

NON-MOTORISED TRANSPORT FACILITY GUIDELINES: WHAT IS NEW AND WHY?

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ABSTRACT

During 2013, the Department of Transport realised that one of the issues contributing to the lack of appropriate Non-Motorised Transport (NMT) infrastructure, is the fact that the 2003 Pedestrian and Bicycle Facility Guidelines were outdated. Although the Pedestrian and Cycling Facility Guidelines (DOT, 2003) included some very good information, there were gaps that needed to be addressed. One of these gaps was the lack of design examples. Furthermore, the DOT realised that Universal Access principles need to be adopted, and that implementation will only follow if guidelines are all inclusive.

The new guidelines provide guidance on the accommodation of NMT under all conditions. This includes NMT only routes (which follow the NMT desire lines), completely separated NMT (for example along freeways), adjacent NMT facility on arterials and collectors and partly mixed motorised and NMT traffic (specifically for cyclists and the likes) at local streets. Other aspects included in the guidelines are the integration with public transport (PT) and the need for facilities (for example bicycle parking) at the trip ends. Furthermore, surface design, maintenance and operations of NMT facilities are now included in the NMT Facility Guidelines (DoT, 2014).

This paper provides a summary of the content of the new NMT Facility Guidelines (DOT, 2014) and the reasoning behind choices that were made regarding the various design aspects.

1 BACKGROUND

The Non-Motorised Transport (NMT) Facility Guidelines (DOT, 2014) are a revision and update of the Pedestrian and Bicycle Facility Guidelines (DOT, 2003). The Guidelines do not seek to set out new policy, but give effect to existing policy (some only came into effect after the 2003 Guidelines were published), by providing guidance on how to approach the design of towns, peri-urban areas (town fringes, including rural schools) and cities in a more balanced way to provide for NMT users. Integration with public transport, trip and facilities, road surface requirements, as well as operational and maintenance requirement are also provided.

These new NMT Facility Guidelines aim to improve the lives of all South Africans, a goal that is directly connected to the eight Millennium Development Goals (MDGs) identified by the United Nations in 2000 (<http://www.un.org/millenniumgoals>). The goals range from halving extreme poverty and the spread of HIV/AIDs to access of education for all. Although transportation is not directly mentioned in these people-focused MDGs, 'access' is, and access is provided through the transportation system. Access to food, education, health-care, economic opportunities and social activities are a direct consequence of improved NMT facilities. Furthermore, improved road safety is also an aim of these new NMT Facility Guidelines as contemplated in the Decade of Action for Road Safety 2011 – 2020 (WHO, 2013).

The NMT Facility Guidelines (DOT, 2014) define a new way of thinking about designing our streets and roads, and re-balancing these to address the safety and sustainability issues that South Africans experience daily (see Figure 1).



Figure 1: New Approach to Road Design
Source: DTTS, Ireland, 2013

The Guideline document supports the application of the **transport user hierarchy** when planning and designing settlements – i.e. consider the needs of the most vulnerable users first: pedestrians, then cyclists, then public transport users, specialist vehicles like ambulances and, finally, ordinary motor vehicles. This can only occur by creating a more **‘people focused’ environment** through careful NMT network planning and detailed design.

As South Africa is striving to become a more equitable nation, and with the general realisation that alternatives to the car-orientated lifestyle need to be found to ensure sustainability, road planning practice in South Africa has to gradually change towards a people focused approach, concentrated on the implementation of NMT and PT facilities.

In addition, universal design/access (UD or UA), which involves the provision of infrastructure and services that cater for the widest range of people possible, is also gaining focus and momentum. This philosophy has been included in these revised NMT Facility Guidelines.

2 METHODOLOGY

The SMEC/UCT Consortium was required to update and expand the document in order to create the new NMT Facility Guidelines (DOT, 2014). The project process involved a stepwise approach as shown in Figure 2.

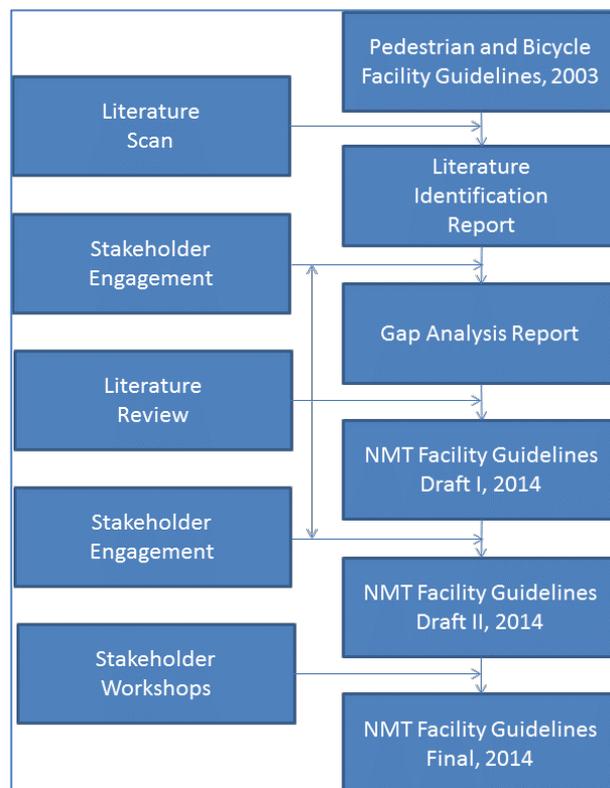


Figure 2 NMT Facility Guideline Project Process

The 2003 Pedestrian and Bicycle Facility Guidelines (DOT, 2003) were used as a starting point. To emphasise the importance of NMT, the 2014 NMT facility guidelines include an overview of mobility and road safety concerns. A literature review provided an overview of international and national documents that contained relevant information that was used to update the Guidelines while the legislation informed NMT planning and design. To make sure UD was included appropriately, national and international UD design standards were reviewed and findings incorporated in intersection and cross section designs. To enable the people focused approach, minimum dimensions were identified for all possible NMT users. This information was applied holistically from the network and route planning phase, the detailed NMT road design phase (cross section and intersection), the special (road safety) and end of trip facilities, as well as the maintenance and operations phase. The output of this process is a new guideline document with the following chapters:

- Policy and Legislation,
- Planning,
- NMT Road Design Details,
- Safety and Guidance,
- End of Trip Facilities,
- Animal Drawn Vehicles,
- Capacity,
- NMT Pavement Design,
- Maintenance, and
- Operations.

Each chapter provides guidance for planners, designers and administrators to ensure that NMT facilities are implemented to provide for a full range of user needs and trip purposes and that these facilities are integrated with existing transport infrastructure in a safe and holistic manner. Some of the particular issues in the guidelines are highlighted in this paper.

3 PLANNING

The network and route planning approaches discussed in this NMT Facility Guidelines are meant to decrease the haphazard provision for walking and cycling by holistically planning networks and routes for NMT. This is done by translating NMT demand estimates (actual or predicted) into a complete network, while also looking at constraints, such as existing road classification, in terms of high speed mobility routes, user types etc.

Planning pedestrian routes and networks requires a fair amount of data. Typical questions that need to be answered upfront are:

- Who are the current users and potential users of NMT facilities? Where are the desire lines originating from, and what are their destinations?
- What is the layout of existing pedestrian desire lines and shortcuts commonly used?
- Where do these desire lines intersect or join with public transport routes and major motor vehicle roads?

- What does the existing urban transport market and the current travel situation in terms of cost, mobility, comfort and accessibility to various modes of transport, look like - and what role does walking play in the City framework?
- What are currently hazardous road sections on existing roads where it is unsafe for people to walk, due to various reasons?
- What are the road traffic volumes and speeds?
- Where are the conflict points?
- What are the reasons for current desire lines and route choices?
- Does crash data exist?
- Does the topography influence these choices?
- What are the distances travelled and time taken to travel?
- For what trip purpose do NMT users travel?
- What are the various categories of road users?

3.1 User Needs

Part of the planning phase is identifying user needs. For example, the needs of cyclists may differ quite a bit for different purposes. In South Africa three types of cyclists are commonly seen, the recreational cyclist, the commuting (or utilitarian) cyclist and the scholar cyclist groups. The scholar cyclists are younger and less adept on their bicycles and, therefore, need greater protection, for example, through the provision of wider infrastructure, while the recreational cyclist training for a race aspires to high speeds and, therefore, smoother surfaces. Their 'terms of reference' are different.

Using the identified questions and taking into account the different NMT road users, required planning data is collected and processed into base maps, facilities, volumes, barriers and potential demand. This information is used in the next step in the planning process, the route planning phase.

3.2 Route Planning

The information collected in the previous steps can be used to develop a strategic outline (I-CE and GTZ, 2009) or sketch mapping of the main NMT network structure by linking and bundling the main origins and destinations, avoiding and/or overcoming the main barriers. A GIS system or transport model can be used to do this. Alternatively, a very simple, though very interactive method called 'Elastic Thread Method' (CROW, 2006) can be used, which works extremely well when resources are limited. The planner basically uses the base map, a soft board, a transparent sheet and a box of short coloured pins and elastic bands. The pins are used to indicate important demand locations, while the elastic bands provide the desire lines on the map. Eventually different elastic bands can be bundled according to the most logical or shortest routes. A detailed analysis of the remaining network, in terms of trip continuity, potential volumes and route purpose (hence class of facility), crossing identified barriers, use of open space, overlap and separation with existing infrastructure as required, connections with public transport stops, schools etc. will form the basis of planning a comprehensive and contiguous set of NMT facilities.

3.3 Inventory and Condition Assessment

An inventory should form the core of the NMT Asset Management System (AMS) and planning activities. The inventory should be assessed for completeness and appropriateness. High quality satellite and aerial photographs of the area are a useful method of assessing where NMT exists or where formal facilities should be provided. The inventory can also be used to assess continuity and conflicts and forms one of the primary inputs into the planning processes.

A condition assessment should be carried out as part of AMS and the outputs, i.e. a Condition Indices (CI) for each asset type should be generated to identify current conditions, degrees of separation and potential conflicts with other forms of transport etc. This is combined with usage data, such as NMT volumes, to identify projects and system improvements.

Improved asset management can be achieved by maintenance practitioners working together to consolidate major refurbishment activities, with route and capacity improvement activities, to develop a coherent set of integrated projects. This is followed by an identification of the extent of the investments needed and prioritisation of projects and levels of service provided.

4 DESIGN

The planning process will identify corridors, routes and access points of the NMT network. These networks need to be developed into a coherent set of NMT ways that allow for both mobility and access. In order to achieve this, the project level plans need to be developed into design concepts for each route and facility. The concepts should, firstly, consider the function (mobility, accessibility or both) that the particular facility will play in a manner similar to road functional classification – i.e. whether the facility is an arterial with a primary mobility function or merely an access route. Aspects, such as UD requirements, are also incorporated in the design phase.

The basis of UD arises from the premise that human beings function in a certain way in order to perform basic activities. These activities support a person in carrying out their daily tasks, and effectively result in the individual being able to be part of society. In this context, mobility refers to the movement of individuals rather than the vehicle speeds required reaching distant destinations.

UD requires a good understanding of the physical space requirements of people, for example walkway users (see Figure 3).

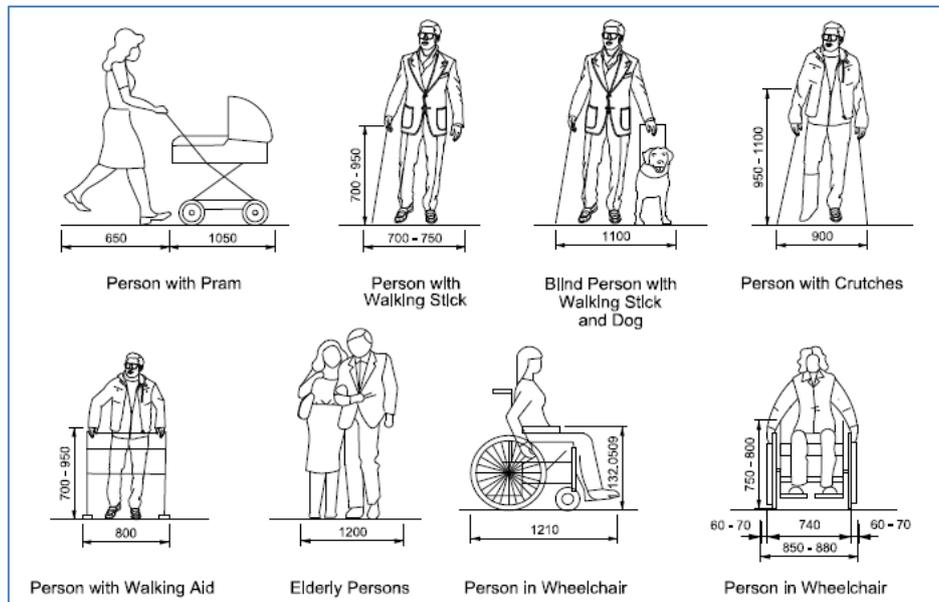


Figure 3 NMT User Space Requirements

4.1 Mobility versus Access

Roads are either provided primarily for mobility or access. However, in the South African context, many roads fulfil both functions. The concept of a clear distinction between mobility (for motorised transport) and (NMT) access roads has been given further impetus in the South African Road Classification and Access Management Manual (TRH26: SARCAMM (COTO, 2012)) by classifying roads in accordance with their primary purpose i.e. mobility or accessibility. Mobility roads have higher speeds with intersections spaced far apart while access roads have lower speeds with closely spaced intersections.

Conflict severity between motorised transport (MT) and NMT, increases as the speed differential increases and mode separation requirements need to be put in place, particularly for higher classes of road that operate at higher speeds. Therefore, NMT designs need to take the typical speeds and urgencies of drivers of motorised vehicles into account to reduce dangerous potential conflicts and serious collisions. NMT designs should not only include physical barriers that ensure separation but should make sure that the NMT facility is more attractive to users from the point of view of distances, gradients, security and ambiance so that users are discouraged from conflict situations.

4.2 Design Principles

The review of the Pedestrian and Bicycle Facility Guidelines (DOT, 2003), national and international literature, South African policies and legislation, implementation documentation, as well as stakeholder engagement, resulted in the adoption of design principles. These principles included MT- and NMT aspects. The effect on road safety, for example, is taken into account. Road safety is influenced by speeds and MT and NMT volumes and conflicts. Furthermore, NMT has direct desire lines that need to be accommodated, as much as possible. NMT facilities need to accommodate the demand. For walkways, for example, all UD users (including people in a wheelchair or with a pram), need to be able to pass each other. Similarly, for cycling, does the infrastructure accommodate passing or less trained cyclists? All

these principles results in a width requirement. A combination of various principles will inform the detailed design.

When identifying the detailed principles, the degree of separation of NMT from motorised transport is an important feature that is taken into account to ensure safety of NMT users. Table 1 shows the degrees of separation identified in the guideline.

Table 1 Degree of Separation between NMT and MT

Degree of Separation	Description
1: NMT Only	The NMT facility is separate and removed from vehicular traffic over most of its extent.
2: Total	No conflict will occur between motorised and NMT even in the event of loss of control of the motorised or NMT vehicle. It can be achieved by means of a heavy barrier or sufficient separation of 1 to 9m between the shoulder breakpoint and the NMT lane depending on circumstances.
3: Partial	No conflict can occur under normal operating conditions. This is generally achieved by means of a level difference between the travelled ways such as a kerb and sidewalk or by means of light barriers.
4: Roadmarking	Motorised and NMT traffic run on the same surface but are separated by means of continuous roadmarking and signage to identify the lane as a bicycle lane or pedestrian walkway.
5: Priority	A section of road where NMT has priority and slow speeds are mandatory - no continuous road markings only signage.
6: None	NMT competes with motorised vehicles for space on the road.

The following paragraphs provide some further insights into this:

NMT Only means that NMT has exclusive ‘rights’ to these facilities which should form the most direct and shortest route between most origins and destinations and should be routed along contours and through “porous” city blocks. Where there are no alternatives and motorised traffic intersects (conflicts), NMT should have right of way (although there are no examples in South Africa, internationally this principle has been proven very successful).

While not detracting from safety related to accidental run-off-the road accidents, where an NMT facility is adjacent to a highway **total separation** involving guard rails, fencing and grade separation are required.

Urban Arterials have slower operating speeds in the range of 60km/h to 80km/h and the kerb represents a barrier between the motorised vehicles and NMT users. In this event it is normal to place the bicycle lane on the other side of the kerb adjacent to pedestrian walkways and this represents **partial separation**.

If space does not allow accommodating these principles and the road is more of a collector/distributor with speeds of 60km/h or less, then the cycle lane can be **road-marked** appropriately painted green and placed on the same level as MT. At intersections coloured infrastructure for cycling is required. At signalised intersections, a bike box (see Figure 4) needs to be created to allow cyclists to clear the intersection first on green and to avoid conflict with motorised vehicles.

Along low volume access roads and streets a number of options are possible depending on the street cross section configuration and its role in the NMT network. Where such a street is used to ensure continuity of a bicycle arterial or collector, its speed limit should be reduced to 40km/h and it can be signposted and marked as a bicycle **priority** street.

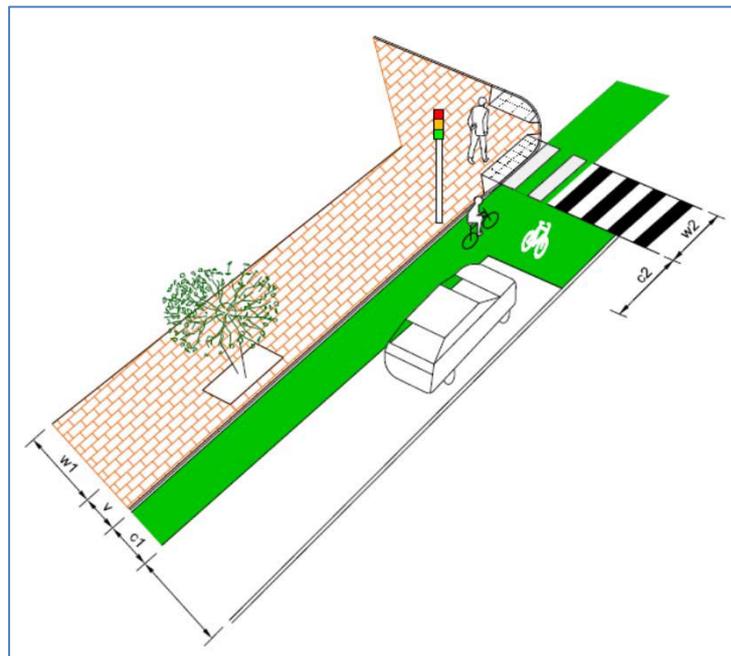


Figure 4 Bike Box at Signalised Intersection

The design of access roads should focus on the creation of pedestrian and bicycle friendly environments, keeping the overall aim of 'access for all' in mind. Careful planning of various design elements, including parking, is required. If the street is well designed and speeds and volumes are low then **no separation** is required and cyclists can compete with motorised vehicles for space on the road while sidewalks are provided for pedestrians. A summary table of the principles described in this section, can be found in Appendix A.

The guidelines provide many details to improve safety, end of journey facilities and Universal Access.

5 MAINTENANCE AND OPERATIONS

When construction has been completed the NMT facility enters various operational stages, including: 1) recording of the asset on the asset register; 2) initial bedding in and defects liability period occurring soon after construction; 3) damage and related repairs of underlying pavement layers, due to settlement, trees, vegetation, vehicles or heavy equipment; 4) preventative maintenance to guard against moisture ingress and moisture accelerated distress and 5) terminal condition and rehabilitation. Condition monitoring of the NMT elements should be carried out in a cost-effective manner. This is often done yearly as an adjunct to the road inspections.

While infrastructure provides the necessary NMT facilities, it is also essential that NMT users understand how to use these facilities and avoid conflict with motorised vehicles. Every road authority needs to dedicate staff to monitoring operations for safety and ensuring that the facilities, signage and roadmarkings are continuously improved to allow for safety and continuity of NMT trips.

Information aids, such as maps and usage guidelines, as well as the distribution of reflective clothing and other safety aids, must be facilitated. Other means of increasing NMT usage, such as bicycle rental schemes, need to be considered and subsidised where appropriate.

6 DISCUSSION

Traditional road infrastructure planning in South Africa is focused on the accommodation of uninterrupted flow for MT. This, combined with the large amount of NMT users, especially pedestrians, leads to unacceptable road fatalities of vulnerable road users.

The above has led to the realisation that South Africa needs to improve NMT facilities implementation. As a first step, the Department of Transport commissioned the NMT Facility Guidelines project that provides a design philosophy, principles and detailed cross sections and intersection designs, as well as designs for special facilities at destinations.

This paper provides a summary of the NMT facility guideline principles, which should be applied by all involved with transport facility planning and implementation to effect a reduction in accidents while, at the same time, increasing the use of this most sustainable mode of transport. Selected issues are highlighted in the paper, which attention when implementing road infrastructure for NMT and MT. At the core of planning and designs, speeds and volumes (absolute and the differential) for both NMT and MT, conflicts between NMT and MT and desire lines of NMT need to be considered. At the same time maintenance and operations need adequate attention to ensure that facilities, usage and safety are all continuously improved.

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Appendix A NMT Facility Design Principles

Road Type	Motorised Transport				Conflict Risks		Non-Motorised Transport					Design requirements
	Speed		Volume				Desire lines	Volume		Dimensions		
	High	Low	High	Low	High	Low		High	Low	Walkway	Cycleway	
NMT Only	N/A	N/A	N/A	N/A	NMT right of way	NMT right of way	Follow direct lines	No mixing of NMT	Mixing of NMT possible	1200m to 2500m	1500m to 2500m	<ul style="list-style-type: none"> Levelling of NMT facilities always Walkway and cycleway can be placed next to each other to minimise earthwork
Highway	Very high road safety risk	N/A	Very high road safety risk	High road safety risk	Grade separation is required	Warning signs are required	Bridges and tunnels need to be placed strategically	No mixing of NMT	Mixing of NMT possible	1500m to 1800m	1500m to 1800m	<ul style="list-style-type: none"> Barriers between MT and NMT Wheelchairs and prams passing space
Arterial	High road safety risk	N/A	High road safety risk	Road safety risk	Separation of cycling via kerb and road marking / colour	Separation of cycling via kerb or road marking/ colour	Facilitate NMT at intersections or create crossing infrastructure	No mixing of NMT	No mixing of NMT	1500m to 1800m	1500m to 1800m	<ul style="list-style-type: none"> Partial separation of cycling via kerb or colour Appropriate drop kerbs at all crossing facilities
Distributor	Road safety risk	Low road safety risk	Road safety risk	Low road safety risk	Crossing facilities at attractions, such as	No special infrastructure is required	Facilitate NMT at intersections or create crossing infrastructure	No mixing of NMT	No mixing of NMT	1500m to 1800m	1500m to 1800m	<ul style="list-style-type: none"> Marked separation of cycling Cycleway width can be less for short distances Appropriate drop kerbs at all crossing facilities

					schools and PT stops		ure					
Access Road	Design speed is 40km/h	Road safety risk	Low road safety risk	No special infrastructure is required	Traffic calming might be required	No mixing of NMT	No mixing of NMT	1800m/ preferably more	N/A Cyclists in roadway	<ul style="list-style-type: none"> All UD users accommodated in the walkway Appropriate drop kerbs at intersections and traffic calming 		