

DEVELOPMENT OF A RESEARCH-BASED FRAMEWORK FOR THE IMPLEMENTATION OF A BICYCLE NETWORK IN ADDIS ABABA.

Submitted in fulfilment of the requirements for the degree of
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Weimar, 27 September 2019

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The last two years in which I did my master's degree at Bauhaus-University Weimar in the programme European Urban Studies were an exciting journey. I am happy about the many new experiences and contents that I was able to learn from my teachers and fellow students with different cultural and professional backgrounds. I would especially like to emphasize the two study trips to Ethiopia, which impressed me deeply and for which I am grateful.

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Cyclist in Addis Ababa, 2019 © Swart

ABSTRACT

The current master thesis examines the relatively unexplored situation of cycling as a mode of transportation in developing countries. The benefits of cycling for health, environment and the livability of a city are being highlighted.

This topic is explored through the lens of the case study Addis Ababa, the capital of Ethiopia. Due to a rapid population growth and urbanization process the transport situation in the economic center of the country is very tense. The economic upturn is also accompanied by an increase of the motorization rate. However, currently, Ethiopia has still one of the lowest numbers in car-ownership worldwide, this offers the chance to leapfrog the motorization phase and, with the right policy choices, transportation can be made more sustainable.

The main objective of this paper is to set a framework for the current planning situation of cycling infrastructure in the city of Addis Ababa. The framework includes two dimensions: The political-regulation-communication-dimension and the spatial-design-planning-dimension, which both should be considered equally in the planning process. Since the evolution of the bicycle in Addis Ababa, from barely existent towards a proper mode of transportation, will be a long way, it only can be successful with a multilayered and interdisciplinary planning approach.

Regarding the measurements of the first dimension, the ideas and concepts can be summarized from the document analysis and the conducted expert interviews. Therefore the following measures should be highlighted: adapting the curriculum of transport related programs and offering capacity building workshops, adopting legal binding documents, strategies and regulation which ensure enforcement of cycling infrastructure. Furthermore, introducing computer-based analysis, planning and visualization tools, creating tax-incentives for a bicycle industry and finally the very important measure of communication and awareness-raising actions.

For the second dimension, some spatial parameters are chosen to create different scenarios with the aim to serve as a communication tool between stakeholders and decision-makers. For the specific examination, a research area in the city center of Addis Ababa was picked. From the analysis it emerged, that factors like the location where to start the cycling network and on what type of streets, also the existing street conditions and the terrain need to be considered.

This work hopes to contribute to the current state of research. The results are specific for the situation of this case study, nevertheless, it can be adapted or expanded for other areas and cities.

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ABBREVIATIONS

AACA	Addis Ababa City Administration
AACRA	Addis Ababa City Roads Authority
AARTB	Addis Ababa Road and Transport Bureau
ADFC	Allgemeiner Deutscher Fahrrad-Club (Engl.: General German Bicycle Club)
AU	African Union
CIM	Centrum für Internationale Migration und Entwicklung
CAD	Computer-Aided Design
CSA	Central Statistical Agency
DAAD	Deutscher Akademischer Austauschdienst (Engl.: German Academic Exchange Service)
ERA	Empfehlungen für Radverkehrsanlagen (Engl.: Recommendations for cycling facilities)
GDP	Gross Domestic Product
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit (GmbH) (Engl.: German Corporation for International Cooperation GmbH)
ITDP	Institute for Transportation and Development Policy
LEDC	Less Economically Developed Country
LMIC	Low and/or Middle-Income Countries
NACTO	National Association of City Transportation Officials
NMT	Non-Motorised Transport
OSM	Open-Street-Map
PBS	Public Bike Sharing
PMV	Personal Motor Vehicles
POI	Point of Interest
RASt	Richtlinien für die Anlage von Stadtstraßen (Engl.: Guidelines for the construction of urban roads)
TMA	Addis Ababa Traffic Management Agency
TOD	Transit-Oriented Development
TPMO	Transport Programs Management Office
TUMI	Transformative Urban Mobility Initiative
UN	United Nations
WHO	World Health Organization
WRI	World Resources Institute
WTO	World Trade Organisation

I INTRODUCTION

Context

One mega trend of our time is urbanization! By 2050 more than half of the world's population will live in cities. Accordingly, living in urban agglomerations will be the typical form of human existence in the 21st century. Therefore, the decision, if our children will live in a more sustainable and healthy environment than today, will be made in cities (cf. Schwedes 2017: 3; UN-DESA 2014).

Especially in developing nations, the urban population is expected to grow, adding 2.5 billion people to the world's cities by 2050, with nearly 90 % of the increase concentrated in Asia and Africa (cf. UN environment 2019). According to the World Health Organization (WHO), the fast, unplanned and unsustainable ways of urban development are making developing cities the key focal points for emerging environmental and health hazards (cf. Montgomery 2004). One reason for health issues is the higher need for mobility and the increasing motorization rate in cities due to the rapid urbanization. Nowadays, there are more than one billion cars on the world's roads, by 2050 it is expected to be three billion. The prediction shows, that without new approaches, drives and other mobility patterns, neither the mitigation of climate change nor the transformation of energy systems can be achieved (cf. sutp.org 2019).

The graphic (figure 1) shows the motorization rate compared to population growth. As one can see the population growth in Ethiopia is with around 3-4 % relatively high, whereas the changes in motorization are close to zero.

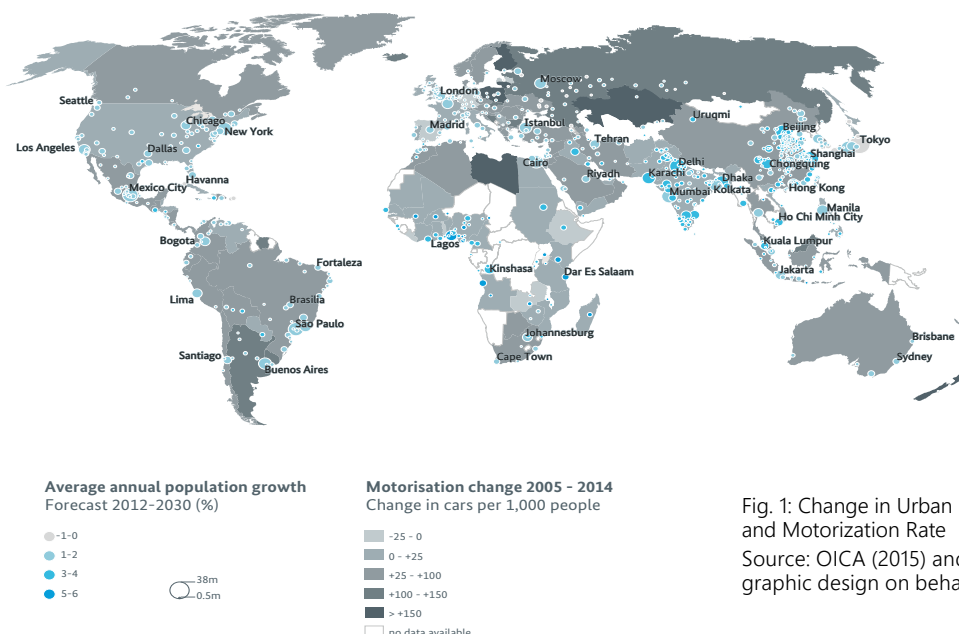


Fig. 1: Change in Urban Population and Motorization Rate
Source: OICA (2015) and LSE (2014),
graphic design on behalf of TUMI

Compared to other countries in the developing stage (the concept will be defined in „What does development mean?“ auf Seite 7), like in South America for example, the situation in Ethiopia is quite unique. This is certainly due to past and current economic and political circumstances in the second most populous nation of Africa. The country with its 105 million inhabitants (2017) is on the one hand, with a GDP growth of 7.7 % one of the fastest-growing economies in the region, on the other hand, with a per capita income of \$783, still one of the poorest countries in the world. The main driver for the economy are the construction and service industries (cf. The World Bank, Ethiopia 2019).

Considering the above-described facts about Ethiopia and the knowledge about the connection of economic growth and the increase of private motorcycles and thereto related environmental and health hazard, one obvious solution comes to mind: *Leapfrogging*. The term describes, especially in the economic and social sciences, the (voluntary) omission or skipping of individual stages of development from different perspectives. In sociology, leapfrogging is often used in the context of developing and emerging countries, which ideally avoid certain (often fossil-fuel-related) development steps (cf. Bechtle 2016). Figure 2 shows the evolutionary process of urban transport and the possibility of leapfrogging the motorization phases straight toward a state of high quality of life with effective public transport and good walking/cycling environments.

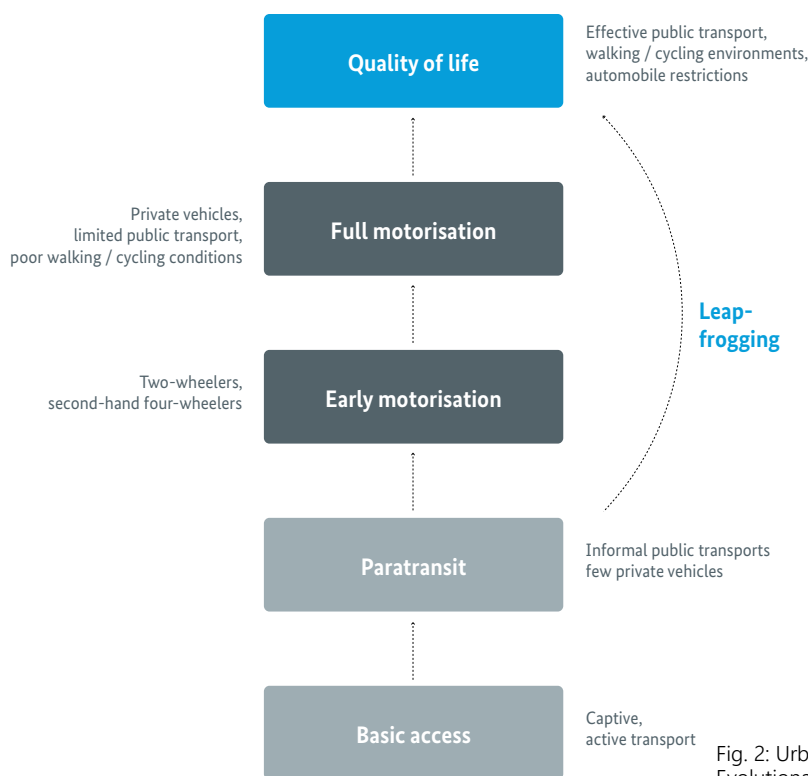


Fig. 2: Urban Transport as an Evolutionary Process
Source: Wright (2005: 22), graphic design on behalf of TUMI

However, from a realistic point of view, this is not entirely and immediately implementable – especially in big cities like Addis Ababa the streets are already highly congested and polluted by motor vehicles. An increasing number of middle-class people in developing countries can afford cars, the widespread perception of the car is that of a status symbol and a chance to escape the dangerous and inconvenient situation as a pedestrian or user of public transport. Due to very poor roads and absent facilities for cyclists, the bicycle is not yet a means of transport in developing cities. The only way of changing the situation and escaping the vicious circle is to implement a holistic strategy - including policies, infrastructure, and awareness campaigns. The planning measures for cycling in developing cities cannot be compared with those in industrialized ones. Hence, it has to be emphasized, that still a high majority of people do not own a car and pushing towards more bicycle-friendly cities will have great benefits for the environment, health, livability, and a more equal society.



Construction and Cars in Addis Ababa, 2019 © Swart

Objective, Structure and Motivation

The qualitative individual case study was selected as the research design. According to Hering and Schmidt (2014), individual case studies can include “individuals, locations, organisations/networks or others phenomena [...]” (Hering and Schmidt 2014: 529). The individual case study is a comprehensive research strategy, which involves a delimitable unit - a case - in its internal structures and its environmental conditions. Herring and Schmidt describe that the linear approach follows a concrete sampling plan, usually from the determination of the research question, the object of the investigation, data collection and evaluation and theoretical embedding (cf. Hering and Schmidt 2014: 529). This approach is applied for the foundation in this thesis.

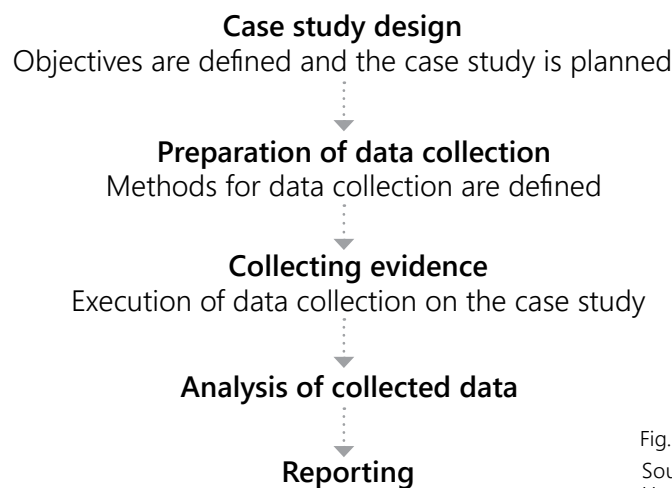


Fig. 3: Case Study Research Design
Source: Own design according
Hering and Schmidt (2014)

The current work aims, on the one hand, to give an overview about the relatively unexplored situation of cycling as a mode of transportation in developing countries. On the other hand, the main objective is to examine the current planning situation of cycling infrastructure in the city of Addis Ababa and set a framework for its improvement.

In the first part of this thesis the literature about cycling in developing countries and its benefits is reviewed and the importance of the topic is shown. In addition, the topic of bicycle infrastructure planning and computation parametric design is examined.

Secondly, the case study examines the current situation of bicycle transport planning in Addis Ababa. This is done by document analysis, expert interviews and the investigation of a research area. For this purpose a field trip to Addis Ababa was made. The roads in the study area were examined for their suitability for bicycle

infrastructure on the basis of certain criteria. The analysis part serves as a foundation for the development of different planning scenarios for the implementation of a first cycle network in the city center. The scenarios are made with the parametric modeling software Grasshopper, which allows the user to manipulate certain parameters which influence the design of a project. The modeling method is described by Brandt et al. (2010) as follows:

“Modeling is a set of activities that structures innovation, collaboration, and creativity in design by creating physical and virtual models of objects under investigation by designers. This activity is guided by a hypothesis or question that enables the designer to test components or systems as a thinking-by-doing activity. It is an iterative process that provides the framework for testing performance of materials, construction strategies, and other physical phenomena [...]” (Brandt et al. 2010: 6f.)

For the planning of a cycling network in the case study area Addis Ababa, the approach of developing a research-based framework with a subsequently modeling is suitable, since there is not much data existing. Furthermore, the planning situation in the city is very complex, the authorities are at the beginning of integrating cycling infrastructure in the city, which is a difficult project with many obstacles, there is no absolute solution, therefore the approach could help further negotiation and give ideas for implementation.

The framework will be specific for the situation of the case-study, nevertheless, it can be adapted or expanded for other areas and cities. The results of the work will be made available to the planners on-site and, in the best case, can contribute to further planning.

The case study was picked for several reasons: Firstly, a personal interest in cycling and the implementation of cycling infrastructure. Secondly, the recently completed internship at the German Development Agency (GIZ) in the sector project Sustainable Mobility. In the framework of the Global Urban Mobility Challenge, the GIZ is providing fundings for pilot projects, in Addis Ababa they work closely together with the involved stakeholders and the authorities with the aim of improving the situation for cyclists. With the help of my former colleague Frederic Tesfay, it was able to gain an inside view in the current situation, connect with other responsible stakeholders and conduct interviews in order to get a complete picture. Furthermore, the long-standing partnership between Bauhaus-University Weimar and Addis Ababa University, Ethiopian Institute for Architecture, Building Construction and City

Development (EiABC) was a major advantage for conducting research in Ethiopia. For the purpose of research for this thesis, a field trip to Addis Ababa took place in June 2019. It has been supported through Bauhaus-University Weimar with financial support of the German Academic Exchange Service (DAAD) in the project Integrated Infrastructure IN³. The last ingredient, which led to the present approach of the work, is the parametric modeling tool DeCoding Spaces (Grasshopper/Rhino), which was introduced during the master study at the Bauhaus-University Weimar.

For reaching the **objective of developing a research-based framework for the implementation of a bicycle network in Addis Ababa**, the following research-questions were compiled:

- **What is the current role of the bicycle as a mode of transportation, in developing countries and especially in Addis Ababa?**
- **Which are the factors for implementing a bicycle network in Addis Ababa:**
 - a) **on the political-regulation-communication-dimension?**
 - b) **on the spatial-design-implementation-dimension?**

The following graphic illustrates the objective of this work and its process.

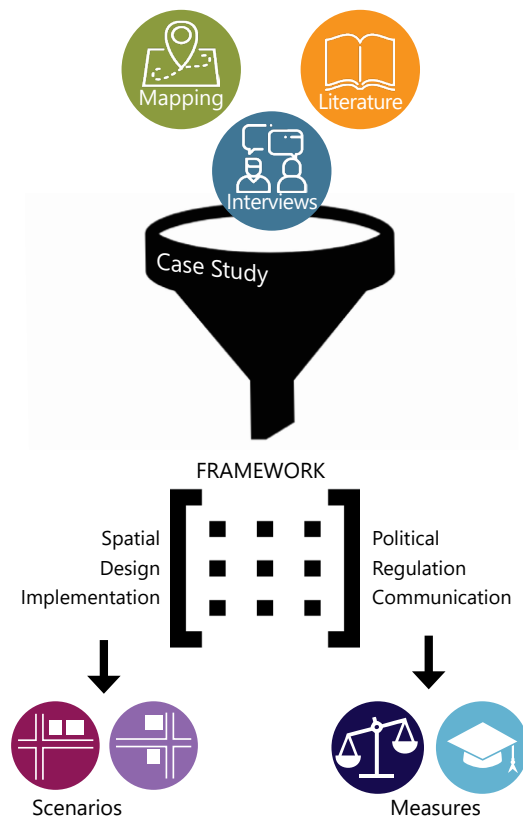


Fig. 4: Process of Thesis
Source: Own Design

II LITERATURE REVIEW

This chapter will give an overview of the literature related to cycling as a mode of transport in developing countries since the relevance of the research design for cycling infrastructure in Addis Ababa must be proven. Furthermore, the existing literature about computational design, as an approach for planning, and its benefits and shortcomings will be examined. Also, the application in planning processes for cycling infrastructure will be reflected.

Cycling as a Mode of Transportation in Cities of Developing Countries

What does development mean?

Oliver Schwedes, professor for Integrated Transport Planning from TU Berlin, states in his book "Urban Mobility in a Global Perspective" that in industrial and developing countries, the urban and transport development is linked to certain economic, political and social circumstances. Since these conditions differ fundamentally between industrial and developing countries, it would be undifferentiated to compare the situations or try to transfer concepts that work for industrial cities to those in developing environments (cf. Schwedes 2017: 59). In the context of his work, in which Schwedes is analyzing transport situations of countries in different development stages, he groups the sub-Saharan African countries together and characterizes their urban development stage as underdeveloped by decades (cf. Schwedes 2017: 60).

When using the terms developing country and underdevelopment, Schwedes refers to the concept defined by Gustavo Esteva (2010) in "The Development Dictionary". According to Esteva's definition, the common concept of development is always linked to the concepts of growth, evolution, and maturation. It implies increasement, in the sense of making "a step from the simple to the complex, from the inferior to the superior, from worse to better" (Esteva 2010: 10). Esteva points out, that for two-third of the people on earth, the common concept of development (country) reflects bluntly what they are not and is demonstrating under what undesirable, undignified conditions they are living (cf. Esteva 2010: 10).

He tracks back the roots of this common understanding, to the American President Truman, who, in 1949, said that the benefits of their scientific advances and industrial

progress must be used for the improvement and growth of underdevelopment areas. According to Esteva, this speech was, in a way, the starting point for the era of American hegemony (cf. Esteva 2010: 6). Over the decades of the 20th century, the concept of development altered, added some aspects of focus, like "environment, population, hunger, women, habitat or employment" (Esteva 2010: 14), and changed the focus from basic needs approach to human-centered development, towards endogenous development. They all have in common that they pursue the shift from focusing on the economic growth towards considering the individuals, the special circumstances of every country and the need of recognizing that each country is its own expert and responsible for the direction of development (cf. Esteva 2010: 15f.). Although the emphasis was, at the first glance, moved further towards working on eye-level, also manifested through the change of the term development aid into development cooperation – Esteva argues, that the transformation of Europe, for example, was always associated with colonial domination in the rest of the world: "Economization and colonization were synonymous" (Esteva 2010: 17). According to Sean Fox and Tom Goodfellow and their book "Cities and Development", countries in Latin America, Asia, and sub-Saharan Africa also experienced post-war economic booms, however, the difference there was, that the poor didn't benefit from it as modernization theory had predicted. Moreover, industrial policies encouraged corruption, which in turn had the effect of an increase of poverty (cf. Fox and Goodfellow 2016: 15). Concluding from that, development, doesn't necessarily imply only positive changes.

Looking at the present concept of developing countries (other expressions are middle-income country (LMIC), less developed country, less economically developed country (LEDC), or underdeveloped country) the Human Development Index (HDI), which includes income, literacy rates and life expectancy at birth; and the nation's Gross Domestic Product (GDP) per capita (i.e. income per person), both compared with other nations, are reference points. Ethiopia's HDI rank is currently 173, the GDP for males lies at 2,1 and for females at 1,3. (UNDP 2019). The World Trade Organisation (WTO) states on their website, that there is no determination whether a country is developed or not – they say, the members have to announce their status themselves (cf. wto.org 2019). The measurements of HDI and the GDP prove, that the economic status of a country is absolutely essential for the whole existence. Fox and Goodfellow put it more directly and state: "This (GDP and HDI) highlights just how important concepts are in shaping our interpretation of development and who is developing" (Fox and Goodfellow 2016: 10).

The current work is accordingly using the term developing country in a critical way with considering all historical, imperialistic and capitalistic imprints. It further should be underlined, when using the term, the special focus lies on sub-Saharan African countries in this sense, since the case study is about Addis Ababa, in Ethiopia. However, considering that all African countries have unique cultural, economic and political backgrounds.

Benefits of Cycling as a Mode of Transportation

Regardless of whether a country has a post-industrial economic status or is in a developing phase - walking and cycling are the most basic and traditional forms of transportation. They provide numerous benefits: no air pollution, no fossil fuel usage, health benefits, very accessible, efficient and cheap options to get around in cities. Therefore, walking and cycling must be considered as what they are - relevant modes for urban transportation systems. In the following, the benefits are described more in detail. Since the focus of this work lies on cycling, walking is not specially mentioned, but always seen as an equally important part of non-motorized transport:

Efficiency

Cycling is the most efficient mode for short distances, the mean average length for cycle trips lies, for instance, in the UK at 4 km and in Copenhagen at 4,2 km, although journeys of up to three times these distances are not uncommon for regular commuters (ukroads.org, LTN 1/04: 15; Colville-Andersen 2018: 152). Another important aspect is, that cyclists have very high efficiency in the usage of public space. As shown in figure 5, bicycles use around a third of the road space used by private motor vehicles to transport the same amount of people

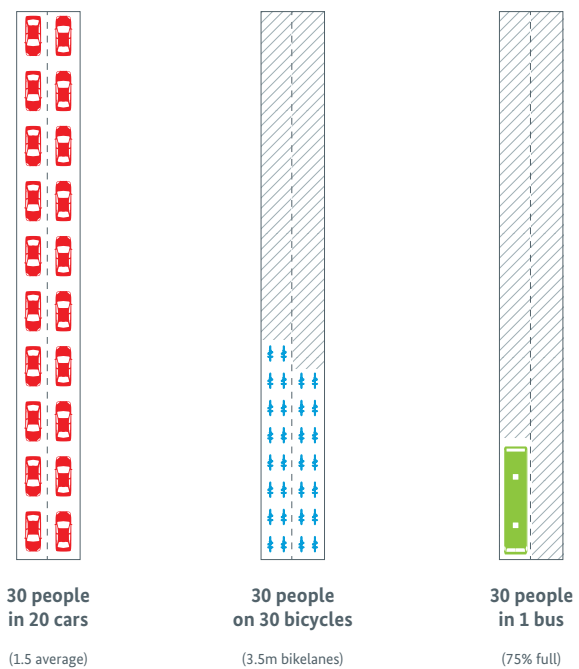


Fig. 5: Road Space Requirements
 Source: Petersen (2004: 8), graphic design on behalf of TUMI

(Hook, 2003: 1). While public transport vehicles under full utilization of capacity are by far the most efficient users of road space (see figure 5 and 6), cycle lanes, can also serve many people, like in the graphic below 14,000 people in one hour. The efficient use of bicycles is obviously only possible when the city provides the necessary infrastructure. Unfortunately, over the last 70 years, planners in industrial cities prioritized the efficiency of cars and made it difficult, especially for pedestrians and cyclists.

“If you make the bicycle the fastest way from A to B in a city - any city in the world regardless of climate or topography - you are halfway to the goal” (Colville-Andersen 2018: 150)

The same is currently happening in developing countries, however, for a livable city and an efficient transport system, the fastest way to get around should be by bike, walking or public transport.

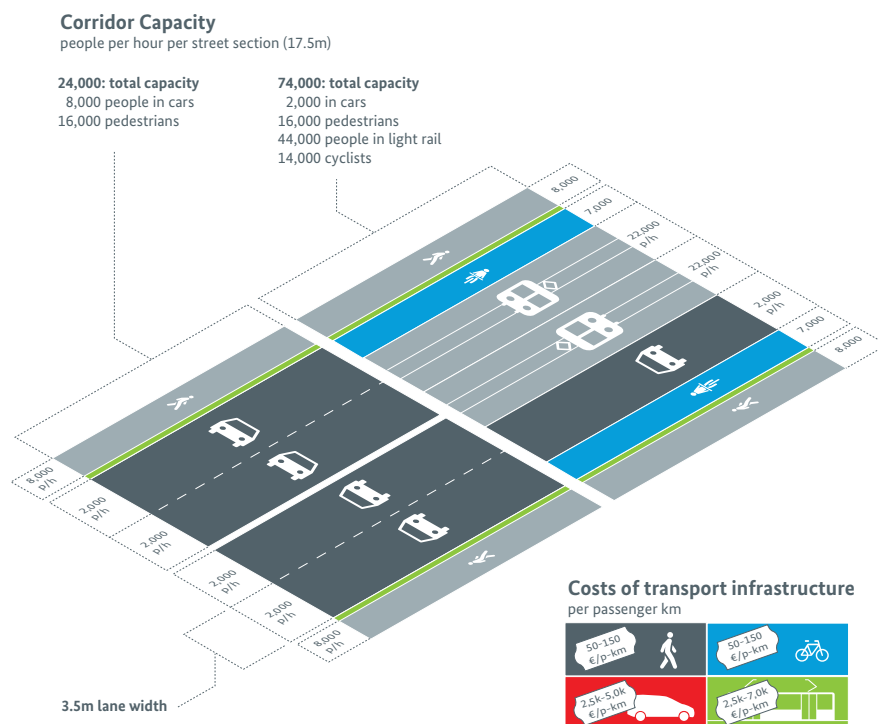


Fig. 6: Corridor Capacity and Infrastructure Costs
Source: Kahn Ribeiro et al. (2012), graphic design on behalf of TUMI

Accessibility

Secondly, in some cities of developing countries, the main areas of employment are in the city center, whereas the residential areas for low-income settlements are more and more pushed to the outskirts. Getting to work is often an arduous journey,

consuming a big part of a family's disposable income and many hours each day. These circumstances are imposing an enormous burden on the poor, and inhibiting their ability to participate in the workforce, as well as gain access to education, healthcare, and other urban services.

Furthermore, the increasing number of commuters is overwhelming the infrastructure, resulting in traffic gridlock. There are many examples of how wrong investment in infrastructure can lead to great exclusion. In Managua, the capital of Nicaragua, for instance, huge investments in new highways, which only connect parts of the city used by the elites, results in segregation of both social groups. The rich got safe new roads and also feel safer because of less contact with the poor, these, in turn, have to deal with a fragmented city with a decrease of mobility (cf. Fox and Goodfellow 2016: 161).

Investments in walking and cycling facilities are investments for the poor. This creates a new society where people of all incomes can meet as equals on a bike path or a sidewalk. In the developing world where income disparities are often very high, this potential role of non-motorised transport is very important (Hook 2003: 3; UN environment 2019).

“A developed city is not a place where the poor have cars, it is where the rich use public transport” (Penalosa 2013)

Health

According to a BMJ research from the United Kingdom, physical activity helps to reduce the risk of diabetes, some forms of cancer, cardiovascular diseases and depression. The researchers found that participants who cycled to work had a 45 % lower risk of developing cancer, and a 46 %t lower risk of cardiovascular disease, compared to commuting by car or public transport (BMJ 2017).

Often coming from backgrounds where compared to industrial countries, it was recently common to walk or cycle everywhere, this change can hit the population of developing countries especially hard. In many developing cities the conditions for pedestrians and cyclists are very poor, when economic growth happens, that often results in motor vehicle use for even short trips. Therefore, health problems associated with lack of physical exercise are not limited to rich cities and it is even more important to provide a healthy environment for all parts of society (Hook: 3).

Figure 7 shows the different health impacts of (fossil-based) automobility, the impacts can be direct like dying through an accident, or indirect through long-term effects like obesity or air pollution.

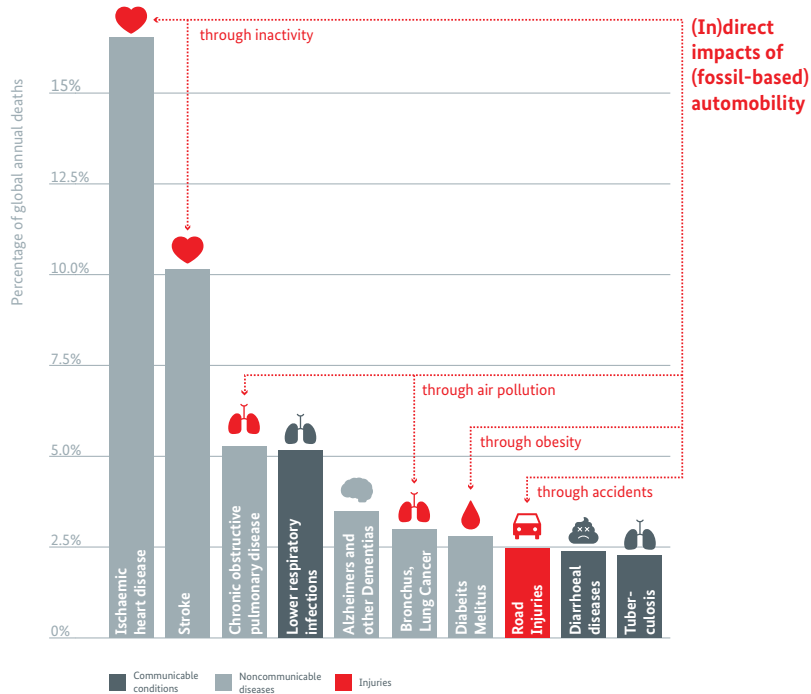


Fig. 7: Health Impacts of Automobility
Source: WHO (2018), graphic design on behalf of TUMI

Air Pollution and Noise

Two other big factors for health risks are air pollution and noise. Air pollution is a major cause of morbidity and mortality in the developing world. People who are exposed to air pollution can have breathing difficulties, hypertension, respiratory disease, impaired urological development, heart attracts, strokes and death (Bartone et al. 1994). The main cause for air pollution is the exhaust fumes from used cars, imported cars from Europe and Japan, which are no longer allowed on European roads, visibly pollute the air with black clouds of smoke. Moreover, 33 % of the individuals are annoyed during daytime and 20 % have disturbed sleep at night due to traffic noise in many cities (Silva and Mendes 2012: 3). Cycling and Walking are modes of transport, which are completely carbon neutral and produce hardly a noise.

Dependencies

Many developing countries are going deep into debt to continue subsidizing oil, which is overwhelmingly used by higher-income motorists. The volatility of oil

prices, and the risk of diminishing global reserves over the next two decades make a reduced reliance on oil critical to avoiding serious exogenous economic shocks to the national economy (Hook 2003: 3). Additionally, in countries without big car manufacturers to import vehicles creates further dependencies on industrial countries and their regulations and taxes.

Status Symbol and Freedom

A factor, which is often forgotten, when talking about sustainable mobility, is the role of private vehicles as a status symbol and a sign for the freedom of movement. As all industrial cities have experienced over the last 60 years, the promotion of the car has led, on the one hand, to extremely increased flexibility and ability to move around. Due to the support of many industrial states, it was only at the beginning of the car-age, a matter of social status and income, whether one could afford a car or not. Many developing countries are in the same situation now, "As the middle class grows, so does the need for status symbols." (Krauß 2018).

Fox and Goodfellow point out, that the key factors for bad transport conditions, such as "[...] scarcity of capital, poor road maintenance, lack of transport planning expertise, weak driver discipline [...]" (Fox and Goodfellow 2016: 162) encourages people who can afford it, to buy a car as quickly as possible. The real challenge here is now to turn the mindset around, provide a proper infrastructure and affordable, good quality bikes so that all people can feel the freedom of riding a bicycle and enjoy the advantages listed above.

Current Status of Cycling

Looking at the mentioned benefits, cycling can be certainly seen as a practical, healthy and environmentally friendly mode of transportation. According to Eco-Counter, a French company that develops devices for measuring pedestrian and bike traffic, cycling as a transport mode is becoming more and more popular. The results (figure 8) show a 6 % increase in biking between 2017 and 2018, whereas the higher increase occurred even in using the bike for commuting (+7 %) (cf. Eco-Counter 2019). Also, other

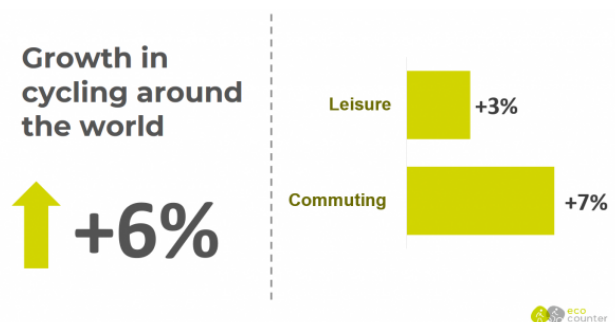


Fig. 8: Growth in Cycling around the World
Source: Eco counter (2019)

II LITERATURE REVIEW

researches found, that the cycle industry and the overall number of cyclists are increasing. In the article "Why we need to encourage cycling everywhere", Leszek Sibilski from the World Bank states: "By some estimates, there are already more than two billion bikes in use around the world. By 2050, that number could be as high as five billion." (Sibilski 2015). However, other voices note that despite significant gains in some parts of the world, the overall rate of bike ownership is on the decline. Kevin Stillwell, states that the data, that Eco-Counter had collected are not valid since they only managed to collect proper data in the industrialized countries. He says: "If we want a global picture of the state of cycling, we must understand what's going on outside of Europe and North America." (Stillwell 2016).

According to the paper "Tracking global bicycle ownership patterns" by Olufolajimi Oke et al. (2015) bicycle ownership is most common in developed countries such as some European countries like Denmark and the Netherlands. Here around four-fifths of households own a minimum of one bike, whereas, in West, Central and North African countries, less than one-fifth of households have even one bike (cf. Oke et al. 2015). In figure xx the findings are displayed visually and show the disparities within regions. Besides many African countries, Peru and the Philippines, for instance, have very low bicycle ownership rates compared with their neighbors. On the other side, Burkina Faso in West Africa is the only non-European country, where 84 % of households own a bicycle in 2010. The researchers consider the country's investment in cycling infrastructure and a "positive attitude" towards cycling among the population as reasons for that (cf. Oke et al. 2015; Rabesandratana 2016).

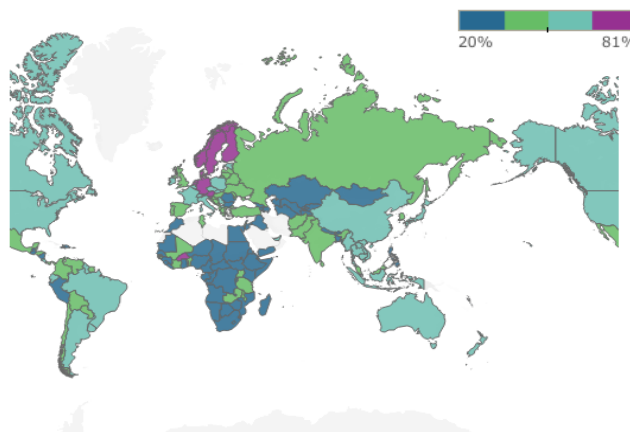


Fig. 9: World Bicycle Ownership
Source: Rabesandratana (2016)

The researchers Mark Brussel and Mark Zuidgeest (2012), who both work for the international Cycling Academic Network (CAN) in the Netherlands, conducted a research about the role of NMT, cycling in particular, in the regions of India, Latin America, and sub-Saharan Africa. In their work, they discuss a number of key contextual issues and challenges of cycling as a mode of transport in developing

countries. They stress, that there is a lot of potential for cycling in developing countries and that the bicycle is an obvious means of transportation that is often under-utilized (cf. Brussel and Zuidgeest 2012: 183). Their research has the objective to push for integrated urban transport and development policies and come up with spatial appraisal and planning tools.

From the case study in Pune, India arises, that the majority of cyclists are "captive" to cycling, so the need to improve the cycling infrastructure is very urgent. For the analysis, they used the cluster-method, mapped all education and employment opportunities, to find out in which area of the city they are located. These clusters equal the destinations people have to reach by bike. Furthermore, a survey was conducted, from which the main findings are, that the average cycle distance lies around 2 km and that the main arterial roads are seen as barriers and very dangerous to cycle or even cross. The created accessibility maps, show, that the highest accessibility is in the center and if the arterial roads are not counted as barriers (cf. Brussel and Zuidgeest 2012: 197f.).

The second case study of Brussel's and Zuidgeest's research was conducted in Bogotá, Colombia. In general, they state, that the situation in Latin America is different from India or sub-Saharan Africa, namely, that in many large cities, the bicycle use is not only restricted to the poor. Many highly educated people cycle. However, rather for recreational reasons at the weekends to pursue a healthy lifestyle, than as a daily mode of transportation. The authors still see a high potential in cycling to function as a feeder mode to the relatively strong and fast public transport. For the Bogotá case-study, they used a method, called "The concept of the climate value of cycling" (CVoC), which represents the total amount of avoided carbon dioxide emissions by all bicycle trips (avoiding costs), and further simulates a substitution of bicycle trips with trips made by an alternative mode of transport (cf. Brussel and Zuidgeest 2012: 189f.).

The third case study examines the situation in sub-Saharan Africa, in particular in Dar es Salaam, Tanzania. Therefore it is especially relevant for the current thesis. Brussel and Zuidgeest describe the general transport situation as very bad, due to "poor roads, low quality and unreliable public transport, fast growth in vehicle ownership and use, and by substandard or absent facilities for cyclists and pedestrians." (Brussel and Zuidgeest 2012: 204). Nevertheless, they see a high potential for cyclists, due to the rapid urbanization and stress the fact that a good cycling infrastructure

contributes to the reduction of poverty. They notice initiatives organizing the access to bikes through different donation schemes, this is definitely needed, but without the right infrastructure, not useful. Hence, the authors suggest a strategical bicycle network planning through modeling with geographic information systems (GIS). They use the so-called "Cycling Network Development strategy", which is based on the idea that bicycle network connections should be as direct and short as possible. For this purpose, they compare the existing network with the Euclidian straight line distance between the ends of a journey. The aim is to indicate important connections away from the main arterial roads. For computing, the methodology needs trip generation rates, network data and cycling behavioral data. In the end, an idealized bicycle network can be derived from the data, by showing which areas have a demand for cyclists and indicating the missing links for an improved network. The authors underline, that this method can be used as the first indication of strategic advice for cities where very little cycle infrastructure exists, but need some further detailed investigations and network design (cf. Brussel and Zuidgeest 2012: 207f). To summarize some other important findings from the several mentioned authors, due to the growing economy and middle class, a larger number of people in developing countries can afford cars. The car is also seen as a status symbol and the chance to escape the dangerous and inconvenient situation as a pedestrian or user of public transport. Therefore the bicycle is not yet a means of transport in developing cities. The only way of changing the situation and escaping the vicious circle is to implement a holistic strategy, including policies, infrastructure, and awareness campaigns. Repeated emphasis is placed on the consideration of bikes as modern forms of transportation and as viable alternatives to cars and public transit (cf. Balk 2018; Rabesandratana 2016; Sibilski 2015; Stillwell 2016).

Computational Parametric Design as an Approach for Cycling Infrastructure Planning

The Approach

In the twenty-first-century, planners, architects and designers have much more to fall back on, than their experience and intuition. Professional skills are obviously still very important, however for understanding the interactions of the parts of a system, as well as the system as a whole, a computational model with specific testing scenarios, can serve as a helping hand in a planning- or design process.

“Simulations are generally iterative. First, a computational model is represented in an appropriate form—2D or 3D. Then, a model is run with simulated conditions that emulate real-life forces to which the actual building might be exposed. Performance outcomes are established and evaluated, and the model is revised, and other simulations run until an adequate level of performance outcome has been reached, based on the understanding of the relationships of the parts to the whole of the system under consideration.” (Brandt et al. 2010: 12)

Today data-driven decision-making is a key factor in several professional fields. Brandt, Chong and Martin, all three US experts in the fields of architecture and planning, state that the architecture, engineering, and construction industries (AEC) are struggling to engage this agenda. They figure, that many professionals have the feeling, that data-based computational design gets in the way of their creativity (cf. Brandt et al. 2010: 12).

Reinhard König, who is a Junior-Professor for Computational Architecture at Bauhaus-University Weimar and Principal Scientist at the Center for Energy at the Smart and Resilient Cities competence unit at the Austrian Institute of Technology (AIT) in Vienna, also underlines this experience. He says that the algorithmic design requires in-depth knowledge of programming techniques that are difficult to understand in the training of architects, as they require strictly logical-mathematical thinking that at first glance can be used to create creative work on architectural designs. In this challenge, he finds the reason, why computational design initiatives, which were tested in the 1990s within the framework of various training programs at experimental universities around the world, were not successful (cf. König 2012). In an Interview with Theresa Fink, who is a researcher in Computational Urban Design at the AIT, König asks her what she thinks about how much creativity remains in a design process, done with parametric modeling. Fink answers, that a designer still has the choice to decide how many parameters are calculated by the computer and how many the human designer creates by himself (cf. Fink 2018).

What exactly means parametric design?

The term “parametric” refers to the relationships between all elements in a model that enable coordination and change management. In mathematics and computer-aided design (CAD), the numbers or properties that define these relationships are called parameters. Therefore, the process performed by the software is called parametric. A geometric model represents certain elements such as points, edges, surfaces, volumes. The data technical representation of these elements takes place primarily on the basis of their properties, e.g. their coordinates for their position. It is important to note that for each form of representation information on certain element properties is required, which can be regarded as parameter values. In this sense, every geometric model is also a parametric model (cf. König 2012; Revit 2019).

Cycling Infrastructure Planning

In general, it can be said, that basically, almost every design of a traffic system is parametric. There is an extensive repertoire of rules and regulations which determine the dimensioning of the traffic facility by means of formulas or other aid for decision making.

The Process

In Germany, the Recommendations for Cycling Facilities (Germ.: Empfehlungen für Radverkehrsanlagen (ERA)) (2010) and the Guidelines for the Construction of Urban Roads (Germ.: Richtlinien für die Anlage von Stadtstraßen (RASt) (2006) apply in particular to the planning of cycle traffic facilities.

According to the Recommendations for Cycling Facilities a bicycle traffic concept has several objectives and functions. The concept defines the medium- to the long-term desired state of the cycling system. This includes points such as infrastructure, service and public relations, as well as measures and responsibilities (ERA 2010: 9). In Germany, cycle traffic planning is embedded in a comprehensive planning and design process. For this thesis, it is only possible to mention a view steps of this process, which are relevant for the development of the case study cycle network for Addis Ababa.

One of such interesting aspects is the planning process for the targeted daily cycling traffic, which is shown in the following chart.

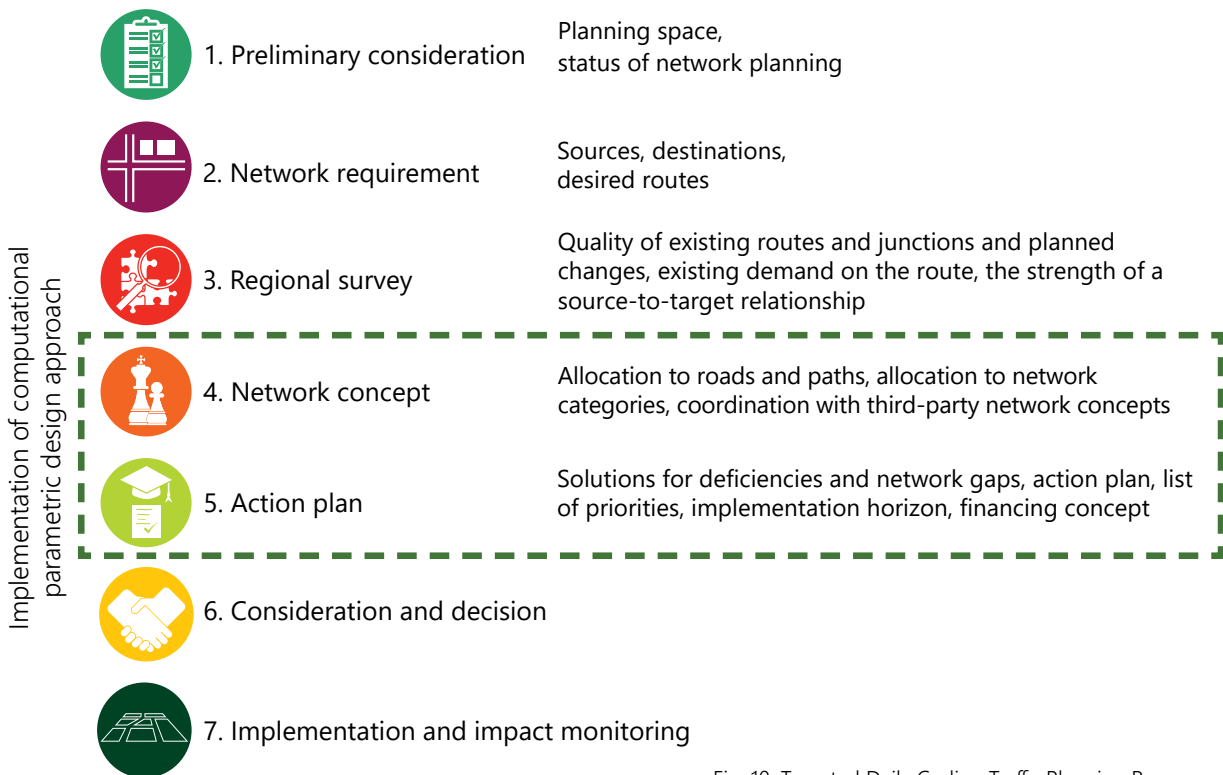


Fig. 10: Targeted Daily Cycling Traffic Planning Process
Source: Own design according to ERA (2010: 9f)

Regarding the preliminary consideration (1.) it is important to mutually coordinate planning at the **regional and supra-regional level**. As for the network requirements (2.) the crucial part is to define the **points of interest (POI)** the network should connect to. Possible points can be universities, residential areas, sports places, commercial areas, etc.. The **survey of the planning area** (3) provides the data on the basis of which the existing and future qualities of the network and the current demand for cycling can be estimated. The Recommendations for Cycling Facilities (2010) say further, that the data should be **organized in such a way that it can be easily updated and visualized cartographically**. If a network for cycle traffic is in the planning phase, the existing roads and paths must be modeled with their traffic resistances (travel times, junctions, slopes, etc.). Furthermore, in the network concept (4.) the desired lines for cycling are transferred to concrete roads. Alternatives are compared and gaps in the network identified. The decisions for network considerations must be made according to the following aspects:

- Quality and road safety deficits
- Expenditure for achieving certain qualities (for an inner-city bicycle network, e.g. target speed of 15 to 20 km/h, 60 s maximum loss of time due to waiting per km, lighting and traffic signs)

- **Minimization of detours and steep incline**
- Small-scale location of sources and destinations on the routes

In the action plan (5.) the planned measurements are listed and sorted according to prioritize. This builds a foundation for a planning schedule for the realization phase. A **cost estimate** of the individual measures and an examination of their classification in immediate action programs, funding programs, and budget plans serves the financing concept (ERA 2010: 9f.).

In a proper legal German planning process, there are even more planning steps, from the preliminary planning until the implementation design, following the iteration principle, in each step the planning goes into more detail.

Planning Example from an Sub-Saharan African City

According to the planning document "How to plan and develop a pedestrian and cycling network - Basis for the Development of an NMT Strategy for Windhoek" by Ernst-Benedikt Riehle (2016), when planning a cycling network, it can be distinguished between a network for commuting to work or educational facilities or for leisure activities. The first needs to provide direct connections, avoiding detours and has to have high quality and safety standards. The second should offer attractive routes, e.g. along greenways. Further, he describes how to proceed manually when planning a workday-cycling network since this is the one which is important for his research and so it is for the one of this thesis. Firstly, the analysis of land use patterns and daily facilities need to be made. This can be done with the **mapping-method**. Additionally, **interviews with experts** about important locations or other kinds of surveys should be conducted. The author suggests categorizing the land uses, such as public facilities, educational facilities, cultural facilities, etc.. Subsequently, points of interest (POI's) can be defined. When the land use patterns and POI's are compiled in a map, they set the basis for the network development. Secondly, an analysis of barriers, obstacles and missing connections will help to find the most direct and easiest routes for cyclists. In Windhoek and also in Addis Ababa, the **terrain** plays a significant role when planning cycling routes, so the routes with the **lowest gradient** should be selected. In the following steps, the travel demand and hotspots for accidents and road safety issues should be analyzed (cf. Riehle 2016: 6ff.). The design process ("Drawing of the network") has, according to Riehle, also several steps. For the first overview, an **idealistic network could be drawn between the defined POI's**, certain POI's might proof a strong connection, which can be

prioritized in the implementation phase. Further, the detailed network needs to be drawn, “[...] by overlapping the idealistic cycling network with the existing road infrastructure, this can be achieved” (Riehle 2016: 10). Furthermore, the findings from the previous analysis of existing road qualities, regarding road condition, availability of existing NMT infrastructure (size, speed, volumes, structures, etc.) need to be considered. In the end, Riehle emphasises, that all decisions regarding the network, should be done in a consensus-driven discussion (cf. Riehle 2016: 10).

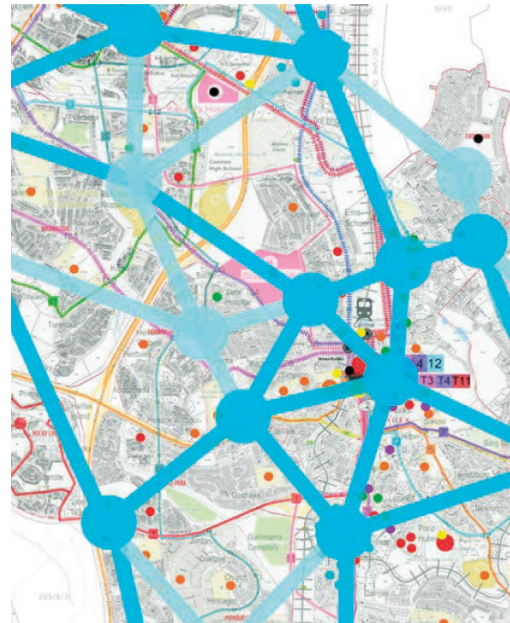


Fig. 11: Idealistic, Hierarchical Day NMT-Network for Windhoek
Source: Riehle (2016: 9)

Design Principles

In the RASt, one can find also more detailed parameters in form of basic dimensions of bicycle traffic areas (figure 12). Furthermore, safety distances for bicycle traffic systems can be found. According to the guidelines, for instance, the width of a single cycle lane should have a minimum of 1 m, plus a safety distance of 0,75 to parked vehicles in a parallel position to the street or 0,50 m to the carriageway (RASt 2006: 28).

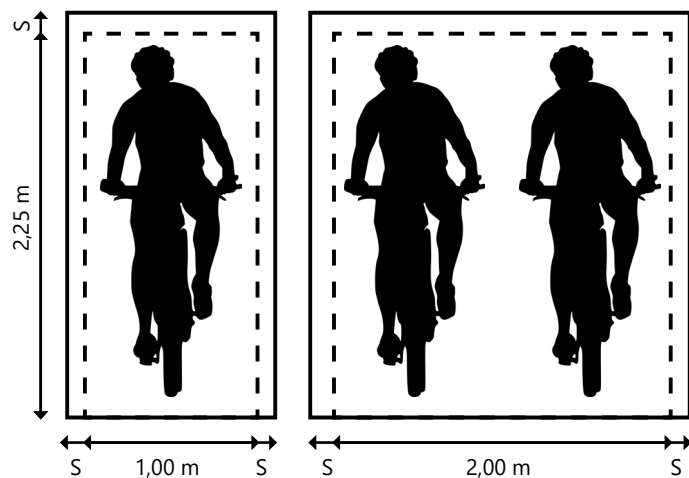


Fig. 12: Basic Dimensions of Bicycle Traffic Areas
Source: Own design according to RASt 2006: 28

One main aspect when planning a cycling network is the decision, at which type of road the cycle paths should lead along. The General German Bicycle Club (ADFC) state in their guidelines that modern cycling infrastructure is designed according to the following criteria:

"In the low-loaded secondary network or with real traffic calming and speeds of up to 30 km/h, cycle traffic is organized in mixed traffic. On roads with traffic speeds above 30 km/h and on roads with a speed of 30 km/h and a high volume of vehicles, the guidance of bikes is directed on cycling lanes. Cycling on roads with speeds above 50 km/h has to be organized on structurally separate cycle traffic facilities. Cycle traffic has to be separated from pedestrian traffic." (ADFC 2016: 1f.)

According to The National Association of City Transportation Officials (NACTO) a city should provide a comprehensive cycle networks through offering a range of cycle facilities that provide safe and convenient routes. While the types of lanes may vary along the way, it is very important that they are continuous, only then cycling can be promoted as an attractive mode of transportation (NACTO 2016: 94). The following graphics show the distribution of cycle lane types in an area (fig. 13) and the corresponding geometries (fig. 13a). The different geometries can be implemented regarding the existing street widths and current speed limits.

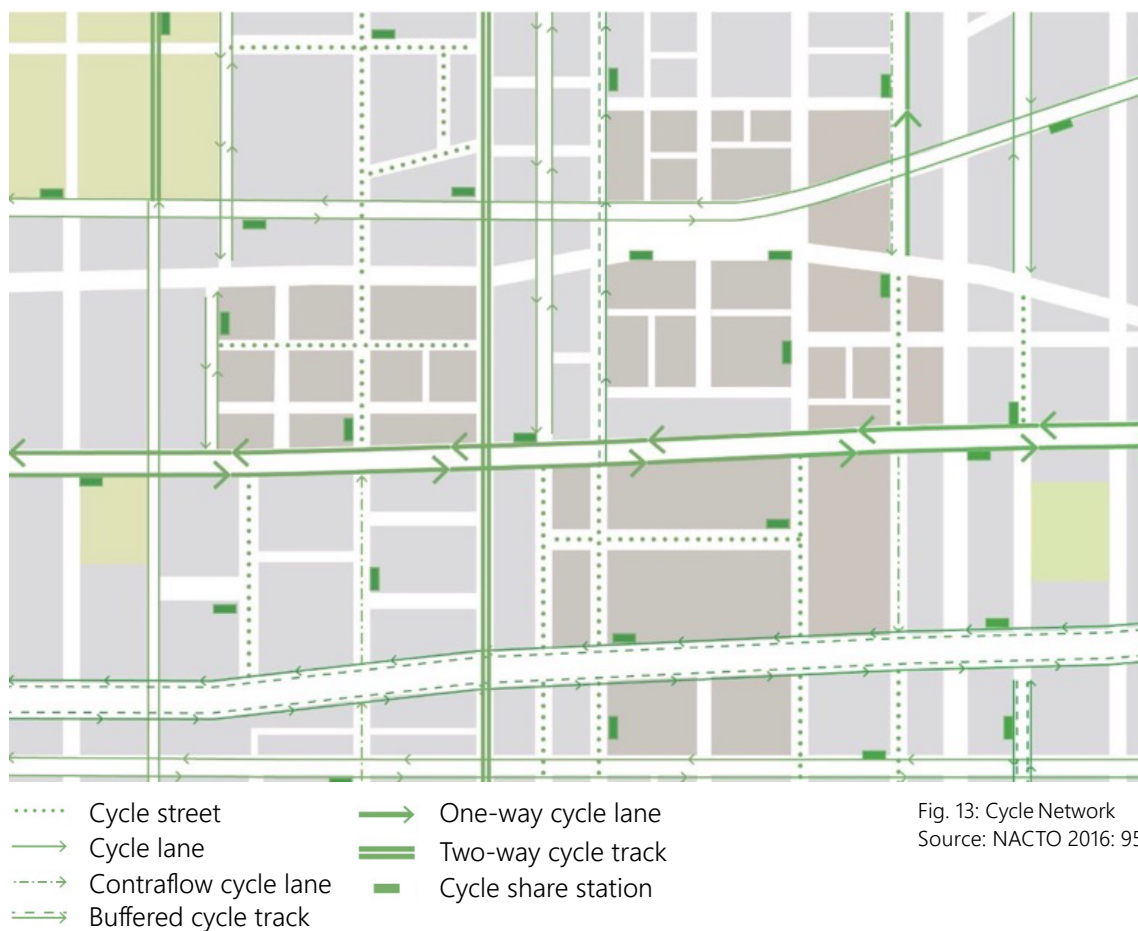


Fig. 13: Cycle Network
Source: NACTO 2016: 95

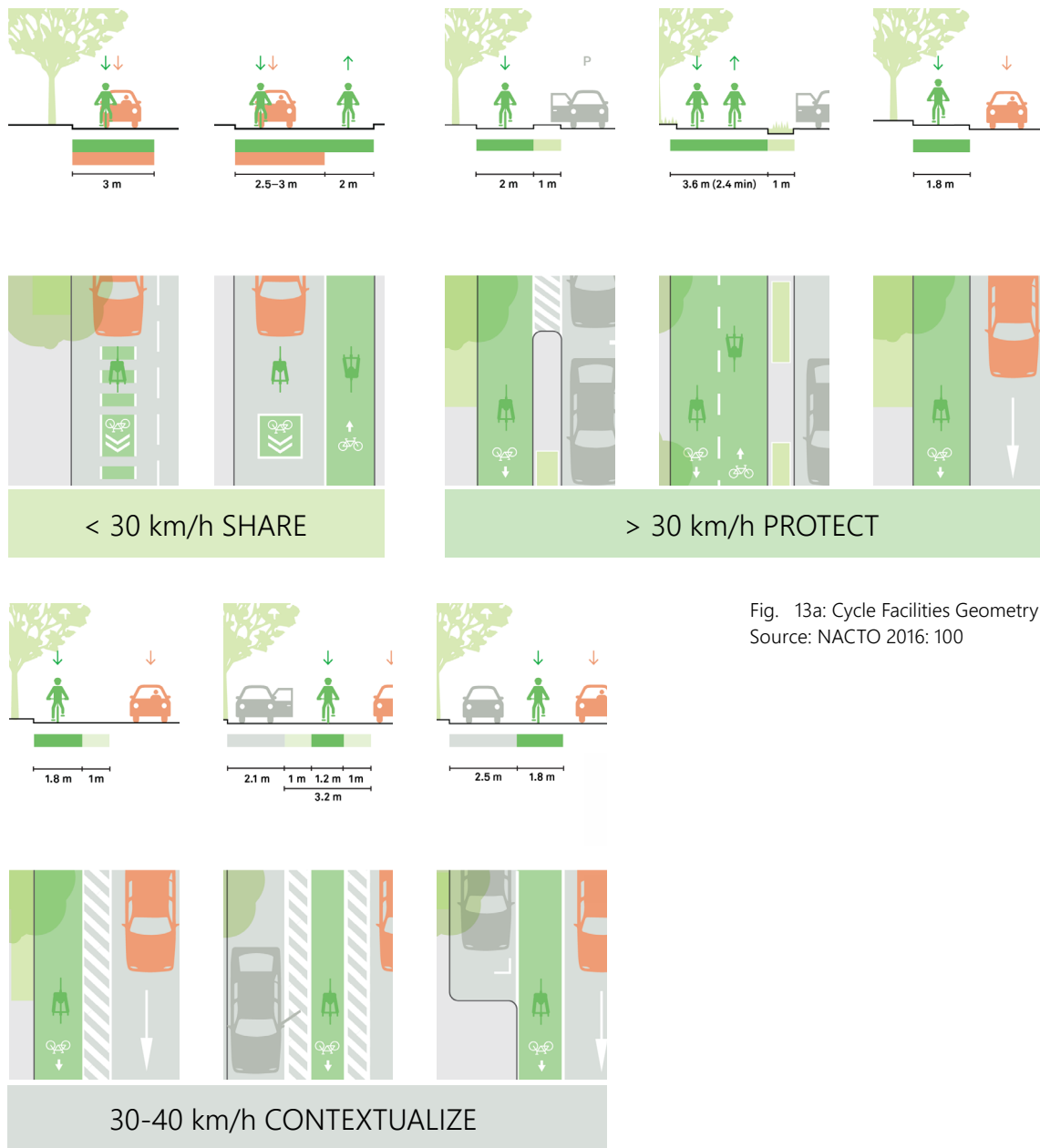


Fig. 13a: Cycle Facilities Geometry
Source: NACTO 2016: 100

The use of CAD in Road Design

In order to take advantage of the efficiency benefits associated with the use of computer-aided design (CAD) programs, CAD-supported design procedures would have to be used at all design stages. However, this also carries a great risk, as the “copy and paste” method cancels out the iteration principle and prevents a gradual improvement of the design (Kuczora 2015: 9).

Looking at the described planning process above (figure 10 and Riehle (2016)), it becomes clear at which steps the computational parametric design approach

could be applied most reasonable. Namely in the design process (“Drawing of the network”), or regarding figure 10, steps “5. Action plan” and “6. Consideration and decision”. In these steps, different parameters have to be weighted against each other. A CAD program, which brings together graphical visualizations with mathematical calculations is suitable for helping the planners making decisions. Parameters like road widths, qualities, intersections, etc. can be fed into the tool. If a holistic survey is conducted, all the data can be saved in the program, therefore it has many advantages: for instance, the parameters can be changed as desired, the data builds a solid foundation - even if the responsible administrative staff is changing, the planning status can be taken up. However, it has to be noted, that the status quo is permanently changing, so it is important to update all constructional changes in the planning area into the program.

The current CAD programs used in road design can be assigned to two groups:

- Specialist application modules for extending basic CAD programs: The use of these shells requires the installation of a basic CAD program (AutoCAD, GEOMEDIA, BricsCAD, etc.). Without this, the application modules are not usable. The shelving units use the basic functions of the basic CAD program and supplement specific shelving functions. Typical representatives are Civil3D, VESTRA Civil3D/CAD/GIS, ProVI, RZI
- Independent CAD programs (standalone): All functions for design, data exchange, and drawing processing are combined in one program. There are no further programs necessary for the use. Typical representatives are CARD/1, VESTRA Pro, Stratis (Kuczora 2015: 9).

For the development of the scenarios for this thesis, the CAD program Rhino3D with its Plugin Grasshopper was used. Therefore it belongs to the first above-mentioned group specialist application modules for extending basic CAD programs. Grasshopper allows the user to create complicated models for parametric designing. The tool will be further explained in the chapter “Scenarios” (see p. 53). In general, Grasshopper is seen as a popular tool among architecture students, due to its intuitive graphical user interface and the many possibilities for experimenting (cf. König 2012). Therefore it was used for the modeling part of this thesis. It has to be underlined that the aim of this work is to have a simple and first decision-making tool for planners, rather than a detailed construction of transport infrastructure. Due to the lack of transportation data, some of the above mentioned programs might be too complex for the planning situation in Addis Ababa.

Interim Conclusion

To summarize it can be said, that due to the especially rapid urbanization of cities in developing countries, there is an extraordinary need for sustainable transport solutions. It has to be emphasized, that walking and cycling are the most basic and traditional forms of transportation, and their benefits are numerous. Besides the facts that cycling does not cause any air or noise pollution, supports a healthy lifestyle (if a safe infrastructure is provided), and is very efficient, one major argument, which has to be stressed is that the role of cycling, especially in developing countries, enables low-income earners to move faster and affordably. It may be a daring thesis, but cycling can counteract segregation. Unfortunately, due to a growing motorization rate, related to economic growth, the situation for cyclists in developing countries evolves from bad to worse.

Planning of cycling infrastructure in developing countries needs to go hand in hand with good city and transport planning. Some housing projects and the construction of highways encouraged urban sprawl and are counterproductive for cycling as a mode of transportation. However, in order to escape the development status, many governments aim for economic growth at any price, that is marked by corruption and is often unsustainable.

Furthermore, many governments of developing countries are affected by instability, due to that, the administrations are likely to change more frequently. A good knowledge transfer is therefore crucial. The processing of traffic-related data in computer programs can be particularly useful here and should be introduced in the administrative work.

As shown above, transport planning processes are complex and need comprehensive analysis. Parametric design tools and data-driven decision-making can be beneficial, especially at the stages of developing a network concept and the following action plan. Testing and modeling can be used, when negotiating with different stakeholders, like experts and the community.

Some stages of the planning process for cycling infrastructure, such as mapping -method, definition of POI's, consideration of the terrain etc., described according to Riehle (2016) will be found in the following. The analysis part is still made manually, but for the design process a parametric computational design tool is used to show first ideas of planning scenarios.

III CASE STUDY ADDIS ABABA

The following chapter is the heart of this thesis and will examine the case-study city Addis Ababa. First of all, some background information about the fast-growing capital of Ethiopia is given. Secondly, the general transport situation is briefly summarized and thirdly the current status quo of cycling as a mode of transportation is further examined. Until this point, the research is done via a document analysis, the crucial documents for this purpose are "The State of Addis Ababa", which is a comprehensive assessment of existing socio-economic and environmental conditions of the city, conducted by UN-Habitat in 2017; moreover the recently published "Addis Ababa non-motorised transport strategy 2019-2028" published by the local transport authorities in cooperation with different supporters, such as ITDP, WRI and UN-Habitat.

One key part of the current chapter is the evaluation of the conducted interviews with relevant, transport-related interviewees from the local authorities or consultancies. Together with the document analysis the interviews serving as a solid foundation for the ensuing scenario development.

In the final part of the case-study chapter, the research area, located in the city center of Addis Ababa, is introduced. The method of spatial data collection for the area is further explained. All this leads to the presentation of three different scenarios, created with the computational analysis Tool Grasshopper.

Background Addis Ababa

According to the UN-HABITAT report "The State of Addis Ababa" (2017) the "economic, social and spatial transformation of Addis Ababa over the past fifteen years has been more than dramatic." (UN Habitat 2017: 1).

This statement can be understood, when looking at the annual urban population growth rate, which lies, according to the World Bank, at 4.8 % and is one of the highest growth rates worldwide (The World Bank, 2018). According to the Central Statistical Agency (CSA) of Ethiopia, 17.5 million (19.5 %) out of 90 million people live in urban areas. Around 3.238 million people, which is a 17 % share of Ethiopia's total urban population, currently live in the capital, Addis Ababa. The experienced urban population growth is expected to continue and reach 4.7 million inhabitants by 2030 (UN Habitat 2017: 3).

The people from rural communities move to the city because they hope for jobs and a better life. That is due to the government's plan to transform Ethiopia into a middle-income country by 2025. The industrialization has been prioritized to promote economic growth and job creation (cf. Gebre-Egziabher and Yemeru 2019). On the one hand, the government's objective can be seen as positive for the people living in Ethiopia, since their quality of life is improving. On the other hand, a lot of pressure is exerted on the infrastructure of the city. The geographical location of Addis Ababa is especially challenged by the land claims of the Oromia region surrounding the city. Consequently, the city needs to increase its density at the centre and limit its horizontal expansion in the periphery. An increased density would also have positive effects in terms of climate change mitigation, by reducing air pollution due to increased transportation distances (UN Habitat 2017: 96).

Transport Situation

Consequently to the above-described urbanization and economic growth of Addis Ababa, the number of private vehicles in the city is rapidly increasing. The resulting hazards are for example air pollution due to worsening congestion, loss of the public realm, and traffic fatalities. According to the Ethiopian Roads Authority (ERA), around 1700 people each year are losing their lives in a road accident and over 7000 (reported) are injured on Ethiopia's roads. 42 % of these injuries happen in Addis Ababa and over 90 % of



Congested Highway, 2019 © Swart

the accidents involve pedestrians (cf. Mohapatra 2015: 13347). Additionally, many people in Addis Ababa are suffering from respiratory problems related to indoor and outdoor pollution. The UN-Habitat report states, that "despite the city's efforts to tackle environmental degradation, translating policies and strategies into practical and effective actions has proved difficult due to human resource constraints and institutional weaknesses." (UN Habitat 2017: 96)

Furthermore, besides environmental issues, or problems with the provision of sanitation and water infrastructure, the city is facing the central issue of urban planning and design. It has to be noted, that "the city does not show a road network grid which allows for a proper traffic flow, provoking congestion and subsequent air

pollution, and limiting the provision of the public transport system such as the bus rapid transit, for example.” (UN Habitat 2017: 96).

A coherent and well-maintained road network would also allow the installation of basic services and infrastructure, such as water and energy supply, drainage and sewerage system or solid waste collection. In these matters, urban design and transport planning plays a major role and has great influence on the efficiency of the city system.

The case study “Development of Sustainable Transport System (Addis Ababa, Ethiopia”, made by the Guangzhou Award also claims that it is very important “to address the demand of the city, socially inclusive, economically affordable, environmentally friendly, and technologically advanced sustainable transport system [...]” (Bickford 2019).

Currently, the Addis Ababa transport system includes, on the one hand, road-based public transport with 3 bus-operating companies (2 public and 1 private) as well as midi-bus and minibus taxis. On the other hand, the light rail system, which is implemented, managed and operated by the National Rail Agency. The dominant modes of transport in the city are still Walking (54 %) and Public Transport (31 %) (cf. Bickford 2019; AACAA 2018: 4).

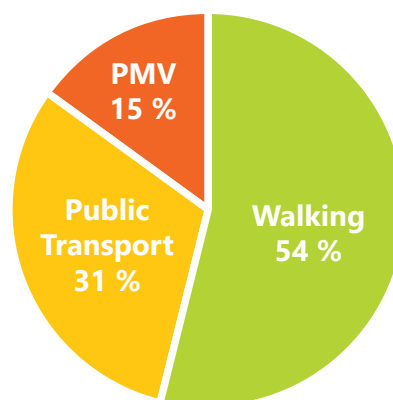


Fig. 14: Modal Split Addis Ababa
Source: AACAA (2018)

On the positive side stands the still quite small number of personal motor vehicles (PMV), however, 70 % of all cars existing in Ethiopia are registered in Addis Ababa. The import taxes on cars are comparatively high and cars expensive, nevertheless between 2016 and 2018 an increase for car importation of around 50 % could be noted. The worst is, that the majority of the cars are in rather bad conditions and have a high exhaust emission (cf. AACAA 2018: 4).

Cycling in Addis

As described in the previous paragraph the large share of non-motorised transport is very positive and offers the chance to leapfrog the further expansion of the motorization phase if the right decisions are made now. Nevertheless, the street design in Addis Ababa has already taken the road to a car-oriented city. Pedestrians face many challenges, including inadequately sized footpaths, dangerous crossings,

inadequate illumination, and poorly maintained infrastructure.

According to the AACCA cycling is considered as a mode for short-distance trips, however, it is mainly perceived as a recreational activity yet (AACCA 2018: 4). The idea of incorporating cycling as a transport mode in the Ethiopian capital is quite new. Only for a couple of years, the responsible authorities and international experts are pushing the topic forward. The recently published NMT-Strategy is one big step in this direction. In the document, it becomes clear, that the objective is to prioritize non-motorised transport (NMT), including walking, cycling, and other forms of non-motorised



Kid on Bicycle, 2019 © Swart

mobility. The benefits of “better access to jobs and educational opportunities; improved public health due to active lifestyles; reduced emissions of dangerous pollutants; and a reduced burden of injuries and fatalities from traffic crashes”, are being highlighted (AACCA 2018: 1). Furthermore, the strategy emphasizes the importance of physical activity, safe opportunities to travel and play in the neighborhood and surrounding areas especially for children (AACCA 2018: 6).

Objectives and Design Principles for cycling

The Addis Ababa NMT-Strategy (2018) shows several design objectives regarding the future cycle network for Addis Ababa. In general a distinction is made between main arterial roads with a width of 30 m and above and smaller streets with less traffic.

For the street with heavy traffic, separated cycle tracks are the only solution. A separated cycle track is characterized by the fact that it is, physically separated with a buffer between the track and the road, that it is elevated above the carriageway, has sufficient width and incorporates clear signage and road markings. The cycle track network should increase the accessibility from surrounding high-density residential areas with the commercial districts in the center. For the implementation phase of the cycle tracks, crucial factors are the provision of first- and last-mile connection to LRT, BRT and public transport terminals, prioritization of streets near rapid transit corridors and streets with flat topography. Further factors are listed in the table

below (figure xx).

For smaller, local streets, such as in residential areas, a shared-space scheme is possible- cars, pedestrians, and cyclists share the street. Therefore, traffic calming measures are essential, very low speed limits, signs, road markings and a proper street scaping create a safe environment for cyclists.

Further objectives of the NMT-Strategy, besides the improvement of pedestrian and cycling infrastructure, are the implementation of a bike sharing system in the inner city, which should improve the first- and last-mile connectivity, the 10-year target is to have 10.000 bikes. Moreover, parking management - the city is currently developing a parking management strategy, including parking fees. Other key-points are vendor management, to ensure that organised vending complements other road uses; street design standards, with best practice design standards for walking and cycling; review of building control and planning regulations, to provide compact condominium layouts, active frontages and the encouragement of transit-oriented development (TOD), and last but not least communication and engagement measurements, like open street events, marketing campaigns for cycling and access for residents about planning processes. According to the NMT-strategy some major projects related to bicycle routes are being planned, for instance Gambia Street/ Churchill Avenue, north of La Gare, is supposed to be closed for pedestrians and cyclists only. (AACA 2018: 19ff.).

The National Association of City Transportation Officials (NACTO) is helping the authorities to develop a design for a bicycle network, including the specific design for cycle tracks. Abhimanyu Prakash, who works for NACTO and is one of the interviewees of the expert interviews (see following chapter) provided a first draft presentation about design ideas. In his presentation he states, that it is difficult to fit in a successful bike lane on many of Addis Ababa's streets, since all-round improvements to sidewalks, road surface, and parking are needed. Furthermore, the implementation of a cycle network requires complete street transformations on many roads or sections (Prakash 2019a: 32).

According to the research and proposal of Prakash, the streets in Addis Ababa can be divided into three street typologies: Through roads, connector roads and local streets. In the current thesis, the streets were categorized in main, secondary and tertiary roads, which will be taken as equivalents in the following work. The three types have different requirements, which are listed below:

STREET TYPOLOGIES	LOCATION AND DESIGN REQUIREMENTS	COSTS (IF AVAILABLE)
<p>THROUGH ROAD (Main roads)</p> <p>Through Roads are defined as roads with a minimum of 2 traffic lanes in each direction, 30-40 width.</p>	Separated cycle track	m road ~190 USD
	Close to LRT, BRT and public transport terminals for provision of first- and last-mile connection	
	Prioritization of streets near rapid transit corridor	
	Flat topography	
	Cycle paths along with parks and waterbodies	
	Connecting important destinations like schools, colleges and markets	
	Intersection improvements: e.g. tightening corner radii, adding medians and refuge islands, narrowing and aligning travel lanes	
<p>CONNECTOR ROAD (Secondary roads)</p> <p>Connector Streets have a width of 18-30 m.</p>	Some separation of traffic mode	Prices are a mix of through roads and local streets
	Traffic calming at intersections	
	Lower speed limits	
<p>LOCAL STREET (Tertiary roads)</p> <p>Local Streets have a <18m ROW and only serve local access.</p>	Mixing of traffic modes	
	Traffic calming (signs)	piece 167.32 USD
	Very low speed limits	
	Asphalt road pavement	m ² 22.85 USD
	Mixed traffic lanes delineation	m road 3.54 USD
	Streetscaping	m ² 88.12 USD

Tab. 1: Street Typologies
Source: AACA 2018; Prakash 2019a; own observation

User Groups

For the purpose of the planned implementation of a Public Bike Sharing (PBS) system, Thomas Melese conducted a study about the potential user groups, which was provided for the current thesis. On behalf of the Transport Programs Management Office (TPMO) he compared the pedestrian size and composition in the urban center with the outskirts area during the off-peak hour. For this reason, firstly pedestrian countings (since there are no cyclists yet) were made and secondly, the target user group was asked to fill out a prepared questionnaire.

As a result of the research it can be mentioned, that for instance in the Le-gare area, which also belongs to the case-study research area of this thesis, the majority group of pedestrians are in the age group of 16-40 years (90 %) and male (70 %). Compared with the examined areas in the outskirts it can be summarized, that the total number of pedestrians in the city center are up to 8 times larger than in the condominium sites. Consequently the people, who are present in the city centre are considered to be the main target group for the future usage of bicycles and were further asked after e.g. work status, current modal share and interest in cycling. In conclusion, 90 % of the pedestrians are either students or belong to the working class, in general there are much more more students in the urban center. Only 20 % of them commute using NMT options, the majority (59-72 %) uses the taxi as main transport mode. Regarding the time, people commute to work every day, 60 % spend ½ hour to commute for their daily trips and 40 % of the home-based trips have a lengths of approximately 3 km. Another key finding is, that 65-70 % of the male respondents are able to ride a bike and 24-29 % of them have riding experience in Addis Ababa. Whereas only 30-35 % of the females can cycle and 11-19 % of them have been using a bike in Addis Ababa before. Important to realize is, that 90 % of the respondents have a very high interest in cycling and the implementation a PBS system in Addis Ababa. In the end of the short research presentation, Melese points out, that the planned bike-ride training package needs to give a special emphasis for female groups to balance the gender gap. Moreover, the PBS implementation needs to address especially trips up to 3 km (cf. Melese 2019a: 44f.)

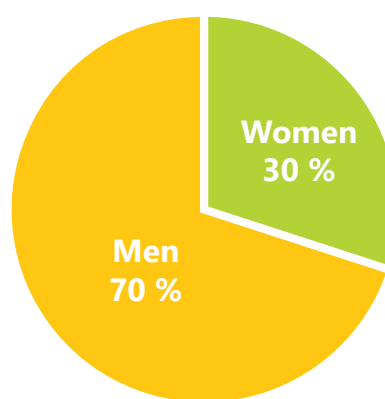


Fig. 15: Pedestrian Count Gender
Source: Melese (2019a), own design

Expert Interviews

As a foundation for answering the research question “How does a framework for a bicycle friendly design in Addis Ababa look like?”, and adding on the above presented document analysis, guideline-based expert interviews were conducted. The methodology and evaluation of the interviews is part of the following chapter.

Methodology Interviews

Both the methodology of the guideline interviews and the methodology of the expert interviews concern the design of the interview situation, the structuring of the interview process and the positioning of the interviewee.

In the chapter “Guideline and Expert Interviews” in the “Handbook on Methods of Empirical Social Research” (2014) Cornelia Helfferich describes the principle of creating a guideline with “As open as possible, as structured as necessary” (Helfferich 2014: 566). The guidelines of the interviews were structured according to topics that correspond to the categories of content analysis presented below. This pre-structuring serves as background information, to answer the research question and as a preliminary study for the creation of szenarios . The questions were kept as open as possible. While guideline interviews are defined by the survey instrument “guideline”, expert interviews, according to Helfferich, are defined by the special target group of the interviewees and on the special research interest in expert knowledge (cf. Helfferich 2014: 560). Michael Meuser and Ulrike Nagel pose the question “How to become an expert?” in the article “Expert interviews - tried and tested many times, little considered: a contribution to the qualitative method discussion” (1991). According to their definition, experts themselves are part of the field of action that constitutes the research object, whether someone is addressed as an expert depends above all on the respective research interest. The status of the expert is therefore relational and is determined by the researcher himself (Meuser, Nagel 1991: 443).

The aim of the selection of the interview partners was to cover a variety of perspectives: from authorities over consultancies, to the current users of bicycles in Addis Ababa. For that purpose five expert interviews were conducted in the period of the research trip to Addis Ababa (6. - 26. June 2019), four of them in person. The interview with Abhimanyu Prakash from NACTO was conducted via Skype, since he was in New York during the research period. All transcribed interviews and the

interview questions can be found in the appendix (see page xx).

The evaluation of the expert interviews is carried out using the method of qualitative content analysis according to Philipp Mayring. For this purpose, categories were developed which enable the statements to be classified into different subject areas (cf. Mayring 2010a: 12). In qualitative content analysis, Mayring distinguishes between three basic techniques: summaries, explications and structuring (cf. Mayring 2010b: 602). A structuring was carried out for the interpretation of the data collected within the framework of this research. Mayring describes the aim of the method as follows: The aim of the method was to “filter out certain aspects of the material, to place a cross section through the material according to previously defined classification criteria or to assess the material according to certain criteria” (Mayring 2010a: 65). Structuring can be done in two different ways: through deductive category application and through inductive category formation. Deductive categorization involves transforming previously defined evaluation aspects into categories in order to assign them to specific passages in the text of the material. The inductive category formation, on the other hand, derives the categories in retrospect from the interview conducted. For the evaluation of the interviews conducted within the framework of the present work, the deductive category application is suitable; the categories are derived from the objective of the research. In addition, there is coverage with the topics considered in the basic part. The following categories and subcategories were created to examine the current situation regarding cycling in Addis and answer the research question:

MAIN CATEGORY	SUBCATEGORY
Interviewee	Position
Bicycle Culture	Purpose for cycling
	User groups
Implementation	Administrative structure
	Political will
	Obstacles
	Construction/Design parameters
	Regulations
	Bike Sharing
Industry	Bicycle shops and costs
Communication	Measurements

Tab. 2: Interview Codes
Source: Own presentation

Findings from Expert Interviews

In this chapter, the conducted expert interviews will be evaluated and structured with the above-described coding method. The main categories serve as “headlines” to structure the chapter, the subcategories can be found in the according paragraph, without further designation. Not all statements of the interviewees can be represented, the collection was made subjective according to relevance, with the aim to create a comprehensive knowledge base for answering the question of how a framework for a bicycle friendly design could look like in Addis Ababa.

Interviewee

The five interviewees have different backgrounds and degrees of involvement in the planning process of cycling infrastructure in Addis, which will be examined in the following:

Abhimanyu Prakash works at the **National Association of City Transportation Officials (NACTO)** as a Program Associate for the Global Designing Cities Initiative. NACTO is funded by Bloomberg Initiative for Global Road Safety and is based in New York. With the city of Addis Ababa, they are working for around four years now: “I have done around 25 trips to Addis, so I am familiar with it” (Prakash 2019: 1). The Association is currently working on the larger cycling network and supporting the Institute for Transportation and Development Policy (ITDP) with their work as an independent tribute body.

“In terms of the phase 1, we are currently focused on capacity building in the city of Addis, where we help them build a design for pedestrians and cyclists. For which we started some conceptual design, based on the street typology of Addis and did some rough costings. We are also looking for doing a demonstration corridor, which will be within one mile of Legehar.” (Prakash 2019: 1)

Iman A. Abubaker works for the **World Resources Institute (WRI)** as an Urban Mobility and Road Safety Project Coordinator. In Addis Ababa she promotes sustainable modes of transport and advises the government. WRI is also working together with ITDP, NACTO and the Transformative Urban Mobility Initiative (TUMI), they reviewed the Non-motorised transport (NMT) strategy, looked at all the content and made sure it was in line with best practice. The WRI is further giving stakeholder

workshops and helps to work on the Safe Cycling Manuel and the communication strategy (cf. Abubaker 2019: 1).

Thomas Melese G. works as Mobility & Infrastructure Development Adviser at the **Transport Programs Management Office (TPMO)**, he works there via the GIZ-CIM program. The TPMO exists since four years, its main task is to report to the Roads and Transport Bureau of the City of Addis Ababa and has authority to act on matters of public transport and traffic management. Additionally the TPMO is building capacity, modernising public transport (increasing supply), integrating all aspects of public transport, and enhancing international relations. Thomas Melese work at the interface of international relations, is responsible for pilot projects and has for instance conducted the survey on bicycle user groups, which was used for this work (see page x).

Temesgen Tigistu is head of the Project Management Division at the **TPMO**. Like Thomas Melese he was involved in working at the NMT strategy, is working with the consultancies WRI, ITDP and NACTO, and attended several workshops.

Nabil Ishak works for Solar Development PLC, he is a **co-founder of a cycling club** in Addis Ababa and an enthusiastic cyclists who cycles everyday from the north of Addis to his workplace in the Bole area.

Bicycle Culture

According to the interviewees, there is some kind of cycling culture existing in Ethiopia. Thomas Melese explains, that in smaller ethiopian cities, the bicycle belongs to the daily life of people: “[...] if you go to Bahir Dar, Hawassa, the secondary cities – they have a very big cycling culture. Most of the people use it. Especially the mid-age group.” (Melese 2019: 1). Also Temesgen Tigistu, who studied in Bahir Dar explains, that there is a high usage of bikes in secondary and tertiary cities (Tigistu 2019: 1). However, in Addis Ababa, cycling is more seen as a leisure activity: “There is actually a big bicycle market for kids’ bikes. Or even for adults, but you just bike in your compound or on empty streets, but it is not considered a mode of transport, yet” (Abubaker 2019: 1). When being asked if she ever cycled in Addis, Iman Abubaker reports about her experience as follows:

"I once cycled on Bole Road and attracted so much attention. Because they haven't seen a woman on a bike before. So, they stopped their cars, were honking, shouted at me "Get of the street", so I just said I can't do that." (Abubaker 2019: 1)

Temesgen Tigistu also recognizes that women don't belong to the current user group of bicycles in Addis Ababa: " There are more men cycling, women are not encouraged to cycle. In other cities women do cycle. But in Addis the number is too small." (Tigistu 2019: 1).

This observation leads to another important issue, in general, namely the question: How to bring women to use bikes as transport modes? Abubaker confirms that cycling is rather a male dominated sector. Furthermore, she points out, that women need to help designing cycle lanes:

"I think it is very important that we have women designing these things, because they bring a certain opinion. And even if we can not bring many women in the sector suddenly, men need to understand what women travel patterns are." (Abubaker 2019: 3f)

Melese emphasizes how bad the conditions for cyclists are in Addis: "For Addis, we must start somewhere, we have the worst cycling culture- so we must shake it somehow." (Melese 2019: 1).

The reason for the bad conditions in the Ethiopian capital, Abubaker finds in the rapid urbanization. She explains, that the second most populated city in Ethiopia is 10 times smaller than Addis. The motorization rate in the whole country is still low, however, around 70 % of the vehicles are driving in Addis. Nevertheless, Abubaker, who is originally from Ethiopia, considers her compatriots as naturally fit for cycling, due to the high altitude.

But there is one big threat for the bicycle culture in Ethiopia, that is "[...] a vehicle being a sign of economic growth. So you think, why would you have a bike if you can have a car?" (Abubaker 2019: 1). She points out, that it is absolutely crucial to work on the communication strategy, that people really need to understand that having a car is not a good thing.

The same development is recognised by Ishak, he describes how even smaller cities like Bahir Dar or Hawassa, which used to be bicycle cities, now move to using motorbikes or cars (Ishak 2019: 1).

Implementation

Temesgen Tigistu gives some insights in the **administrative structure** for transportation planning. He explains that on the top is the Addis Ababa Road and Transport Bureau (AARTB), on the level below are different offices with specific responsibilities: The Transport Programs Management Office (TPMO), which is mainly creating pilot projects and is testing new approaches; Addis Ababa City Roads Authority (AACRA), which is responsible for construction works of streets and infrastructure; Addis Ababa Traffic Management Agency (TMA), which main task is traffic management. The TPMO needs to align and communicate plans with the AARTB and AACRA. However, currently they are reorganising the whole planning structure: "But now we are getting to some transforming the whole structure. We will have some less offices. For example, ACCRA will shift to the local authorities, for the city administration" (Tigistu 2019: 1).

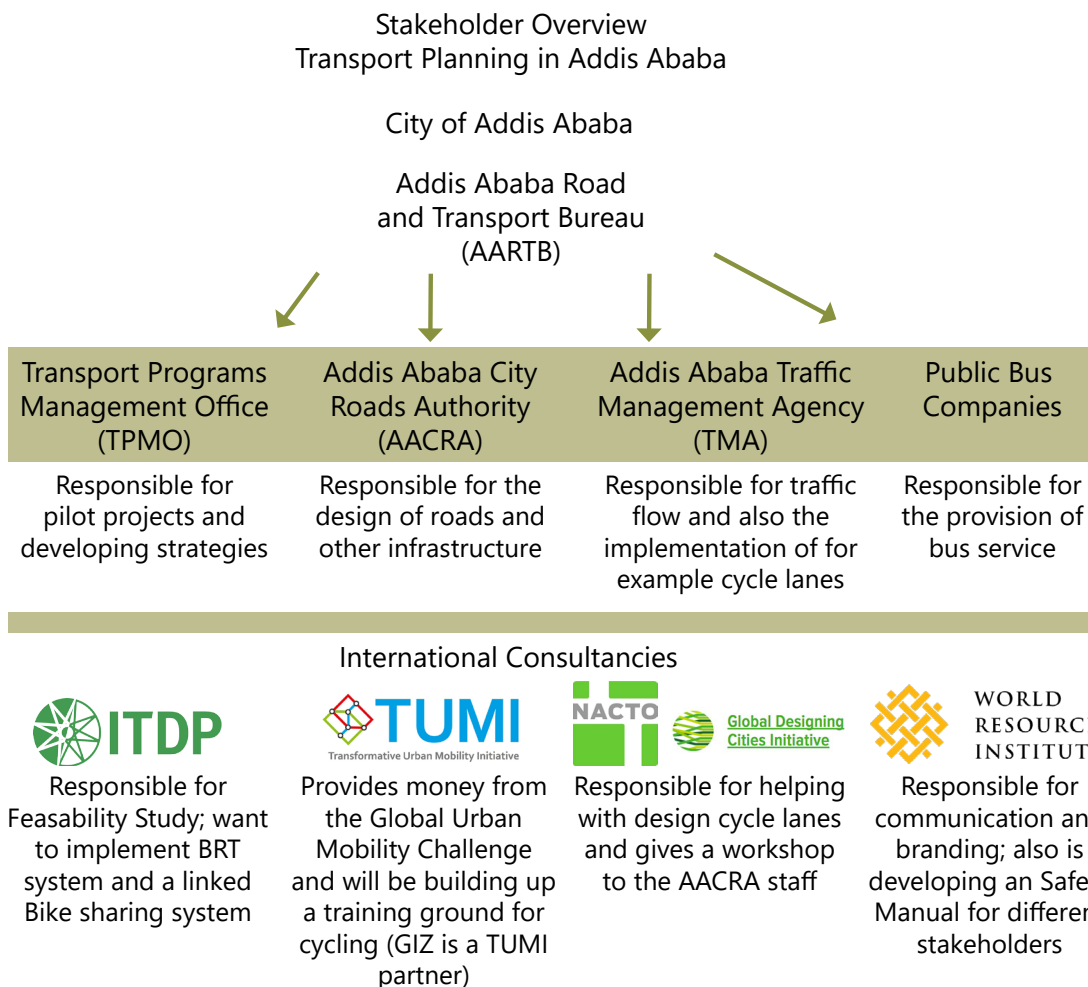


Fig. 16: Stakeholder Overview Transport Planning Addis Ababa
Source: Interviews, own presentation

Looking at the education system, Abubaker observes, that the responsible people in administration are trained as highway engineers only, “[...] we don’t have urban planners or no understanding that you can’t make a high-speed road in the middle of a pedestrian area”. According to her, it will need a lot of capacity building to convince the responsible people to start thinking as cyclist or pedestrians (cf. Abubaker 2019: 3). Tigistu made similar experiences, he reports that the engineers are taught to focus on car infrastructure and when the TPMO “[...] discussed with them about the bike transport, they are not much interested, that is a big problem.” (Tigistu 2019: 1). To change this situation, workshops with universities are organised, the plan is to include the design ideas for bicycle infrastructure in their curriculum, so that in the future there will be a greater awareness and shift in the planning approach (Tigistu 2019: 2).

Regarding the question, if there is a **political will** for establishing cycling infrastructure and encouraging cycling as a mode of transport, Melese responded positively:

“After what we started yes, there is a big commitment! Even from the prime minister, he gave a direction for the transport minister to come up with something like pilot projects.” (Melese 2019: 1)

Additionally, Tigistu thinks, that the current Prime Minister Dr. Abiy Ahmed, is doing positive work towards a more sustainable transport situation in Addis. He point out, that Ahmed gave approval for the riverside project, which has the “objective to develop these corridors, the riverside, for recreation and walking and bikes also.” (Tigistu 2019: 3). He further argues, that “Dr. Abiy Ahmed has travelled to many European cities, he knows about the transport issues. He wants to copy the ideas here in Addis.” (Tigistu 2019: 4).

However, on the negative side stands the fact, that “ there is some resistance from higher officials, they see a bright future for cars in Addis. That is also the problem from the education, from the people who are not much told about what is good for the environment, for the health.” (Tigistu 2019: 4).

As for the **obstacles**, Abhimanyu Prakash from NACTO considers enforcement as one of the biggest challenges in the implementation process. From the negative experience with two already implemented cycle lanes in the outskirts of Addis Ababa, which are filled with trash and construction, he concludes “[...] another challenge is to just prevent the squatting of the bike lanes by all the vendors and shop owners

and people throwing trash.” (Prakash 2019: 2). From the bicycle user perspective Nabil Ishak can confirm this failure:

“In some areas, where I live for example the Summit area, they have separated bike lanes. The best way. But then some entity comes and makes some development in the area, so they dig the road, but they don’t put it back the way it used to be. So, somebody comes in and dumps something, sand and gravel and it becomes unusable. If they could maintain it like this and insist that it stays like it would be used so much more. We do this a lot – we start something, and we don’t finish it.” (Ishak 2019: 4).

Furthermore, Tigistu reports even from destroyed concrete barriers, which were built to separate cycle lanes from the road traffic (Tigistu 2019: 4). This shows, that for the future bike lanes, the regulations need to be formalised. It needs to be part of building contracts between the city and investors and even if the lanes are not used, they have to be kept available for possible cyclists. Additionally, Prakash points out, that one essential problem will be the plain non-existence of cycling as a current mode-share. In terms of convincing the government to put money in cycling infrastructure, this will need good persuasion skills:



Poor Sidewalk Conditions, 2019 © Swart

“With the pedestrians you can make a case because there are so many pedestrians, with the transit design you can make a case, because there are so many people in transit. How do you make a case for cyclists which don’t even exist in the city currently?” (Prakash 2019: 2)

For Melese, providing the right of way¹ is the biggest obstacle in establishing infrastructure for cyclists. (Melese 2019: 1)

When talking about the **implementation of design measures** and the **location** to start at, Prakash mentions the lanes in the outskirts of the city, which were established as last mile connection. However, apparently the corridor was so far away, and without enough ridership, the project failed. According to Prakash, in a

¹ The term right of way also refers to a preference of one of two vehicles or vessels, or between a motor vehicle and a pedestrian, asserting the right of passage at the same place and time. It is not an absolute right, however, since the possessor of the right of way is not relieved from the duty of exercising due care for her own safety and that of others. Online available: <https://legal-dictionary.thefreedictionary.com/right+of+way> (last accessed: 12.09.2019)

workshop the giz had organized last year, everyone agreed on the new build cycle lanes being in the city centre (cf. Prakash 2019: 2). From the Interview with Iman Abubaker, it arises, that this agreement was the result of a controversial discussion. In the periphery the bike lanes are underused, but in the city centre there are already many different transport modes competing for space, she emphasizes the need for an integration of all transport modes:

“For example we have the LRT, we have the taxis, we have the public busses, walking, motorized transport, motorcycles, and then if you are out cycling, unless you have a shared street concept, where you really have slow speed and it is safe for everyone - it is very difficult to do it in the core of the city. You have to look at the integration with the other modes and maybe for example with the LRT when you can take out the busses and minibuses and if the LRT could take up the capacity, you could have bicycles.” (Abubaker 2019: 2)

Regarding the location for starting the cycling network in the city, Abubaker presents her favourite idea of implementing cycle lanes, inside or close to university campuses. She argues, that the students are the best target group for the usage of bicycles: “They are young and would like to have cheaper alternatives and modes of transport. And the campus is sort of spread out, so you cannot walk from one campus to the other, [...]” (Abubaker 2019: 3)

Furthermore, Abubaker explains that there is no one-fit all solution for implementing cycle lanes in the whole city. She states, that the main roads are good to begin with, due to the importance of the first- and last mile connectivity: “For example, from Legehar all the way to Churchill there is supposed to be a pedestrian street. That kind of makes sense, because there is a lot of secondary options for cars.” (Abubaker 2019: 4) But in other areas, it could make more sense to have cycle lanes in secondary roads, to prohibit all buses and taxis to use those roads so that they would be preserved only for pedestrians and cyclists. However, the secondary roads often have cobblestones or are in bad conditions, that is a disadvantage of the concept. (cf. Abubaker 2019: 5)

The idea of implementing cycle lanes on main roads, as well on secondary roads is confirmed by Melese: “ We also want to introduce cycle lanes in local districts, because this road is where you have vehicles with low speed, so that is safer. So, for big roads it is high-speed traffic, so we must segregate the cycle lanes and on the smaller roads they can share the space with the cars.” (Melese 2019: 2)

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Top left: Main road, Top right: Secondary road, Bottom left: Residential road , all photos © Swart

Closely connected with the question where the cycle paths should be built, is the question where **bike sharing** stations would make sense.

The initial aim of the Global Urban Mobility Challenge (project of the Transformative Urban Mobility Challenge, see fig. 16) was to implement a bike sharing system in Addis Ababa. In the course of the project development it became clear that it makes sense to approach the problem more holistically. Therefore, the Challenge funding is now being used to build training grounds. However, a bike sharing system should still be implemented in the long term.

In the future the bike sharing stations are supposed to be implemented in the city centre, but were initially also planned in the residential areas in the periphery:

"We are planning on doing it for the urban centre since this is more feasible. People who commute to work from the outskirts only use the bikes for one way and so the bike is standing still, for the rest of the day – that is not feasible for the provider of the sharing system." (Melese 2019: 2)

Abubaker explains, that it was not easy to decide where to build the bike sharing stations. Logically it makes sense to place the stations in the residential areas to serve as a last-mile-connection. However, there is no infrastructure at all. A pilot project has already failed:

“We had two separated arguments. The first was the program at the periphery, in residential areas. That didn’t work, so it was sure we need it in the city centre. But here we have already so many different modes of transport that are competing, on the main road.” (Abubaker 2019: 2)

This dilemma can not be solved entirely. However, people who use the bike sharing also need infrastructure to cycle on, so the location of bike sharing and bike network should match. According Abubaker, another argument in favour of the city centre is that the stations could be installed at University campuses, since there is a high risk of the bikes being stolen.

Furthermore, an important factor, that needs to be considered when designing cycle lanes, are the design of proper intersections: “So, if you don’t design the proper way of how to get on and off the bike lane, the traffic can be a huge challenge. Also, the right material and signage are going to be a challenge.” (Prakash 2019: 2).



Temporay LeGare Intersection Design
© Global Designing Cities Initiative (2018)

Regarding the question about **legal regulations** Melese point out, that there are several documents existing:

“At the moment we just develop the transport strategy. But we already have the traffic safety strategy and also climate resilient Addis strategy, somehow, they are going to address cycling as a means of transport. Especially the NMT strategy addresses cyclists.” (Melese 2019: 2)

When being critically asked, if these documents are binding, Melese answers: “When we come up with an implementation plan, we are going to make it binding somehow” (Melese 2019: 2). That is approved by Tigistu, who says, that “ for the new roads, which are under construction in Addis, we are incorporating the bike tracks. For the new roads. We are forcing them to incorporate the lanes.” (Tigistu 2019: 2). One advantage is, that the land is owned by the government, so you could build anything anytime. (Abubaker 2019: 3)

Industry

One very interesting finding from the interviews concerns the fact that there is no bicycle industry existing in Ethiopia. All bicycles are imported to the country and have quite a high taxation. Abubaker underlines, that there is a high need for more accessible and affordable bikes. She recently talked to the Federal Transport Authority Deputy and found out, that the government is planning on reducing the taxes on bikes and also make it an incentive for manufacturers to open an industry here. So, she concludes that there is some interest in promoting cycling (cf. Abubaker 2019: 2). According the interview with Thomas Melese, her statement can be confirmed, he states, that the legal framework will be altered in



Private Bike Shop in Addis Ababa, 2019 © Swart

a way for improving the bicycle markets, “[...] like (with) duty free bikes. Also inviting investors who can assemble bikes, like opening a factory. ” (Melese 2019: 1)

According to Melese, currently an average bike costs around 6.000 Birr (200 Euros). He says there are shops and markets where to buy the bikes, but they are rather expensive, due to the taxation (Melese 2019: 1).

Even more expensive is the purchase of a more professional bike, to be able to cover longer distances. Nabil Ishak tells, that he paid 20.000 Birr (~600 Euros) for his bike, other members of the club even paid between 40.000 and 100.000 Birr. He further explains that there are only a few bike shops existing and many don’t have high-quality equipment, if they do, the bicycle parts are expensive: “[...] due to the lack of access to certain currencies, everything is expensive in Ethiopia.” (Ishak 2019: 1). It seems like there is a huge potential in developing a bicycle industry, according to

Ishak that would be positive in many ways- creating awareness, providing jobs and when making bikes more accessible, the user rate will grow automatically:

"We talked about people who aspire to have a car, not a bike. But if we would have a lot of bike shops or outlets, who are developing the bike industry, if we would have the manufacturers, bicycles manufacturing is not that difficult. We are assembling cars here, I don't know why we can not assemble bikes! I hope for a growing bicycle industry, with shops, factories, technicians, engineers and so on." (Ishak 2019: 2)

He further believes that private investment is the way how the sector could grow, in his opinion the bicycle industry needs access to the market and then everything will go its way (Ishak 2019: 4).

Communication

All interviewees agree on the high importance of communication and awareness-raising. One of the measures taken to reach out and inform about non-motorised transport is the car-free day, which is happening every first Sunday (morning) of the month. Melese explains who the target groups of this measurement are:

"At the moment the car-free day is becoming one platform to promote cycling and walking. So, we just inviting every group of society in Addis, weather it is Kids or adult people, we are providing the space for them. In addition, we are inviting sporting activities as one way of promoting walking and cycling. In that way, I would say we are addressing every group of people." (Melese 2019: 3)

Tigistu is also a supporter of the car-free day measurement, he thinks it is important to promote the NMT idea and to educate the people about health, environment and cost factors (Tigistu 2019: 4)

Nabil Ishak also knows about the open-street days: "They even have days where they open the streets and ban the car for pedestrians, bikes and exercise are aloud." (Ishak 2019: 1). He puts some hope in the process of change he is recognizing in the city, but is aware that this process will take some time:

"But for groups like us, I really hope that there will be more bikers on the road, that there will be more bike lanes and that there will be more awareness by the drivers for bikes. We hope that the behavior will improve. It is a long-term thing." (Ishak 2019: 1).

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Furthermore, he thinks that social media is important. He believes that the whole awareness process has several layers: “The authorities need to be aware and investing in the infrastructure. Public awareness is very important. Training and development. Schools are the best places to start with.” (Ishak 2019: 3).

According to Abubaker, training is one important part of the whole process. She is mentioning the plan of building a training ground as part of the TUMI initiative. She believes, that teaching people how to bike makes absolute sense: “Because only having a bike doesn’t make you able to cycle.”(Abubaker 2019: 3)



Open Streets Day, Addis Ababa 2019 © Menged Le Sew

Interim conclusion

The conducted interviews are very informative and give good insights into the current status quo, planning strategies and also obstacles regarding the implementation of cycling infrastructure. Together with the document analysis above it gives a clear picture of the transport situation in Addis Ababa.

To summarize the findings from the document analysis and the expert interviews, it can be noted, that the bicycle, as a means of transport, is still in its infancy in Ethiopia. It seems that there is a bicycle culture existing, but only in the smaller cities. That is due to the very dangerous traffic situation in the capital Addis Ababa and the lack of awareness regarding sustainable mobility. When looking at the rapid urbanisation and the related environmental and health hazards, the transformation towards a more sustainable and accessible transport system in Addis Ababa is definitely urgent.

However, the political will, the restructuring of the local planning authorities and the willingness to cooperate with many international consultants and experts gives hope. The international perspectives can help with the training of authorities, changing the curriculum in transport planning education and thereby build a foundation for another planning approach.

According to the interviews, currently, there is no real bicycle industry existing in Ethiopia. The taxation on bicycles is very high and therefore solid bicycles are not accessible for everyone, however the government is planning to change this situation. The importance of this measure should be emphasized here. If more people would have access to good quality bicycles, the purpose of usage could more easily shift from recreational/toys for kids towards a proper mode of transportation. Also the user group would extend from the current "risk taking males" towards a broader group of the society, including females. From the interview with Iman Abubakar arises, that the future focus group should be especially students, they could get a special cycling training and use the bicycle to commute to **university and between the campuses**.

As for the obstacles regarding the implementation phase, the interviewees agree, that the maintenance of the cycle paths, the enforcement of the ROW and the related regulations (e.g. parking management) will be very challenging.

Regarding the design principles for cycling, which are important for the development of scenarios, it can be said, that there are two major variants of design for cycle paths: either a physically separated cycle track on main roads with heavy traffic or the shared-space scheme on smaller local streets. Reasons for cycle tracks on larger streets, are that there is a coherent network of these streets existing. Additionally, arterial and main roads are mostly connected to LRT, BRT and public transport, so a cycle network can serve as first- and last mile connection.

The aim of building cycle paths on this type of streets is also to connect the surrounding residential areas with the commercial areas in the centre on the **shortest route**. In contrast, the reconstruction of local streets does not need a buffer zone, but often a new asphalt road pavement is needed, since the surface conditions of residential streets are even worse than on the main roads. Furthermore, traffic calming signs are essential and the enforcement of speed limits can be a challenge.

In the future perspective, a bike-sharing system with stations along the new cycling network is also in the planning stage. Here it would be very interesting to find out, where the stations can be placed most effective.

In fact, both variants of cycle paths mostly will need all-round improvements, like improvements of sidewalks, road surfaces, new intersections, and other street quality measures. However, building separated tracks with buffers is more expensive (estimated average of 190 USD per meter) than having cycle paths on mixed streets (estimated average of 80 USD per meter). One finding is, that it is best, to have a mixture of cycle tracks on main roads and cycle paths on local streets. One factor for the decision where to build a new cycle lane is certainly the **construction price**. Another finding is from the interviews and documents is, that the terrain is a crucial factor in planning cycling infrastructure. Addis Ababa is partly (especially in the northern part) quite hilly, so it makes sense to implement the first cycle lanes on rather **flat streets**.

The period of growth of the bicycle in Addis Ababa, from barely existent towards a proper mode of transportation, will be a long way and therefore has to be multilayered. When looking at the above described findings the measurements can be divided into two dimensions: the political-regulation-communication-dimension and the spatial-design-implementation-dimension. Both dimensions are connected to each other. However, for answering the research questions and for developing different

spatial scenarios, the parameters of the two dimensions are shown separately in the following matrix. Some parameters which are relevant for the spatial design of the cycling network will be used as a foundation for the scenarios in the following chapter.

Political-Regulation-Communication-Dimension

Regulations regarding ROW	Taxation for bicycle import	Support of bicycle industry	Communication measurements like Open-Street-Days	Training ground
More sustainable planning approach	Traffic calming	Creating a bicycle culture	Safety measurements and trainings	

Spatial-Design-Implementation-Dimension

Type of cycle path	Construction costs	Topography	Surface quality	Shortest connection	POIs
Intersections	Centrality	Connection to Public Transport (LRT/BRT)	Locations for bike sharing stations	Street widths	Land uses

Tab. 3: Matrix with parameters
Source: Own presentation

Scenarios

The aim of this chapter is the presentation of the scenarios. With the foundation of the previous case-study chapter, with its document analysis and expert interview evaluation, the parameters for the development of the scenarios could be derived. Firstly, the selection of the research area will be explained, secondly, the process of data collection on the field trip to Addis Ababa and the examined criteria will be shown. Thirdly, the tool, used for the scenario creation will be introduced and finally, the scenarios will be presented one by one.

Selection of the research area

The research area is located in the center of Addis Ababa, it is covering a one-mile radius around La Gare (French for train station) train station. The station, which is built in a French style, was completed in 1917, and would connect the city to the Ethiopian-Djibouti Railway, securing the importance as a connector to the Port of Djibouti. The station is no longer in use, but still a landmark and close to a major transit hub. In November 2018, the Dubai-based property developer, Eagle Hills has launched plans for La Gare: a huge mix-used redevelopment, which will host more than 4,000 residences and feature residential, commercial, hospitality, retail and leisure facilities, will be implemented (Eagle Hills 2019). This will change the area massively. However, there is the chance of using the construction to integrate cycle lanes in new road projects. Furthermore, the old train station is close to the LRT station Legehar, which makes sense, in terms of first- and last-mile connectivity. Therefore the radius of one mile around the station was chosen. Other factors are, that the northern central areas are hilly and less favorable for cycling, that a cycling network is more difficult to implement in lower-income neighborhoods (pavement, indirect, hilly, operation) and that important buildings like the United Nations & African Union and several universities are lying within this area.



La Gare Today © Swart



La Gara Development © Eagle Hills (2019)



Fig. 17: Satellite Image of the Research Area
Source: Google Earth

Process Data Collection and Evaluation Criteria

For the purpose of the data collection, the mapping-method was chosen. Satellite images for each sector of the area were used. While visiting the streets in the research area certain evaluation criteria were mapped manually on the paper. For better orientation, one marking on Open-Street-Map (OSM) was set, to later assign the right criteria to the correct location. The objective was to manage to set at least one point at every street. The criteria for the analysis of the current street situation was chosen before the research trip. The aim was to evaluate if there is an existing infrastructure for cyclists and how suitable the streets in the area are for future cycling infrastructure.

III CASE STUDY ADDIS ABABA

Scenarios

Subsequently the handwritten criteria was transferred in an excel sheet. The total number of mapped locations is 94. In figure 18 some points set on OSM are shown on a satellite image, in table 4 an example of the raised data (criteria) can be found. The entire data for all locations can be found in the appendix on page 76f.



Fig. 18: Mapping Points
Source: Google Earth

Point	11	14	18
Street Hierarchy	Main Road	Main Road	Secondary Road
Surface Quality	Good	Good	Poor
Lanes	6	6	2
Width	15 m	30 m	6 m
Sidewalk	Yes	Yes	No
Width	2 m	3 m	
On Street Parking	No	No	Yes
Greenery	medial strip	No	No
Landuse	Public	Commercial, Religion	Mixed
POI	Sports Place	Church	Broadcasting Authority
Crossing	---	---	---
Total ranking	Medium	High	Low

Tab. 4: Evaluation Criteria
Source: Own presentation

Like shown in table 4 each point was ranked regarding the evaluation criteria, resulting in high, medium or low suitability for cycling infrastructure. The main factors for the ranking of the suitability are the street hierarchy, surface quality and street width. A main road with a good surface quality and a width of over 15 m would be ranked as **high**. As for the surface quality, streets with a closed asphalt cover are seen as good quality, defective asphalt surface or closed sand surface are seen as medium quality and cobble stone roads or roads with severe deficiencies such as pot holes are seen as poor quality. The results are visualized in figure 19, the street segments are colored according to their ranking in green, yellow or red and put on different layers in Rhinoceros 3D.

The Tool used for Scenarios

Rhinoceros is a 3D modelling CAD application. It is one of many available, but it is popular due to its high level of compatibility with other softwares. Grasshopper is a visual programming language and environment developed by David Rutten and Robert McNeel & Associates. It was originally developed as a separate external plugin for Rhinoceros 3D, but comes included in the current version Rhinoceros 6. Grasshopper offers a graphical editor for parametric modeling, which allows to define parameter dependencies between element groups and to link these dependencies with predefined or self-created algorithms. Therefore informed models can be created that are ideal for parametric design. Furthermore, it is also possible to define circular dependencies between geometric elements using Grasshopper, so it can be used for algorithmic design. One of the biggest advantages is, that the visual approach is highly intuitive and logical, and does not require previous knowledge of programming and scripting in other coding languages. For this reason, it is highly popular among architects and designers (cf. Day 2009; König 2012).

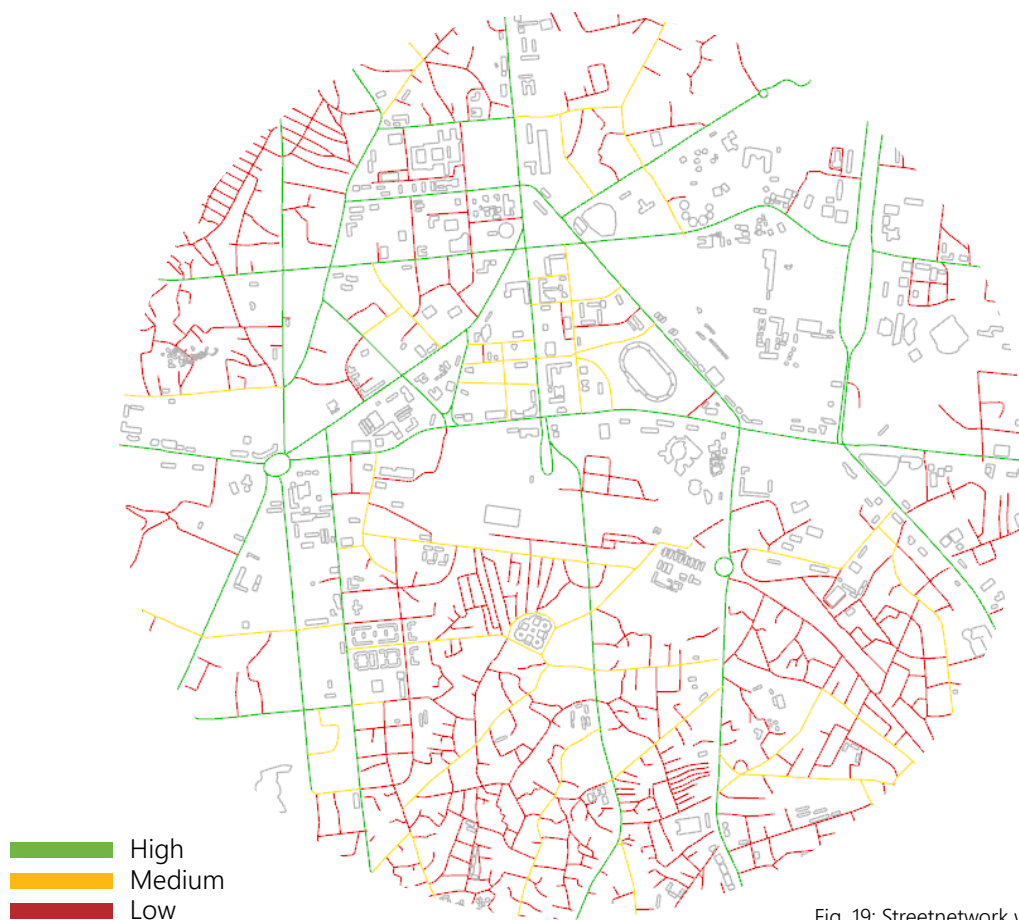


Fig. 19: Streetnetwork with Ranking
Source: Rhinoceros 3D

Some of the scenarios have been created with the DeCodingSpaces Toolbox for Grasshopper. The toolbox is a free software released by the Computational Planning Group (CPlan) and is a result of long term collaboration between academic institutions, such as Bauhaus-University Weimar, ETH Zürich, Emerging City Lab – Addis Ababa, Future Cities Lab Singapore, Austrian Institute of Technology and the DecodingSpaces GbR. The toolbox for Grasshopper is a collection of analytical and generative components for algorithmic architectural and urban planning, it provides some special components for street network analysis, which were used for the indicated scenarios (cf. Abdulmawla et al. 2019).

For further scenarios the Accessibility Analysis Tool, developed by Andrej Sluka at the Austrian Institute of Technology (AIT), was used. The tool is also based on Rhinoceros 3D and Grasshopper, it aims to create scenarios for public transport, walking, cycling and bike sharing. It was chosen to use, due to its simplicity, the tool only needs very simple data. It functions with a street network represented by lines, separated at every junction, which is for most areas available on OSM. This makes the tool ideal for areas with lack of data, therefore suitable for Addis Ababa. The biggest advantage of the tool is, that it provides an user interface, which was provided for the current thesis.

Points of Interest

For some of the following scenarios, five Points of Interest (POI's) are chosen to span a network between them. A network with a larger number of locations is definitely possible, however, these five points arised from the previous document- and interview analysis and are seen as suitable starting points. Since the research area is located in a one-mile radius around the old La Gare train station, the first point can be exactly found there. The aim to connect the African Union (AU) and United Nations (UN) within the cycling network comes from the NACTO planning document, so therefore the second point is located at the AU. According to the previous research, the advantages of connecting the University campuses within the first cycling network, makes absolute sense (e.g. cyclist target group), therefore points three, four and five are located at St. Mary's University, College of Health Sciences AAU and the Rift Valley University College.

Scenario: Shortest and Fastest Routes

For calculating the shortest route it is important to understand the graph theory, which lies behind the creation of the first scenario. Graphs are mathematical structures used to model pairwise relations between objects. They are made up of points which are connected by lines.

The streets in the research area are represented by graphs: the streets are shown as connecting polylines and their intersections being the nodes. These graph representations of the streets are used to look for a shortest path. Important to mention is, that as long as the street does not intersect with another street, it is only possible to continue along the line until it reaches an intersection. The relations between these intersections are used for finding a shortest path between the manually set POI's.

Properties and conditions of streets do not equal. Sometimes the shortest path routine would take a road that is not suitable in physical space. Therefore, streets can be ranked according to i.e. their length, slope or surface condition. The ranking for the model is provided by the on-site evaluation of streets as seen in figure 19. The streets with a high suitability get the highest value, so the script is looking for the shortest travel time, gives them higher preference. Similarly, streets that are not ideal for cycling, due to terrain, low quality of the pavement or other reasons, can be given lower value, causing the script to avoid them.

At this point it is important to understand the difference between the shortest and the fastest route. In general the shortest route means the shortest distance, fastest means the route where it is possible to arrive in the shortest amount of time. When only walking is considered, shortest and fastest might be mostly overlapping, but when using a bicycle the speed is different on certain types of streets. For instance, one can go faster on a proper cycle track on main roads with an adequate surface.

The following three figures show the shortest routes between two POI's. In figure 20 weight was given to secondary and tertiary roads, figure 21 shows the shortest route from the bicycle map in OSM, which is very similar to the one calculated with the DeCoding Spaces Toolbox, except the little detour on the bottom-left of the map, where the script is really trying to avoid the main road. Whereas in figure 22 the shortest route, prioritizing main roads is shown. Since the main road has currently the best surface quality, this would probably (assuming a proper cycle track would exist) equal the fastest route.

III CASE STUDY ADDIS ABABA

Scenarios



Fig. 20: Shortest route prioritizing secondary and tertiary roads
Source: DeCoding Spaces Toolbox

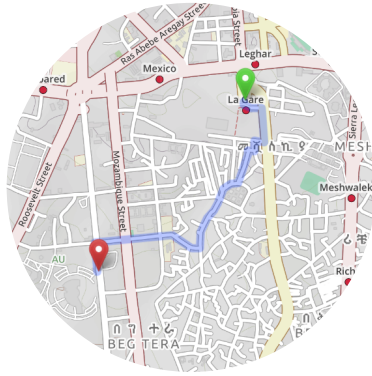


Fig. 21: Shortest route for bicycles on OSM
Source: OSM

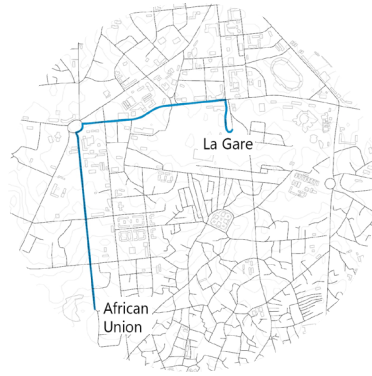


Fig. 22: Shortest route prioritizing main roads
Source: DeCoding Spaces Toolbox

When using the Accessibility Analysis Tool it is possible to adjust the speed of cycling on different street types. The script is using the map with the street rankings and gives each type a certain travel speed, figure 24 shows that for roads with low suitability it calculates with 3.6 m/s

(meters per second), for medium suitability roads with 4.32 m/s and the fastest option for high suitability roads with 5.01 m/s. Therefore, the POI's shown in figure 23 can be reached regarding the possible speed of the road type and of course the distance to destination. In order to show some more distant routes, seven points have been added to the indicated POI's.

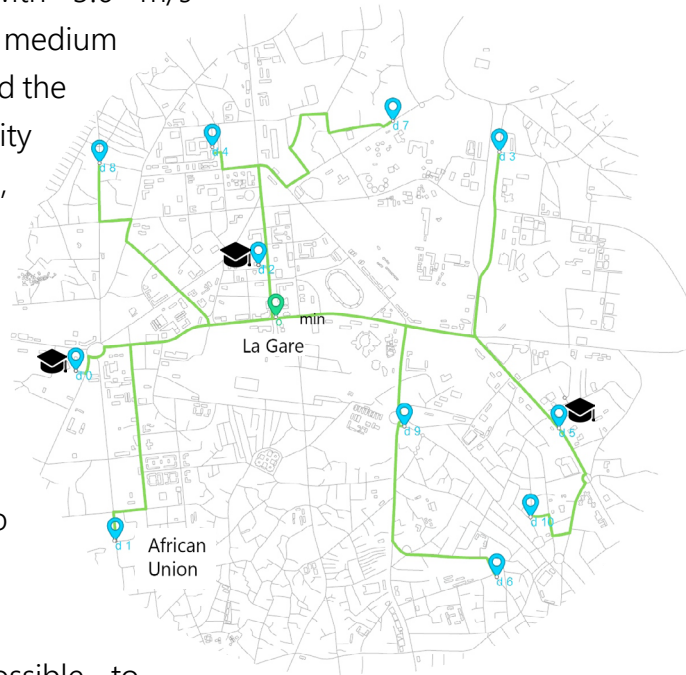


Fig. 23: Shortest route between several POI's
Source: Accessibility Analysis Tool

Another option, which is possible to calculate with the Accessibility Analysis Tool, is showing the accessibility of one or more points, using Isochrone maps.

Those Isochrone maps are displaying areas of equal travel time. They display curves called isochrones, which are showing a boundary on a map connecting points that

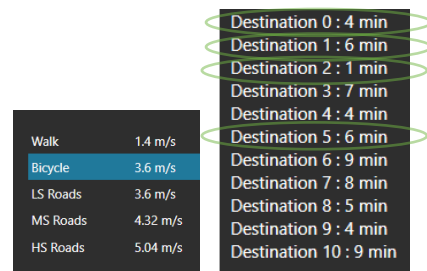


Fig. 24: Travel speed and time
Source: Accessibility Analysis Tool

can be reached within the same time. The travel speed is the same like used for the previous scenario (fig 23 and 24).

In figure 25 one can see the accessibility by using a personal bike, starting at La Gare station. The blue inner circle can be reached within in travel time of 5 minutes, the second boundary shows the area which is reachable in 10 minutes and the lighter green boundary can be reached within 15 min. The tool is considering the street quality, which was given by the ranking. This makes it useful when allocating new cycle lanes in the city.

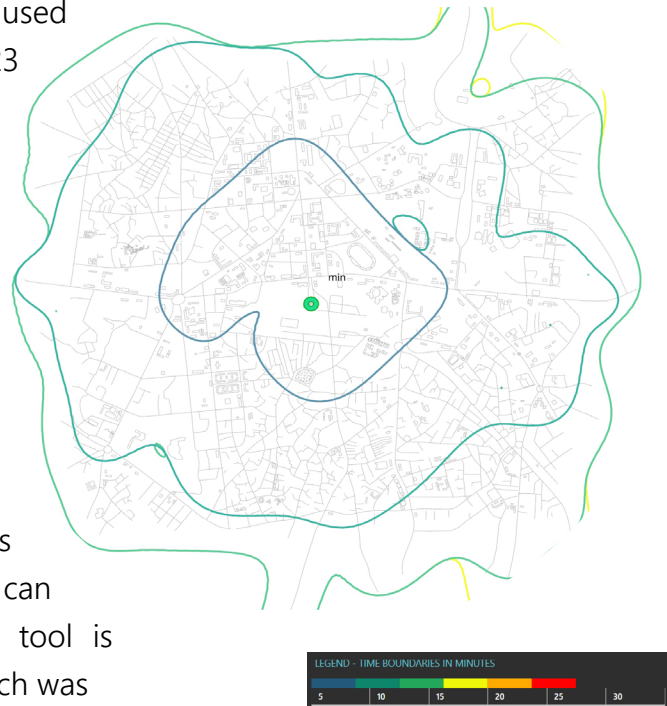


Fig. 25: Accessibility by using personal bicycle from La Gare
Source: Accessibility Analysis Tool

Scenario: Cheapest Routes

Building up on the scenario shortest route with either given weight to main or secondary/tertiary roads, created with the DeCoding Spaces Toolbox (fig. 20 and 22), the construction costs can be calculated easily. The tool can show how many meters the route is going along the specific road type and come up with a sum for the whole distance. Taking the prices calculated by NACTO as a basis, which are approximately 180 USD per meter main road, 150 USD per meter secondary road and 80 USD per meter tertiary road, the following construction prices could be evaluated:

Figure 20: 449 m main road + 1184 m secondary road + 521 m tertiary road cost around 300.100 USD

Figure 22: 2200 m main road cost around 396.000 USD

The simplified price calculation can be helpful in planning decisions and crucial in negotiation processes. The chosen example is very simple, but still representative. The cost estimation can be later adjusted with "real prices" and can be extended to larger areas.

Scenario: Flattest Routes

The scenario of the flattest route is calculating the route regarding the existing terrain in the area. The topography data for the area was put under the road network in Rhino. Like one can see in figure 26, the overall altitude in the research area is higher towards the northern part (red, yellow) and lower in the south (green, blue). However, in general the topography of the research area is rather flat compared to other parts of the city. This scenario could be used as a recommendation for a route with least amount of effort and energy consumption for upward cycling.

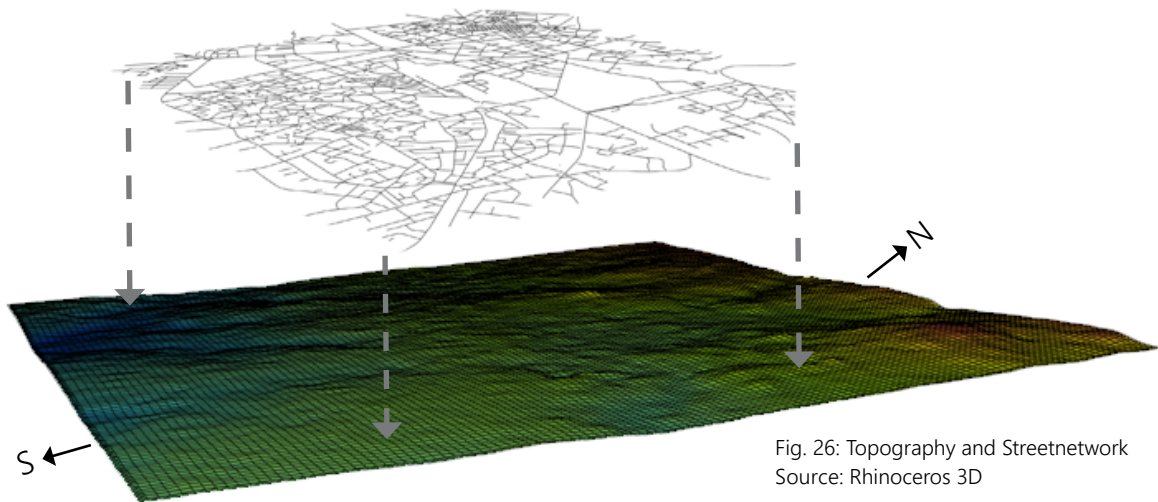


Fig. 26: Topography and Streetnetwork
Source: Rhinoceros 3D

Before starting any calculations involving the topography, the street network has to be prepared, the street segments (which are given from the OSM data) have to be extended, so that they definitely meet and dead ends need to be cleaned. In turn, for the slope analysis, the segments are split into smaller pieces, each having a more precise slope value and therefore a more accurate evaluation output.

The purpose of figure 20, is to visualize the relationship between the existing street network and the topography. The Grasshopper components calculate the vector of each street segment of the network, the vector is projected to the flat surface to get the angle between the surface and the slope vector. One problem, which occurs when calculating, is that initially the angle is always positive and therefore the direction of the route is not considered (from A to B the road goes up the hill and from B to A it goes down-hill). By checking if the slope vector has a negative or positive z-value, the direction can be calculated. The "card"-component chooses the positive or negative angle value based on that z-value.



Fig. 27: Shortest route between POI's considering the topography
Source: DeCoding Spaces Toolbox

Figure 27 shows the calculation result. The sections which are colored in green are rather flat, the yellow sections are a little steeper and the red are very steep. The program is therefore looking for the route with the most green sections and avoiding the red. For visualization a szenario with the shortest route between the five POI's was created. The script is on the one hand calculating the shortest paths between the point, but also considering the terrain. In this case, the displayed route is also the most logical, with other points or a topography with a serious slope, the outcome might be differrent. The following flow-chart is showing the calculations made by the program:

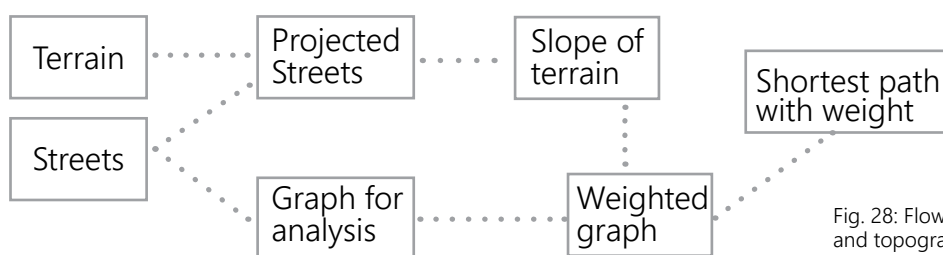


Fig. 28: Flow-chart shortest path and topography
Source: own presentation

Scenario: Betweenness Centrality Analysis

The Betweenness centrality analysis is another approach for finding out which street is the most important, most active in a network. It quantifies the number of times a node acts as a bridge along the shortest path between two other nodes. Therefore, in this case it can be calculated which street segment is the best connected to all others and in turn would be suitable for building a cycle lanes in the initial phase. The following figures show four different scenarios using the betweenness centrality component with different weight given to consider the slope (slope weight: 1) or prioritizing the main roads (main road weight: 1), or even both together. The appropriate scenario for the corresponding planning approach can be selected. In this case fig. 32 would be most useful, since using main roads for cycling and avoiding slope are both important factors, which emerged from analysis.



Fig. 29: Betweenness Centrality
Slope weight: 0; Main road weight: 0



Fig. 30: Betweenness Centrality
Slope weight: 0; Main road weight: 1

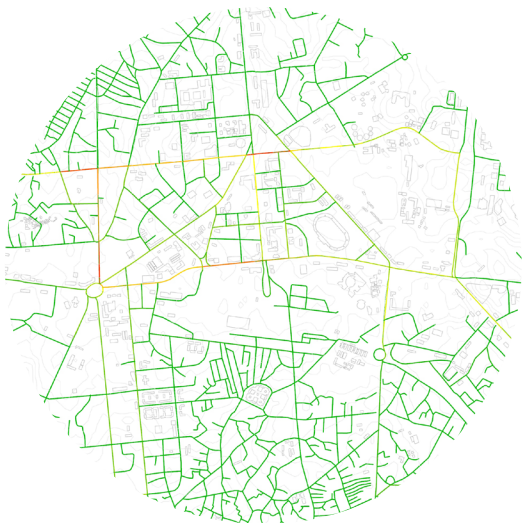


Fig. 31: Betweenness Centrality
Slope weight: 1; Main road weight: 0



Fig. 32: Betweenness Centrality
Slope weight: 1; Main road weight: 1
Source: DeCoding Spaces Toolbox

Less  Most connected

Scenario: Accessibility with Bike Sharing Stations

An important parameter that has emerged from the previous analysis is the objective to install a bike sharing system in the city center of Addis Ababa.

When finding the best locations for the bike sharing stations, the Accessibility Analysis Tool can be helpful. The increase of accessibility in an area with adding bike sharing stations can be displayed (see figure 33). The following scenario shows the accessibility of the research area with two initial bike sharing station set at La Gare and the African Union, the area is shown with the dashed line. When adding further stations at the other POI's, the accessibility is expanding, this is shown with the solid line. In addition a coupling with the Betweenness Centrality Analysis would be possible to find out which streets are most frequented to place bike sharing stations.

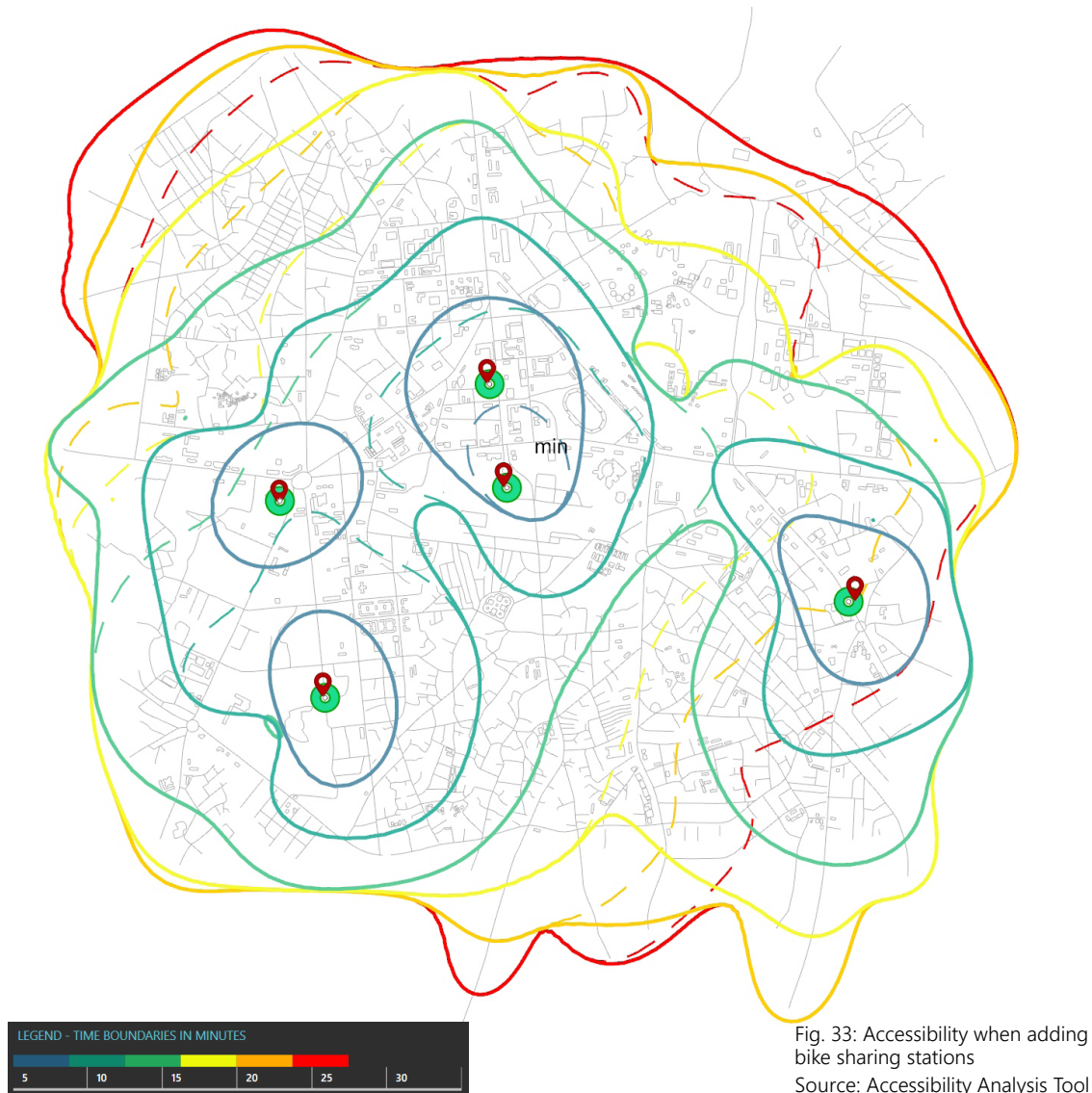


Fig. 33: Accessibility when adding bike sharing stations
Source: Accessibility Analysis Tool

Discussion of Scenarios

The shown scenarios offer a good basis for the further development of a network design for bicycle infrastructure in the research area around La Gare station. The presented analysis methods: shortest path, fastest paths, cheapest paths, most active paths and accessibility of added bike sharing stations have different focuses.

They all contain the parameters derived from the previous analysis of this work and are therefore quite relevant. The shortest and fastest path with the included weighting of street qualities give a suggestion for future route guidance. The Betweenness Centrality Analysis shows the suitability of roads in relation to the rest of the network. Furthermore, the analysis with the Accessibility Analysis Tool gives a first orientation about the spatial accessibility by using a bicycle.

In the context of this work it was unfortunately not possible to create a concrete proposal for a bicycle network in the study area. It would be interesting to combine the scenarios after consultation with the responsible actors to subsequently develop a network.

IV CONCLUSION

In the last chapter of this thesis the previous work is reflected, classified into the current state of research, the research questions are answered, problems in the work are discussed and subsequently a final conclusion is drawn and a short outlook is given.

The aim of the current work was to examine the role of cycling as a mode of transportation in Addis Ababa and to set a framework for the current planning situation of cycling infrastructure. First of all the literature about cycling in developing countries has been examined. In order to do so, the term developing countries had to be defined. With regard to various definitions, it became clear that development is always linked to economic growth. The current work is using the term developing country in a critical way with considering all historical, imperialistic and capitalistic imprints. With regard to the planning of mobility, it is argued that it should aim at equality, social integration and environmentally friendly mobility and not only at economic growth. In order to classify the current state of research, case studies from developing countries were examined, unfortunately the literature is currently still limited, but it is important to say that planning methods that work for industrialized countries cannot simply be adopted. Therefore a research trip to Addis Ababa, including the examination of the case-study area around La Gare and the conducted expert-interviews, was inevitable for a comprehensive research. The present work hopes to contribute to the current state of research. The results are specific for the situation of this case-study, nevertheless, it can be adapted or expanded for other areas and cities.

Answering the Research Questions

What is the current role of the bicycle as a mode of transportation - in developing countries and especially in Addis Ababa?

Due to the extremely rapid urbanization of cities of developing countries, there is an extraordinary need for sustainable transport solutions. It has to be emphasized, that the benefits of daily cycling are numerous. Besides the facts that cycling does not cause any air or noise pollution, supports a healthy lifestyle, and is very efficient, one major argument, which has to be stressed, is that the bicycle, especially in developing countries, enables low-income earners to move faster and affordably. Unfortunately, due to a growing motorization rate, related to economic growth, the

situation for cyclists in developing countries evolves from bad to worse.

Literature has shown that despite significant gains in bicycle ownership in some parts of the world, most of all Europe and North America, the overall rate is on the decline. In many industrialized countries around four-fifths of households own a minimum of one bike, whereas, in West, Central and North African countries, less than one-fifth of households even have one bike. From a study on cycling in developing countries it emerged the situations in different countries is varying. In Pune, India, the majority of cyclists are "captive" to cycling, and is closely linked to the topics of exclusion of the poor. Whereas in Bogotá, Colombia, many highly educated people cycle. However, rather for recreational reasons at the weekends to pursue a healthy lifestyle. For Dar es Salaam, Tanzania, the situation is very similar to the one in Addis Ababa, it is described as very bad, due to poor roads, low quality and unreliable public transport, fast growth in vehicle ownership. Furthermore, the facilities for cyclists and pedestrians are by substandard or absent. Another finding from the research is, that when talking about the role of the bicycle, the role of the car has to be understood, which is namely often seen as a status symbol and the chance to escape the dangerous and inconvenient situation as a pedestrian or user of public transport. Therefore it can be concluded, that the bicycle is not yet a means of transport in developing cities.

Looking at Addis Ababa this statement can be confirmed: the bicycle, as a means of urban transport, is still in its infancy in Ethiopia. According to the interviewees, it seems that there is a bicycle culture existing, but only in the smaller cities. That is due to the very dangerous traffic situation in the capital Addis Ababa and the lack of awareness regarding sustainable mobility. When looking at the rapid urbanisation (~3.3 million inhabitants which is expected to reach 4.7 million by 2030) and the related environmental and health hazards, the transformation towards a more sustainable and accessible transport system in Addis Ababa is definitely urgent. However, according the AACCA walking has with 54 % still the largest share. Looking at personal motor vehicles (15 %) this offers the chance to leapfrog the further expansion of the motorization phase if the right decisions are made now. According to the interviewees from TPMO, the current Prime Minister Dr. Abiy Ahmed, shows a positive attitude towards a more sustainable transport situation in Addis Ababa, which can be noted as important. Nevertheless, the street design in Addis Ababa has already taken the road to a car-oriented city. Pedestrians face many challenges, including inadequately sized footpaths, dangerous crossings, inadequate

illumination, and poorly maintained infrastructure. The idea of incorporating cycling as a transport mode in the Ethiopian capital is quite new, answering the following two questions gives an idea of what to do for successful implementation.

Which are the factors for implementing a bicycle network in Addis Ababa on the political-regulation-communication-dimension?

As stated in the literature review, planning of cycling infrastructure in developing countries needs to go hand in hand with good city and transport planning and supporting political decisions. A very important finding, that emerged from the interviews is, that the training system must be adapted and include sustainable mobility solutions. The current planning approach is apparently very car-oriented and focused on the construction of highways. Here a change in the curriculum of the according study programs and the measure of capacity building workshops on the political and administrative level are important (which is already done by actors like NACTO, ITDP, WRI and GIZ, but must be implemented in the long term).

In terms of regulations, it became clear that it would be important to formalise the regulations for squatting the cycle lanes. The interviewees described that a projected already failed, the cycle lanes were not accessible due to trash, vendors and parked cars. Here fees for the blockage would be a possible solution. In order to achieve this, however, a greater planning security, with binding documents and strategies and general understanding among the population must first be achieved. As mentioned in the literature review the Recommendations for Cycling Facilities (ERA) regulate that planning process in Germany, which could be taken as an example, especially the points of data collection and the organization of it for the easy update and cartographically visualization, should be stressed here. A foundation for future network planning and cost estimation has to be built. At the moment the mentioned consultative actors have a high influence in these tasks, here a good measure is to building a task-force, teach computer-based planning, analysis and visualization tools in order to ensure a long-term independence from the stakeholders. Another interesting finding was that there is no bicycle industry in Ethiopia, that taxes on imported bicycles are very high and that for this reason alone a safe bicycle as a means of transport is out of the question for many. The policy must counter this with tax cuts and incentives for industries.

From the interviews emerged the high importance of communication and

awareness-raising. One of the measures, already taken to reach out and inform about non-motorised transport is the car-free day, which is happening every first Sunday (morning) of the month. However, one finding is, that the whole strategy has to be multi-layered. The communication goes vertical to politicians, authorities and investors who need to provide the infrastructure and horizontal to the future cycling target group. Here it has to be underlined, that currently only very few males are cycling, for women it is considered to be too dangerous. Accordingly, the whole image has to be changed, through role models, or measures like social media campaigns, and actual cycling trainings in schools and workplaces.

Which are the factors for implementing a bicycle network in Addis Ababa on the spatial-design-planning-dimension?

First of all, it should be noted once again that the planning of bicycle traffic infrastructure in Addis Ababa is still in its infancy. Therefore fundamental questions arise, for instance: Where is the best place to start? As the interview evaluation has shown, the decision where to implement the first cycle lanes was not made easily. There was already a project with separate bike paths and bike sharing in the residential areas on the outskirts, but this failed for several reasons (e.g. under-utilization, trash on the cycle lanes). Therefore, it was now agreed to start in the city center. According to the NMT-strategy there are some major projects related to bicycle routes being planned, for instance Gambia Street/Churchill Avenue, north of La Gare, is supposed to be designated for pedestrians and cyclists only. One other idea, which emerged from the interviews is, to implement cycle lanes, inside or close to university campuses, since the students belong to the target group and could act as role models.

From the document analysis it arised, that regarding the design several parameters have to be considered. Firstly, whether to prioritize the cycle network on main or secondary roads. It is distinguished between a low-loaded secondary network with speeds of up to 30 km/h, here cycle traffic is organized in mixed traffic. On roads with traffic speeds above 30 km/h and a high volume of vehicles, the guidance of bikes is directed on cycling lanes. Cycling on roads with speeds above 50 km/h has to be organized on structurally separate cycle traffic facilities. The decision is based on several influencing factors, on the one hand the construction price. It is cheaper to have cycle lanes in the secondary network, because there is no need to build buffers like on main roads. One of the scenarios calculated the differences, the result

was, that it is around one-third cheaper to designate a cycle path on secondary and tertiary roads. However, from the field study it emerged, that the surface conditions of the different road types vary in their qualities, furthermore the network of main roads is much better connected, so the route is mostly shorter and the cyclists could go faster due to the better pavement. Additionally, considering, that the drivers in Addis Ababa are not yet used to bicycles, it is recommended to have separated cycle tracks anyway.

Another factor, when planning a cycling network is that it should be payed attention to the terrain, with the DeCoding Spaces Toolbox, which was used for some scenarios, it is possible to incorporate the terrain and calculate the flatest route in an area. This is highly recommended.

As for the planning phase, which is according to the literature the steps of developing a network concept and action plan, the previously presented scenarios can be helpful when negotiating with different parties. The example which displays the accessibility of an area when implementing bike sharing stations can be indeed relevant for the actual planning in the research area.

Limitations

In retrospect on the course of the work and the research results, the following shall be reflected on the limitations and problems of the current work.

With regard to the general subject of research - cycling in developing countries - it must be noted that the available literature is limited. There are many European or American studies and regulations, but they were only of limited use for this work. This shows even more the importance of the topic.

The case study itself is highly interesting due to its topicality (the acute need for action with regard to bicycle traffic planning in Addis Ababa), but also contained some complications. First of all, it should be noted that research in other countries, with a for the researcher not familiar culture and planning system, always involves certain risks. The results of this work should therefore be seen in the light of language differences and the confrontation with an unknown situation on the ground. Furthermore, it is not possible to examine the object of research in its entirety within the framework of a master's thesis. However, due to the unusually high willingness to cooperate, very exciting and important interviews could be conducted. These provided a good overview of the status quo of the plans regarding bicycle traffic in Addis Ababa.

The second part, the investigation of the study area on the basis of certain criteria, was extremely challenging. Due to special weather conditions (rainy season) each time window had to be used. Furthermore, it has to be considered that openly showing oneself as a researcher often met with scepticism or curious questions, which slowed down the investigation further. It should be noted, however, that the weeks on the streets of Addis Ababa will be remembered as personally very enriching and lastingly impressive.

The previously determined investigation criteria and the mapping method are assessed as sufficient. There certainly could have been improvements, for example a laser measuring device for the road width (unfortunately no hand measuring device which could have been used under the light conditions could have been borrowed). Also a tool for the direct input of the data with geo-referencing would have saved much work, the manual mapping of the criteria on the paper and the entry of point in OSM, certainly led to inaccuracies.

In the course of the work, it became clear that even term descriptions such as main road, secondary road and tertiary road could have been better defined beforehand. NACTO, who is also working on the cycle path planning in Addis Ababa, for example, uses the terms through road, connector road and local street, which were used as equivalents in the current work, but would certainly require further differentiation. Nevertheless, it was possible to establish a ranking of the roads for their suitability for cycle paths, which was important for the scenario development and is considered sufficient.

With regard to scenario development, it must be admitted that the possibilities offered by the used tools (DeCoding Spaces and Accessibility Analysis Tool) certainly go beyond what is shown. In addition, there are certainly other programs that can be used to carry out more in-depth analyses. However, the use of the tools is considered appropriate regarding the simple available data basis (e.g. no user-related data or no CAD network basis), which consists of the use of OSM data. In general, a model can only be as good as its database and this is limited for Addis Ababa. It should also be emphasized that the city is still at the beginning of the cycle traffic planning process and every kind of analysis can be seen as an enrichment.

Some parameters derived from the analysis could be illustrated by the use of the tools in scenarios, this is regarded as a success, even if, as already mentioned, there is still room for improvement here.

Finally, it should be noted that the author of this paper does not see herself as an expert in the field of traffic planning, nor in the field of computer-based modelling, but rather as an interface that tries to bridge the gap between the different principles and actors. Personally, working on these topics was seen as a great pleasure and the chance to go on a research trip to Addis Ababa is acknowledged as a great privilege.

Final Statement

Finally, it can be stated that the steps described above, namely the literature research, the research trip with the investigation of the area around La Gare in the city centre of Addis Ababa, the interviews carried out and the design of some scenarios, a framework for the implementation of a first bicycle network in Addis Ababa could be created.

This framework consists of the two dimensions with the factors found and shown by answering the research questions. The political-regulation-communication-dimension and the spatial-design-planning-dimension, should both be considered equally in the planning process. Since the period of growth of the bicycle in Addis Ababa, from barely existent towards a proper mode of transportation, will be a long way, it only can be successful with a multilayered and interdisciplinary planning approach.

Outlook for Further Research

With regard to the limited state of research on the bicycle as a means of transport in developing countries, there is a clear need for research. Of particular interest here would be a more comprehensive target group analysis, user behaviour and travel patterns. From the discussion with Iman Abubaker and from personal experience, the influence of the bicycle on women's mobility would be interesting. What travel patterns do women have? Can their access to the labour market be improved by using a bicycle?

With regard to the case study Addis Ababa, it would certainly be interesting to develop the scenarios outlined in this paper further by experts in the field of traffic planning and computer-based modelling, to extend them to a larger part of the city and to use them as a planning basis in a dialogue with the responsible actors.

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Mapping Points

1 mile radius around La Gare station

Legend

 point



APPENDIX

Mapping Data

Pt	Street Hierarchy	Surface Quality	Lanes	Width	Sidewalk	Width	On Street Parking	Greenery	Landuse
1	Main Road	Good	6		Yes	6 m	No	No	Mixed
2	Main Road	Good	5		Yes		Yes	green strip	Commercial
3	Secondary Road	Medium	2		No		Yes	Trees	Mixed
4	Main Road	Good	2	10 m	Yes	2 m	Yes	No	Commercial
5	Main Road	Good	4	12 m	Yes	2 m	Yes	No	Mixed
6	Main Road	Good	4	16 m	Yes	2 m	Yes	No	Mixed
7	Main Road	Good	4	18 m	Yes	2 m	Yes	Trees	Mixed
8	Main Road	Good	6		Yes	2,5 m	Yes	Medial strip	Commercial
9	Secondary Road	Good	2		Yes	2 m	Yes	No	Commercial
10	Secondary Road	Good	2		yes		yes	trees	Commercial
11	Main Road	Good	6	15 m	Yes	2 m	No	medial strip	Public
12	Main Road	Good	6	6 m	Yes	3 m	No	medial strip	Mixed
13	Main Road	Good	8		yes	6 m	No	No	Mixed
14	Main Road	Good	6		yes	3 m	No	No	Commercial, Religion
15	Main Road	Good	6		Yes	5 m	No	Medial green strip	Commercial
16	Secondary Road	Medium	2		No		Yes	No	Mixed
17	Main Road	Good	8		Yes	3 m	No	Medial strip	Commercial
18	Secondary Road	Poor	2	6 m	No		Yes	No	Mixed
19	Secondary Road	Medium	2	6 m	No		Yes	No	Mixed
20	Main Road	Good	6		Yes	3 m	No	Trees	Mixed
21	Main Road	Good	6	30 m	Yes	5 m	Yes	Medial green strip	Mixed
22	Tertiary Road	Poor	2	6 m	No		Yes	No	Mixed
23	Main Road	Good	6	30 m	Yes	5 m	Yes	Medial green strip	Mixed
24	Tertiary Road	Poor	2		No		Yes	No	Residential
25	Secondary Road	Medium	2	6 m	No		Yes	No	Mixed
26	Tertiary Road	Poor	1	5 m	No		No	No	Residential
27	Main Road	Medium	2	10 m	No		Yes	No	Mixed
28	Main Road	Good	4	15 m	Yes	2 m	Yes	No	Commercial
29	Main Road	Good	4		Yes	2 m	No	No	Commercial
30	Main Road	Good	4	20 m	Yes	2,5 m	Yes	Medial green strip	Commercial

POI	Crossing	Total ranking	Comment
Leghar Station	Zebra,	High	
Bank	Zebra	High Medium	
Inernat. China	Zebra	High	
Commercial College	Zebra, T. L.	High High	
E. Road Authority		High	Very broad street
Bus station	Zebra	High	
St Georg Brewery	Zebra	Medium Medium	
Oromo Cult. C.		Medium	
Bus station	Zebra, T. L.	High	
National Museum		High	
Church		High	
New Park		High	New Park at Riverside, could be used for cycling connection!
Hotels		Medium High	New Construction Area
Broadcasting Authority		Low	
Gym		Medium Medium	
Eagle Hills Development		High Low	The whole area will be reconstructed with Hotels, Gated Communities
	Zebra	High Low	Very broad street, good for seperated cycle lanes
		Medium	Old informal settlement, will be refurbished soon
		Low	Coca Cola bottle station
		Medium Medium	
	T. L.	High	Close to big Roundabout - right of way for cycling
		High	

APPENDIX

Mapping Data

31	Main Road	Good	6 25 m	Yes	2,5 m	No	Medial green strip, trees	Commerccial
32	Secondary Road	Poor	2 10 m	No		Yes	No	Mixed
33	Tertiary Road	Poor	0	No		No	No	Mixed
34	Tertiary Road	Poor	2	No		No	No	Residential
35	Main Road	Good	6 30 m	Yes	3 m	Yes	Trees	Commercial
36	Main Road	Good	8 30 m	Yes	3 m	No	Medial green strip	Commercial
37	Main Road	Good	6 20 m	Yes	3 m	No	Medial green strip	Mixed
38	Secondary Road	Medium	2 10 m	No		No	No	Mixed
39	Main Road	Good	6 30 m	Yes	3 m	No	Medial green strip	Mixed
40	Main Road	Good	6 30 m	Yes	3 m	No	Medial green strip	Commercial
41	Secondary Road	Medium	2 6 m	No		Yes	No	Mixed
42	Tertiary Road	Poor	2 20 m	No		Yes	No	Residential
43	Tertiary Road	Poor	2 21 m	No		Yes	No	Residential
44	Tertiary Road	Poor	1 5 m	No		No	No	Residential
45	Secondary Road	Good	2 6 m	Yes	2 m	No	No	Residential
46	Secondary Road	Medium	2 20 m	No		Yes	No	Mixed
47	Secondary Road	Poor	2 20 m	No		Yes	No	Residential
48	Secondary Road	Medium	2 20 m	No		Yes	No	Residential
49	Main Road	Good	4 20 m	Yes	2 m	Yes	No	Mixed
50	Main Road	Good	4 20 m	Yes	1 m	Yes	Trees	Public
51	Main Road	Good	4 25 m	Yes	2 m	Yes	Medial green strip	Public
52	Main Road	Good	4 15 m	Yes	2 m	Yes	Trees	Commercial
53	Main Road	Good	3 20 m	Yes	2,5 m	No	Medial green strip	Commercial
54	Secondary Road	Medium	2 15 m	No		Yes	No	Commercial
55	Secondary Road	Medium	2 25 m	No		Yes	No	Commercial
56	Main Road	Good	4 10 m	Yes	2,5 m	No	Trees	Public
57	Main Road	Good	5 30 m	Yes	3,5 m	No	No	Mixed
58	Main Road	Good	8 100 m	Yes	3,5 m	No	Medial green strip	Commercial
59	Main Road	Good	6 50 m	Yes	3,5 m	No	Medial green strip	Public
60	Main Road	Medium	2 30 m	No		Yes	No	Mixed
61	Main Road	Good	6 70 m	Yes	6 m	Yes	Trees, Medial green strip	Commercial
62	Secondary Road	Medium	2 30 m	No		Yes	No	Commercial

Federal Police HQ		High	
St. Marys University		Low	
		Low	Only Pedestrians
		Low	
National Theatre Rounda.		High	Important street (is planned to be turned in pedestrian/cyclists street)
Urban Development Agency		High	
		High	
		Medium	
	Zebra, T. L.	High	
		High	
		Medium	
	Nothing	Low	
	Nothing	Low	
		Low	Cobbleston Road
	Zebra	Medium	
		Medium	
Many schools		Low	Very steep road with cobble stones
		Medium	
		Medium	Construction area, road steep
TPMO, other offices	Zebra	High	
African Union	Zebra	High	
		High	
		High	Extra Bus lane existing
	Zebra	Medium	
	Zebra	Medium	
United Nations	Zebra, Police	Medium	Pretty steep
		High	
		High	
Ministry of Foreign Affairs		High	
Zewditu Memorial Hospital	Round about	Medium	Churchill Avenue!
Mosque		High	
		Medium	This area is close to the river, where

APPENDIX

Mapping Data

63	Secondary Road	Medium	2 20 m	No		Yes	No	Residential
64	Secondary Road	Medium	2 20 m	No		Yes	No	Mixed
65	Secondary Road	Medium	2 15 m	No		Yes	No	Commercial
66	Main Road	Good	6 50 m	Yes		No	Medial green strip	Commercial
67	Main Road	Good	6 30 m	Yes	1,5 m	Yes	Medial green strip	Mixed
68	Secondary Road	Medium	2 50 m	No		Yes	Trees	Commercial
69	Secondary Road	Medium	2 30 m	Yes	4 m	Yes	No	Commercial
70	Main Road	Medium	6 30 m	Yes	2,5 m	Yes	Medial green strip	Mixed
71	Main Road	Medium	4 30 m	Yes	2,5 m	Yes	No	Mixed
72	Main Road	Good	6 70 m	Yes	2,5 m	Yes	Medial Green Strip	Commercial
73	Main Road	Medium	4 70 m	No		No	No	Mixed
74	Main Road	Medium	4 70 m	No		No	No	Mixed
75	Main Road	Good	6 70 m	Yes	2,5 m	Yes	Medial green strip	Mixed
76	Main Road	Good	6 70 m	Yes	2,5 m	Yes	No	Mixed
77	Tertiary Road	Poor	1 15 m	No		Yes	No	Mixed
78	Main Road	Medium	6 70 m	Yes	2,5 m	Yes	Medial green strip	Mixed
79	Secondary Road	Poor	2 10 m	Yes	1,5 m	Yes	No	Mixed
80	Secondary Road	Medium	2 30 m	No		Yes	No	Mixed
81	Secondary Road	Poor	1 10 m	No		Yes	No	Mixed
82	Secondary Road	Poor	2 6 m	No		Yes	No	Residential
83	Secondary Road	Medium	2 8 m	No		Yes	No	Residential
84	Tertiary Road	Poor	2 5 m	No		Yes	No	Residential
85	Tertiary Road	Medium	2 15 m	No		Yes	No	Mixed
86	Tertiary Road	Poor	1 5 m	No		No	No	Commercial
87	Secondary Road	Poor	2 6 m	No		Yes	No	Mixed
88	Secondary Road	Medium	2 15 m	Yes	1 m	Yes	No	Mixed
89	Tertiary Road	Poor	1 5 m	No		Yes	No	Residential
90	Main Road	Good	4 50 m	Yes	3 m	Yes	No	Mixed
91	Secondary Road	Medium	4 20 m	No		Yes	No	Mixed
92	Secondary Road	Medium	4 20 m	Yes	2,5 m	Yes	No	Mixed
93	Tertiary Road	Poor	1 6 m	No		No	No	Residential
94	Tertiary Road	Poor	1 6 m	No		No	No	Residential

River		Medium	
Souvenir Shops		Medium	
Souvenir Shops		Medium	
Socialist Monument	Zebra, T. L.	High	Very busy street
Lycée Guebre-Mariam School		High	
Immigration Office	Zebra	Medium	
Black Lion Hospital	Rounda.	Medium	Steep road
		Medium	
Metrological Research Institute		Medium	
	Zebra, T. L.	High	
Ministry of Health		Medium	
Ministry of Health		Medium	
	Zebra, T. L.	Medium	
	Zebra, T. L.	Medium	
		Low	
		Medium	
Dembel City Centre		Medium	
		Medium	
		Low	
		Medium	
Hotel		Medium	
		Low	
		Low	super narrow
Market area		Low	
LRT Station		Medium	
		Medium	
		Low	Cobble Stones
		High	Medial Parking strip - could be transformed into cycle lane
		Medium	
Shopping Centre		Medium	
		Low	
		Low	

Transcripts Expert Interviews

Interview questions (on the example of TPMO)

Introduction and Background

- What is your position at the Transport Programs Management Office (TPMO)
- Does a bicycle culture exist in Ethiopia and who are the people cycling already in the city?
- Where do people cycle to (if they do) – to work, school, for leisure activity?
- Did you ever used a bicycle in Addis?

Implementation

- Which is the main responsible body for the implementation?
- How many planners are working on the implementation of cycling infrastructure?
- Is there the political will of really investing in bicycle infrastructure?
- After developing the NMT strategy, what do you think will be the main obstacles of implementing it?
- Can you estimate how much the construction of one km of separated cycling lane costs?
- In which timeframe you think you can start building the first kilometres of separated bike lanes on arterial roads?
- How would you identify the suitable roads for cycle lanes?
- What is your plan about the implementation of bicycle sharing systems? When and where do you want to start?

Law

- Do you have a road traffic act? What does it say about the rights for cyclists?
- Are you willing to adapt the law, so that there is a priority for cyclists, including fines for illegal parking, design of crossing which priorities cyclists etc.?

Equipment

- How much does an average bike cost in Addis?
- Where to get it?

Communication

- How important are Communication and engagement activities like Open Street Days?
- Do you think that this is suitable to reach many different groups of citizens?

Thank you for your time!

**Interview Abhimanyu Prakash, Skype Interview, 21.06.2019,
Addis Ababa to New York**

Interview questions could not be recorded, due to a problem with the recording tool via Skype.

A: Hello thank you I am fine, just have been in New York this week and flying out to Zurich and then Dublin for the Velocity Conference, an annual gathering of 1000 practitioners from all around the world come together to talk about best practices in cycling.

A: I am from India, but the whole NACTO team is based in New York.

A: We would love to learn more about the work. What exactly is your thesis? A design proposal?

A: Just to give you a little bit of background, maybe Frederic has given you a little information already. So, we are working on the larger cycling network for the city of Addis Ababa. In terms of the phase 1 we are currently focused on capacity building in the city of Addis, where we help them build a design for pedestrians and cyclists. For which we started some conceptual design, based on the street typology of Addis and did some rough costings. We are also looking for doing a demonstration corridor, which will be within one mile of Legehar.

A: We are planning the demonstration project in the week from the 13th of September, so right after your submission. In case you would be able to travel then, that would be amazing. But what I can do is to share with you the design proposals we made so far. And maybe you can share your work with us, you can share your progress, so if we move closer to the demonstration project, we can see what we can pick up from your research and your studies.

A: We have been working with the city for 4 years now, I have done around 25 trips to Addis, so I am familiar with it. At any point you need any help with us to review something or you need any help with photos or material, please feel free to contact us.

A: (10:00) We supported ITDP as an independent tribute body. So basically, just to give you some background. We at NACTO are funded by Bloomberg Initiative for Global Road Safety. This was a five-year grant under which the Bloomberg Initiative was funding partners like us to provide technical assistance to 10 cities around the world to help reduce road death and road fatalities and increase the sustainable mobility road share. Under that our team at NACTO the first year we produced the Global Street Design Guide, I don't know if you are familiar with that. And several

publications. And then for the last years we have been supporting 5 cities. We work in Addis Ababa, Mumbai, Bogota, Fortaleza and Sao Paulo in Brazil. I lead the work in Addis Ababa and Mumbai. So, under that we work in three or four main areas. One is capacity building; we train 500/600 practitioners in Addis on street design. Now we are doing some capacity development specifically for cycling. Then the second is a lot of technical assistance and design review. Help them to correct their strategies and review them, do data collection and also help them to develop strategies and programs. We helped them working on the Master Plan for the city. We worked on the Road Safety Strategy, on the NMT Strategy and we helped them to develop some programs, like the Safe-Intersections-Program. The first project was the transformation by Legehar. We worked with EiABC. We did the implementation. The intersection is much tighter now, on our Website you can see how it looked in the past. With the EiABC we worked together to redesign the Churchill Avenue. The final thing we do is metrics and valuation.

A: (14:57) Nothing is implemented, you can ask Abraham and others to show you the Street-Scape-Project. Then now we are supporting them in doing the detail design also. So, this is where we are coming from. Cycling was the next step, after walking and pedestrian infrastructure in the city. That was what we were doing, then the giz grant came through and the city showed interest. So, it was time to collaborating with all these partners. We are supporting to capacity building and doing design review and help the city to design the phase one of the design network.

A: The presentation I will send you will show the network that we are planning. Two years back the city have built bike lanes in the outskirts of the city, as last mile connection. But unfortunately, the corridor is so far away, and there was not enough ridership, so the project failed. So, after that and after the workshop the giz had organized last year, I think everyone did an agreement that it has to be in the city centre. (18:00)

A: The Safety Strategy was launched 1,5 years back.

A: (19:47) Enforcement is the biggest challenge. I don't know if you noticed, but the streets around Mexico going to the south, they have painted dedicated bus lanes. But they are planning to put physical barriers also, but the biggest challenge is how to do enforcement and that is our biggest worry also with the cycle lanes.

A: One of the things with the bike lanes, which is going to be another challenge is to just prevent the squatting of the bike lanes by all the vendors and shop owners and people throwing trash. I don't know if you have visited the two old cycle lanes, that exists on the outskirts of the city, they are just filled with trash and construction. The other problem is the designing, if they design the cycle lanes but don't do proper

intersections. So, if you don't design the proper way of how to get on and off the bike lane, the traffic can be a huge challenge. Also, the right material and signage is going to be a challenge. Some of the other obstacles could be costs, because investing in cycling which is currently a mode share which is not exciting in the city, which is not going to be an easy thing for any government to issue. With the pedestrians you can make a case because there are so many pedestrians, with the transit design you can make a case, because there are so many people on transit. How do you make a case for cyclists which don't even exist in the city currently?

A: (24:16) And there are going to be a lot of backlash from the public. Because they are already feeling that the streets are congested, so how do you get more space of the streets from on-street-parking or car-lanes and give it to cyclists? That is going to be a challenge, for sure.

A: Thanks alright, thank you. Bye. And feel free to add me from my signature on WhatsApp. And we can communicate. Thank you. Bye.

Interview Iman A. Abubaker, WRI, 25.6.2019, Addis Ababa

A: What is your position at WRI?

I: I am the Urban Mobility and Road Safety Project Coordinator. My main roles and responsibilities include, basically working with governments on issues related to road safety and public transport, mobility planning, walking and cycling and we basically leverage what we learned from our global offices from Mexico, Brazil and here and we try to advise the government and also propose recommendations and solutions. We basically promote sustainable modes of transport in Addis.

A: How is WRI involved in the planning of the cycling infrastructure? Have you also been involved in the NMT strategy?

I: We initially had discussions with the city to develop an NMT strategy. So, we were in the process of working with the city, but ITDP had a lot of experiences with doing this in other cities, and funding and expertise to do it. So, we basically reviewed, looked at all the content and made sure it was in line with best practice. In terms of cycling we are one of the partners that is working with the city on the TUMI Challenge. So, we have been coordinating, giving stakeholder workshops, because there are lot of partners that are going to be working on the Safe Cycling Manuel and the communication strategy. As you can see a lot of people are not aware. And it is more like leisure activity. There is actually a big bicycle market for kids' bikes. Or even for adults, but you just bike in your compound or on empty streets, but it is not considered a mode of transport, yet.

A: Do you have any experiences with cycling in Addis? Did you ever cycle here?

I: It is more a road safety concern. I used to cycle within my neighbourhood. But now a lot has changed in terms of land use. It used to be mainly residential, so I could cycle there. Now there is a lot of commercial activities, so there is a lot of cars parked on sidewalks, or you know people don't expect you to cycle. I once cycled on Bole Road and attracted so much attention. Because they haven't seen a woman on a bike before. So, they stopped their cars, were honking, shouted at me "Get of the street", so I just said I can't do that.

A: That is actually my last questions, but I am going to ask it now: Is there a bicycle culture existing in general? And in Addis?

I: I think it is because it urbanized so fast. If you compare Addis to other, even secondary cities, the second most populated city in Ethiopia is 10 times smaller than Addis. So, even if we look at Hawassa, Bahir Dar or Tredoir they are not as urbanized, and they don't have a high motorization rate in general.

A: The motorization rate of Ethiopia is pretty low anyway, right?

I: Yeah and in Addis it is concentrated, I think around 70 % of the vehicles are in Addis. I think there is huge potential. You know, people walk anyway. And we are in a high altitude, so we are naturally fit to do it. But because of being unsafe and also there is this cultural shift towards a vehicle being a sign of economic growth. So you think, why would you have a bike if you can have a car (5:05). I think, that is one of the things we identified - when we want to implement the bike sharing system or any biking facility – we need to work in the communication. We need to make sure that people really understand that having a car is really not a good thing.

A: Yes, there is a big chance of leap-frogging the phase of motorization. In European cities for example, we made so many mistakes in the last 60 years. That is why I find it so fascinating in Addis, where still so many people walk.

I: You know about the Prime minister’s initiative about the rehabilitated river projects.

A: Yes, I heard about it. How is it going?

I: Well, the concept itself is good, but it is gentrifying the city. So the people who will be using it again will be probably the well off – middle to high income. Because to access a park of such a nature you probably will have a fee you have to pay. They actually haven’t talked with us about the details. We have been asked, as WRI, to advise on the project as a whole. So we have been contacted by UNDP to do that. But because of the PM showing that he is committed to cycling, the Federal Transport Authority is now interested in doing a nation-wide effort in cycling. But you see one thing, the biggest lesson I very much appreciate learning from Addis is, that even when you have the infrastructure and you even buy fancy electric bikes, there can be a shift suddenly and people consider cycling as bad.

A: I always wonder, where to start then- with the awareness, with the infrastructure, with getting more bikes and teach people? Or all together?

I: So our workshop last year identified what you just said. I think one of our main takeaways there needs to be changes in how expensive bikes are. Bikes need to be more accessible and affordable. So I talked to the Federal Transport Authority Deputy. He said that they are open to reduce the taxes on bikes, also make it an incentive for manufacturers to open an industry here. So, the city definitely is interested and promoting cycling. But what is forgotten is, those soft things you must do. You need to even look on the cultures already existing practices, you can embed the whole measures in. Because I am sure the cycling association, is it a group?

A: You mean the guy I met? Yes they are a club and they meet once a week to cycle in Addis or outside the city to certain destinations.

I: So, it is not impossible. It is not easy, but it is like you said, we have to do a lot of things at once, and we have to do it before the city is urbanized even more. I

think having the NMT strategy is important, because that ensures when new roads are being build, pedestrians as well as cycling facilities are considered. There was actually a huge debate when we were looking at the bike sharing. Where do we going to put the bike sharing? (10:06). We had two separated arguments. The first was the program was at the periphery, in residential areas. That didn't work, so it was sure we need it in the city centre. But here we have already so many different modes of transport that are competing, on the main road. For example we have the LRT, we have the taxis, we have the public busses, walking, motorized transport, motor cycles, and then if you out in cycling, unless you have a shared street concept, where you really have slow speed and it is safe for everyone. It is very difficult to do it in the core of the city. You have to look at the integration with the other modes and maybe for example with the LRT, when you can take out the busses and minibuses and if the LRT could take up the capacity, you could have bicycles.

A: It is not cycling stand alone; it really has to be included in the whole transport strategy. They really should send more trains. What is the matter with that?

I: Chinese investment. When the contract was agreed, there was no clause on maintenance. (12:00) I think they are negotiating now, because 50 % of the trains don't work. There should have been a maintenance agreement. So now they are negotiating. But we are also looking how to make it more efficient. The LRT is just another whole complex topic. It is an urban rail, but they wanted to operate like a metro, they wanted to go super-fast. The LRT wants to close stations, it was not the best option to begin with, but they are learning how to work around it now. The city really should negotiate to have more carts, to take more people. And also have a proper schedule, a proper timetable. Now you have everybody come out, because they don't now when the train is leaving, they could have gone 20 min later. There is the taxis and minibuses, they provide long distance options. But people think buses are for low-income, so they try to avoid it. The city is asking us how to make buses sexy (laughs). We have gone past buses all the way to metro, now it feels like they are going back.

A: Yes, they are also working on the BRT lanes. What do you think will be the main obstacles when implementing cycle lanes?

I: Yeah, I think we have discussed it. I guess if you ask from a technical point of view, it is difficult because it is already so urbanized and dense. One advantage is, that the land is owned by the government, so you could build anything anytime. But if you want to take lanes away, people and especially the government would ask "for cycling, really?". They can understand for BRT, but not for cycling. So, what we need to do is creating the demand, so that people really understand. Our idea is, which

was the second discussion we had, is to have cycling within the universities or close to the universities. They are young and would like to have cheaper alternatives and modes of transport. And the campus is sort of spread out, so you cannot walk from one campus to the other, so you cannot go out on the main road, because it is blocked. So, if there is a cycling system you can cycle around and the campus is kind of spacious, so you could have a shared space system there.

A: They could be role models then, the students.

I: Yeah, they can also spread it via social media. Also, with the bike sharing - one issue is theft, if you have the bike stations on the campus, you can lock it during night-time. There will be security and people are less likely to steal it. One obstacle would really be the ROW issues in a build up city. Then, as we talked about, using cycling as a mode of transport, rather than only for fun. And I think the third thing is the policies around making cycles affordable and accessible to people. (17:12) And I think one part of the TUMI initiative is also to build a training ground, so I think also teaching people makes sense. Because only having a bike doesn't make you able to cycle.

A: And also to teach the staff of the authorities, so they can become role models, too. We learn cycling in school and learn it in school. That would be good for pupils here too.

I: Yeah it is also about the education system, the people are trained as highway engineers only, we don't have urban planners or no understanding that you can make a high-speed road in the middle of a pedestrian area. So, one is building that capacity as we go along, that people have that thinking as a cyclist or pedestrian. One challenge will be first making the planners think as a pedestrian and now think as a cyclist. It could be a lot of capacity issues.

A: Yeah sure, even in some European cities, it is far away from awareness for these issues in the authorities. That is really a good point to start with. Maybe I can ask you something more about the role of women, because you are actually the first women I talk to, which is super amazing. [...] What do you think, if the cycling in Addis gets safer, with separated lanes, do you think women will eventually start cycling as well?

I: I think in the beginning you still will find many males; it is a male dominated sector. I think for example the rental program was a thesis of someone, which the government then took to start a program. Initially he thought about to have bikes for women and men, so that it would be easier to ride. There is much more than segregating the lanes, even understand where women would go and how they travel.

A: Yeah there are different routes and travel patterns women have, they might travel

more in the residential areas or go to markets.

I: So, what we as WRI do is, a project we are doing with the Flone-Initiative, Women in transportation workshop, which will be hold in December. We are looking at the role of women in the transport sector in terms or decision makers and designers, but also at the other and as users and commuters. But also looking at how certain aspects of transport are really specific for women's needs. For example, with the bus operators, Ambessa Bus, decided to employ women, as drivers. What they found was that women were less likely to have an accident. So that was cheaper. But when I talked to the associating lead of the bus drivers, she told me that they don't even have rest rooms for the women drivers. So, men get off the bus and pee in the street and get back. The women can't. So, they ended up getting a lot of infections from holding it back. And also, once they park at night it is very unsafe to walk back at night. So, things you don't think of, that is why I think it is very important that we have women designing these things because they bring a certain opinion. And even if can not bring many women in the sector suddenly, men need to understand what women travel patterns are. They can have focus group discussions and ask, "where would you cycle from 9 am" or if your are a student "where would you cycle to" and so on.

A: Like making big surveys and questionnaires? To find out what people need. I think that is crucial. Even with my program it is not done at all. We must participate people and ask where the routes should be.

I: You could do some mapping and ask women to map if they would have a bike where they would go and see the attraction points. We do that with road safety and kids. They show you where they feel unsafe and draw said faces and stuff. Even bullies at school, we just started the project, but in Mexico they work with schools. They had to get kids paint unsafe areas where they get bullied. [...] So I think thee stakeholders here need to work with women and kids to really understand what their routes are and the attraction points (25:44). How do you feel as a women when you cycle back home.

A: Lightning is important I think; it is nicer when the streets are lightened. There are some routes through parks I would not take maybe. Then I prefer routes without a lot of traffic lights or intersections. Maybe I also like smaller routes. That is also an interesting point. The NMT Strategy recommends building cycle lanes along major roads. And I am always wondering if that is really a good idea because of the pollution. In Berlin, which is really not the best example when it comes to cycling, but we have some dedicated cycle lanes where you only have cyclist, that is my favourite street to cycle on. That leads to my last questions, when implementing the

cycle lanes here, do you think it is better to have it on the main roads or maybe on secondary and tertiary roads?

I: I mean again I think the main road is to begin with we have to consider the first and last mile connectivity, that is what we have to push for. With for example with Addis, we don't need all the busses and taxis to go into the secondary roads, we don't need them to do that, they create a lot of congestion. But looking at the entire transport sector, we need to look where cycling makes sense. For example, from Legehar all the way to Churchill there is supposed to be a pedestrian street. That kind of makes sense, because there is a lot of secondary options for cars. If you do that people in that area, whatever they need to do there, they can do it with a cycle. Looking how we can do it in many more areas, is smarter than to just say next to all main streets going to be cycle lanes. Because like I said ROW is an issue, parking is an issue, you are competing with more.., I mean you are telling the government to take away roads for busses, technically to transport more people – to take that away for people on bicycles where we yet have to ask for the demand. In Copenhagen you can make that case, and that will work. So people on a bike can actually equal people in a bus. So, I think for us realistically you want to look at areas where you can take it up – universities, with a mixture of main roads and secondary roads. But the problem with secondary roads is there are cobble stones and they are not really comfortable for bikes.

A: Yes, that is my results as well. When I look at my mapping, I can see good quality surfaces on the main roads and medium to poor quality on the secondary roads.

I: There are actually some better maintained roads, but when it rains after a few years they will be destroyed due to the poor quality. I really like the fact that you are working with a programme that can look at all factors at once. I think as human being we only can think of many possible factors at once, if we think on road surfaces, we might forget lighting conditions and so on. For Addis I was actually one of the people who was against the supposed cycle road from Mexico, passed Legehar until Stadium. I said why would I take a cycle, when I can take a taxi or LR, I could get of where I want. The only way what would make sense is if the government would say, that all the others would feed into the LRT and the streets would be free for pedestrians and cyclists. I don't think we don't have enough information about travel patterns. Does your program also look at travel patterns?

A: No, not really. I don't have the information; I think I could feed it in another program. But for now I am only looking at the hard facts.

I: For example, there are not a lot of people who live directly in Legehar or Mexico, so they are commuting. Let's say they took the LRT or bus and got to Mexico, if

there is a long line that makes sense. But we even don't know if they get of there or take another line or if they want to go somewhere else. That is why it is safer to start at university areas or areas like Mercato, the market area. Or I kept on pushing for Haya Hulet, because that has a grid system. If you go into Haya Hulet you can take the main road and it is a very commercial area, where people can shop and then eat, it is very easy to navigate there. And there is also a lot of need for commercial delivery. So you could redesign the whole thing (33:29). But again the whole thing the street is cobble stone or it is not maintained.

A: In the area where I live there are actually a lot of cyclists on the main roads. It is very nice to see.

I: We have this conversation also with Car-Free-Day when we were thinking about the locations. We were thinking about where people usually go on Sundays? What you want is to align peoples travel patterns to, if they tend to go to Haya Hulet then you would do it there, and they stay there the whole day. But if you ask them to go out of there way where they usually go to, it is very difficult. So what we did was an mixture of residential areas, so people could just walk out there houses and have fun with their kids or we picked central locations, where people could go to and do other things afterwards. So even with cycling we have to understand if we are selecting the main roads, we would have to understand where people would go after.

A: So an incremental development would work I guess, start somewhere, see how it is used, then adapt it for other routes.

I: Then I think even with the city if the university one goes really well, then the city will stay we actually gonna start and relocate road space for cyclist. For example, Bole Road, I think, is very smooth to cycle on, it is very high speed, you can not make any turns. It is very straight, from Mesquel Square to the Airport you can get really easily. And technically you don't need a lot of taxis there. So, we have ask them to reduce the speed, because it is a commercial area, with many cafes, restaurants and so on. But they are responded, when people come out from the Airport a and drive into the city, a lot of people judge, that is there first impression of the city. So to see a narrow road with no cars, people would think that it is not an economically developed city. That was there argument. They said that is a VIP road and you don't tough a VIP road. There are so many accidents happening, it is one of the deadliest roads in Addis.

A: I would think the other way around, if you come to a city and the vibrant, liveable streets, then you will have a good impression. But that is another way of thinking.

I: I think these ideas of tactical urbanism and plazas, that is what I really like, and

Addis has the potential for that. As you can see, we are a very social society, look at how full all the cafes are. Imagine if you allocate space and give it to the cafes and restaurants...but I think we need to show it more. So with the TUMI project we hope to do one pilot lane with paints, maybe they can shift it around the city and see where it works. But it is not easy.

A: Alright, thank you so much. I going to stop the interview now.

Interview Temesgen, TPMO, 11.06.2019, Addis Ababa

A: Hello, what is your position at the TPMO?

T: My position is head of the project management division.

A: Does a bicycle culture exist in Ethiopia. And who are the people cycling at the moment?

T: When you go to Hawassa, Bahir Dar or other secondary or tertiary cities you have a bicycle culture. Before the cars arrived and dominated the cities, we had a cycling culture there. People bike.

A: And children, do they learn cycling in school?

T: When I was a student, I biked, we had two bikes in our home. But in Addis the situation is different. There is no culture. Due to the domination of cars and motorbikes is growing. When we go to the kids, they get bikes as a toy, so they have bikes, but only to play.

A: If people cycle, where are they cycling to?

T: In Addis, for work, students also use it for university. Kids also use it in their compounds.

A: But are there people cycling to work in Addis?

T: In some areas they use it. Especially males. There are more men cycling, women are not encouraged to cycle. In other cities women do cycle. But in Addis the number is too small.

A: Do you think that is because it is too dangerous here in Addis?

T: Also, the influence of the culture, it does not encourage the women.

A: Why? Is it the religion? Are they embarrassed? Or the clothes is not suitable? What do you think?

T: That is a deep question. It is not the cloth; it is more the culture...I haven't seen many women. But on the car-free day I saw some.

A: Did you ever use a bike in Addis?

T: We have some pilot project corridors; there I used the bike and on car-free days. When I were a student in Bahir Dar, I used a bike often.

A: Which is the main responsible body for the implementation of cycling infrastructure?

T: There is some transformation now, due to the government. Before that we have the Addis Ababa Road and Transport Office on the top and under it 7 other offices. That is the city level of Addis Ababa. Including TPMO, AACRA, which constructs the streets and infrastructure, also TMA, this is more for the traffic management, TPMO is mainly creating new projects, like pilot project. After that the projects will be transferred to AARC or TMA. (10:00) We also have some bus operation companies.

But now we are getting to some transforming the whole structure. We will have some less offices. For example, ACCRA will shift to the local authorities, for the city administration. The painting of the lanes is done by TMA.

A: Can you estimate how many planners are working on the implementation of the cycling infrastructure? In Germany for example we hear sometimes the excuse, that the infrastructure cannot be developed faster, because there are not enough planners. Do you have the same problem?

T: We have such problems, yes. But more important problem is that they are taught in school to focus the planning on cars. The problem when we discuss with them about the bike transport, they are not much interested, that is a big problem. For that we have tried to train the AACRA stuff together with ITDP, NACTO and so on. We train them. Also, we are working with universities. Last time we had some workshops with universities, to include urban design ideas in their curriculum. Because when you construct the infrastructure, it is not safe for pedestrians and cyclists. So we try to incorporate the urban design concepts in their education, to have some awareness about the current city planning ideas.

A: That is a very good point. Very interesting.

T: Also, we include different stakeholder, technical committee, which is representative for bike projects, from AACRA, from the plan commission, from different projects in Addis. There are some planners, we are working together with.

A: Do you think you will manage to change their minds?

T: Yeah, especially for the new roads, which are under construction in Addis, we are incorporating the bike tracks. For the new roads. We are forcing them to incorporate the lanes.

A: Did you implement the idea in a law? Do you have a transport law?

T: We have a transport policy. The transport policy is not only about bikes. But we have the NMT strategy. We ordered the different offices to incorporate the ideas in their planning strategies.

A: But is that binding? So, do the other departments really have to consider the ideas?

T: It is more you should, an advice to follow the ideas.

A: What do you think will be the main obstacle of implementing the NMT strategy?

T: There is some gap of knowledge what NMT. Our experts are not really aware of pedestrians and cyclists.

A: That leads to my next question – do you think there is a political will of implementing the NMT strategy? Who is responsible for the main decisions? Who are the people to convince?

T: There is some resistance from higher officials, they see a bright future for cars in Addis. That is also the problem from the education, from the people who are not much told about what is good for the environment, for the health. There is limited education and awareness. We have not worked much on the awareness part. But if you look at the modal split, most people in the moment walk in Addis. The problem is a financial problem, and also the Public Transport is not good, due to the reason we have a big walking culture. If we want to keep that share, we need to improve the walking infrastructure and facilities.

A: Yeah that is what I find so super exciting about the whole situation, that if you make the right decisions now, Addis has really the chance of becoming a walking and cycling city. (22:17) It can become a role model in that sense.

T: If people become richer, they won't walk anymore. But if the infrastructure become good for walking and cycling people will use it and don't use their cars. Due to congestion you are losing a lot of hours. Some people need a better option.

A: Can you estimate how much the construction of one km of bike lane costs?

T: Our existing Prime minister has some better knowledge than the previous ones. He is also planning the construction of the riverside project; it has the length of 54 km and touches two rivers in Addis. The objective is to develop these corridors, the riverside, for recreation and walking and bikes also. It costs around one billion Euros.

A: But all together? The restructuring of the greenery and the infrastructure?

T: Yes, in total. It starts from Intoto to the Palace and goes to the south, it also touches this area here, the African Union. He also wants to have some biking transport. There is high commitment from the Government Side.

A: So, the highest leaders are pro and supporting the ideas, but the authority leaders need to be still convinced?

T: Dr. Abiy Ahmed has travelled to many European cities, he knows about the transport issues. He wants to copy the ideas here in Addis. But as you say there is some gap of the lower officials.

A: What is your plan about the implementation of bicycling sharing systems and when you want to start that?

T: We have some pilot projects before in some areas. We have constructed some cycling lanes around 5 km. But around Bole we have some pilot project as well, we took some space from on street parking, we limited that and gave it to bikes. But it was not successful.

A: Why was that?

T: The separating infrastructure was not strong enough. You know the drivers in Addis are crazy, they are not aware. We concrete pollards so vehicles can't go

through, but they crashed it. It was not string enough.

A: The drivers are really resisting?

T: If there is really much congestion, the drivers try to claim that space for driving or parking. There is also not much respect for walking. That is why it has not succeeded.

A: So you think before implementing any lanes or sharing systems the mindset has to be changed?

T: For that we must work on the communication, to have some awareness about bike transport.

A: How important is the communication, like Open Streets Days, and what else does it need to reach the people?

T: The Car free Day is to promote NMT. To educate the people about health, environment and cost factors. The reason we are trained to promote the bike with using this car free day event, we also have some bike competition.

A: How many people do attend the Car-free-day usually.

T: I have to guess; I am not sure. But it is getting more and more.

A: What about the timeframe of implementing the targets you have named in the NMT strategy? (34:21)

T: We have some grant from the GIZ project. With that money we are working now with NACTO, WRI and ITDP. With NACTO we are training the ACRAA stuff, with NACTO we are giving some trainings. With WRI we are working on the Safety Manual. Also, we are working with Branding and Marketing with WRI. With ITDP We are making a feasibility study and with bike sharing system. We are also trying to have some trainings ground. On this trainings ground NACTO also helped us with the design. In Bogota they have some training ground. They also want to bring the expertise to Addis to have some better design.

A: Where will the training ground be?

T: We are proposing some areas, at Stadium we are having an existing training ground, we will modify this one. That will be a public area for everyone. For start we have to start on two areas and then we have to expand the areas.

A: Do you have a Road traffic Policy?

T: We have a Transport Policy for Addis, but there is no Federal Policy. I think the policy was developed 5 or 6 years ago, but the bike transport was not mentioned enough. There is some gap, so we must revise it. It is more promoting the cars.

A: When you want to revise it?

T: I cannot tell you that. I do not know.

A: How much does an average bike cost in Addis?

T: A good one costs 7.000 Birr. An average one around 5.000 Birr. Another thing is

the transport authority, they have to reduce the taxation on the bikes. To promote the bike, you have to reduce the costs. So that it is accessible for everybody.

A: Does bikes have a lot of taxes right now? Do you know the percentage?

T: I am not sure about the percentage, it was getting higher and higher over the last years, something around 2000 Birr. They are planning to reduce the taxes, the transport authority.

A: Are the bikes in Ethiopia imported or do you also produce your own bikes?

T: They are all imported, that are Chinese bikes.

A: Where to get the bikes? Are there shops or markets?

T: Sometimes they sell used bikes, there are shops in around Mercato and Piazza. Super crazy place Mercato.

A: Also important are maintenance shops, right? To repair the bikes.

T: Around Piazza we also have some maintenance area. [...] for the bike sharing the city centre is the best place, our aim is to remove on-street-parking and use the place for bikes. There also people can use their own bikes as well.

A: Thank you so much for your time.

Comment: The interview is shortened by the interviewer, due to the sake of understanding, the interviewee is repeating the sentences quite often and speaks unclear English.

Interview Thomas Melese G., Mobility & Infrastructure Dev't adviser, Transport Programs Management Office via GIZ-CIM Program, 11.06.2019, Addis Ababa

A: What is your position at the Transport Project Management Office?

T: I am Mobility and Infrastructure Mobility Advisor in the Transport bureau, in behalf of giz

A: Do you think does a bicycle culture exist in Ethiopia and who are the people cycling already?

T: If the question is, in whole of Ethiopia, yes definitely there is a cycling culture with huge experience in cycling. But in Addis it is very low, as you have noticed. But if you go to Bahir Dar, Hawassa, the secondary cities – they have a very big cycling culture. Most of the people use it. Especially the mid-age group. Also, the older people use it. But there is a development of people who prefer using Bajajs or Motorcycles. They are taking up more and more the space of cyclists. So people don't feel safe anymore.

A: So, there is also intervention needed in the smaller cities? But you must start with some regulations, right?

T: For Addis, Somehow, we must start somewhere, we have the worst cycling culture- so we must shake it somehow.

A: Where do people cycle to? Work, school, leisure activity?

T: Look at my survey I have provided, I will send it to you.

A: Did you ever use a bicycle in Addis?

T: In Addis, yes – a few times, but not often. Because of the bad infrastructure and safety issues.

A: Do you think there is a political will of really investing in cycling infrastructure?

T: After what we started yes, there is a big commitment! Even from the prime minister, he gave a direction for the transport minister to come up with something like pilot projects. So, we had a meeting last week with the federal transport authority, what kind of support they have to provide.

A: So, there is some money for those projects?

T: And, the legal framework, they want to improve that, for supporting bikes, like duty free bikes. Also inviting investors who can assemble bikes, like opening a factory.

A: That would be awesome.

T: We told them to take such kind of initiative. So, there is some will from the top, yes.

A: After developing the NMT-strategy, what to you think will be the main obstacles

you will face?

T: The obstacles, the NMT-strategy came up recently, so the last two three months, the implementation plan is under development, once we have that document by next year we will going to comment, but I don't see that as such big challenges. Once we have the government commitment, I hope we can achieve that.

A: Ok, so positive thinking! No obstacles.

T: Maybe the obstacle could be the right of way in providing enough space for pedestrians and cyclists.

A: In which time frame do you think you can really start implementing the first kilometres of separated cycle lanes?

T: We are planning by the coming year or end of this year. October, November...

A: How would you identify suitable roads for cycle lanes? In the NMT-strategy you say you want to implement them on arterial roads?

T: No, not only in the arterial roads, we have different kind of plans. We also want to introduce cycle lanes in local districts, because this road is where you have vehicles with low speed, so that is safer. So, for big roads it is high speed traffic, so we must segregate the cycle lanes and on the smaller roads they can share the space with the cars.

A: What is your plan about the bicycle sharing programs? Where and when do you want to implement it?

T: We are planning on doing it for the urban centre, since this is more feasible. People who commute to work from the outskirts only use the bikes for one way and so the bike is standing still, for the rest of the day – that is not feasible for the provider of the sharing system (remembrance protocol of further conversation)

A: Do you have a traffic policy and what does it say about cyclists?

T: At the moment we just develop the transport strategy. But we already have the traffic safety strategy and also climate resilient Addis strategy, somehow, they are going to address cycling as means of transport. Especially the NMT strategy addresses cyclists.

A: But these strategies are not really binding instruments, right?

T: When we come up with an implementation plan, we are going to make it binding somehow

A: In Germany for example we have a policy where you have to pay fines when you park on the cycle lane. Will you have something like that as well?

T: At the moment, since we don't have much cycle network, there is no way you can implement that. But we are going to implement that somehow.

A: That is also the next question. Are you willing to adapt the law so that there is

priority for cyclists?

T: Yes, definitely we will do that.

A: How much does an average bike costs in Addis?

T: In Addis, in average cost would be – like my brother just bought a bike for 6.000 Birr, which is like 200 Euros.

A: That is a lot for people with normal jobs, right?

T: Yea I would say it is expensive.

A: And where to get the bike? Are there bike shops?

T: Yea there are shops and markets, but because of the duty this it what makes it expensive.

A: So there has to be tax reductions on the bicycles?

T: We must adopt that kind of measures.

A: And the communication? How important are the communication and engagement activities? Like Open Street Days and other awareness rising campaigns? Do you think you can reach different groups of citizens with it?

T: At the moment the car-free day is becoming one platform to promote cycling and walking. So, we just inviting every group of society in Addis, weather it is Kids or adult people, we are providing the space for them. In addition, we are inviting sporting activities as one way of promoting walking and cycling. In that way I would say we are addressing every group of people.

A: And hopefully that will change their minds and opinions....

T: You know people start buying bikes for their kids, even though they are not riding bikes every day, but just to letting their kids' practice. Especially at the condominium site.

A: Thank you very much.

T: You are welcome.

Interview Nabil Ishak, Solar Development PLC, 15.06.2019, Addis Ababa

A: How much does an average bike cost here in Addis?

N: I bought my bike for close to 20.000 Birr. We have some bikes for around 40.000 Birr. Some of our club members bought their bikes for around 100.000 Birr, but that is rather rare. And they might not have payed the full price. We invite some international riders to our trips over the weekend. So, for that trips people from Canada, Italy, Spain and so on come to ride with us and when they leave they sell their bikes to our team members.

A: That is a win-win situation. They sell their bikes to you and you take them on a ride knowing the country and situation. So, there is no bicycle industry in Ethiopia, right?

N: No, there are some bike shops, even that is not a lot. Very view bike shops. And a lot of those bike shops you don't get they high-quality stuff that you need. Within our group there are a couple of guys who are in the bike-shop market, so they import, and they sell bikes. So, most parts and bikes we buy from them. But there are not a lot of choices.

A: And that is why they are so expensive, right? Because all they part and bikes need to be imported.

N: Exactly and due to the lack of access to certain currencies, everything is expensive in Ethiopia.

A: What do you think, is there a possibility that there will be a market in the future? That the bicycle industry will grow?

N: Ethiopia is currently going through a phase of awareness creation. Not especially for bikes, but for sporting, for exercises. They even have days where they open the streets and ban the car for pedestrians, bikes and exercise are aloud.

A: Ah you mean the Open-Street-Days?

N: Exactly. This is to create awareness. So, there is a lot of people being aware, a lot of exercises. Weather it is running, bike is not there yet. Mainly it is running. But for groups like us, I really hope that there will be more bikers on the road, that there will be more bike lanes and that there will be more awareness by the drivers for bikes. We hope that the behaviour will improve. It is a long-term thing.

A: Definitely it is. [...] The motorisation rate in Ethiopia is still low. So, there is the chance of leap-frogging the motorization phase that we had in for example European cities.

N: Yeah that is right, not everyone here can afford to buy a car. With the little number of cars, we have on the roads, the roads are already congested. We don't have enough access and the road network is not good or well developed. So, this

is the chance for us – forget about the cars and go straight to using the bikes. But I don't know how easy that is. Because people who never had cars, don't aspire to have a bicycle. They aspire to have a car! People like us, who are already driving, are the once who go back to the bicycle. I don't know how the opportunities' going to be to convince people to forget about cars and go back to the bicycle.

A: Maybe just show the bad examples of European cities. There are so many car dependent cities. Over the last 60 years planners made so many mistakes and focused the planning too much on cars. It is so much effort now to rebuild the whole infrastructure.

(06:10) N: From where you and I stand, this perspective and totally right, but from where they stand, it is totally different. By the way, my background, I am of an Ethiopian background, of Ethiopian parents. I was born here, but I grew up in Melbourne, in Australia.

A: Ah, I see.

N: I came back eleven years ago. I always preach to youngsters: when you do businesses in Ethiopia, you don't have to dream to go to America, Australia or Germany, there are a lot of opportunities here. And people like us, in diaspora, are looking to come back to Ethiopia and invest, while you guys are thinking of leaving and this is where the opportunities are. And they won't listen to me. They always say, yeah you say that because you have been there, you have lived in Australia. You brought some capital with you. They always say, we want to go there as well and then decide where we want to do business. I think bicycles are going to be the same.

A: That is a good point. I think that is the same with a lot of things, everyone wants to make its one experiences.

N: It is all about aspiration as well, they aspire to have a car one day.

A: Well, because that means a certain standard in the society or status.

N: But you know. Some cities. Even cities that used to be more of a bicycle city in the past, are now changing. Like Bahir Dar, used to be a bicycle city, a lot of people used to ride. Hawassa used to be bicycle city. Now it's either motor bike or the car. So, people are moving away from bicycles you know. Which is a pity.

A: That is really a shame. But what is your hope for Addis? In what way you want to see the city change in the next years?

N: The city? In terms of bike? [exhales loudly] I think there are a few things I wish would happen. We talked about people who aspire to have a car, not a bike. But if we would have a lot of bike shops or outlets, who are developing the bike industry, if we would have the manufacturers, bicycles manufacturing is not that difficult. We are assembling cars here, I don't know why we can not assemble bikes! I hope for

a growing bicycle industry, with shops, factories, technicians, engineers and so on. I struggle to maintain my bicycle, there is only one guy I trust, I can take my bike to. I don't care if he is in a shed of a big building, important is the job he does. I need the spare parts.

A: That is also a good job market, isn't it?

N: Yeah, spare parts! Now I must bring my spare parts from outside. So, when I go to Germany, I want to buy helmets, shoes for my pedals, spare tires and tubes, all those things you can't find here. I bought my stuff last time when I was in Italy. Another thing is, like you said, the job opportunities. People employed in bicycle repairs, in shops. The small number of shops we have here, only have a standard bicycle. Very cheap standard. Which is totally fine for commuting every day, but for people like us, that is not enough. That is about the market development. The other one is about the environment. I wish that the authorities realise, that when they are constructing new roads, that they consider bicycles for future cities. To accommodate that future need. Unfortunately, in Ethiopia, we don't think about tomorrow, we only think about right now! Right this minute.

A: Why is that? What is your explanation?

N: I think that is the culture.

A: Maybe also the investors? I heard a lot about the Chinese who are investing, in the road for example, and they are doing it rather cheap and quick, than proper and sustainable.

N: I don't think that is the Chinese who are investing, it is the Chinese who are constructing. The contracts are the government contracts. So, if the authorities decide we need bike lanes, then whether it is the Chinese or anyone else who is constructing it, they have to do it.

A: So, you kind of blame government for the development?

N: I think the authorities have to understand, recognize and realize that this is what is better for the people and for the city.

A: I have the feeling, that they start to do that now, but it is still a long process.

N: I really hope so. There are small signs here and there, they have tried to organize bike lanes. Even though those bike lanes are underused, cars park there, you know the lanes are not respected. In some areas, where I live for example the Summit area, they have separated bike lanes. The best way. But then some entity comes and makes some development in the area, so they dig the road, but they don't put it back the way it used to be. So, somebody comes in and dumps something, sand and gravel and it becomes unusable. If they could maintain it like this and insist that it stays like it would be used so much more. We do this a lot – we start something, and we don't finish it.

A: Maybe some fines and fees for illegal behaviour would help.

N: You know the traffic police were going to regulate the traffic, that the pedestrians are crossing the streets at the zebra crossings. They would go out in numbers, I see police everywhere, they do the right job and then a couple of weeks they are not there anymore. That is the same with the bicycle lanes.

A: So there is a lack of consistency?

N: Exactly.

A: But we don't want to be only negative, right. Do you think there is some hope for the future of cycling?

N: We are not the only bike group. So, there is some hope. There are many groups out there. And the encouraging thing is the young people I see on bikes. Like I said earlier, I wish they would use proper gear, like helmets.

A: I think awareness is a big topic. People also need role models, like you. If they see someone with protection, they are more likely to copy that. What do you think is the best way to influence people, via social media maybe?

N: Yeah social media is important. I think it is multifaceted. The authorities need to be aware and investing in the infrastructure. Public awareness is very important. Training and development. Schools are the best places to start with.

A: Do you learn cycling in school, actually? We in Germany do a cycling license in elementary school. When did you learn cycling?

N: I did it as a young boy in Melbourne. When I came back here, I found this group and started cycling with them and alone.

A: Do you know about kids here? Do they learn how to cycle?

N: Ehm they do it in the suburbs, close to their homes. They have tricycles.

A: But it is more for playing, than as a mode of transport?

N: Yes. The other thing I hope we can do is to bring cycling as a sport. We have sport clubs for running, for soccer, so I wish we also could make cycling popular like this. There are some cycling clubs, but there are not many. They are underfunded, they don't have equipment, the science behind it is not here yet. Maybe we need some innovative ideas. Public awareness. But maybe as you know, most developments in the world are driven by privatisation. If it is not a private sector, maintaining is very difficult. You can't always continue with this NGO mentality. It must be run by private. If the private sector finds access to a market for repairing, for supplying, for spare parts, then it is possible.

A: Ah that is an important point. So, if big bike companies would start investing or settle here, the industry could be enhanced. And then the rest will follow. If the demand is there, the market offers more and then more infrastructure is needed and so on. Thank you so much for the conversation.



Zebra Crossing in Addis Ababa, 2019 © Swart

