CHAPTER 6

REDESIGNING THE NMT INFRASTRUCTURE

6. DESIGNING NMT INFRASTRUCTURE

6.1 Introduction

Cities all over the world are developing NMT infrastructure to enhance accessibility, safety and health conditions for bicycle riders. As the number of motor vehicles increase in African cities, cyclists and pedestrians are increasingly vulnerable. In addition, bicycles become less attractive as a mode of transport unless the road safety aspects of cycling are improved and reinforced (UNEP, 2013). This chapter examines design criteria and principles to be considered when designing NMT infrastructure.

6.2 Underlying principles and design parameters for cycling

6.2.1 BASE CYCLING NETWORK

Creating new cycling infrastructure requires a city-wide vision of the cycling network, as was noted in Chapter five. The network would need to take into consideration the origins and destinations of trips as well as the interaction between pedestrians, cyclists, public transport and the motor vehicle.

The basic design principles for cycling are captured in the 2003 NMT FacilTies Guideline Document.

6.2.2 BASE WIDTH OF CYCLING LANE

Bicycle dimensions vary according to the vehicle type. Basic dimensions are captured in the 2003 NMT Facilities Guideline Document, as illustrated in Figure 6.1.The average length of a bicycle as recorded in the NMT Guidelines document is 1.8m long and 0.6m wide. However, the bicycle requires 400mm of manoeuvring space on either side of the handlebars.

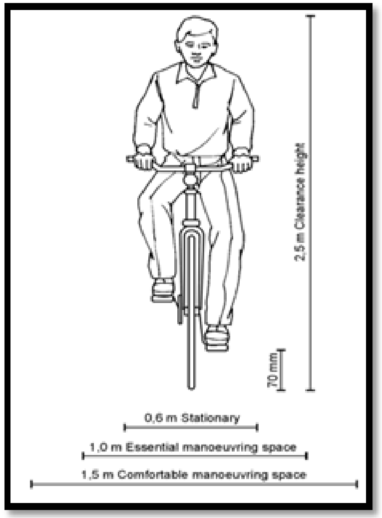

Figure 6.1 Base width of cycling lane

Thus, a minimum width of cycle lanes should be 1.5m in South Africa cities.

In many cases, the bicycle is a "tool of trade" that functions as a means for people to earn their livelihood. Thus, some bicycles seen in South African cities are attached to bicycle trailers and hand carts.

6.3.3 CYCLE LANE TYPOLOGIES

The 2003 National NMT Facilities Guidelines established the following bicycle lane classes and hierarchies:

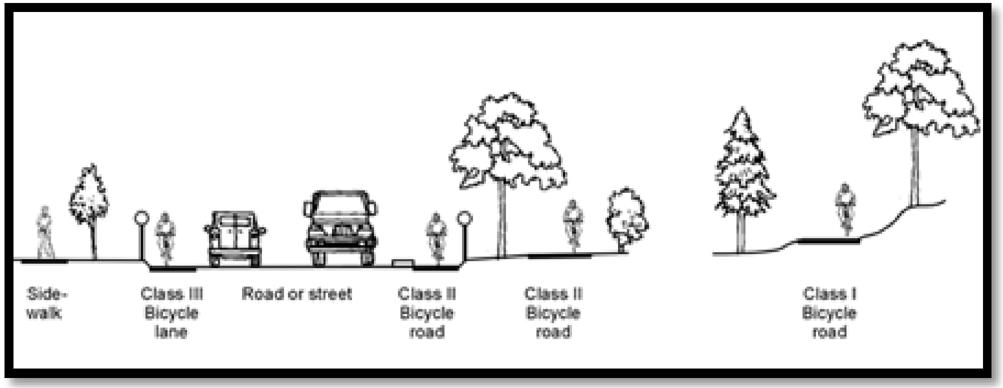

Figure 6.2 Bicycle lane classes

Class 1 bicycle road

A class 1 bicycle facility is completely segregated from any other mode or facility, especially along recreational parks and outdoor facilities. The ETA's Pilot Project has recently completed the construction of a Class I facility through Albert Park in the CBD.

Figure 6.3 Class I bicycle road, Albert Park, Durban

Class II bicycle road off-street

A Class II bicycle facility is also termed a “detached” NMT facility. The bicycle road is separated from the motor vehicle road by a buffer such as trees / street furniture. This is evident in the City of Johannesburg’s Orlando NMT Pilot project, where the cycle road is located away from the motor vehicle road and is shielded by trees and bollards.

Class II bicycle road on-street

Class II on street bicycle roads are separated by a physical barrier, which acts as a protection for the cyclist against motor vehicle traffic. This separation is achieved by utilising cobblestones, thermoplastic road markings, kerbing, trees and shrubs.

Figure 6.4 Class II bicycle road off street implemented in Ethekwini

Class III bicycle lane

Class III bicycle lanes are specifically marked on the roadway pavement. These should only be provided on streets and roads with speed limits of less than 60km/hr – preferably 50km/hr and even lower.

Figure 6.5 Class III bicycle lane in the CBD of Cape Town

6.3 Underlying principles and design parameters for walking

6.3.1 PEDESTRIANS VERSUS CYCLISTS

It is best practice to separate bicycles from pedestrian traffic, and only where there are few cyclists and walkers, such as in recreational parks, should the two modes share facilities.

6.3.2 PEDESTRIANS SIDEWALK DESIGN DIMENSIONS

Sidewalks, provided on both sides of a street, are the preferred pedestrian facility, which provide the greatest degree of comfort and safety for pedestrians. In most cases, sidewalks are paved, usually with concrete blocks and pavers.

The DoT specifies a minimum sidewalk width of 1.5m, with a desirable width of 1.8m. Sidewalks in CBDs need to accommodate greater volumes of pedestrians and should thus be wider. A shared path between a cyclists and pedestrian should be 2.4m wide, minimum, in one direction.

TABLE 6.1 MINIMUM SIDEWALK AND WALKWAY WIDTH

Minimum sidewalk and walkway width	
Description	Minimum Width##
Absolute minimum width	1.5m
Desirable width	1.8m
Sidewalks in Business Centers	2.5 – 3.5m
Shared cycle track / walkway	2.4m

(Public Rights-of-way Access Advisory Committee, 2001)

6.4 NMT design checklist

A checklist was developed which was used to assess the designs for the NMT pilot projects in Johannesburg, Polokwane and Ethekwini municipalities. The assessment tool can be found in ***Annexure A***. The assessment can be used on various cycling projects to be implemented in South African cities. A summary of the detailed checklist is provided in ***Table 6.2***.

TABLE 6.2 CROSS-SECTIONS CHECKLIST

Criteria	Attribute	Requirements
Cross-sections	Minimum lane width	According to AASHTO, 2012 – the minimum paved width for a two-directional shared path is 3m. The minimum width for a normal cycling lane/road is 1.5m.
	Equity	Shared NMT paths should be physically separated by a raised barrier kerb of 300mm – which should be located after the parking space.
	Verges	Where existing verges do occur, these should be used to act as the "buffer zone" between the NMT and motorised traffic. Along high-speed roads, the normal accepted buffer zone should be 1.5m wide – failing which a physical barrier or railing is required.
	On-street parking	On-street parking can be utilised as the buffer zone between the NMT users and motorised traffic as shown in Figure 6.6 below.

FIGURE 6.6 DEMONSTRATES THE SPACE REQUIRED TO ACCOMMODATE PARKED AND MOVING VEHICLES, PEDESTRIANS AND CYCLISTS AT A CROSS-SECTION.

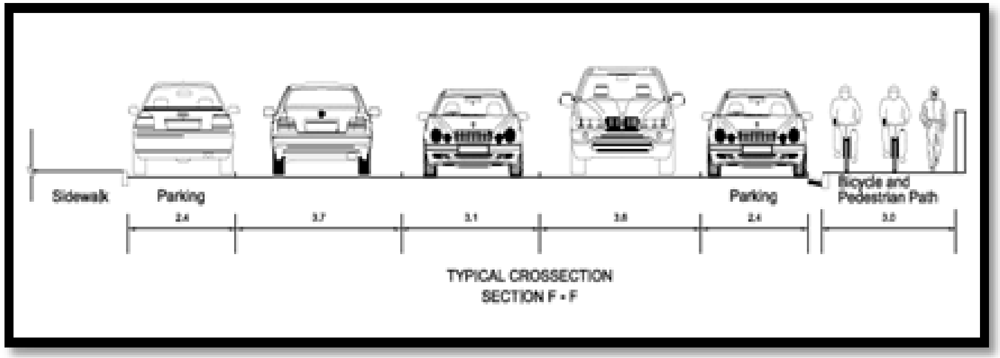

Figure 6.6 Cross-section with on-street parking for Ethekwini project

TABLE 6.3 HORIZONTAL ALIGNMENT AND MATERIALS CHECKLIST

Criteria	Attributes	Requirements
Horizontal Alignment	Design Speed	The NMT paths should have a generally flat slope with gradients of less than 2% for proper drainage. The design speed for cyclists is 30km/hr.
	Stopping sight distance (SSD)	Adequate warning needs to be provided at approaches to crossings. For an at grade alignment, a minimum of 40m SSD is required for cyclists.
Materials	Type	NMT paths must be evenly surfaced; have good drainage; include ramps at intersections and avoid obstacles as much as possible. Asphalt or concrete are the most preferable materials on NMT paths, followed by paving blocks.

Type of pavement Criteria	Gravel	Paving slabs	Concrete	Asphalt
Comfort level for cyclist	•	••	•••	••••
Material locally available	•••	•••	•••	•••
Labour intensive construction	••	•••••	••••	•••
Construction Cost m2	••••	••	••	••••
Maintenance Cost m2	•••	•••	•	•

(Source: Design manual for bicycle traffic (CROW))

Criteria	Attributes	Requirements
	Pavement layers	A minimum pavement depth of 150mm including the surface course is recommended. Any pavement section must be placed over a compacted subgrade.
	Bicycle parking	Bicycle parking should be placed at specific locations in the entire system. Secure bicycle storage areas are proposed for rail stations to promote cycle-rail park and rides; at various schools and at key buildings that are used by municipal workers. The bicycle parking facilities should limit the risk of damage and provide chaining facilities
Signals	Signal timings	Traffic signals need to be evaluated as to whether they can accommodate enough green times for NMT users, limit waiting time as much as possible for NMT users and provide adequate clearance times for NMT users to exit the intersection safely.

TABLE 6.4 CROSSINGS CHECKLIST

Criteria	Attributes	Requirements
Crossings	Mid-block / Intersections	All crossings will be at the intersections. Mid-block crossings can also be provided.
	Vehicle speed	Vehicle speeds affect the type of NMT facility to be provided. The higher the vehicle speeds in the area, the more segregated the NMT facilities should be from the roadway. Class III on-street bicycle lanes are only recommended on traffic calmed streets with low vehicle speeds and volumes.
	Conflicts	Conflict points can be reduced by locating the NMT pathway on one side of the route – and limiting these to the side with less accesses. Where this is not possible, the NMT crossing facility should be located a bit further away from the intersection as possible.
	Universal access	Crossings must be adequately marked for NMT users. **Dropped kerbs and/or kerb ramps are required wherever a pedestrian or cyclist needs to cross a road. These mainly provided for use by persons using wheelchairs, and persons pushing items such as prams, wheelbarrows and others, but can also be useful for persons with mobility impairments.** **They should be provided at all road junctions, midblock crossings, medians, islands and any other locations where a kerb must be crossed, without exception.**

Figure 6.7 Intersections in Ethekwini along the Pilot Project

TABLE 6.5 SIGNAGE AND VERTICAL BARRIERS CHECKLIST

Criteria	Requirements
Signage and way-finding	Adequate road signage enhances the safety for both pedestrians and cyclists as it clarifies the rights and roles of each mode and user in the transport network. Signage can either be placed horizontally or vertically.
Vertical barriers	Vertical barriers that separate cyclists from the road surface can be concrete kerbs; trees; parking; street furniture. These act as separators along Class II Cycle ways.

TABLE 6.6 STREETSCAPE IMPROVEMENTS AND TRAFFIC CALMING CHECKLIST

Criteria	Attributes	Requirements
Streetscape improvements	Additional	Additional facilities such as street lighting; textured paving; street furniture; railings; trees and landscaping should be considered for implementation along pedestrian side-walks. However, these should not impede upon the effective width of the sidewalk.
Traffic calming	* Raised Intersections * Chicanes * Mini Traffic Signals * Shared Streets	Most accidents involving NMT users occur at intersections. The purpose of traffic calming is to design streets in a manner that makes it safe for NMT users. More innovative approaches use ob-structions in the roadway; chicanes; meandering roads; raised intersec-tion tables; textured road surfacing. Different measures are appropriate for different classes of roads.

6.5 Key lessons learnt

- **Universal access design** is important along the entire NMT corridor. This includes provision for dropped kerbs at intersections; providing tactile paying; ensuring there are no street lights in the middle of sidewalks; and using suitable material that is universally accessible.

- Pedestrian and cycling design is inter-related, though they are not the same. It is optimal to **separate pedestrian and cycling infrastructure**, especially in areas where both modes are in great demand.

- **Cycling and pedestrian logos** on NMT paths are a good way to delineate pathways and to alert drivers to the presence of cyclists (the cycle logos could possibly be located on the right hand side of the near side lane, which is about 5m wide).

- **Reduction in traffic speeds** along the designated cycling route – by lowering the speed limit, narrowing the off-side vehicle lane to 3m, introducing vehicle activated speed warning signs and speed cameras, introducing traffic islands at regular intervals, introducing controlled pedestrian crossings and signal controlled junctions are all good measures to achieve these.

- **Improving facilities for pedestrians and cyclists to cross the main road**, by means of (i) controlled crossings and traffic signals at main junctions; (ii) traffic islands at intervals, especially at some junctions with side roads (to shelter right-turning cyclists and vehicles), and at popular pedestrian crossing points (to shops, parks, public buildings, etc.); iii) applying universal access design principles at intersections.

- **Providing raised tables across side roads**, to assist pedestrians crossing the side roads, and slow traffic entering and leaving the side roads.

- **Providing cycle route direction signs**, and generally raising the overall profile and image /awareness of the cycle route (possibly using coloured surfaces in places, such as across busy junctions.

- Using **paving material** which is most conducive to whichever mode one is designing for. For example, cyclists prefer to cycle on asphalt and concrete. Cities are still too hesitant to apply this preference, as block paving is seen as a more labour-intensive means of construction material so cities are more inclined to construct using block paving.

6.6 Concluding comments

Adequate provision for NMT infrastructure is part and parcel of transportation planning and urban design. For maximum efficiency and best result, it is best to factor it in at the design stage although it can be included retrospectively. Comprehensive criteria and checklists have been developed for the inclusion of NMT in the pilot cities and these may be used by other municipalities planning to embark on NMT design and planning.