INVESTIGATION AND GAP ANALYSIS OF SELECTED CYCLING UPGRADES IN CAPE TOWN AND THE NEW NMT FACILITY GUIDELINES

J Baufeldt and M Vanderschuren

Centre for Transport Studies, University of Cape Town, Rondebosch 7708
Tel: (021) 650 2584; Email: bfljen001@myuct.ac.za;
marianne.vanderschuren@uct.ac.za

ABSTRACT

Non-Motorised Transport (NMT) in South Africa is currently a marginalised mode of transport with the implementation of NMT facilities being of a low standard and demonstrating little consistency in terms of design and adhering to standards. The Pedestrian and Bicycle Facility Guidelines (2003) have recently been updated and expanded upon by the Department of Transport, to form the new NMT Facility Guidelines (2014). The update of the guidelines was seen as necessary in order to address recently acknowledged challenges and gaps that were identified since the drafting of the 2003 guidelines.

The gap analysis, which was done during the NMT Facility Guideline update, as well as an analysis of recent infrastructure implementation in the City of Cape Town, forms the basis of this study. As NMT facilities implementation, using the revised NMT Facility Guidelines (DOT, 2014), has not commenced yet, the recent upgrades to Military Road Corridor in Cape Town will be used as an example of NMT facility upgrades. Data regarding volume, velocity and customer Level of Service (LOS) was collected and used. This paper reports on the key findings and the challenges that still need to be addressed.

1. BACKGROUND

In South Africa, Non-Motorised Transport (NMT) is experiencing many challenges, in terms of addressing the needs of NMT users. The National Department of Transport (DOT) has recognised these challenges and, in a bid to address some of these challenges, has recently undertaken a study to expand and update the National NMT Facility Guidelines.

The purpose of the updates is to provide practitioners and stakeholders with clear and comprehensive guidance regarding accommodating NMT users within public areas, especially along transport routes and at end facilities. Furthermore, the NMT Facility Guidelines aim to become a standard of acceptable NMT facility designs and implementation practices within South Africa, as these are currently lacking, leading to multiple variations of facilities, even in one municipality/metropolitan area. It should be noted that, while the National Department of Transport fully supports the guidelines, they are not yet legal standards – i.e. practitioners are not, as yet, required to apply them legally.

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There have been several NMT upgrades and implementations throughout South Africa, including various ones within the Cape Town area. However, there has been little research into the level of success that these upgrades and implementations have had, in terms of improving the Level of Service (LOS) and safety for the NMT users.

The selected case study, Military Road corridor, situated in Cape Town, was reviewed. The focus of the review was in terms of the actual implementation versus what is recommended, according to the NMT Facility Guidelines, as well as the effect that the implemented changes have had on user volumes and safety

2. METHODOLOGY

A thorough review of the newly drafted NMT Facility Guidelines (DOT, 2014) was completed alongside the investigation of the selected cycling upgrade case study. The NMT Facility Guidelines were then compared to the current infrastructure (post upgrade, not informed by the new NMT Facility Guidelines (DOT, 2014)). Elements of the upgrade that adhere to the new NMT Facility Guidelines, as well as those that do not, are highlighted in order to determine the degree to which the upgrades are aligned with the recommendations in the new NMT Facility Guidelines.

Using various resources (Rose-Innes, 2014; TCT, 2014) and before and after data collected in Military Road by BEN Bikes, the corridor was investigated and analysed. The focus of the research that was collected on the cycling trips was mobility, accessibility and safety.

After determining the effect that the upgrades had on the cycle trips along this corridor a comparison, between what had been upgraded and the Guidelines, is presented. A reflection on how a different implementation, that followed the Guidelines more closely, would have a greater positive effect on the cycle trips of this area, concludes the paper.

3. CYCLING REQUIREMENTS: NEW NMT FACILITY GUIDELINES

The new NMT Facility Guidelines (DOT, 2014) outline several recommendations and criteria that should be considered when designing, upgrading and implementing cycling facilities. Requirements for cycling facilities vary based on the nature of the environment (rural and urban), the surrounding traffic volumes and speeds, the gradients of the links, and the available space that can be allocated for cyclists. In Table 1, the various recommended widths of cycle lanes are given. Other requirements include clear signage, appropriate surfacing and road markings, as well as the removal of barriers and obstacles (including street furniture and kerbs).

Table 1: widths of various cycling lanes (adapted from DOT, 2014)

Facility	Parameter	Accepted Minimum	Recommended Minimum	Optimal
Cycle Lane – total separation – two way	Min width	1.5m[1] (assure adjacent walkway space)	1.8m	2.0m subject to capacity requirements
Cycle Lane – partial separation – two way	Min width	1.5m[1] (check sight distances)	1.8m	2.5m subject to capacity requirements
Cycle Lane – marked separation – one way	Min width	1.5m	1.8m	1.8m subject to capacity requirements
Cycle Lane/Animal Drawn	Max Gradient	1:15	1:25	1:50
Cycle Lane	Min Radius	3m	5m	5m

An important section of the new NMT Facility Guidelines (DOT, 2014) was the inclusion of Universal Access or Design (UA), identified by the Department of Transport as one of the shortcomings in the 2003 Pedestrian and Cycling Facility Guidelines. This omission creates severe inequalities and barriers to individuals that have one or more disabilities.

The seven guiding principles of UA, as mentioned in the new NMT Facility Guidelines, include the following (DOT, 2014): equitable use; flexibility in use; simple and intuitive use; perceptible information; tolerance for error; low physical effort; size and space for approach and use. Ensuring that all public transport facilities adhere to these UA principles, as far as what is considered feasible, is an important step in creating an inclusive society, where all persons with varying abilities can engage in activities and have equal opportunity to access and mobility. In terms of how UA can influence cycling facilities, the focus in this paper will be on the gradient of paths, surfacing (in terms of smooth or rough), as well as ease of use.

4. CASE STUDY: MILITARY ROAD CORRIDOR

The case study area that was selected for this investigation was the Military Road corridor situated in Cape Town. The Military Road corridor had the most detailed secondary data (before and after) regarding cycling and the implementation of a NMT facility. The corridor and the surrounding areas have many characteristics of many other South African communities. There is limited public transport and middle/lower income groups are situated far from places of work and education. Therefore, the daily challenges that face these communities can provide insights into the experiences that commuting cyclists in South Africa are typically exposed to, when engaging in NMT in South Africa on a daily basis.

Ensuring that all road users are adequately provided for, in terms of transport facilities, is a central goal of government in addressing the inequalities from the apartheid era (City of Cape Town, 2005). Therefore, measuring and benchmarking convenience, comfort and safety is another important aspect of improving the LOS of NMT users whom, as citizens and active members of South Africa, have a constitutional right to adequate facilities.

4.1 Description of Selected Case Study: Military Road Corridor

The corridor that was investigated was 3.1 km long. It runs from the intersection of Military Road and the Main Road (M4) eastwards, through various suburbs, and ends at the start of S^{t} Bonaface Road.

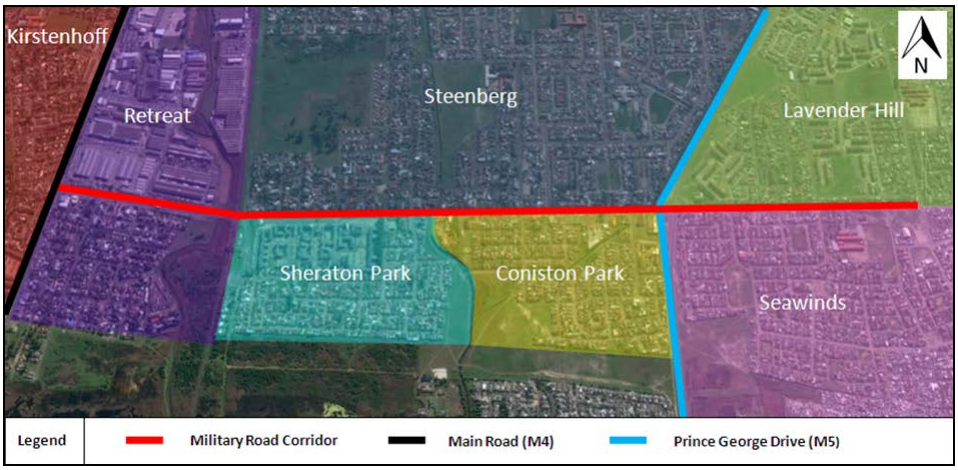

Figure 1: location of Military Road Corridor
Source: Rose-Innes, 2014

The suburbs that the corridor serves have a high dependency on NMT. This is, mainly, due to the economic incomes of the surrounding areas being either low-income or middle-income. Individuals have limited access to privately owned motor vehicles and depend mostly on public transport or NMT modes to fulfil their transport needs. However, the overall modal split of the traffic still aligns closely to the modal split of the Western Cape (Rose-Innes, 2014).

Another characteristic element, in determining whether the route is likely to be conducive to NMT traffic, is the elevation profile. Individuals are more likely to engage in NMT if the elevation profile of the corridor is relatively level with gentle gradients. For the selected corridor, the elevation profile was neither unusually flat nor steep, but has moderate elevation changes. This contributes to the case study in demonstrating what can be expected from a general case study, if the elevation profile is neither favourable nor excessively unfavourable.

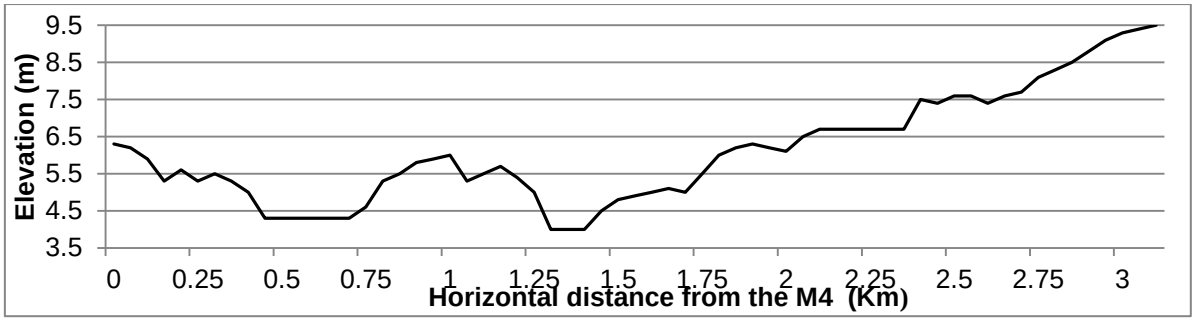

Figure 2: elevation profile of Military Road
Source: Rose-Innes, 2014

As data from surveys conducted along the corridor suggest, the profile of the corridor was not found to be a significant deterring factor for the current NMT users. However, it could be a factor for more sensitive NMT users / cyclists. For example, according to UA guidelines, any slope over 1:12 is not considered to be acceptable and a slope of no more than 1:20 is recommended for cyclists (CROW, 1998). From Figure 2, it was determined that the slope varies from completely level to gradients that were acceptable and fell below the recommended gradients of 1:20 for cyclists.

An indication that the corridor is perceived to be risky to cyclists is the significantly higher percentage of males, in comparison to the amount of females, that cycle. It has been noted by several studies that female cyclists are an "indication species for NMT facilities, therefore, a low percentage can indicate a risky or insufficient NMT facility" (Baker, 2009). Security issues might also be at the core of the low level of female cyclists. Therefore, it is required to consider safety (and security) issues at the corridor.

4.2 Characteristics of Cycling Trips

From a recent survey (Rose-Innes, 2014), the main purpose of cycling trips along this corridor was accessing places of work, while the second largest purpose was trips for school. This is shown in Figure 3.

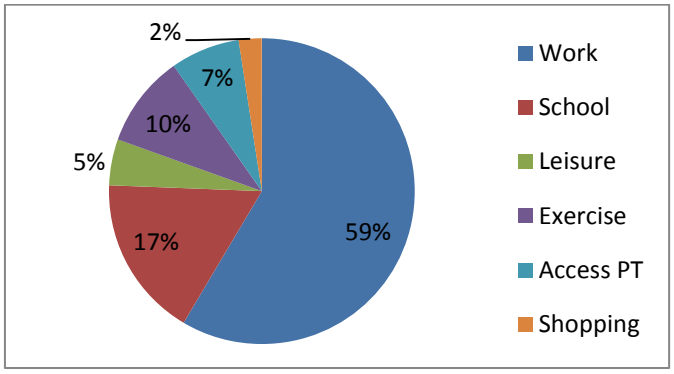

Figure 3: purposes of cycling trips
Source: Rose-Innes, 2014

As can be seen from Figure 3, the majority of the trips are of a functional nature and not leisure/recreational. This indicates that NMT is, currently, serving an important role in providing better mobility and accessibility to individuals for daily commuting.

4.3 Factors that Discourage Cycling

However, despite the presence of cycling trips occurring on the corridor, it is not indicative of a sustainable cycling link. The current cyclist is, generally, captive to the mode, due to socio-economic factors, as well as the lack of viable alternative options. While Rose-Innes (2014) indicated that the users are, generally, satisfied with the NMT facilities, they did express concern regarding their safety and security. The total of the various security concerns (personal safety, accidents, theft) accounted for 44% of all the perceived hindering factors.

The second most significant hindering aspect, that was reported, was that destinations to, mostly work, were considered to be too far, especially from zones of employment. While the terrain was initially suspected to also be a hindering factor, it was only reported by 4% of the respondents. Thus, this is a comparatively minor concern of the current cyclists, and in line with CROW (1998) guidelines.

It needs to be mentioned that there may be other concerns, such as a lack of affordable bicycle supply, a lack of maintenance services, a lack of lockable facilities at the destination or at interchanges, as well as social and culture stigmas'. However, these were not mentioned by the respondents and are, therefore, not included in the remainder of this paper.

4.4 Results of Upgraded Routes

The upgrades that happened along the corridor correspond with a significant increase in the cycling activity on the corridor. This was compared to a control route (Prince George Drive), which had experienced no upgrades during the same time frame.

In Table 2 there is a clear increase in all the flows, barring flows F and G, which showed a decrease in cycling counts. No cycling / NMT upgrades occurred on routes E, F, G, H (Prince George Drive) during the period of investigation, while upgrades did occur on routes A, B, C, D (Military Road corridor).

Table 2: average bicycle counts for different directions

Description	Peak Hour Bicycle Counts								
	Total	Military Road corridor				Prince George Drive			
		A	B	C	D	E	F	G	H
Avg. prior to upgrade	170.4	12.2	121.0	66.0	6.8	10.6	18.2	74.3	8.6
Avg. after upgrade	180.3	14.8	144.0	79.0	8.0	12.4	16.0	73.8	8.8
Change	9.9	2.6	23.0	13.0	1.2	1.8	-2.2	-0.5	0.2
% Increase	5.8	21.6	19.0	19.7	17.1	17.0	-11.9	-0.7	2.3

Source: BEN Bikes, 2014

The access routes (C and B) to the nearby Public Transport facilities experienced the second and third highest increase in cycling trips, with 19.7% and 19% increases respectively. This was the most beneficial aspect of the upgrades, as it improved accessibility of NMT users to the public transport stations. This was clearly beneficial for the residents in the eastern areas of the corridor (Lavender Hill / Seawinds).

It was reported that separating cyclists from motorised vehicles was found to be a significantly positive element of the upgrades, with regards to increasing the use of bicycles in the case study (Rose-Innes, 2014). The routes where cyclists and pedestrians were allocated to the same road space were found to be problematic. The shared space had a significant impact on the mobility of the cyclists, especially during peak morning traffic.

5. GAPS BETWEEN IMPLEMENTED FACILITIES AND RECOMMENDED DESIGNS

Aspects of the upgrade were selected and discussed in terms of what was initially implemented, how it was then upgraded and what the new NMT Facility Guidelines would recommend differently. Safety is the most significant hindering factor identified by the cyclists. Therefore, the focus of the comparison will be on the safety aspects that the NMT Facility Guidelines (DOT, 2014) recommend.

Many of the safety issues, that hinder or deter cyclists, are linked to inadequate road space for NMT users and inadequate separation of NMT facilities from motorised traffic in South Africa. Cyclists mention the lack of adequate space and separation from motorised traffic when speeds or speed differentials are high (Rose-Innes, 2014). As indicated before, separating the cyclists from motorised traffic had a significant impact on the volume of cyclists.

These two aspects, lack of adequate road space and separation, have significant implications for the safety of the NMT users, especially in terms of avoiding collisions with motorised traffic. There was insufficient long-term data, regarding the accidents involving cyclists after the upgrades, in order to determine whether the upgrades have had significant impacts on the number and severity of accidents along the corridor (Rose-Innes, 2014).

Providing efficient and well defined road space can also aid cyclists to travel with minimised interruptions, by either pedestrians or by motorised traffic. This would increase the convenience and efficiency of cycling trips. In the new NMT Facility Guidelines (DOT, 2014) the minimum separation requirements for a “collector” road classification is “marked separation” for both urban and rural areas.

The Military Road corridor falls under the road classification of a “collector”. Therefore, “marked separation” is what has been recommended. From Figure 5 it can be seen that, before the upgrade, there was no separation between cyclists and motorised traffic. After the upgrade, there was marked separation of the cycling lane and motorised traffic. In terms of what was implemented and what is recommended by the NMT Facility Guidelines (DOT, 2014), this element of the upgrade aligns well. However, additional elements that are highlighted in the guidelines, such as

providing adequate signage of cyclists in the area, sufficient community awareness of NMT users and facilities, as well as law enforcement, are not clearly evident.

Figure 4: Military Road, route A: pre and post upgrade
Source: Rose-Innes, 2014

Providing adequate maintenance of the road markings, as well as ensuring that the allocated bike lanes' surfaces have a sufficient grip, are other aspects mentioned in the NMT Facility Guidelines. Surfacing of bike lanes is important, especially during wet weather, to ensure that cyclists do not slip and fall. This aspect does not, currently, seem to be taken into consideration as part of the upgrade. Establishing a high level of forgiveness of error is another aspect that is mentioned in the guidelines, under Universal Access Design. This means that, even when cyclists or motorists commit an error in travel behaviour, the consequences thereof should not be severe.

6. REFLECTION

In this section the pre- and post-implementation, as well as the NMT Facility Guidelines (DOT, 2014) recommendations, are discussed and reflected upon. While the investigated upgrades have certainly taken a step in the right direction, based on the NMT Facility Guidelines (DOT, 2014), there is still much to be done in order for the cycling facilities in this area to be considered adequate, in terms of serving the NMT users.

Table 3: reflection between pre-, post-implementation and NMT guidelines

Before Upgrade	After Upgrade	NMT Facility Guidelines Recommendations (DOT, 2014)
No established cycling network	Improved links but not cycling network	Focus on creating safe, well connected cycling links that allow the integration of NMT into public transport, as well as efficient NMT routes to key activities and places of work/education and interest
No adequate road space allocated to cyclists	Bike lanes added, in some sections the lanes are separate to pedestrian facilities, however, in other sections they are combined which is problematic	Separate bike lanes from pedestrians with the recommended widths (minimum of 1.5m)
No demarcated bike lanes	Bike lanes demarcated	Bike lane markings should be standardised with adequate signage indicating cyclists in the area
No surface treatment done with consideration of cyclists done	No surface treatment was implemented. Considering the high volumes of traffic and the consequential wear on the surfacing of the road, it is possible that the surface is dangerous for cyclists in wet weather, especially for cyclists cycling across road markings	Ensure bike lanes provide sufficient grip even in poor weather and that road markings also provide sufficient grip
Very poor level of road forgiveness	Slightly improved, due to allocated lanes, however, poor driver awareness of cyclists and driving behaviour mean that there is still a low level of forgiveness especially if the cyclist is to err	Increase the level of forgiveness, by calming the traffic in the area using physical interventions as well as road safety awareness, with a focus on NMT users and associated behaviours

The considerable lack of data regarding NMT users, trips and accidents is a significant barrier in determining the effects that the upgrade has had. This is not only problematic in terms of quantifying the improvements, but also hinders further improvements of the NMT facilities, as problems remain unidentified. The issue of insufficient data being collected regarding cycling national-wide is one that should be

addressed, in order for a comprehensive understanding of the demands on the cycling networks to be sufficiently understood. Data regarding NMT user fatalities and injuries face similar challenges, which also need to be addressed.

Improved data collection, management and availability should be highlighted as a key element of addressing the challenges that face NMT. Alongside better data on a wider scale, the new NMT Facility Guidelines can be used to increase the safety, efficiency and effectiveness of NMT for a significant proportion of South Africans in their daily commute. The example that was used, illustrates some of the challenges that face NMT, and cycling in particular. While some aspects of NMT facilities implementations are being done well, there is still much to improve on.

It was, unfortunately, not possible to back up the benefits of the investigated cycling facilities with increased volumes and reduced fatalities. However, the authors are convinced that a further roll out of facilities will, eventually, prove to be beneficial. Currently, many destinations are not accessible by safe infrastructure, keeping many off the bicycle. Other countries, such as Germany, have proven that a roll out of sufficient safe infrastructure will, eventually, lead to increased use and improved safety.

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