disadvantages of bicycle transport

ii. To assess best practice from bicycle friendly countries

iii. To assess the extent of management and challenges of bicycle transportation
   - To assess the government policy/institutional approaches about bicycling transportation in the study area.
   - To examine the availability of bicycle infrastructure and affordability of bicycle in the study area.
   - To identify the existing safety and security conditions in bicycle transportation
   - To examine the development and problems by comparing both study areas

iv. Identify some best models (opportunities) and recommend to bring about safer and attractive bicycling.

1.5 Methodology

1.5.1 Data Sources and Data Collection

Both primary and secondary data were used to fill the stated objectives of the research. Sources of primary data are bicycle users, traffic police and trade and tourism offices. Quantitative and qualitative methods of data collections are employed. More specifically, the selected methods to collect the necessary data are questionnaires, interviews, and observations. Secondary sources of data are collected from published and unpublished documents. The case studies made by Alehegne in Bahir Dar (2008) and and Deneke in Hawassa (2008) are bases for this study.

1.5.2 Sampling Techniques

The registered bicycles in Bahir Dar and Hawassa are about 24,571 and 16,458 respectively of which 208 and 200 are taken as the sample by using purposive sampling techniques. To get additional information about challenges and solutions of bicycle transportation, 12 and 20 purposively selected transport sector,
traffic police division, and municipality officials from Bahir Dar and Hawassa were interviewed respectively. In other words, from total of 41,061 population, 440 bicycle users and officials were taken for the study.

To select representative samples the bicycle users in the city were classified into four groups based on the trip purpose; namely work trips, school trips, shopping and business trips and recreational and social trips. These are the main trips made by bicycles. From each trip makers by bicycles, samples were selected by giving quotas for each group. Quotas were given based on the proportion of bicycle users from each trip maker groups.

The employees included for the questionnaire were from governmental and non-governmental organizations, factories, restaurants, hotels and cafeteria, while the students were selected from secondary schools. Shopping and business trip maker samples were selected in the market days from main market, in the shops and groceries. Recreational trip makers were mostly found available in hotels, restaurants, cafeterias and other popular recreational areas where as social trip maker were contacted in churches, mosques, health institutions etc.

1.5.3 Data Analysis

The methodology of the study is based on quantitative and qualitative data analysis. These methods vary from simple summations and percentages to advanced techniques.

2. Literature review

2.1 Comparing Modal Share of Bicycles among Cities in Developed and Developing Countries

Among NMT, cycling is an important mode of transportation in both high and low income countries. As illustrated in Figure 2.1, bicycle disparities reflect policy and planning factors more than geography or climate. For instance, as explained by ABW 2010 cited in Litman 2012, Scandinavian countries, Switzerland, and the Netherlands have cold, wet climates, and San Francisco, Boston, and Seattle are cold, wet and hilly, but all have high non-motorized mode share due to supportive transport and land use policies and community attitudes. Netherlands is with the highest share of bicycles followed by Denmark.

![Figure 2.1 Modal split of bicycle in high income countries](image)

In terms of low income countries, modal share in Honai(Figure 2.2), is 84.6% with the highest bicycle ownership(909 per 1000 people); and in Shangai, 95.9% with about 865 bicycles per 1000 people.

Generally the ownership of bicycles in developing countries such as in China, Asia, Latin America and Africa is 53, 40, 16 and 0.4% of their total population (Heyen-Perschon 2001).

Informal collective transport is the main means of motorized transport across the whole of the African continent and accounts for around 35-40% of most urban transport trips (Figure 2.3). NMT (walking and
cycling) is the second most important group with a modal share of 30-35% (with walking being the most dominant).

Therefore as illustrated in both graphs, motorization in developing countries is less accessible because of lack of affordability. Hence; bicycles are alternative modes of transportation for the poor only where the track is available.

**Figure 2.2: Transport modal share cities’ bicycles as compared to other non motorized vehicles and bicycle density per population in Asian cities**

**Figure 2.3 Transport modal share in African cities**

<table>
<thead>
<tr>
<th>City</th>
<th>Private Car</th>
<th>Bicycle and walking</th>
<th>Motorcycle</th>
<th>Public transport (bus)</th>
<th>Private taxi</th>
<th>Informal(minibus, collective taxi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windhoek</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Nairobi</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Lagos</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Johannesburg</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Douala</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Dakar</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Addis Ababa</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Accra</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
<tr>
<td>Abidjan</td>
<td>Blue</td>
<td>Purple</td>
<td>Green</td>
<td>Purple</td>
<td>Purple</td>
<td>Red</td>
</tr>
</tbody>
</table>


Source: Adopted from UITP and UATP 2010

### 2.2 The Significance of Bicycle Transportation

Bicycles provide direct benefits such flexible and affordable means of transportations (such as door-to-door service), and indirectly by providing health, recreational, environmental and social benefits.

#### i. Travel Costs and Individual Mobility Benefits

Bicycles, because of their small size and weight can be used for door-to-door transport with small sized goods like personal bags with improved travel time and route options (Grava 2003). This improves peoples’ opportunities to participate in economic and social activities. As stated by Spreekmeester and et al. 2000, for each traveled kilometer, travel expenditure for the bicycle is lower than any other means of transport with the exception of walking.
The average speed of car traffic during the rush hour is often not greater than 10 kilometers per hour (Spreekmeester and et al. 2000). Moreover, bicycling is often faster than public transport in short trips because it avoids transport to and from the railway station/bus stop and waiting times.

**ii. Environmental Benefits**

Bicycles consume human power and produce no air pollution. Each percent shift of automobile travel replaced by cycling decreases by 2 to 4 percent motor vehicle emission (Kumanoff and Roelofs 1993 cited in Victoria Transport Policy Institute 2008). Cycling creates no noise. It is true; every kilometer traveled by bicycle will be a kilometer without environmentally damaging emissions.

**iii. Safety, Health and Recreational Benefits**

Per capita collisions between motor vehicles and non-motorized travelers decline with increased non-motorized travel (Litman 2004). Cycling is also the realistic way to keep reasonable body fit and weigh to physically inactive and overweight people and a way to overcome variety of medical problems such as cardiovascular diseases, bone and joint injuries. Cycling for half an hour every day has been shown to significantly reduce the chance of developing diseases such as obesity and diabetes (WHO, 2000; Grava 2003; Litman 2004).

**iv. Economic Benefits**

Cycling has gained an increased recognition in recent years globally. Increasing fuel costs, land consumption for transport infrastructure and urban vehicle traffic congestion have diverted some countries policy attention towards less energy and space intensive forms of transport. Cycling is also an affordable form of transportation as compared with motorized modes of transport. It has low capital and its operating cost is by far very less as compared with motorized transport.

In comparison to the car, the bicycle saves a lot of space that can be used for other purposes. A single bicycle occupies 2m² space when it is standing and 5m² when it is in movement as opposed to 25m² and 55m² for the private car respectively (Grava 2003).

**v. Social and Community Livability Benefits**

Cycling enhances community livability and social interaction by providing more intimate connection between people and their surrounding than can motorized transportation. In general cycling and walking provide a more intimate connection and social cohesion between people and their surroundings than a car (Grava 2003). Heyen-Perschon (2001) has also summarized social and economic features of bicycle as illustrated in Figure 2.4

*Source: Adapted from Heyen-Perschon 2001*
Generally, all benefits discussed above can be summarized by Denmark’s and Portland’s socioeconomic analysis. Denmark’s analysis compares costs per kilometer of cycling with automobile (Table 2.1). Cycling is estimated to have net costs (costs minus health benefits) of 0.60 Danish Kroner per kilometer. Health benefits include reduced medical and disability costs valued at 1.11 Danish Kronor (DKK) to users and 2.91 DKK to society, plus 2.59 DKK worth of increased longevity. Car travel is estimated to have net costs (costs minus duties, which are large because Denmark has very high fuel taxes) of 3.74 DKK per kilometer. This would be even higher under urban-peak conditions due to higher congestion costs according to Litman 2012.

### Table 2.1 Average Costs Per Kilometre for Cycling (2008 Danish Kroner)

<table>
<thead>
<tr>
<th></th>
<th>Cycling (16 km/h)</th>
<th>For Reference: Car (50 km/h) in city</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Internal</td>
<td>External</td>
</tr>
<tr>
<td>Time costs (non-work)</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Vehicle operating costs</td>
<td>0.33</td>
<td>0</td>
</tr>
<tr>
<td>Prolonged life</td>
<td>-2.66</td>
<td>0.06</td>
</tr>
<tr>
<td>Health</td>
<td>-1.11</td>
<td>-1.8</td>
</tr>
<tr>
<td>Accidents</td>
<td>0.25</td>
<td>0.54</td>
</tr>
<tr>
<td>Discomfort</td>
<td>?</td>
<td>0</td>
</tr>
<tr>
<td>Branding/tourism</td>
<td>0</td>
<td>-0.02</td>
</tr>
<tr>
<td>Air pollution</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Climate changes</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Noise</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Road deterioration</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Traffic congestion</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.81</td>
<td>-1.22</td>
</tr>
</tbody>
</table>

Source: Litman 2012

A study in USA on Bicycle Improvement Benefit/Cost Analysis (Gotschi 2011 cited in Litman 2012) assessed Portland, Oregon’s bicycling investments using past trends, future mode share goals, and a traffic demand model. This analysis indicates that by 2040, $138 to $605 million in total investments will provide $388 to $594 million in estimated healthcare benefits, $7 to $12 billion in reduced deaths, and $143 to $218 million in fuel savings. The benefit-cost ratios are positive and very large when reduced deaths are included.

### 2.3 Challenges of Bicycling Transportation

As overviewed above, bicycle transportation plays a paramount role for low income groups. This does not mean that bicycling does not have limitations and challenges. Among these, few are overviewed below:

#### i. The Vehicle Itself

The compatibility of a bicycle is different from motor vehicles in its size, speed and operational characteristics. Bicycles are not suitable for drivers (users). The use of bicycles implies biological limits and safety concerns preventing very young children and elderly persons because bicycling requires a
certain amount of strength, stamina and agility. For instance, most cyclists in China were between 16 and 45 years (64%) and few were under 15 and above 60 years (34%) and men dominated about 60% (Vasconellos 2001; Grava 2003). In Indonesia, for example, scooters are an option for women because they can be ridden in traditional dress as there is no frame cross-bar that must be straddled (Orn 2002). Moreover, cycling is effective means of transportation for short distance at about 8km in small and medium sized cities with comfortable speed of 16kph. Above this limit, mostly causes fatigue (Grava 2003). Cycling is difficult in bad weather conditions and on rugged topography where the slope is above 5%.

ii. Safety
Cyclists and pedestrians have fatality rates per kilometer traveled 10 to 20 times higher than those of car users (WCTRS & ITPS 2004; Grava 2003). Out of the total reported traffic accidents in Uganda between 1998 and 2001 cyclist share about 15 percent death and 14 percent injuries (Boss et al 2003). Most of the accidents of bicycles are caused due to poor infrastructure facilities, hostile street environments, at one hand and lack of adequate skill and fully aware of appropriate riding techniques and unsafe riding such as against vehicular traffic ignoring traffic signals, using sidewalks, not making proper turn, exceeding appropriate speed, riding at night with poor reflector or no light, cutting in front of vehicles of cyclists (Grava 2003; Vasconellos 2001). Particularly, speedy driving/ riding increase the chance of fatality. For example if an accident occurs at 70 km/h, the likelihood that the cyclist will be killed is estimated to be at 83%; at 50km/h speed, 37% fatality, whereas at 30km/h speed it reduces to 5% (Hass-Klau 1990, as cited in O'Flaherty 1997.

iii. Affordability
Though bicycle is the cheapest mode of transport system, affordability is the key barrier to use in developing countries. For example in Malaysia and India the bicycle ownership becomes substantial 40% more of households owning a bicycles when income levels reach about 10 times the cost of bicycles and in Nigeria households own bicycle had incomes of 19 times its cost. In Kenya 65% of bicyclists bought second hand bicycle because of poor income level (Barwell and Lagget 1986; Addeebisi 1985; Kaira1985; Overton1985 cited in World Bank 1994). Moreover, in Bamako (Mali) and Ogaudugu (Burkina Faso) the percentage of rich households exceed their poor counter parts in bicycle ownership (Vasconellos 2001). Therefore, affordability is a function of purchase price.

iv. Inefficient Support by the Governments and People’s Negative Social Attitudes
Marginalizing NMT by transport decision makers and politicians is both discrimination against low income people and ignoring the environmental benefits. Moreover, the richer and more politically influential classes are likely to be car users and to have interest in reducing the nuisance offered by slow moving and congestion of NMT (World Bank 2002). As a result, the planning techniques do not consider bicycles.

In terms of social attitude, in some African cities, using bicycles is seen as the sign of poverty. Also cultural perception to bicycle transportation is problematic. Certain member of people who will regard cycling as not very dignified activity associates with children's game and teenage exuberance. For instance, in Uganda, the bicycle is seen as a provision for only men which are the main constrain in promotion of cycling (Grava 2003, Boss et al 2003).
2.4 Best Practices:

2.4.1 The Netherlands

Confronting with severe congestion and the negative environmental effects of increasing car traffic, many industrialized countries are now giving more attention to the potential benefits and complementary role of bicycles.

As stated by Fromsen (2006), Netherlands is the most densely populated country in Europe. In this country, cycling transportation has a long tradition. To combat congestion, urban sprawl and reduce environmental hazards, it began a ten year development program. The bicycle strategy of Netherlands has been formulated within the framework of national policy. The issue of bicycle is returned to mainstream of government policy debate on environment and mobility, and part of integrated traffic and transport approach. A master bicycle plan has been developed based on policy statement that was approved by parliament.

Bicycle facilities integrated with mass transit system to enlarge the catchment areas and to provide and to reduce door-to-door travel time. The government deliberately invested 20 billion dollars in cycling infrastructures and promotion in last 30 years.

As result:
- The Dutch, which are famous for their high degree of bicycle use, are 30-50% of trips by bicycle, second right after private car.
- The Netherlands are the only western nations in Western Europe not to have increased in obesity since World War II and studies have shown that this is primarily due to large number of trips made by bicycles.
- Netherlands now has bicycle network of more than 22,000 kms.

Like Netherlands, Denmark, and Germany are making driving relatively expensive as well as inconvenient in central cities through a host of taxes and restrictions on car ownership, use, and parking.

2.4.2 China

In China, electric bicycling has been implemented in 2010 and the density is almost 10 e-bike per 100 people today. The economic context of e-bikes is fundamentally different in China than in North America. In China, most electric bike buyers are increasing in vehicular speed and comfort from heavy, low-performance bicycles. They are opting for electric bikes not in place of cars but in place of bicycles, motorcycles, or scooters. In the North America, e-bike buyers are stepping down in vehicular speed and comfort from the automobile (Vitoria Transport Policy Institute 2012).

2.4.3 In Africa and Other Cities

Cycling in medium size cities is viable can be an attractive mode of urban travel. As explained by Longen and Temble (2001) examples are given to Morogoro and Eldoret. Cycling in big cities, in Nairobi and Dar es Salaam is more encouraging along collector roads, through speed humps and raised pedestrian crossings. Cycling by women is not everywhere but in Tanzania (Mwanza) is common.

Many arterial roads have been converted from 4- to 3 lane or 4 to 2-lane reductions with bike lanes as part of road diet treatments (Burden and Lagerway 1999; Rosales 2007 as cited in Victoria Transport Policy Institute 2012).
3. Data analysis and interpretation

3.1 Bicycles as Compared to Other Modes in Bahir Dar and Hawassa Cities

The dominant mode that Bahir Dar and Hawassa cities use as the means of transport is bicycling. Table 3.1 illustrates Modal share of bicycling barring walking, code 03(commercial) and code 04(governmental) vehicles because of non availability of data. The share of bicycling is 89.26% which is 90.32% for Bahir Dar and 87.71% for Hawassa. The second popular mode is animal drawn mode (4.68%) which is dominated in Bahir Dar city (5.5%) than in Hawassa which is 3.46%.

Table 3.1: Modal Share of Vehicles in Bahir Dar and in Hawassa (2008)

<table>
<thead>
<tr>
<th>Mode type</th>
<th>Number of vehicles</th>
<th>Bahir Dar(1)</th>
<th>%</th>
<th>Hawassa***(2)</th>
<th>%</th>
<th>Total(1+2)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobiles(Code No 02)</td>
<td>124*</td>
<td>0.46</td>
<td>102</td>
<td>0.54</td>
<td>226</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Taxis and minibuses</td>
<td>178*</td>
<td>0.65</td>
<td>98</td>
<td>0.52</td>
<td>276</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Bajaji/motorize three wheelers</td>
<td>227*</td>
<td>0.83</td>
<td>1114</td>
<td>5.94</td>
<td>1341</td>
<td>2.92</td>
<td></td>
</tr>
<tr>
<td>Motorcycles</td>
<td>604*</td>
<td>2.22</td>
<td>342</td>
<td>1.82</td>
<td>946</td>
<td>2.06</td>
<td></td>
</tr>
<tr>
<td>Bicycles</td>
<td>24,571**</td>
<td>90.32</td>
<td>16,458</td>
<td>87.71</td>
<td>41,029</td>
<td>89.26</td>
<td></td>
</tr>
<tr>
<td>Carts/animal drawn</td>
<td>1,500**</td>
<td>5.51</td>
<td>650</td>
<td>3.46</td>
<td>2150</td>
<td>4.68</td>
<td></td>
</tr>
<tr>
<td>Total Vehicles</td>
<td>27,204</td>
<td>100</td>
<td>18,764</td>
<td>100</td>
<td>45,968</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Source: *Adopted from West Gojam Zone Transport Branch Office 2008  
**Adopted from Bahir Dar City Office(2008)  
***Adopted from Municipality and City Administration of Hawassa 2008

When we compare the growth rates of registered bicycles in both cities, the number has raised from 20,000 in 2005 to 24,571 in 2008(22.86%) in Bahir Dar. The average annual growth rate of bicycling in Bahir Dar is 7.1%. This shows that the number of bicycles in 2012 is 32,326. Similarly in Hawassa, it has raised from 11,926 in 2005 to 16,458 in 2008(73.94%) with the annual average growth of 11.33%. This raises the number of bicycles to 25,280 in 2012.

There are a number of unregistered bicycles providing transportation service in both cities. As the interview conducted, about 30.8 and 36.8% of bicycles are not registered in Bahir Dar and Hawassa respectively.
In Hawassa there is an introduction of Bajajs (increased from 97 in 2006 to 1114 in 2008, change by 1046%) and introduction of more motorcycles (from 228 in 2007 to 342 in 2008). Such innovations have automatically influenced the former dominance of taxis (a decline from 138 in 2006 to 98 in 2008).

The bicycle density per 1000 people is greater in Bahir Dar(169) than in Hawassa(117). When unregistered bicycles are considered, the density reaches up to 222 and 162 respectively (Table 3.2). But it is opposite in terms of density per unit area. Assuming that all bicycles distributed equally in the city areas, in each of one square kilometer, we can get 202 bicycles in Bahir Dar and 505 bicycles in Hawassa.

### Table 3.2 Comparing Bicycle Density in the Study Area (2012)

<table>
<thead>
<tr>
<th>Study area</th>
<th>Population (2012)</th>
<th>Area (km²)</th>
<th>Population density</th>
<th>Number of registered bicycles</th>
<th>Number of bicycles (including un registered estimation)</th>
<th>Bicycle density/1000 people (registered)</th>
<th>Bicycle density/1000 people (including unregistered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahir Dar</td>
<td>191,016</td>
<td>160</td>
<td>1194</td>
<td>32,326</td>
<td>42,347</td>
<td>169</td>
<td>222</td>
</tr>
<tr>
<td>Hawassa</td>
<td>215,396</td>
<td>50</td>
<td>4308</td>
<td>25,280</td>
<td>34,886</td>
<td>117</td>
<td>162</td>
</tr>
</tbody>
</table>

Source: CSA and own computation based on the secondary data collected 2012

### 3.2. Characteristics of the Respondents

Out of 408 bicycle users in both study areas, the younger bicycle users dominated. Users between 15-35 age group were 75% and the use of bicycle decreased with an increase of users’ age. Most women were unwilling to receive the questionnaires. As the result, 26.92% and 21% of the total respondents were participated in the study in Bahir Dar and Hawassa respectively. The most frequent bicycle users in the cities are government employees (46.15% in Bahr Dar and 42% in Hawassa).

### 3.3 Purposes of Bicycles in the Study Area

In both secondary cities, bicycle transport expansion could be very high due to the suitability of the topography, favorable climate and moderate size of cities, relatively better city development planning. These conditions or opportunities have made the city residents to use bicycles for various transportation purposes even in the night time. For instance, out of 200 respondents in Hawassa, 60% use their bicycle for all necessary activities, 17% use for schooling only, 13% use for regular working and 10% use for social relation such as visiting friends, shopping etc. 64% of these 200 also use their bicycles both for day and night times whenever necessary, 27% use only for day activities and the rest 9% use for night activities only such as for evening schools and overtime works. The females, who are using at night account 2% from 9% of night time users.

The increase in bicycle mode in cities also created job opportunities. Bicycles selling shops, repairing and maintenance, washing services, spare part shops, bicycle hiring and paid guarding of parked bicycles etc. allow employment for the unemployed youth in the city. For instance, in Hawassa, there is recently established bicycle repairing and maintenance private organization managed by Indian Company. In Bahir Dar city too there are small kiosks which are used to sale bicycle spare parts.

Generally, in both cities, the use of bicycle transport for all purposes especially at night time reflects good safety, better security, and relatively good availability of infrastructures as well as attractive cycling atmosphere in the area.
3.4 Challenges of Bicycle Transportation

Even though bicycle transport has various socioeconomic advantages, there are various challenges to address stakeholders’ demand. Among these, security (bicycle theft), safety (traffic accident), infrastructure (bicycle lane and parking areas), affordability and institutional concerns are the most important factors which affect bicycle transportation in the study area.

3.4.1 Bicycle theft

Inadequate facilities and fear of theft are major obstacles to bicycle transportation. Out of 408 respondents 33.6% replied that their bicycles were stolen (i.e., 32.21% in Bahir Dar and 35% in Hawassa)

From stolen bicycles, 19% replied that their bicycles were returned through formal legal process or support of the community, 19.71% reported that their bicycles were returned through negotiating with bicycle thieves (which involves decisions not to report to Police and paying certain amount of birr for bicycle thieves) and 61.31% reported that their bicycles were not returned at all (83.6% in Bahir Dar and 40.0% in Hawassa). Moreover, respondents explain that formal legal process to return stolen bicycles is time taking and the police members were not cooperative.

Ridding bicycle at dark time in inner roads and selected spots are often risky and exposes to robbery and harassment as the respondents replied. Sometimes the security in these areas at dark time is not well controlled; cause not only loses of bicycles but also user’s life is risky. As the best opportunity, group ridding of evening students along the risky areas had been observed.
3.4.2 Traffic Accident

Urban traffic accident is one of the major problems in transportation management. The bicycle transport is not considered as the means of transport by motorists and the role expected from traffic police and concerning institutions is very low. Efforts made to record and manage traffic accidents related to bicycles are very poor. According to the respondents, more than 29% of total bicycle users are victimized by traffic accidents. In Bahir Dar for instance, among various problems, traffic accident is the second largest rank after bicycle theft.

According to the information obtained from the traffic police of both cities, most traffic accident on cyclists is caused by the negligence of motor vehicle drivers. In other side, there are also collisions and injuries happened due to the fault of bicycle riders. The following are some of the errors that most bicycle riders encounter chances of collisions:

i) *They do not follow the traffic laws while they are riding bicycle;*
   - Riding bicycles on the wrong directions of streets;
   - Speedy riding;
   - Double riding;
   - Overloading;
   - Improper turning and crossing street etc.

ii) *Bicycles don’t have lights and reflector mounted on their bicycles while they are riding at night time;* 46 and 64% of the respondents in Bahir Dar and in Hawassa replied that their bicycles are without reflectors respectively (Figure 3.2). Similarly, 49 and 78% of the respective bicycle users do not fulfill the light on the bicycle. Lack of mounting such necessary equipments is very high in Hawassa than Bahir Dar. Even un registered (bicycles without legal plate exceed in Hawassa(34%) than in Bahir Dar(31%).

It is obvious that these conditions are illegal according to Ethiopia’s transport regulation No 279 /1963 as indicated in articles of 57and 76. These articles restrict riding bicycles unless his/her bicycle is in a good and road worthy mechanical condition and firmly state about loading on bicycles which prevent his/her full control and properly riding with other vehicles. For instance, Article 76 states that “No person shall ride a bicycle during night time unless said bicycle shows a white light towards the front, clearly visible from a distance of not less than one hundred meters and red reflectors reflect towards the rear”.

Besides these, reckless driving behaviors of bicycle users with poorly equipped bicycles; the traffic police members do not show interest to fully enforce the existing traffic regulations. One traffic police from Hawassa says that:

…it is difficult to enforce all regulation upon cyclist due to many reasons: firstly, the traffic regulations are very general which needs amendment depending on local conditions. Secondly, some important issues such as age limit, license, and plate are not included in the regulation. Thirdly, lack of integration and common understanding between different institution and traffic police is poor to improve the conditions.
Table 3.2. Equipment Status of bicycles in Bahir Dar and Hawassa

<table>
<thead>
<tr>
<th>Plate/Registered (%)</th>
<th>Bahir Dar</th>
<th>Hawassa</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>69</td>
<td>71</td>
<td>140</td>
</tr>
<tr>
<td>No</td>
<td>51</td>
<td>49</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light (%)</th>
<th>Bahir Dar</th>
<th>Hawassa</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>96</td>
<td>86</td>
<td>182</td>
</tr>
<tr>
<td>No</td>
<td>64</td>
<td>78</td>
<td>142</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reflector (%)</th>
<th>Bahir Dar</th>
<th>Hawassa</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>59</td>
<td>64</td>
<td>123</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>34</td>
<td>66</td>
</tr>
</tbody>
</table>

Source: Field Survey

<table>
<thead>
<tr>
<th>Table 3.3 Access of traffic education in Bahir Dar and Hawassa Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source: Field Survey</td>
</tr>
</tbody>
</table>

iii) Some of them haven’t learned how to handle and control their bicycles effectively;

The traffic safety education given for cyclists in particular and for the whole people in general is not sufficient and not regular. Accordingly, 24.02% of the total cyclists responded as there is no traffic education at all. This shows that these people do not have traffic concept in general. This problem is more dominant in Hawassa than in Bahir Dar (Figure 3.3).

The main problems upon traffic polices as mentioned by respondents are also:

- Most of them are not loyal in their assigned work position,
- They are corrupt, have ethical problems, negotiate with violators of traffic rules
- They have capacity problems/limited knowledge;

iv In addition to the aforementioned problems, most users don’t keep their bicycles in good mechanical condition, and some of them also drink alcohol and ride their bicycle.

This problem is against the rule and the regulation of the country mentioned above. The enforcement of police is also week in this regard

3.4.3 Availability of Bicycle Facilities

Bicycle Parking, storage and shower/changing rooms (collectively called end of trip facilities) are important and better ways to provide convenience and security for cyclists. But non-existence of this with guards, width and quality of right-of-way, special bicycle lanes, road markings, lights along the roads, road signals and signs etc increase the risk of bicycling.

The flat topography in the area is convenient for bicycling. However, encourage high speed due to the absence of traffic calming and other measures. Bicycles in both study areas are using a mixed traffic system in main roads; and with pedestrians and animal drawn carts in inner roads. Most of the traffic signs and signals including the road marks are not visible along the roads.

There are 8,780 hours in the year; bicycles may run an average of one hour per day (365 hours in the year). In line with this, bicyclists need waiting area for the remaining 8415 hours to park their bicycles. In both cities bicycle parking places are highly needed especially at educational centers, large and small industrial establishments, office blocks, bus terminal, public buildings, recreational areas etc.. But in most of places of the study areas there are no sheltered and well secured parking places.
The Figures below illustrate parked bicycles in Bahir Dar University, Protection House Commercial Building and Mango Park from left to right respectively. It is unsheltered, unpaved and even no traditional fence. In general, absence and lack of secured bicycle parking places and facilities in the city is deterrent for the use and expansion of bicycle transportation so far.

Figure 3.4: Parked Bicycles in Bahir Dar City

3.4.5 Lack of Bicycle Lane

As indicated in the figure below, no special bicycle lane provided in the study areas. they are using mixed traffic system (with motor vehicles, pedestrians and animals). It is obvious that this will result in traffic accident

Figure 3.5 Cyclists, pedestrians, animals and motor vehicles in mixed traffic system (photos of a and b are from Hawassa and c is from Bahi Dar)

3.4.6 Lack of Proper Management

Problem of structural setup, lack of commitment for fully enforcement of the laws and regulations either by traffic police or transport sector contributes to unsafe cycling in the study area. In other words, lack of transport policy and institutional framework related to bicycle transport are among bottle necks which hindered the smooth functioning of bicycle transport.

Most of the people in Ethiopia are low income people which cannot afford the current rising cost of bicycle. According to information from bicycle retailers in the study area, the price of all kinds of bicycles and its spare parts was increased by two fold in the last three years due to increase in transport cost, shop rent and import tax. This has negatively impacted on the bicycle users not to replace the old
3.5 Some Measures Recently Undertaken by the Concerned Bodies

Nowadays because of an increase of bicycle theft in the city, the City Police has tried to organize the unemployed youth to look after bicycles parked on open spaces informally with a small fee. For instance in Bahir Dar: Felege Hiwot Hospital, Bahir Dar City Service Office, Mango Park, Ethiopian Insurance Company Office Building and Ethiopian Electric Power Corporation Office. In these places the parked bicycles are guarded with a fee of 0.25 Birr per bicycle in the day and this is a good trial in the city. In such parking places facilities are not fulfilled and bicycles are parked simply on open spaces. In Bahir Dar University two campuses, students’, especially extension students’ bicycles are parked on an open space and the campus polices are guarding these bicycles with a small fee, i.e., 0.20 Birr per bicycle.

3.6 Some Models (Opportunities) to Bring Safer and Attractive Bicycling

A) Bicycle right-of-way (segregation) is essential and practical in bicycle friendly countries. In Chinese urban roads bicycle facilities were appropriately divided into five types with the first two types being recommended for large and medium size cities.

i. Special bicycle roads, independent of the road network and dedicated to bicycle use only;

ii. Semi-independent bicycle roads, positioned on one or two sides of motor vehicle lanes with physical separation;

iii. Non-independent bicycle roads, positioned on one or two sides of motor vehicle lanes but without physical separation;

iv. Mixed traffic roads, where motor vehicles and bicycles share the same right-of-way;

v. Pedestrian-bicycle roads, where bicycles and pedestrians share the same right-of-way.

B) Bicycle storage (parking). Litman and et al. (2002) classified bicycle parking facilities in to two:

Long-term (Class I) parking is needed at residences, employment centers, schools, and transportation terminals to safely store bicycles for several hours or days at a time. It must be fully protected from the weather, and enclosed in a secure space. This includes lockers, storage rooms, or fenced areas with restricted access.

Short-term (Class II) parking is needed at commercial and recreation centers. It should be as accessible (close to destinations) as possible. At least some short-term bicycle parking should be protected from the weather (a portion can be unprotected, since demand tends to increase during dry weather), and it should be visible to by-passers to discourage theft. Bicycle racks should support the frame of the bicycle and provide something to lock the frame and wheels.

Visibility, security (adequate lighting and close watch), weather protection (where possible to protect bicycle parking from the weather) and adequate clearance are the required factors considered when locating bicycle parking facilities.

C) Others like efficient traffic management and encouragement of bicycling are strategies used in bicycle friendly countries.

4. Conclusions and recommendations

4.1 Conclusions

Bicycling has been around for more than 100 years. Though it is not an advanced technology, it has never lost its utility. Promotion of bicycle traffic means they use human energy, no emission, and
noise, require very small parking space, cheap to own and operate, offer door to door service, and keep the rider in a good health, safe when they are segregated from fast traffic. Though the bicycling mode as low cost mobility has huge importance particularly in medium level cities, it is not yet well cultured and well managed in Ethiopia.

In Ethiopia, medium sized cities are the most bicycle-friendly. Primate City, Addis Ababa, and tertiary cities are deficient of this mode. In medium sized cities of Ethiopia more dominant users of bicycles are found to be government employees relatively who are medium and low income as well as 15-45 age groups. For instance, the most frequent bicycle users in Bahr Dar and in Hawassa are government employees (46.15% and 42% respectively).

Rapid growing trend of bicycles and bajajs in these secondary cities has negatively affected the growth and the role of taxis. Such kind of shift can be put as a huge modal revolution in Ethiopia.

Generally, in both cities, the use of bicycle transport for all purposes even including at night time reflects relatively good cycling atmosphere in the area. But, saying this does not mean that there is no problem in managing bicycle service in these secondary cities: security (bicycle theft), safety (traffic accident), infrastructure (bicycle lane[use of mixed transport routs] and parking areas), affordability problems, lack of institutional frame work, low considerations about bicycle’s role, lack of transport policy and clear rules and regulations are among the most important factors which affected the smooth functioning of bicycle transportation.

4.2 Recommendations

Based on the findings of the study, the writer recommends the following suggestions to be taken to reduce the challenges and promote sustainable bicycle transportation in the cities:

One structural means to counteract the socio economic marginalization of low income, vulnerable and disadvantaged groups is to foster their mobility by promoting bicycling which are known by their affordability, efficiency and energy-saving. Therefore, bicycle transportation should be given more emphasis at federal, regional and local level and be included in the transportation policy, apply reasonable tax for the import of bicycle and their spares,

Improving conditions for bicycling often require public resources (money and land devoted to bike lanes and parking), the public cost per trip is usually less than that of automobile travel (money and land devoted to roads and parking facilities); and so such improvements can be considered to increase horizontal equity,

Creation of awareness to politicians, administrators, professionals and stakeholders to benefit low cost mobility options to alleviate poverty, gain economic and social development in the cities and towns is very essential,

Many communities have significant latent demand for bicycle transport. That is, people would bicycle more frequently if they had suitable facilities and resources. But these needs have been covered by various challenges. Bicycle thefts are prevalent in the study areas. Hence, based on strong institutional setups, the police should work together with bicycle maintainers, justice and users parties. Regular campaign should be made to provide information using local media about looking for bicycles, the importance of reporting theft and the measures that can be taken,

All bicycles should be registered and regularly inspected. Promotion to form their own association and keeping their rights and legal coverage is very essential. Besides, transportation safety problem solutions should also be action based in: legislation, regulation, enforcement, education, engineering, and encouragement
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1. **INTRODUCTION**

People or social groups are always, in one way or another one, excluded from the environments, situations or instances. Exclusion is being out on the sidelines, without possibility of participation, in social life as a whole or in some of its aspects. The high social and economic inequalities in Brazil and especially in its metropolitan areas, needs treating on the extremely unequal relationship that exists, through public policies which aim the social inclusion.

This work focuses on one of these public policies seeking to enable the excluded ones the access to essential public services through improves mobility with the expansion of the network of public urban transportation. The possibility of access to this essential public service changes the reality of the population and opens new perspectives for the development of their capacities and to exercise their rights and seeking opportunities.

The service the transport needs within villages and slums presents physical and operational barriers that generally discourage the government and operating companies to find out solutions to the issue.
The matter is aggravated by the growth of these areas on hillsides without at least road system, which condemns its entire population to walk long distances on a difficult topography to get their commuting.

As part of an administrative policy guided by the inversion of priorities and direction of investments to the poorest areas, the experience of Belo Horizonte begins in May 1996 with the establishment of a shuttle minibus collective operating in the region of Barreiro, in the extreme north of the city. The investments of the municipality in the urbanization of villages and slums, with construction of new roads and paving the existing ones allowed a gradual expansion project. The system currently has ten lines of buses which transported an average of 281,000 passengers/month in 2011. The service is operated by private concessionaires and is managed by Belo Horizonte Municipality through a public company of its indirect administration: BHTRANS.

The work covers five steps required for conceptualizing the theme and reviews the procedures. The first step deals with the socio-spatial segregation in a sociological perspective, the second section considers social exclusion and mobility, while the third describes the Specific Global Plan, the fourth step describes how the program to improve mobility in towns and slums is made and eventually the final considerations on the topic.

2. THE SOCIO-SPATIAL SEGREGATION IN A SOCIOLOGICAL PERSPECTIVE

Discussing the concept of socio-spatial segregation in Brazil, especially its measurement and the consequences of its existence, it is important to seek work which took as its aim of study the two largest cities in Brazil: Rio de Janeiro and São Paulo.

A historical retrospective presented by Ribeiro (2003, p. 163) on the experiences of being examined social space points to the need to “find units of analysis for constructing a synthetic representation of their differences.” According to the author, everything goes back to London in the late nineteenth century, when Charles Booth led to the term “first experience of analyzing social space for public policy purposes” (RIBEIRO, 2002, p.159). This sort of study was also conducted in the United States, by members of the Chicago School, which “sought to develop techniques to apply of showing the influence of territory – understood as the social environment – the understanding of a vast range of social problems, such with juvenile mental illness, etc.” (RIBEIRO, 2003, p.161). In Brazil, according to this author, the first studies for the purpose of urban planning, social analysis of the territory, have been prepared by the Society of Graphical Analysis and Concepts Applied to Social “Mecanografica” (SAGMACS) on the cities of Rio de Janeiro, São Paulo and Belo Horizonte.

But conceptualize as “segregation” in order to then study it? Marques and Torres (2005, p.13) argue that residential segregation is “the degree of residential segregation or isolation between different social groups.” For Ribeiro (2003, p. 163), in turn, the term residential segregation denotes the idea of separation and exclusion of certain groups from the whole city situations where there is absence of relationships that bind these groups together with the social.”

Eduardo Marques (2005, p.31) argues that “socio-spatial segregation in terms involves at least three distinct processes.” The first method would be one that implied in total and isolation (as in the case of ghettos and citadels). The second process is related to unequal access. The third turn is related to the “separation or homogeneity internal and external heterogeneity in the distribution of the groups in space” (MARQUES, 2005, p. 34). The author explains that there is not a unified position on the issue in Brazilian production, “being the term used to designate both separation and inequality of access” and these positions are not mutually incompatible (MARQUES, 2005, p. 34).

Torres (2004, p.81) states that part of the problem encountered in studies on the subject is not able to reach “a consensus about an adequate concept of segregation”, and that “the only kind of understood
as the degree of segregation residential separation between different social groups have been effectively measured in other countries.” The author estimates that by studying residential segregation in Latin America “this concept has often been used loosely, as if the segregation was merely a reflection of the differences between social groups” (p.82). The term was being used inappropriately as a synonym for “inequality”, “exclusion” and even of “poverty.” For him, in their analysis, “segregation can be understood as the degree of clustering of certain social/ethnic group in a given area” (TORRES, 2005, P.82).

Peter Marcuse (quoted by Torres, 2005, p.83) considers the phenomenon more closely: “Segregation is the process by which the population is forced, therefore unintentionally, to cluster in a particular area, in a ghetto. The process of formation and maintenance of the ghetto. “In examining this definition, highlights Torres (2005, p.83) points out that “an aspect often overlooked: the segregation should be understood mainly as a relational phenomenon, i.e., there is only segregation of a group when another group secretes or is secreted. “In a study in which certain areas of the city named as “fortified enclaves”, Teresa Caldeira (2000, p. 212) states that “the rules that organize urban space are basically patterns of social differentiation and separation. And more: “These rules vary culturally and historically, reveal the principles that shape public life and indicate how social groups interrelate within the city.” (BOILER, 2000, p. 212).

Some established concepts, it can be sought to answer where segregation was happening. In this regard, Ribeiro (2003, p. 163) argues emphatically that “all cities exhibit clear signs of social division on its territory” which leads to believe in the need to study it and measure it for, then measure its impact. After all, the author highlights the fact that there is a social division does not necessarily imply that there is a situation of segregation. It should highlight a relevant assessment of Torres (2005, p.81): “Paradoxically, few times the residential segregation of our cities was measured in empirical terms, despite a long tradition of international measure the phenomenon, particularly in the United States. Before proceeding, it is worth highlighting Ribeiro’s alert (2003, p. 163) that “use of the term segregation as a concept depends on the theoretical view that is adopted to explain social relations and understanding of the distinction between differentiation, segmentation and segregation”. Regardless of view adopted, it seems important to discuss the concept of segregation along with the concepts of inequality and poverty.

As for poverty, it can be said that his analysis is not a simple task, it is important to point out that “most sociological studies of poverty is essayistic form, making it difficult to compare between different realities, regions in space and moments in time” (MARQUES, 2005, p. 40). After all, “the concept of poverty can only be understood as a social construction, since the companies were awarded collectively the set of goods and services to which all citizens should have access” (MARQUES, 2005, p.40). This is complex issue “since associates access to goods, services and opportunities differently to various social groups defined on the basis of their characteristics” (MARQUES, 2005, p.40).

As social inequality means that is, generally, “the existence of different social characteristics between social groups established from some cleavage continuous or dichotomous/categorical” (MARQUES, 2005, P. 41).

In terms of concepts, it can be said that inequalities in access have gained special relevance. These, from Kaztman (quoted by Ribeiro, 2003, p. 42), are the difficulties in accessing the labor market and the difficulty of access to public policies.

Asked the conceptualizations, it is important to advance the understanding of the measurement of segregation. From studies conducted in São Paulo, one arrives at a “very detailed description of the spatial distribution of social groups, showing the existence of various types of poverty” (MARQUES, 2005, P.59). From the intersection of the variables income and education, for example, concluded that, in São Paulo, “income tends to be more spatially and socially distributed that schooling” (MARQUES,
The studies brought to term in the metropolitan region of São Paulo indicate that the territory is occupied “by various social groups very different from each other,” worth it both for the rich and for the poor and the middle class (MARQUES, 2005, p.68). These results confirm the belief in “the existence of various forms of poverty”, which shows a complexity that “tends to grow further, becoming very complex overlap between the effect of heterogeneity and cumulative” (MARQUES, 2005, p. 68).

But what are the effects of residential segregation and segmentation in the process of reproduction of inequality and poverty? Ribeiro (2003, p. 155) presents “the virtues of social analysis of urban spaces as a tool able to identify the possible role” these effects. The author identifies three mechanisms that are currently identified as causes of increased residential segregation in cities: globalization, the growing perception of insecurity and decentralization (with transfer to the national level) function of investment in public services (equipment and provision services).

And what to do with the information and analysis obtained through research on segregation? You would say that “there are basically two types of government strategy to combat segregation and promoting fairness” (MARQUES, 2005 p.50).

The first strategy in pursuit of equity is the state promotion of social mix, creating mechanisms that force people from different incomes to live more closely. Important here is to highlight some statements that Bourdieu (2003, p. 165-166) recalls: “in fact, nothing is more intolerable than physical proximity (experienced as promiscuitry) the socially distant”; “certain spaces, and particularly the more closed, more select, require not only economic capital and cultural capital, but also social capital “and” the meeting in the same place in a homogeneous population also has the effect of dispossession redouble dispossession, especially regarding culture and cultural practice.”

The second strategy described by Marques (2005, p. 50) is “to improve the conditions of urban areas inhabited by the poor, raising its status to a standard nearest experienced by groups with better social condition.” The author points out that both strategies “can lead to the production of a city more mixed and less unequal, although, the experiences from advanced countries do not always confirm this” (MARQUES, 2005, p.50). Here, once again, what seems to motivate the author in his conclusions is the focus on the complexity of the matter: “our analyses indicate that these situations are more complex than the literature suggests [...]. The central element is the combination between the complexity of the social structure, the heterogeneity of peripheral spaces and elements and processes of cumulative socially negative.” (MARQUES, 2005, p. 53)

One can therefore consider the segregation study as “an instrument capable of enunciating social problems” (RIBEIRO, 2003, p. 164). In the field of policy formulation, in turn, argues that, “especially in the case of urban policies, the space is considered one of the central dimensions in building these capabilities [technical and administrative], for potential use in building territorialized strategies of state action” (MARQUES; TORRES, 2005, p. 14). Putting in another way, the social analysis of urban space should be seen as a “tool able to identify the possible role of targeting and effects of residential segregation in the process of reproduction of inequality and poverty” (RIBEIRO, 2003, P.155).

3. TRANSPORTATION AND SOCIAL EXCLUSION.

The share of the population living in the city has its formal mobility with guaranteed quality, not only by the capacity of this type of funding, but also by the availability of adequate infrastructure to mobility with quality. The same cannot be perceived in the informal city, where mobility is reduced due to the absence of the conditions necessary to qualify the displacements Torquato (2004). Thus, the use of urban space and its benefits are unevenly distributed, exacerbating social inequality.

In designing the service of socially inclusive public transportation to the city should stick to the
specificities of each region and territorial dynamics. The process of social and spatial segregation of the poorest, present in large Brazilian cities, has a result of the conditions limiting the mobility of this population group, often due to not being adequately met the needs of transport.

Gomide (2003) considers that the provision of a service of public transportation accessible, efficient and quality, which ensures the accessibility of the population to the entire urban space, causes an increase in the quality of life of the poorest people, contributing to an increase in income, providing access to base social services and job opportunities. Thus, public transport is an important tool to avoid urban poverty and promoting social inclusion.

Some attributes appear to be crucial to understanding the ease of access to public transport service: the distance travelled on foot to enter the system, the availability of information about the service, the existence of adequate infrastructure to service the route of the line (paved roads, lane width), quality of service and price.

4. **SPECIFIC GLOBAL PLAN**

Improvements in villages and urban slums of Belo Horizonte were designed through a partnership between the Municipality and local communities. These experiments demonstrate that urban interventions in spontaneous settlements are much more successful and more durable as the beneficiary population participates. Thus, the government acts on a request from residents and explicitly in line with efforts by the communities themselves.

In participatory urban upgrading projects in villages and slums, analyses the dynamics of each village or slum on the organization of neighborhood associations, seeking to prioritize the works discussed and approved by the community. Projects must be appropriate to the type of soil, topography, vegetation, climate and other physical and geographical characteristics of each locality. Expropriation, removals are avoided so as not to destroy the existing neighborhood relations. The techniques and design standards used must be adapted to the context of the villages and slums, whereas interventions may not be definitive. It should employ economic solutions without sacrificing the quality of work.

The process of improvements in urban slums and villages conducted by Urbel, the public body responsible for the urbanization of villages and slums, in partnership with the local community encompasses many sequential steps and interrelated and culminate with the Global Urban Plan. According ARROWS-MG (1992) this is a tool that ensures the development and implementation of urban improvement projects consistently and according to proper conception of the physical and socioeconomic characteristics of the area, in addition to equipping the community in search of resources and support for fulfillment of their demands.

The definition of the road system is one of the primary steps in the development of the Global Urban Plan of villages and slums because this is the structuring element in the organization of urban space. In conventional classification, the streets and alleys of the slums and villages fall under the category of local roads and pedestrian routes, but you can divide the local roads into the Main Street and side streets, and for the transportation system interests through the main street type.

In the development of road projects in villages and slums the interrelationship between Urbel and BHTRANS, manager of urban public transportation system, enabled the works carried out in villages and slums ensured the possibility of movement of public transport on the streets of the leading brand. The road projects are simplified pattern adapted to local physical conditions and allow the design of public transport vehicles receivable and other essential public services, noting maximum gradient, track width, etc.

5. **VILLAGES AND SLUM PROGRAM**
The Municipality of Belo Horizonte implemented since 1999 as a result of Specific Global Plans, works to improve the infrastructure of the villages and slums, many of them through the features of Participatory Budgeting. The deployment of these new roads, paving and widening of existing ones BHTRANS allowed to enable the implementation of the Project for Improvement of mobility for residents of villages and slums of Belo Horizonte, an old demand of its residents.

This program of social inclusion and formalization of the informal city, which consists of the implementation of mass transit lines within those communities, reverses the perspective of traditional priority of public managers of the urban transportation: direct investments to areas of lower System passenger demands and less road infrastructure, public transport priority and security of users of the system; produce a transportation service with a focus on user needs; vehicles use low capacity in the system to perform regular service, usually taken as uneconomical; ensure the service by social viability, not economic, and designing the service in partnership with the effective participation of the community through meetings with CRTT’S – Commissions for Regional Transport and Transit.

Overcoming the obstacles to meeting the transportation needs in villages and slums could be overcome only with the integration of actions between government, community and business operators. The community is fully involved and in all phases of project development and implementation, through several meetings with representatives and community leaders, and members of the Community Associations.

Community leaders played an important role in approving the route of vehicles. According to the NTU (2004) the operation of the service can only be done safely if the consent of the informal leaders and community acceptance. Throughout the operation, the operators sought to maintain this partnership and community leaders, today, are driven not only for discussions on the operation and management of the lines. But also to reduce the conflicts between: the company, its officers employees and community.

The lines are designed to make the internal links and the surrounding villages and slums. It intends to enable the community to shift the main points of a desire to travel, in particular the urban facilities: health centers, schools, churches and local businesses. To allow coordination with the city, these lines integrate physically and tariffly the end of rows with other service features in the city.

In the implementation of this service, the operators sought and BHTRANS suit the limitations road, completing the vehicle technology by using a model adapted minibus for this sort of operation.

The vehicle defined for the service operation was a specially adapted minibus to travel on narrow and steep roads. Smaller than that found in the market, this vehicle carries 25 passengers seated and 15 standing. The Volkswagen microbus or 8.5 tons was adapted by the operator in conjunction with the manufacturer: It was shortened the wheelbase so it could work with up to 6 tons and so super-dimensioned brake systems and clutch components such plenty requested for service operation. The reasons are that these vehicles carry very low speeds, the path constraints, with a high number of deceleration and acceleration, and downhill, they have to walk very slowly, requiring an effort above normal for these components.

In 1993, with the start of line operation 7902S – Set Taquaril, the BHTRANS establishes a new public policy planning and management of urban public transport system and contributes decisively to improving the quality of life and social inclusion of its residents. That was the first line of transportation circulating in the city of Belo Horizonte in the informal city.

The line 7902S came through with zero tariffs, free carrying locals to the end point of an existing bus line (line 7902). The problems encountered with this free service were such that the actual community leaders requested that the charge was introduced, creating an integration tariff between the line 7902S
Three years later, a program was developed and named as Program for Improvement Mobility Villages and Slums, with the guideline and principle inclusion. In this program, the first service was offered the line 319, in May 1996, to serve two communities: Town Cemig and Hope Set. The last two lines were put into operation at 107 and 336, in 2007. There are in operation today, ten lines, as described in table 1, in different villages and city slums.

<table>
<thead>
<tr>
<th>Lines</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Aglomerado Santa Lucia</td>
</tr>
<tr>
<td>102</td>
<td>Vila N Sra. De Fátima.</td>
</tr>
<tr>
<td>103</td>
<td>Cafezal</td>
</tr>
<tr>
<td>107</td>
<td>Vila Marçola / Rua do Ouro</td>
</tr>
<tr>
<td>201</td>
<td>Morro das Pedras</td>
</tr>
<tr>
<td>203</td>
<td>Morro das Pedras / Ventosa</td>
</tr>
<tr>
<td>204</td>
<td>Estação Vila Oeste / Nova Gameleira</td>
</tr>
<tr>
<td>319</td>
<td>Vila Cemig / Conjunto Esperança</td>
</tr>
<tr>
<td>321</td>
<td>Olhos d’água / Pilar</td>
</tr>
<tr>
<td>336</td>
<td>Hospital Eduardo de Menezes / Vila Bernadete</td>
</tr>
</tbody>
</table>

The lines that serve the villages and slums have a monthly cost of R $ 222,838.80, while the monthly income is around R $ 64,312.45 (base May/05). There is no external subsidies to public transport system of Belo Horizonte, and therefore used the system of cross-subsidization, where surplus lines transfer funds to deficit through the Clearing House Tariff - CCT. Despite this high deficit, proportionally the amount is relatively small compared to the total system cost.

The tariff lines reduced to slums and villages was implemented in December 2000 and had a major positive impact on the city. This tariff level, 27% of the cost of the fare dominant, was created with the goal of social inclusion of people to the transportation system, providing access to local services (schools, hundreds of health, commerce) and other lines in the system. This solution proved to be interesting benefit for local travel, macroaccessibility extend (integration with larger number of lines) and inhibit evasion. Initially the integration took place through paper tickets. From December 2004 promoted to full fare integration through smart card BHBUS, allowing residents of Villages and Slums only pay a fee to use the lines of Villages and Slums associated with regular lines.

According to Borges (2001) in Santa Lucia Particleboard before the implementation of the online population moved an average of 1.5 km on foot, by steep paths to reach the bus stop lines that are surrounding. The line deployed, with 7 km long, allows the internal links to promote access to internal and external equipment to integrate with the end point of the lines around. The situation in Sierra Particleboard was no different before the implementation of internal line. Large portion of its population walked for 2 km on steep paths to reach the bus stop. With the implementation of the lines 102 and 103, with 3.6 km and 4.8 km long respectively, it was possible to articulate the interior of the village and integrate with the rest of the transport service in the city. The reality on Particleboard Morro das Pedras, in Vila Cemig eyes and water is no different from these two noted above.

Traders estimate that this service despite deficit has to be provided as it ensures the universality and equity of care transport network throughout the city, besides contributing to the formation of a positive image of the operators. The community says that the service has contributed to improving their living conditions and has led to reducing violence by allowing an offset safer, but has not attended to the continued growth of demand (NTU, 2004).
In selecting drivers and collectors, there was a high rate of refusal because of the low level of security function. The solution was to hire employees from the community to also curb in part to revenue evasion. According to the testimony of local residents attended, this measure helped to reduce evasion and without it almost no one would pay passage (NTU, 2004).

The five communities served by the lines are the larger towns and Slums of Belo Horizonte who did not have a mass transit system in its interior and its population is described in Table 2.

Table 2

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Aglomerado Santa Lúcia</td>
<td>16.914</td>
</tr>
<tr>
<td>Aglomerado da Serra</td>
<td>46.086</td>
</tr>
<tr>
<td>Aglomerado Morro das Pedras</td>
<td>14.363</td>
</tr>
<tr>
<td>Vila Cemig</td>
<td>4.352</td>
</tr>
<tr>
<td>Olhos d’Água</td>
<td>2.520</td>
</tr>
</tbody>
</table>

Moving average passenger refined lines of service to villages and slums in June 2005 was 6835 passengers per day. The following are Graphs 1 accompanying historical lines that show the evolution of passengers carried in the lines of villages and slums. Note that the lines show a steady growth in demand over the years, except the lines of Particleboard Saint Lucia (101), Morro das Pedras (201) Eyes and water / Pilar (321) do not show a significant increase in their demand, but stability in the volume of passengers carried. It should be noted that not observed in any of the lines there is no significant reduction in the volume of passengers over the years.

Graphic 1
6. **FINAL CONSIDERATIONS**

Overcoming social exclusion involves the universalization of citizenship. A strategy to fight against the social exclusion, in this sense, is ensuring access to essential public services. One such service is public transportation. In this sense the Municipality of Belo Horizonte invested in the urbanization of villages and slums with the introduction of new routes and widening and paving of existing roads, which allowed these regions BHTRANS deploy a service of public transportation with good quality and affordable.

The use of minibuses for transportation services in areas with poor road system, integrated physics and tariff the other lines of the conventional system ensures deleted for a segment of the population, access to public transportation, in addition to contributing for the integration of slums and villages to the urban fabric. It constitutes one of the instruments of public policy that helps the excluded are able to recover their dignity and materializes the participation in collective action; improving access to employment, income, social services and education, as well as health and cultural programs.

The results of this program can be characterized by the following benefits transferred: ensuring the residents of these villages and slums service access to public transportation; reducing the time and distance of travel on foot, and improving accessibility and mobility of residents.

In aspects tariff highlight two points. At first it appears that the application of differentiated tariffs and
the insufficiency to cover operating costs of the lines indicates an initial perception of inefficiency, but this deficit is compensated by attracting new demand for the system. The second is that a program of social inclusion in public transport services cannot be limited to the tariff subsidy for a group or for all users. But, they should also stick to the expansion of network services and the regularity and reliability of services.

However, some questions still remain unanswered and need to be answered, especially those that deal with the comparison of transport in the city offered as formal and informal in the city. Were the residents of the entire city on foot over distances of the same order of magnitude to reach their destinations? What about manning the lines? What about the age of vehicles? And the ranges of travel? What about the stability of demand in some of the front lines to the steady growth in other lines?

Data relating to the research of origin/destination held in 2001/2002 indicate that citizens from Belo Horizonte make 1.66 trips/day. However, when evaluating this mobility index by income that is observed is the inhabitants of the lowest income bracket (less than 0.5 times the minimum wage per capita) are only 1.13 trips/day. Taking only the collective modes, the inhabitant from Belo Horizonte makes 0.44 trips/day while those with lower incomes are only 0.34 trips/day. In non-motorized modes, in turn, what you see is the reverse situation: the city average is 0.29 trips/day and in the range of lower income is the average of 0.61 trips/day.

The data presented in this article were obtained directly in BHTRANS, but not all data required for a more thorough analysis of service are available, especially those relating to daily demand of each line over time, since the creation of each one. The moment that Brazil is under the aegis of two new regulatory frameworks, it can be said that this difficulty need to be overcome. These milestones are: a) Federal Law 12.587, enacted in January/2012 establishing the guidelines of National Policy on Urban Mobility in coordination with those provided in the Federal Constitution of 1988 and the Statute of the City, 2001; b) Federal Law 12.527, enacted in November/2011 and entry into force in March/2012, which provides for the procedures to be observed by the Federal Government, States, Federal District and municipalities to ensure access to information provided in the Constitution of 1988.

To comply with legislation that is being called “law on access to information,” the BHTRANS should provide data and indicators to society well acquainted with the services managed by it, including the public transport service in villages and slums in Belo Horizonte. To comply with the law that has been called the “National Policy for Urban Mobility”, in turn, society should participate in the development of diagnostics, indicators and targets stipulated for achieving universal service transportation. After all, do not just take the service to the geographically segregated communities: it is necessary this service is offered with quality similar to that offered in the rest of the city and that such offer is able to intervene positively in the segregation of its residents.

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