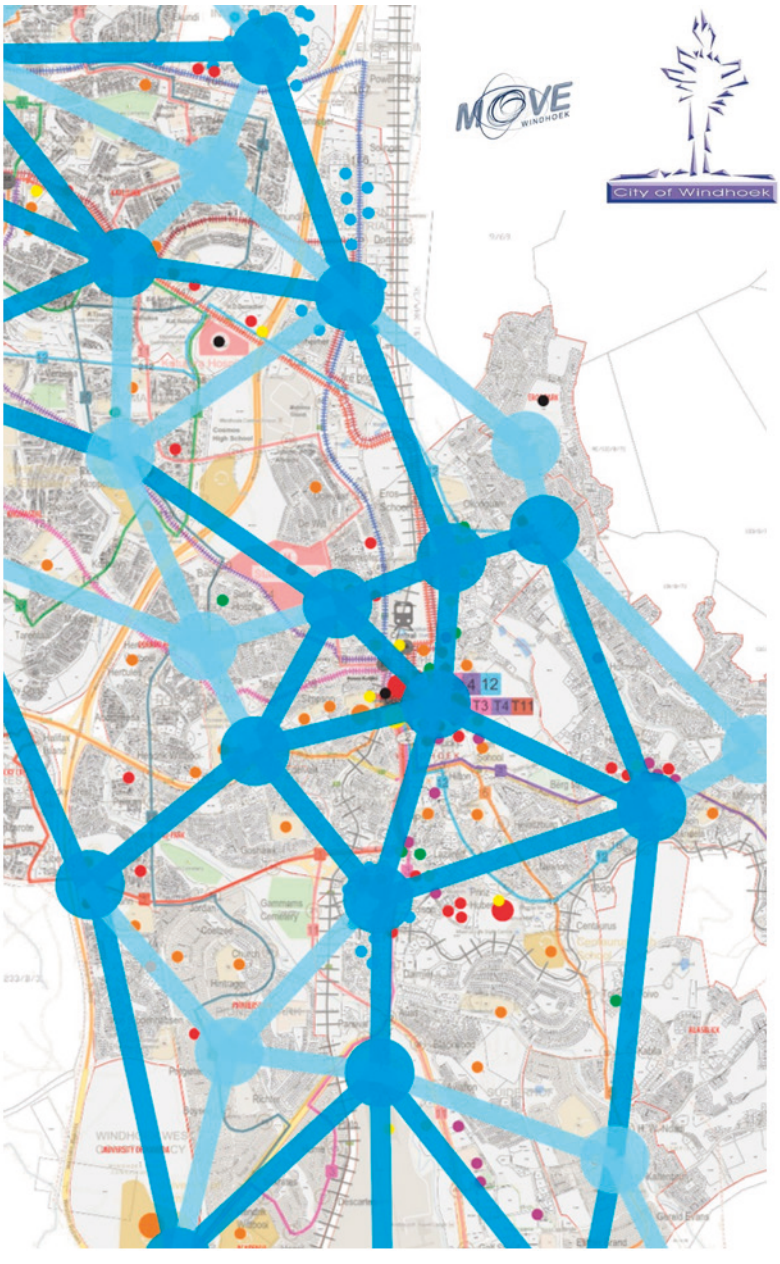
Federal Ministry
for Economic Cooperation
and Development



How to plan and develop a pedestrian and cycling network

- Basis for the Development of a NMT Strategy for Windhoek -

Published by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

SUTP. 15 years serving the sustainable urban mobility community

SUTP

15 years serving the sustainable urban mobility community

Sustainable Urban Transport Project

SUTP supports decision-makers worldwide to plan and to implement innovative and sustainable mobility solutions. SUTP offers a comprehensive knowledge platform, capacity development, hands-on advice and networking opportunities. Within the past 15 years, more than 5,000 decision-makers, planners and students have benefited from our training offers. We've produced a rich library of Sourcebook Modules, Technical Documents, Case Studies, Factsheets, Policy Briefs and Reading Lists. All documents are accessible through our webpage, along with a comprehensive photo collection and a video channel.

Be invited to use and distribute them!

http://www.sutp.org

About the author

Ernst-Benedikt Riehle studied Geography at LMU Munich and obtained his M.Sc. in Spatial Planning at TU Dortmund. He is working as Technical Advisor at the GIZ Transport Project in Namibia since 2014. Before he joined GIZ he worked as a Transport Planner with specialisation on non-motorized transport (NMT) concepts. He can be contacted at ernst-benedikt.riehle@giz.de. The paper was elaborated to support the City of Windhoek in their ambition to develop a NMT strategy.

Acknowledgements

We would like to thank all those who have reviewed earlier versions of this document, including ***Armin Wagner*** and ***Mathias Merforth***.

How to plan and develop a pedestrian and cycling network

- Basis for the Development of a NMT Strategy for Windhoek -

Disclaimer

Findings, interpretations and conclusions expressed in this document are based on information gathered by GIZ and its consultants, partners and contributors.

GIZ does not, however, guarantee the accuracy of completeness of information in this document, and cannot be held responsible for any errors, omissions or losses which emerge from its use.

Copyright

TABLE OF CONTENTS

1. Introduction . . . 1
2. Basics of NMT Network Planning . . . 2
3. Cycling Network . . . 3
3.1 Network requirements . . . 4
3.2 Different cycling needs . . . 4
3.3 Planning of Cycling Networks . . . 5
3.3.1 Analysis of urban structure . . . 5
3.3.2 Analysis of potential cycling users and estimation of volumes . . . 8
3.3.3 Definition of Points of Interest . . . 9
3.3.4 Drawing of the network . . . 9
4. Pedestrian Network . . . 10
4.1 Pedestrian Needs . . . 11
4.2 Network requirements . . . 11
4.3 Planning of Pedestrian Networks . . . 12
4.3.1 Analysis of urban structure . . . 12
4.3.2 Analysis of pedestrian groups . . . 13
4.3.3 Definition of desire lines . . . 13
4.3.4 Drawing of the network . . . 14
5. Conclusion . . . 14
6. Sources . . . 15

TABLE OF FIGURES

Figure 1: Outcome of Cycle Campaign “30daysofbiking” 1
Figure 2: Street Scene Monte Christo Road Windhoek 2
Figure 3: Example from Colombia: NMT policy components 3
Figure 4: Section of Independence Avenue in Katutura, Windhoek, which offers potential for improved NMT use 4
Figure 5: Extract from land use analysis for Windhoek - SUTMP (MWT 2013: 25) 5
Figure 6: Potential Points of Analysis - Analysis of potential Origins and Destinations for NMT use in Windhoek 7
Figure 7: Idealistic, hierachical leisure time NMT network for Windhoek 8
Figure 8:Idealistic, hierarchical work day NMT network for Windhoek 9
Figrue 9: Core NMT network Windhoek 10
Figure 10: Pedestrians on a road in Windhoek (GIZ Transport) 11
Figure 11: Accident hotspots - A section of Monte Christo Road in Windhoek showing the interlinkage between accident hotspots and pedestrian crossings 12
Figure 12: Aerial picture of informal pathways Northern Industrial Windhoek (Polytechnic of Namibia Department of Architecture and Spatial Planning) 13
Figure 13: Drafted Desire Lines for pedestrians of a quarter in northern Windhoek 13
Figure 14: Prioritisation of Core NMT network - Defined priority implementation areas for the NMT network for Windhoek 14

1. Introduction

Walking and cycling is on the one hand the most basic and traditional form of transportation and on the other hand the most efficient form of transport for short distances. Both aspects are crucial when looking at the relevance of non-motorized transport (NMT) in developing environments.

"In most, if not all, urban areas of Africa, non-motorized transport (NMT), particularly walking, is the dominant mode; walking makes up between 50% and 90% of daily trips." (SSATP 2015: 18).

In developing economies however non-motorized transport is often seen as a mode of transport for low income population, due to "captive-ridership [i.e. no other options to choose from than NMT], [which] is often heard as the main reason for walking or cycling" (I-ce 2000: 100). Due to that "it appears that in a growing number of countries economic development goes hand in hand with motorization of transport (…). The dominant position of motorised traffic is one of the major deterrents for NMT" (ibid.). This goes along with biases and constraints in planning and design of urban transport infrastructure, seeing NMT as inappropriate for developing economies and favouring the use of motorized transport.

Yet the benefits, such as economic efficiency and improved accessibility, can be of central interest for low-income households and a key to the perception of NMT as proper addition and alternative to motorized transport. simple promotional activities and events already proof the feasibility and the advantages of NMT usage in Windhoek (s. fig 1) and enhancement of people's accessibility and mobility can be achieved by improving NMT systems. Therefore the basis of NMT development needs attention.

"Most African cities lack adequate sidewalks, or signalized and safe intersections, and accessibility to public transport stations is inadequate. Road intersections and pedestrian pathways (where they exist) are often usurped by motorists using the space as parking, or by street vendors using the space for trading" (SSATP 2015: 18).

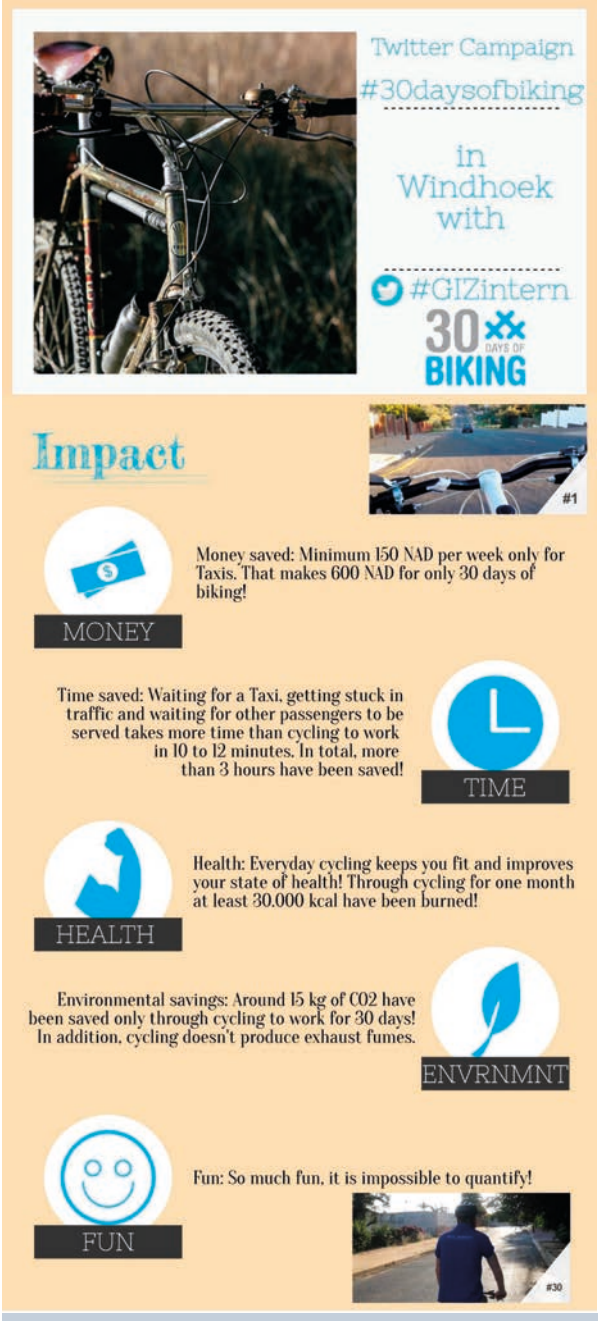


Fig.1: *Outcome of Cycle Campaign "30daysofbiking". Source: Tilmann Müller, GIZ Transport Namibia 2015*

Fig. 2: *Street Scene Monte Christo Road Windhoek .Source: GIZ Transport August 2015.*

The same applies for Windhoek. In this regard it is important to cater for the needs of pedestrians and cyclists in order to offer safe and functioning infrastructure for the existing extensive NMT demand, to strengthen NMT mobility as an alternative for motorized transportation and therefore relieve the pressure on the city's transportation system, which is dominated by motorized transport. With almost 30% of traffic users being dependent on NMT, mostly in the sense of walking (s. MWT 2013: 36), and NMT modes being the most affordable mode of transport for 87% of the population (MWT 2015: 6), the provision of proper NMT infrastructure is of high importance for a secure and functioning transportation system in Windhoek.

Moreover the development and improvement of NMT networks will improve the accessibility and mobility of the citizens of Windhoek and can also contribute to the improvement of road safety, which is a remaining challenge and of high relevance, as "cyclists and pedestrians are vulnerable to road crashes due to the lack of facilities and poor bikability and walkability conditions" (MWT 2015: 6). Cyclists and pedestrians account for up to 28% of fatalities in road crashes nationwide (MWT 2015: 20) and around 34% road accident fatalities in Windhoek were pedestrians in recent years (MWT 2015: 76).

The outstanding need for the NMT development was already recognised by the City of Windhoek and Ministry of Works and Transport (MWT) in the development of the Sustainable Urban Transport Master Plan (SUTMP). Intended implementation now sets the need to follow up with recent city developments, to analyse in detail the urban structures and demands of NMT users and to develop a comprehensive network for pedestrians and cyclists in order to have a detailed concept at hand for implementation and to strategically develop and improve the NMT System in Windhoek.

NMT development is a crucial basis for every urban transport system - especially in emerging environments. However, despite high demand and its effective means, it seldom is a first step approach, due to resources or capacity constraints. In the following a simple, flexible and replicable approach to effectively develop a basic NMT network is presented, which enables short-term achievement despite respective constraints.

2. Basics of NMT Network Planning

Prior to the planning exercise the following principles need to considered. NMT Network Planning cannot be done on the basis of conventional road infrastructure development, as pedestrians and cyclists have different network requirements and demands than users of motorized transportation. It is important to first look into the desired and ideal connections before breaking down on the existing infrastructure.

NMT Network Planning follows a ***destination-oriented approach***, which assumes that between certain Origins and Destinations present as well as potential demand for walking and cycling exists, which needs to be covered by a NMT-friendly network.

Therefore origins and destinations of pedestrians and cyclists have to be analysed and form the basis of the NMT Network.

The following three aspects need to be considered during the planning process:

1) Cyclists and pedestrians have a high detour sensitivity. As a matter of fact especially pedestrians tend to take the shortest way possible, often leading to the creation of informal pathways.

2) People are more likely to walk or cycle if these modes offer the most direct and shortest connection (length and time) to their destination and therefore are of advantage compared to motorized transport modes.

3) NMT development is not only catering for existing needs, such as the high number of pedestrians in Windhoek, but also developing potential demands, such as an increase in cycling usage, as improved infrastructure and direct connections will, often aligned with restriction of car-usage, increase the interest in NMT usage.

NMT network planning is a tool for the improvement of urban transport systems through catering for NMT demands and thus enabling citizens to walk and cycle in a safe environment with consistent, direct connections.

The improvement of NMT networks and the increase of NMT users is not only done by the provision of networks and respective infrastructure. The improvement of the transport system, to cater for pedestrians and cyclists, needs a comprehensive approach that also makes provision for complementing services (shelters, streetlights, bike parking, signage etc.), continuous operation (planning, maintenance, enforcement) and involvement of the civil society, awareness raising as well as education through information and communication. A core element among these pillars is the existence of quality standards for design, construction, organisation and communication. If these are not already in place they constitute another important pillar.

Therefore it can be stated that the development of an NMT Strategy consists of four main pillars that need to be achieved simultaneously:

- Infrastructure (Networks)
- Quality Standards
- Services and Operation
- Information and Communication

The definition of the pillars may vary due to the context, envisaged process and stakeholders involved (cf. Fig. 3).

Fig. 3: *Example from Colombia: NMT policy components (Infrastructure and services, Citizen participation, Regulation/ Institutions, Monitoring/Operation).* Source: IDB (2015)

A comprehensive approach is the core characteristic of a proper NMT strategy and the NMT Strategy for the City of Windhoek will consist of these pillars.

This document is a short complementary guideline that describes the way forward on how to achieve the **first pillar** – the development of a NMT network in accordance with international standards on qualitative NMT infrastructure.

The development of a cycling and pedestrian network goes hand in hand, as they both follow the same approach. Nevertheless each network creation requires a different focus in analyses.

3. Cycling Network

Cycling networks are either developed to match the demand of an increasing number of cyclists, to provide the users with high quality and safe infrastructure, or they are developed in order to create cycling demand and actively increase the number of cyclists, to create a cycling friendly environment and develop cycling as a proper alternative for motorized urban transport as well as a feeder to public transport systems.

In Windhoek the number of persons cycling on a daily basis is low so far. Yet there is the potential for increased cycle use, as distances within the city are rather short, a distinguished number of people tend to use cycling in leisure activities and the overall road infrastructure is of good condition and can offer and accommodate suitable bike infrastructure.

3.1 Network requirements

The development of a proper cycle network leads to certain requirements that the future routes need to fulfil in order to be regarded as a qualitative cycling network:

Fig. 4: *Section of Independence Avenue in Katutura, Windhoek, which offers potential for improved NMT use.*
Source: GIZ Transport Namibia 2016.

- Due to the high detour sensitivity origins and destination are to be connected in the most direct way. In total the routes shall form a comprehensive, coherent and consistent network. Parallel routes should be avoided.
- There are natural and manmade obstacles that need to be bypassed or crossed through constructed measures,
- Roads with an enforced speed limit of 30km/h or less are regarded as cycling friendly as the likelihood of severe accidents is low. These streets do not need additional infrastructure for cyclists (s. fig 2),
- Existing infrastructure is to be integrated into the network in order to keep the costs for infrastructure development low,
- Trip combinations shall be promoted through the networks (e.g. Home-Work-Shopping-Home),
- The Networks shall help to diminish accident hot spots,
- Provision for the connection between different modes of transport shall be enabled (bike-bus-walking, …),
- The networks need to be complemented where applicable by street lights, weather protection, bike-parking facilities, as well as other informational and communication services (e.g. traffic signs),
- And also the optic quality of the urban surrounding influences the decision on routes and may be considered in the decision on routes.

3.2 Different cycling needs

The user requirements on the networks need to be differentiated between different demands. In most cases a distinction can be made between:

- workday cyclists, who use cycling on a daily basis for commuting to work and other daily points of interest,
- leisure cyclists, who use cycling mainly as leisure time activity and "place more value on open space, boulevards, parks and routes separated from traffic" (RSA 2014: 27),
- and scholar cyclists, who are mostly younger and "less adept on their bicycles than adults and therefore need greater protection and more careful planning" (RSA 2014: 27).

These differentiations may also apply for Windhoek, although the focus should be firstly on the implementation

of a network that caters for education and work trips, due to the existing transportation challenges.

A network for workday cycling to educational facilities, work and shopping, needs to firstly offer direct connections, avoiding detours, it needs to offer high infrastructural quality and social control (safe cycling), whereas leisure networks are required to firstly provide attractive routes and have less quality requirements than workday routes. Moreover usually destinations for workday and leisure time differ and therefore create different routes.

Thus a proper cycling network needs to differentiate at least between **workday cycling network** and **leisure cycling network**.

3.3 Planning of Cycling Networks

The citizens' needs for trips, their length and duration, arises out of the urban circumstances the people live in, e.g. their proximity to modes of transport, the local distribution of daily points of interest, the functional distribution throughout the urban structure (residential, commercial, industrial areas), but also their physical ability and their socio-economic conditions (income, employment, vehicle ownership…). The structure of a city influences the demand for transport and the patterns of mobility, the physical and socio-economic aspects determine mostly the choice of transport modes.

The development of a cycling network is done through a destination-oriented approach (s. above). Based on the potential origins and destinations, daily points of interests are defined, which will be connected through an idealistic network, which later is laid out on the existing road infrastructure. The basis for the analysis of potential origins and destinations is a comprehensive analysis of the urban structure and potential cycling users.

As detailed as the analysis of these aspects is, as detailed can the estimation of daily travel demands and the determination of origins and destinations be accomplished and differences in demands be envisaged.

However, even a practical approach, defining the Origins and Destinations through insider knowledge or discussion among stakeholders, will lead to a first valuable outcome to define a basic network.

Fig. 5: *Extract from land use analysis for Windhoek - SUTMP (MWT 2013: 25)*

3.3.1 Analysis of urban structure

a) Analysis of land use and daily facilities

The analysis of **land use patterns** provides a comprehensive overview on the structure of the urban environment, e.g. whether residential areas are in proximity to major points of working day interests.

Land use patterns to analyse and map are at least:

- Residential areas
- Commercial Areas
- Industrial Areas
- Public Open Spaces (Parks, Pedestrian Zones…)
- Waterbodies

The analysis of land use patterns alone might not be sufficient to define points of interest, yet is an important aspect to understand the structure of the city. During further procedure more specific locations have to be anaylised.

Within a city there is of a multitude of daily points of interests for its citizens, which can be categorized according to funcitons.

The table below offers a feasible separation of functions and lists various daily points of interests that need to be analysed and mapped in order for planners to be able to differentiate between different uses and for a proper understanding of the distribution of the potential origins and destination throughout the city.

If applicable existing cycling routes should also be mapped and analysed. Yet with Windhoek having, apart from some isolated sections, not a determined cycling network in place, the development can be done from scratch. Other aspects might also need to be considered, such in the case of Windhoek, the new developed Bus network, into which the NMT network needs to integrate.

Land use patterns and potential Points of Origin and Destination need to be compiled in a map, which sets the basis for network development. Color differentiation enables a quick perception of the distribution of origins and destinations (sf. Fig. 6 on the following page.)

***Common potential NMT Points of Origin and Destination* can be defined as follows:**						
Public Facilities	**Educational Facilities**	**Mobility Facilities**	**Sport Facilities**	**Leisure destinations**	**Cultural Facilities**	**Work day key centres**
■ Ministries ■ Hospitals, Med Facilities Churches ■ Public Service ■ (Post, Bank, RA...) ■ Cemeteries	■ Universities ■ Schools ■ Kindergartens ■ Public Educational facilities	■ Taxi Ranks ■ Bus Stops ■ Train Stations ■ Bus Terminal	■ Stadiums ■ Sport clubs ■ Sport hall	■ Parks ■ Lakes ■ Recreational facilities ■ Night life	■ Historical buildings ■ Museum ■ Cultural centres	■ Major work places ■ Malls and shopping centres ■ Pedestrian Zones

b) Analysis of barriers, obstacles and missing connections

The objective for the network will be to have a coherent network of connected, most direct routes that enable cyclists to easily cycle from A to B. With various natural and man-made barriers and obstacles within an urban environment it is important to analyse and map these in order to plan the routes accordingly.

"The main infrastructure barriers, such as highways, swamps, railway lines, insecure areas, amongst others, that obstruct logical origin-destination connections should be identified and added to the base map" (RSA 2014: 29).

A further aspect for the City of Windhoek is the analysis of the terrain in order to define areas that need to be detoured due to ascending terrain, which is too steep to cycle.

The analysis of barriers was already done to a certain extent during the Sustainable Urban Transport Master Plan (SUMTP), yet it should be revised in order to have an up to date overview on barriers, obstacles and missing connections.

Also new urban developements like gated communities, commercial plots or other infrastructure might have an obstructing effect, which needs to be considered.

c) Analysis of urban developments and respective travel demands

Windhoek is a growing environment, population wise and economically speaking. This leads to continuous urban developments. The elaboration of a cycling network has to go hand in hand with the envisaged urban developments, contributing to the city's vision and complying with future transport demands.

The City of Windhoek has decided on corridor development in northern and southern direction, which needs to be recognised in the network planning. Moreover informal settlements are an ongoing and increasing issue and need to be taken into consideration as well.

The analysis needs to look into:

- Strategic urban developments
- Planning and ongoing construction work and plot/ zoning developments (residential, commercial, industrial areas)
- Road infrastructure development
- Transport System developments
- Disclosure of protective areas
- Etc.

Unforeseen or not integrated planned developments can change the urban landscape in way which might hinder the development of a coherent and consistent cycling network and lead to detours that need to be avoided.

As an example a new residential development might create a new heavily populated area which requires new access for NMT. An upgrade and extension of a road might become an additional barrier for crossing NMT users etc.

d) Analysis of accident hotspots and road safety issues

As mentioned before cyclists as well as pedestrians contribute to the high amount of fatalities in road accidents and therefore have an increased demand for safe infrastructure and route networks.

The development of a cycling network will contribute to diminish accident hotspots and increase the safety of road users. In order to incorporate these aspects and plan accordingly. The current accident hotspots and major safety issues in the urban structure of Windhoek have to be analysed.

First analyses have been conducted, such as the Road Safety Assessment on major arteries in Windhoek (MWT 2015). This approach can be carried on and needs to be complemented by analysis of current accident data for Windhoek.

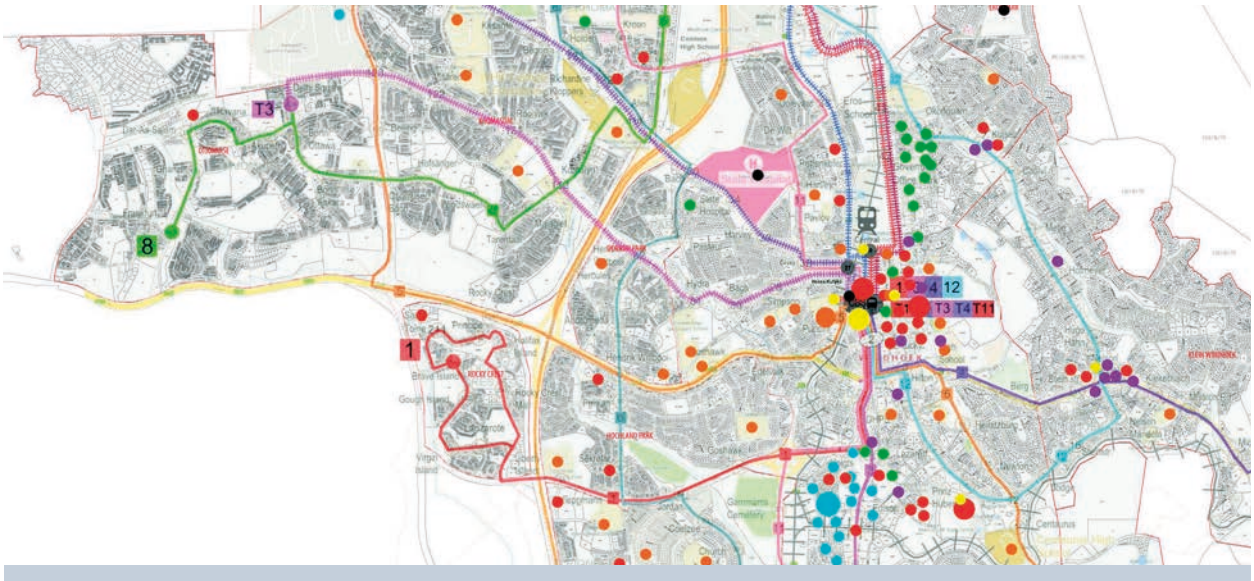


Fig. 6: *Potential Points of Analysis - Analysis of potential Origins and Destinations for NMT use in Windhoek.* *Source: GIZ Transport Namibia, EBR 2016.*

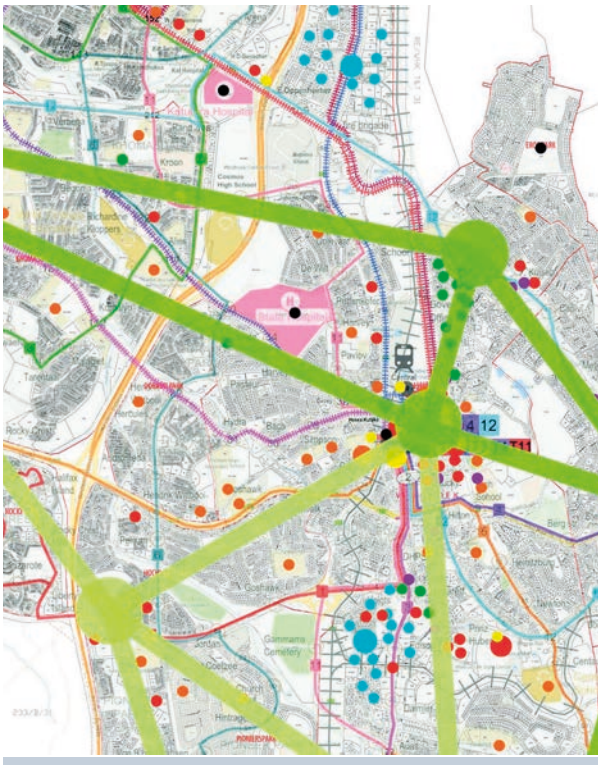


Fig. 7: *Idealistic, hierachical leisure time NMT network for Windhoek. Source: GIZ Transport Namibia, EBR 2016.*

3.3.2 Analysis of potential cycling users and estimation of volumes

The analysis of the urban structure can be complemented by an analysis of the socio-economic structure of the city's society, to derive potential cycling user groups and estimate the potential development of cyclist volumes.

This might be an aspect which cannot be conducted due to resources or capacity constraints and thus cannot be seen as a pre-requisite for NMT development. However the insights of such analysis enable are more comprehensive and detailed planning, which further enables proper prioritisation of implementation.

a) Potential cycling users

As mentioned above there are different needs of cyclists and different cyclist groups can be differentiated. With hardly existent cycling traffic, little is known about the extent of these cycling groups in Windhoek and there is no experience on the demand of different user groups.

Conducting further research might lead to the definition of more specific cyclist groups such as e.g.

- Employees,
- Small businesses,
- Industrial workers,
- Students,
- School children,
- Sport cyclists,

and to developing an understanding of their respective needs and interests.

Therefore it is a proper approach to also analyse the potential cycling users through qualitative and quantitative research and understand different needs, demands and expectations and thus get additional input on the decision for the development of cycling routes, as the analysis of potential bicycle users can contribute to the definition of the core Cycling Points of Interest of the City of Windhoek and thus to a prioritisation of cycling routes.

This helps to get a sense of

- the likelihood for certain groups to cycle
- existing constraints
- and finally to estimate roughly future volumes

b) Estimation of volumes

Creating a cycling network from scratch with only little existing cycle traffic is based on the assumption that there is potential for greater bicycle use. "Potential demand (also called latent demand) describes potential new bicycle trips, which are currently suppressed, but could take place if cycling conditions were improved" (RSA 2014: 29). In order to justify intensive network development with aligned financial investment it might be necessary to underpin the planning with research on the latent demand. In order to elaborate this latent demand qualitative and quantitative research can be conducted.

"The analysis of cycling potential seeks to quantify the nature and extent of the potential for cycling (…), by identifying trips made at present by other modes, and assessing whether they could potentially be cycled, based on a set of criteria about the person and trip" (TfL 2010: 2). This can be carried out in a travel demand survey that researches the main constraints of potential bicycle users for not using a bike. This has been done to a certain extent in student research projects and could be extended to confirm the approach of network development.

Apart from pre-estimation of cycling demand, continuous monitoring of bicycle usage during and after implementation is a proper tool to proof the increase of NMT use over time and rectify further developments.

3.3.3 Definition of Points of Interest

The different analysis steps need to be compiled into analytical maps that visualise all respective aspects that influence the development of a cycling network.

Based on the information gathered in the analyses the main origins and destination can be consolidated and defined as core cycling Points of Interests (POI) within the city: Which represent the most important areas of the city, which need to be connected amongst each other in order to provide a comprehensive, consistent and coherent cycling network that meets the user's needs and demands. Single Points of Interest in close proximity lead to the definition of a core POI, that is of city wide interest.

Certain points within the city, and their surroundings, can already be defined as major POIs due to their apparent city wide significance for daily trips, such as

- The CBD
- Universities
- Industrial and commercial areas
- Major Malls and Shopping Centres

Apart from these central points the compilation of the analysis can lead to further city wide POI, but also to the definition of secondary POI that are rather of interest for certain districts of the city.

Out of this POI definition a hierarchical cluster is developed which in the next steps leads to a first outline of a cycling network.

As there are **no given criteria for the definition of POI**, the definition is discretionary and needs to be decided in a consensus driven discussion, integrating also the point of view of important stakeholders and interest groups.

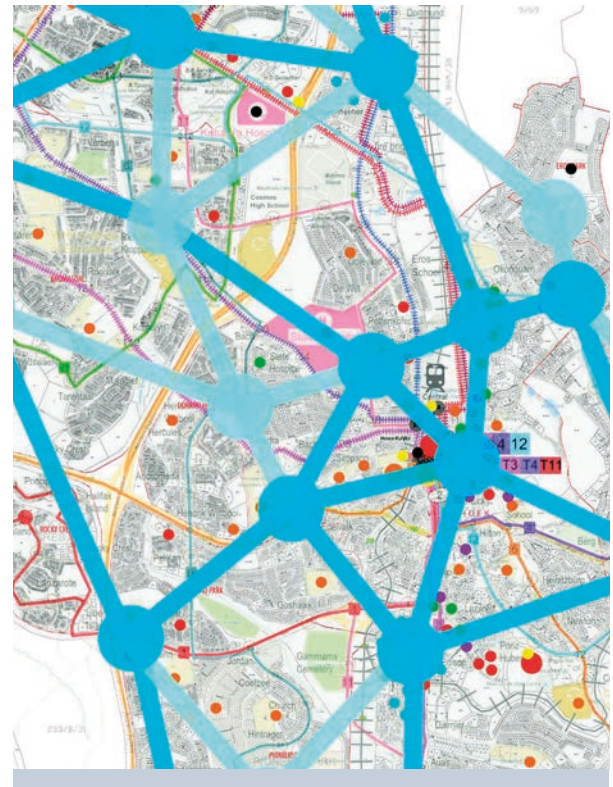


Fig. 8: *Idealistic, hierarchical work day NMT network for Windhoek. Source: GIZ Transport Namibia, EBR 2016.*

3.3.4 Drawing of the network

a) Drawing an idealistic network

Each POI of city wide interest and each POI of urban quarter interest receives a most direct connection. This creates an idealistic network, showing the urban areas which are to be connected through network. It furhter reflects the hierarchical structure of the cycling network ("Core network") (s. Fig. 7 and 8).

There might be certain POI that proof a strong connection with several POI through the entire city structure as they are of major interest for most cycling users. This might lead to a further definition of the most important route within this cycling network and can be used as a prioritisation in the implementation phase.

b) Drawing a detailed network with different hierarchies

By overlapping the idealistic cycling network with the existing road infrastructure the detailed cycling network can be developed, taking into consideration existing road infrastructure and deriving connection gaps that need to be filled through new infrastructure.

At this stage a thorough analysis of the existing road network is necessary to define:

- Road condition, to conclude the need for construction improvement
- Availability of existing NMT infrastructure, to minimise the cost
- Eligibility of roads for the accommodation of NMT infrastructure, due to size, speeds, volumes etc.
- Function of roads in the city wide network

This analysis may lead to the development of a NMT Asset Management System (AMS) that offers an inventory of the network infrastructure and enables decision makers and planners to assess the completeness and appropriateness of the network (s. RSA 2014: 31). As part of the AMS the condition assessment will be carried out on a regular basis to provide information to be used in project identification and system improvement.

Again the elaboration of the detailed cycling network is discretionary and needs to be done in a consensus driven discussion with all relevant stakeholders.

These basic steps enable the quick elaboration of at least a core network for most important connections (s. Fig 9) and provide for the definiton of a comprehensive NMT network. A core cycling network is most likely to also serve as core pedestrian network and should therefore make provision for both. In general both networks can strongly interlink, yet both perspectives should be applied as separation and individual routes for pedestrians and cyclists might be necessary.

Fig. 9: *Core NMT network Windhoek. Source: GIZ Transport Namibia, EBR 2016.*

4. Pedestrian Network

The number of people walking in Windhoek is high, yet designated infrastructure, if available, often is low in terms of standards and conditions. There is a high demand to improve the pedestrian network within short term and to make provision for safe and qualitative infrastructure that also caters for future demands and developments.

Although the ideal situation would be to ensure that each road in the city's network offers facilities for pedestrians, a network of core pedestrian routes needs to be elaborated in order to offer safe infrastructure for the major routes of pedestrians within Windhoek and thus improve road safety for this vulnerable group of road infrastructure users sustainably.

Although many people within Windhoek tend to walk for long distances, walking as mode of transport is most effective for short distance up to max. 1-2 km, depending on the urban environment and existing mobility culture. Therefore the development of a pedestrian network needs to look into the origins and destinations of pedestrians within a defined area, such as city quarters, as the majority of walking trips are conducted within this proximity (quarter-based-approach). Alternatives such as cycling and public transport have to be provided for those with longer distances and integrated into the pedestrian network.

Creating pedestrian networks on the basis of city quarters will in combination sum up to a city wide network of pedestrian routes. The focus for the definition of routes will however be on the coherence, consistency and comprehensiveness for direct and safe route on the urban quarter level.

4.1 Pedestrian Needs

Pedestrians are not a homogenous group. "Given the diversity of pedestrians, scheme designs should consider a wide range of user needs, including the needs of children, those with mobility aids and older pedestrians" (NZ Transport Agency 2008: 3-1). Infrastructure needs to make provision not only for people on foot, but also people with buggies, walking frames, in wheelchairs etc.

"Schemes should, wherever possible, be designed for pedestrians with the lowest level of ability. This removes access barriers for those with special needs, and ensures pleasant, convenient routes that are beneficial for all pedestrians" (ibid.).

Fig. 10: *Pedestrians on a road in Windhoek. Source: GIZ Transport.*

Speed and abilities are other aspects that need to be considered in planning for pedestrians. Walking speed is affected by:

- pedestrian characteristics such as age, gender and physical condition
- trip characteristics such as walking purpose, route familiarity, trip length and encumbrances
- route characteristics such as width, gradient, surfacing, shelter, attractiveness, pedestrian density and crossing delays
- Environmental characteristics such as weather conditions.

Physical abilities vary with health, age, over trip time and depending on loads that might be carried. "For example, children's heights and varying cognitive abilities at different ages need to be considered, as do declines in speed of reflexes, hearing and sight among older pedestrians" (NZ Transport Agency 2008: 3-4).

4.2 Network requirements

The development of a proper pedestrian network leads to certain requirements that the future network needs to fulfil:

- Completeness, Coherence, Comprehensiveness which comprises easy access and orientation, connection with other forms of transport and clear transitions and passages
- Directness, as pedestrians are most detour sensitive
- Less Conflict, due to high vulnerability of pedestrians

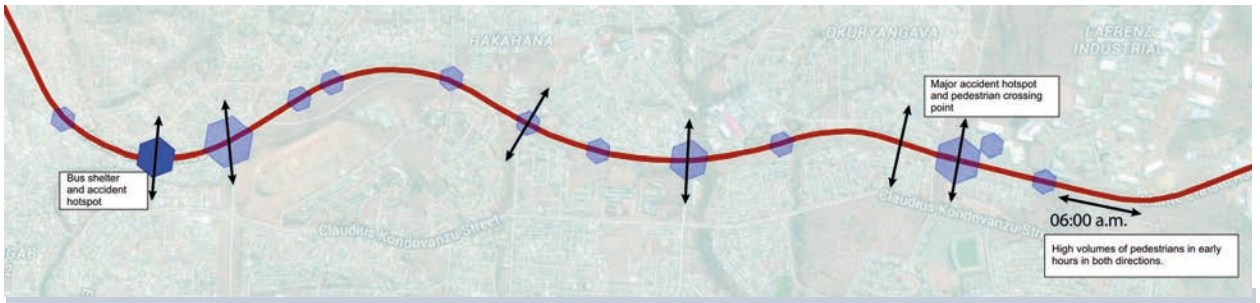


Fig. 11: *Accident hotspots - A section of Monte Christo Road in Windhoek showing the interlinkage between accident hotspots and pedestrian crossings.* *Source: GIZ Transport Namibia 2016*

- Speed Appropriateness, as this creates a safe and secure walking environment
- Attractiveness and Comfort
- Barrier Free, which strengthens the attractiveness and comfort
- Safety, which comprises of social security through good visibility , open spaces and street lights

Therefore each route should be planned in a way that

- limits encounters between NMT and high volume, high speed motorised traffic
- reduces the friction between motor or bicycle traffic and pedestrians wherever possible
- shows awareness of any freight routes that it traverses and the safety needs of pedestrians

(s. RSA 2014: 25).

4.3 Planning of Pedestrian Networks

To develop a pedestrian network a thorough analysis has to be conducted, which forms the basis of the network development. With the higher sensitivity of pedestrians compared to cyclists, this exercise requires a stronger detail perspective, despite the similar approach to cycling network development. Thus, this analysis needs to look into

- the structure of the urban quarters
- and the groups of persons walking (who walks/walks not, where and why)

Both factors determine the need for respective infrastructure and set the basis for the network routes.

4.3.1 Analysis of urban structure

"An origin-destination survey or a simple mapping of important future/current NMT origins and destinations is very useful (also for the development of a pedestrian network) looking at:

- Residential areas,
- Schools and universities,
- Offices and industries,
- Shopping areas and markets,
- Leisure, tourist and entertainment facilities, and
- Natural areas.

An inventory of these locations can be mapped using a basic land use map in a GIS-system" (RSA 2014: 22, 23).

The Analysis of the urban structure can be aligned with the detailed analysis for the cycling network. Nevertheless the quarter based analysis for the pedestrian level should closely look into the proximity of origins and destinations and keep the quarter based approach in mind.

A much stronger focus needs to be put on following aspects compared to cycling analysis:

- Proximity of origins and destinations
- Access points to public and semi-public transport
- Accident hotspots
- Barriers
- Urban development
- Existing informal pathways

It is advisable to work with spatial buffers (visual distances of different length in km around origins and destinations) to allocate the **proximity** of origins and destinations, as urban quarters differ in size.

A certain focus should be laid during the analysis on the spatial distribution of **access points** to other mobility forms such as bus-stops or taxi ranks, as walking is also used as a pre- and post-public-transport form of transport.

Pedestrians being the most vulnerable traffic participants are often facing conflicts with motorized transport. A certain focus has to be laid on the analysis of **accident hotspots** in the urban structure to take them into consideration for the network development, and ensure improvement through a pedestrian network with respective quality infrastructure.

The sensitivity regarding detours and need for direct connections is much higher for pedestrians compared to cyclists. Therefore a thorough analysis of **barriers** and obstacles in urban quarters needs to be conducted. This includes all barriers that obstruct "logical origin-destination connections" (RSA 2014: 23).

With pedestrians being extremely sensitive to detour and inconsistent routes, the consideration of **urban development** is of high importance, as the development of the pedestrian network shall cater for a long term perspective of pedestrian routes and enable most direct and consistent connections. Unexpected urban development or even uncontrolled site development can influence the network negatively.

As pedestrians tend to take the shortest way possible, **informal pathways** easily develop as alternatives to formal infrastructure. The popularity of informal routes in Windhoek can be visualised on aerial photos, which also indicate desired connections where infrastructure is not provided (see figure 12). The analysis of informal pathways is crucial for the understanding of the existing urban structure and people's demand for connections.

Fig. 12: *Aerial picture of informal pathways Northern Industrial Windhoek (Namibia University of Science and Technology (NUST))*

4.3.3 Definition of desire lines

Other than in the development of a cycling network there is no additional benefit from the definition of core Points of Interests, as the network development for pedestrians is done on a smaller scale level, thus it might not be possible to consolidate single POI into core POI that are of interest for a greater surrounding. The development of a pedestrian network can rather be done along desire lines which are derived from the urban structure and the analysis of pedestrian groups.

Desire Lines indicate the demand for connections between certain areas of interest. The connections are not strictly linked to a certain defined point, but rather a direction, as a connection might be of interest for various users although the destination varies. Desire Lines can run along existing infrastructure or visualise existing network gaps. Several desire lines can so transform into one pedestrian route, covering all areas of interests. The definition of desire lines can also be done through qualitative research, asking pedestrians to draw their desired connections on a map.

The definition of desire lines leads to a similar output as the drawing of an idealistic network for cycling, yet it is less oriented on central points of interest but rather on the visualisation of desired connections within an urban quarter.

4.3.4 Drawing of the network

The drawing of the network takes into consideration existing formal infrastructure as well as informal pathways.

Fig. 13: *Drafted Desire Lines for pedestrians of a quarter in northern Windhoek. Source: GIZ Transport Namibia, EBR 2016.*

Through overlapping the information of the analysis steps with the defined desire lines the pedestrian network will be developed.

It needs to be developed in a way that meets the needs of the elaborated pedestrian groups, takes into consideration future urban developments and offers proper interconnectivity with other forms of transport.

Based on the urban quarter approach, the networks also need to be defined in a way that the quarter networks connect to a city wide pedestrian network without gaps and barriers.

5. Conclusion

A similar approach is used for the development of a cycling and a pedestrian network, as both are developed on the assumption that there is a certain existing and future potential for walking and cycling between different origins and destinations. Nevertheless both networks have to be developed according to their respective requirements and user needs.

Despite the simplicity of the approach, which leads to effective, basic results, a thorough analysis of the NMT environment, its users and the affected transport system is recommended, as it helps to more specifically meet the users' needs and the city's future development objectives.

As highlighted in the beginning, the depth of analysis and planning might be aligned to limited resources and capacity, which requires to adhere to a practical approach for this important planning exercise. In the case of Windhoek, NMT was recognised as a crucial element for a sustainable urban transport system, which up to date is characterised by a strong orientation on individual motorized transport and thus ignoring a big part of the population. As transport system developments require long term efforts it is also necessary to develop the NMT system in a long term approach. Thus it needs section wise prioritisation, despite the definition of a core network. For Windhoek the core network was devided in three long-term implementation stages (s. Fig. 14). Moreover the entire network (cycling and pedestrian) with all its hierarchical dimension will need a clear stepwise prioritisation to adhere to limited capacities and resources. An important aspect in this regard is to maintain with each implementation step the objective of coherence and connectivity. Thus each implementation stage should lead to consistent networks, and prevent the realisation of single sections, which do not interconnect. This enhances the overall character for a sound and user-friendly network.

Following the development of the networks will be the need for thorough analysis of the existing infrastructure and the definition of required additional infrastructure. Thus the elaboration of an action plan which describes the necessary implementation measures, time frames and respective costs is the next logical step, after a NMT network has been defined.

Finally it needs to be considered that the network development and its roll-out is just one aspect for a sustainable NMT development. All pillars (Infrastructure, Quality Standards, Service and Operation, Information and Communication - s. beginning) need to be applied equally as they depend each other. Further stakeholder involvement in all phases, from planning to implementation, is a pre-requisite to ensure and enhance the practicability and appropriateness.

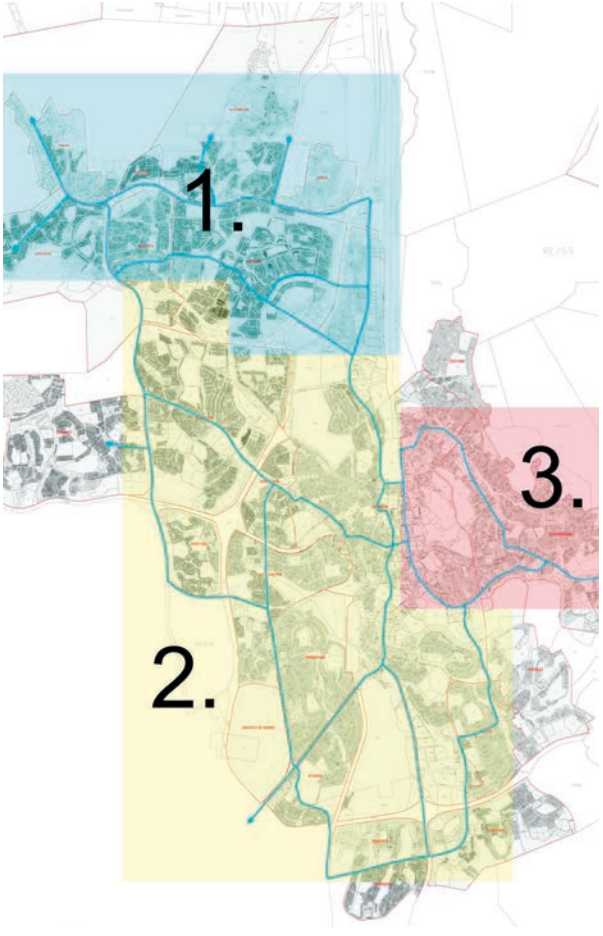


Fig. 14: *Prioritisation of core NMT network - Defined priority implementation areas for the NMT network for Windhoek.*
Source: GIZ Transport Namibia, EBR 2016.

Non-motorized transport development is an essential aspect in urban development, especially in emerging environments, which are often at a verge which provides the unique opportunity to shape the urban landscape, its transport systems and thus the mobility of its citizens. Adhering to its principles this practical approach enables cities to quickly define NMT networks and set the basis to effectively achieving step wise implementation, which in the end caters for both, present and future needs, and supports overall urban development in a sustainable manner.

Strengthening of Institutional and Management Capacity in the Road Sector Sustainable Transport in Namibia

Context

The road network represents Namibia's economic heart. Crucial to its tourism, mining and transport sector, Namibia's roads were chosen by decision-makers to cater for a huge proportion of Namibia's future economic growth as well as to assure social, political, and cultural access. The intended growth, however, has rendered an extensive reform of the road sector inevitable, an undertaking which was started by the Namibian government in 2000.

Convinced by the benefits for the entire public, the German Federal Ministry for Economic Cooperation and Development offers its financial and technical support through the Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) to the Namibian government for this ambitious task.

Starting in early 2004, GIZ initiated the project "Strengthening of Institutional and Management Capacity in the Road Transport Sector" in order to assist the relevant Namibian institutions in achieving Namibia's goals spelled out in its Vision 2030 and its current National Development Plan 4. In this context, GIZ helps to train the personnel of relevant government offices and to improve the parastatals' organisational development, assists in the implementation of their performance monitoring, to increase the safety on Namibia's roads and to improve Windhoek's public transport infrastructure.

Improvement of efficiency and resource use in the (Roads-) Transportation Sector

The focus is on supporting the Ministry of Works and Transport (MWT) and other transport institutions in their efforts to efficiently manage, plan, monitor and regulate the transport sector. Among others GIZ consults the Ministry in the field of transport policy, performance monitoring of the state-owned enterprises and supports the human-capacity and organisational development through trainings and the provision of international consultancies.

As an achievement MWT is the first Namibian ministry to make use of performance agreements for monitoring and steering its affiliated parastatal enterprises. The companies' performance has improved measurably since the introduction of the contract and the monitoring has become an integral part of the management processes within the ministry.

A new White Paper on Transport Policy has been developed, replacing the former one from 1995, a crucial basic framework for the sustainable development of the road transport sector.

Every year more than 600 Namibians lose their lives in road accidents. The poor management of road safety, law enforcement and deficits in the licensing system in Namibia are main reasons that the trend is worsening. In the field of Road Safety, the project supports the National Road Safety Council (NRSC) in the development of a legal framework responding to Namibia's road safety challenges, road safety campaigns and trainings. Furthermore NRSC develops a database for accidents which will be an integral instrument for road safety in Namibia. The traffic units of the police force are an important stakeholder for road safety. Police officers have been trained in traffic law enforcement and road safety issues and a curriculum for Advanced Training is going to be developed.

In a joint project with the City of Windhoek, MWT and GIZ developed a Sustainable Urban Transport Master Plan for the City of Windhoek. It enables decision-makers in the transport sector to develop an affordable, accessible, attractive and efficient public and non-motorised transport system for the next 20 years. The programme is assisting in the implementation of this respective Plan and involved in the ongoing plans of developing a Sustainable Transport Master Plan for the northern regions of Namibia. Within these activities the project promotes the use of non-motorized transportation (NMT) by supporting the City of Windhoek as well as NGO's in the drafting of NMT-policies and implementation of NMT-concepts.

Promotion of Civil Engineering in the Tertiary Sector

Although many obstacles to the reform process have been overcome, Namibia is still facing essential challenges to the final realization of Namibia's long-term objectives. Striving for an empowering and sustainable transport sector which is less dependent on outside experts and know-how, Namibia's government and GIZ identified the lack of adequately trained specialists, especially in the field of civil engineering, to be the major problem. In cooperation with both Namibian universities, the University of Namibia (UNAM) and the Polytechnic of Namibia (PoN), GIZ has sought to improve the teaching and research quality at both institutions in order to improve and increase the qualifications and number of Namibian civil engineers.

In this context, the Namibian institutions have been assisted in their development of Bachelor and Master curricula. Advice on the design and re-structuring of the relevant modules has focused on a student and industry centred approach as students are trained for possible tasks they might encounter in their future job descriptions. GIZ has also assisted both institutions in the accreditation process of their programs. Furthermore the project is supporting the universities in institutional development, Equipment of research facilities as well as academic exchange.

Results Achieved so far

- New Transport Policy 2016 elaborated and about to be approved by the Namibian cabinet.
- Sustainable Urban Transport Master Plan approved by cabinet in 2014, implementation hast started; the project received UITP Africa Grow with Public Transport Award for Integrated Mobility in 2013 and receives honourable mention for Sustainable Transport award 2017.
- 24 new public busses were procured jointly by Federal Republic of Germany and City of Windhoek. They are operating on the new bus system.
- Process of Master Plan Development for Northern Regions has been initiated.The number of enrolled students in civil engineering increased to more than 500 by now
- Development of an NMT strategy has been triggered with City of Windhoek and MWT.
- The number of enrolled students in civil engineering increased to more than 500 by now.
- More than 25% of enrolled students are women.
- First Namibian Master and First Namibian PhD Programme in Civil Engineering successfully implemented in 2014.

6. Sources

City of Cape Town 2005: NMT Policy and Strategy. Volume 1 – Status Quo Assessment.

City of Cape Town 2011: Comprehensive Integrated Transport Plan 2006 – 2011. Annual Update 2011.

City of Copenhagen 2011: Good, better, best. The City of Copenhagen's bicycle strategy 2011-2025.

City of London 2005: Bicycle Master Plan. A guideline document for bicycle infrastructure in the City of London. Planning Division. London.

City of Philadelphia 2012: Pedestrian and bicycle plan. Philadelphia City Planning Commission.

City of Toronto 2001: Bike Plan. Shifting Gears.

City of Toronto 2015: Toronto Cycling Network Plan. Online: http://www.torontocyclingnetwork.

info/studying-toronto/

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH 2015: Non-motorised transport policy in India. The need for a reform agenda. Sustainable Urban Transport Project – Policy Briefing No. 2.

Republic of South Africa (RSA) 2014: NMT Facility Guidelines 2014. Department of Transport. Policy and Legislation, Planning, Design and Operations.

Interface for Cycling Expertise (I-ce) 2000: The significance of Non-Motorized Transport for Developing Countries. Strategies for policy development. Utrecht, Netherlands.

Land Transport Safety Authority New Zealand (LTSA) 2004: Cycle network and route planning guide.

Ministry of Works and Transport (MWT) 2013: Sustainable Urban Transport Master Plan (SUTMP) City of Windhoek. Final-Main Report. Published by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Windhoek, Namibia.

Ministry of Works and Transport (MWT) 2015: Non-Motorised Road Safety Assessment on Main Roads around Windhoek. Published by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Windhoek, Namibia.

National Transport Authority (NTA) Ireland 2013: Draft Greater Dublin Area Cycle Network Plan. Dublin.

New Zealand (NZ) Transport Agency 2008: Pedestrian planning and design guide.

Ottawa Town Council 2008: Downtown Transit Solution and Rapid Transit Network – Recommendations. Online: http://ottawa.ca/calendar/ottawa/citycouncil/occ/2008/05-28/joint%20trc-ttc/ACS2008-PTE-PLA-0016.htm

PTV Group 2015: Excited about PTV Visum 15: GIS in PTV Visum. Posted on 2015-10-09 by Michael Oliver. Online: http://www.traffic-inside.com/tag/data/

SSATP - Africa Transport Policy Program 2015: Policies for Sustainable Accessibility and Mobility in Urban Areas of Africa. Working Paper No. 106. Published by Federal Department of Economic Affairs, Education and Research EAER. Swiss Confederation.

Transport for London (TfL) 2010: Analysis of Cycling Potential. Policy Analysis Research Report.

Transport for London (TfL) 2014: International Cycling Infrastructure Best Practice Study.

United Nations Environment Programme (UNEP) 2013: Share the road. Design Guidelines for Non Motorised Transport in Africa. UNEP Share the Road Event and TEST Network Policy Dialogue. 25-26 June 2013. Nairobi, Kenya.

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
GIZ Bonn and Eschborn, Germany

Sector Project 'Sustainable Mobility'
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
Tel. +49 (0) 6196 79-2650
Fax +49 (0) 6196 79-802650
transport@giz.de
www.giz.de/transport

Author
Ernst-Benedikt Riehle

Manager
Armin Wagner, Mathias Merforth

Design and layout
Linzee Obregon Prescott, Sophia Sünder

Photo credits
GIZ Transport Namibia, EBR 2016

As of
August 2016

GIZ is responsible for the content of this publication.

On behalf of
Federal Ministry for Economic Cooperation and Development (BMZ)
Division Water; Urban development; Transport

Addresses of the BMZ offices
BMZ Bonn
Dahlmannstraße 4
53113 Bonn, Germany
Tel. +49 (0) 228 99 535 – 0
Fax +49 (0) 228 99 535 – 3500
poststelle@bmz.bund.de — www.bmz.de

BMZ Berlin
Stresemannstraße 94
10963 Berlin, Germany
Tel. +49 (0) 30 18 535 – 0
Fax +49 (0) 30 18 535 – 2501