IF YOU BUILD IT, THEY WILL COME

The impact of dedicated infrastructure on
cycling activity levels

Velo Mondial
March 2006

Athol Moore
KwaZulu-Natal Department of Transport
South Africa
athol.moore@kzntransport.gov.za

Co-author: Rob Barker
BCP Engineers
South Africa
robb@bcp.co.za

Co-author: John Ramsden
Msunduzi Municipality
South Africa

IF YOU BUILD IT, THEY WILL COME
(The impact of infrastructure on cycling activity levels)

Roads engineers and municipal planners often cite the lack of significant numbers of utility or commuter cyclists as reason for not providing dedicated infrastructure for cyclists which would be suitable for cycling commuters. Cycling activists counter that the lack of utility cyclists is due to the absence of safe infrastructure for cyclists. This paper presents the results of a pilot project proposed by the KwaZulu Natal Department of Transport and funded by the South African National Department of Transport and the Msunduzi Municipality. The project involved the construction of a five kilometre long and three meter wide dual-use cycle and footpath between the mid to low income area of Imbali and the Pietermaritzburg CBD. The path was constructed along one of the city's major urban arterials, Edendale Road, which previously had no continuous formal pedestrian infrastructure. The paper will examine the design options investigated and detail the final design, highlighting compromises made and design problems. The paper will also examine the impact of the construction of the path on the number of pedestrians and cyclists utilising the corridor. Surveys done before and after the construction of the path will be used to draw conclusions as to whether the provision of cycling infrastructure alone can have a significant impact on the number of utility cyclists using a corridor serving a low income area.

1 INTRODUCTION

The provision of infrastructure for cyclists is often neglected by roads engineers and municipal transport planners. Cycle and pedestrian paths are recognised as essential in the vicinity of schools but cycle routes for commuters are not seen as an important part of the transport network. The lack of significant numbers of utility or commuter cyclists is often cited as the reason for not providing suitable dedicated infrastructure for cyclists. Cycling activists counter that the lack of utility cyclists is due to the absence of safe infrastructure for cyclists.

Motorised traffic is by far the main mode of transport over medium to long distances. Less than 5% of workers use a bicycle to get to work in South Africa. Inevitably cycling therefore does not feature highly on the list of priorities. With limited budgets, funding almost always goes to address maintenance and construction needs for motorised traffic. The result of this is that conditions for cyclists continue to deteriorate as traffic volumes on the roads increase. Due to the lack of safe conditions for cycling the number of utility cyclists decline and hence less priority is given to them. This vicious cycle has contributed to South Africa having extremely low levels of utility cycling despite conditions being amenable to the growth of utility cycling in many areas.

Conditions which indicate that cycling should be more prevalent within urban areas of South Africa are evident in the National Household Travel Survey. For 23.2% of the population the main mode to work is walking. Within metropolitan areas only 8.9% walk whilst in urban areas 24% walk. Of those walking 22% walk more than 30 minutes to work. Approximately 39.7% of commuters use public transport. In metropolitan areas it is as high as 49.1% whilst in urban areas it is 34.9%. Of these public transport users 38% pay more than 15% of their income on public transport.

The climate in South Africa varies widely from semi-arid to subtropical to mediterranean. Although diverse the climate in most of the country is conducive to cycling. These factors should make cycling an attractive option for far more commuters than at present.

There are however several factors that mitigate against cycling within the South African context. These factors include:

- Apartheid's spatial legacy of long commute distances
- The high crime rate and the lack of personal security in poor areas
- The lack of secure storage facilities for bicycles at work and home
- The lack of showers and lockers at work for cyclists
- The cost and availability of bicycles and spares for utility cycling
- The lack of safe cycle routes to work

Any strategy to increase the attractiveness of cycling should attempt to address as many of these factors as possible if an environment conducive to cycling is to be created.

2 PILOT PROJECT

The promotion of cycling needs to be done through a comprehensive programme covering all the areas making cycling a less attractive transport option. Although this is recognised there is a need to test the impact that could be achieved by addressing just one of the constraints. The constraint which has the single largest cost for government is the provision of infrastructure to allow for safer cycling.

A pilot project to test the impact of infrastructure on cycling was proposed by the KwaZulu-Natal Department of Transport for funding from the National Department of Transport's Shova Kalula (ride easy) programme. This programme aims to promote cycling within disadvantaged communities.

The aim of the pilot project was to test the extent to which the lack of safe infrastructure for cycle commuters constrained cycling where conditions would otherwise be conducive to people cycling to work. In order to test this it was imperative that an example be chosen where significant potential for commuter cycling exists but where the extent of cycling was limited.

The pilot project specifically focussed on cycle commuters as opposed to learners who cycle to school. This focus was taken due to the fact that most decision makers, whether technical or political, tend to see cycling as a solution to learner transport problems, but not a viable option for worker transport. The pilot could thus provide an example of how cycling can be made a viable alternative transport mode for workers.

In order to select an appropriate site for the pilot project the following criteria were used.

- The pilot should focus on a major movement corridor within an urban area
- Distances between residential and employment centres should not exceed 10km
- The topography along the corridor should be relatively flat route with no major hills
- The corridor should serve a large low to mid income area
- The corridor should have some existing NMT traffic
- The corridor should have high traffic volumes and / or speeds
- The corridor should lack appropriate cycle friendly infrastructure

In order to ascertain the impact of one factor it is essential that all other factors remain constant. Unfortunately this is not possible in this pilot since several factors would be out of the control of the pilot project. These factors are:

- The retail price of bicycles
- Economic growth and hence the number and wealth of commuters
- Public transport fares

Ideally a similar corridor within the urban area should have been monitored in order to have a “null alternative” against which to compare the outcomes of the pilot project. This could have been used to ascertain the extent to which these other factors influenced the attractiveness of cycling during the period of the pilot project. Due to budgetary constraints such comparative surveys were not commissioned as part of the pilot.

3 PLANNING OF PILOT PROJECT

The Edendale Road corridor in Pietermaritzburg was selected as an appropriate site for the pilot project. The corridor was identified in the Msunduzi Municipality as a major development corridor serving the main previously disadvantaged residential areas in the municipality. Pietermaritzburg is a medium sized city which has relatively short commute distances for a South African city. The large mid to low income suburbs lie within 5 to 15 kilometres of the central business district and industrial areas on a strong urban movement corridor along Edendale Road. Edendale Road is aligned along the Msunduzi river valley and thus is very flat.

Due to the short city hall commuter distances and relatively linear development pattern along the Edendale Road corridor it lends itself to non-motorised transport. Existing conditions along the corridor made non-motorised transport unattractive. These conditions include:

- High traffic volumes and speeds along Edendale Road
- No continuous pedestrian or cycling infrastructure along the corridor
- No provision for pedestrians or cyclists at intersections

Although there was some NMT infrastructure along the corridor the maintenance thereof was lacking and it was not continuous between the residential areas, industrial areas and the CBD.

No planning had been undertaken by the Municipality to develop a NMT travel plan. Despite this it was clear from the Municipalities Integrated Development Plan (IDP), traffic data and on site observations that the corridor warranted an intervention to improve conditions for NMT. Several bottlenecks were identified along the corridor which made cycling dangerous. At either end of the

corridor conditions for cycling were observed to be more favourable. Edendale Road was thus identified as the major impediment or bottleneck preventing workers from cycling between the residential areas of the Edendale valley and the areas of employment along the corridor and in the Pietermaritzburg CBD.

By providing a continuous NMT path along the corridor it was anticipated that latent demand for non-motorised transport would be released. This would result in an increase in NMT use along the corridor being observed.

The extent of cycling along the corridor was not known prior to identification as the pilot project since no surveys had ever been done to measure the extent of NMT on the corridor. From observations it was however noted that a few cyclists used the corridor for commuting. It was also observed that footpaths adjacent to the road indicated that significant numbers of pedestrians walked along the road.

4 THE EDENDALE CORRIDOR

The Edendale valley houses an urban population of 200,000. Unemployment is high at over 40%. The Edendale Road corridor is the main arterial linking the urban residential areas in the Edendale valley to the Pietermaritzburg Central Business District (CBD) with some of the city's industrial areas falling along the corridor between these residential areas and the CBD. Edendale Hospital is also a major node along the corridor.

The distance from these residential areas to the city hall is relatively short with Imbali being a mere 6 km whilst George Town is the furthest at 12 km. Between George Town and the hospital the Edendale Road corridor is made up of a 4 lane, dual carriageway arterial with service roads on either side and wide emergency lanes. The service roads on the south side are surfaced for most of the 4.2 km distance and serve primarily as pedestrian walkways with almost all motorised traffic using Edendale Road.

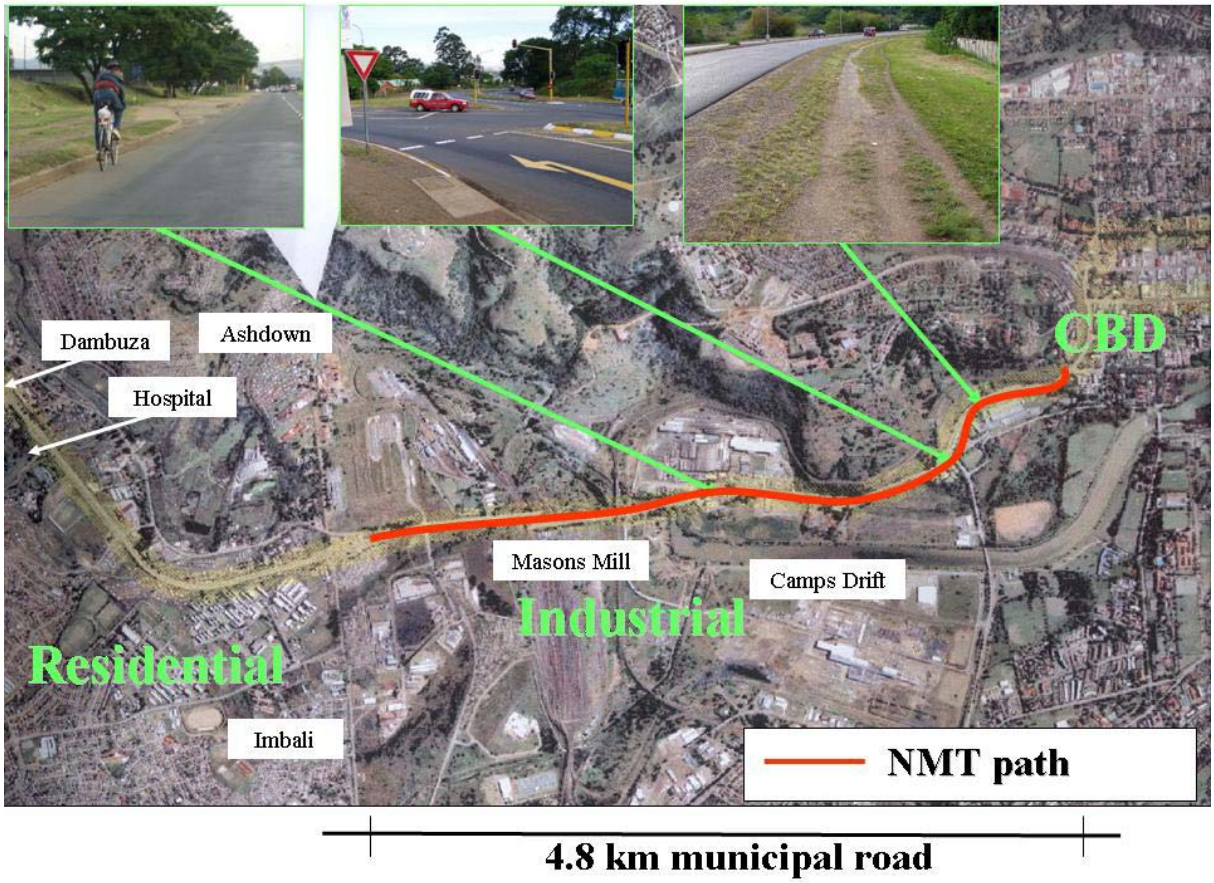
Between Edendale hospital, Imbali, the industrial areas and the CBD, Edendale Road continues as a 4 lane, dual carriageway arterial but it has no service roads. There was no continuous formal pedestrian infrastructure along the 4.8 km portion of road although 400 m of pedestrian sidewalks existed in the vicinity of the Hullets Aluminium factory and there existed 800 m of old road parallel to Edendale Road in the vicinity of Masons Mill which was used as a pedestrian path. Between the Hullets industrial area and the CBD the road narrows and no emergency lanes are provided for. No formal pedestrian paths existed along this stretch of Edendale Road.

Traffic volumes on Edendale Road are high at over 35,000 vehicles per day. Speeds along Edendale Road are well in excess of 50km/h between intersections. Speeding is a problem along the corridor and poses a great threat to cyclists and pedestrians due to the wide emergency lanes being used occasionally as overtaking lanes during peak traffic hours. The corridor is the main public transport corridor in the municipality with approximately 50,000 passengers transported daily by approximately 9,000 bus and taxi trips.

Based on the characteristics of the corridor it was postulated that the major constraint to cycling along the Edendale corridor was the lack of continuous infrastructure for cyclists between Edendale Hospital and the CBD combined with the high traffic volumes and speeds along Edendale Road. For this reason the pilot project focussed on this section of the corridor. Due to budgetary constraints it was not possible however to build an NMT path along the full extent of this section. The path constructed thus terminated at the Imbali residential area.

The location of the corridor and some photos of existing conditions are provided in figure 1. It can clearly be seen how dangerous existing conditions were for cyclists. Intersections did not accommodate pedestrians at all. The existence of informal gravel tracks provides evidence of the extent of pedestrian movements along the road.

Figure 1: Edendale NMT Path



5 BEFORE SURVEYS

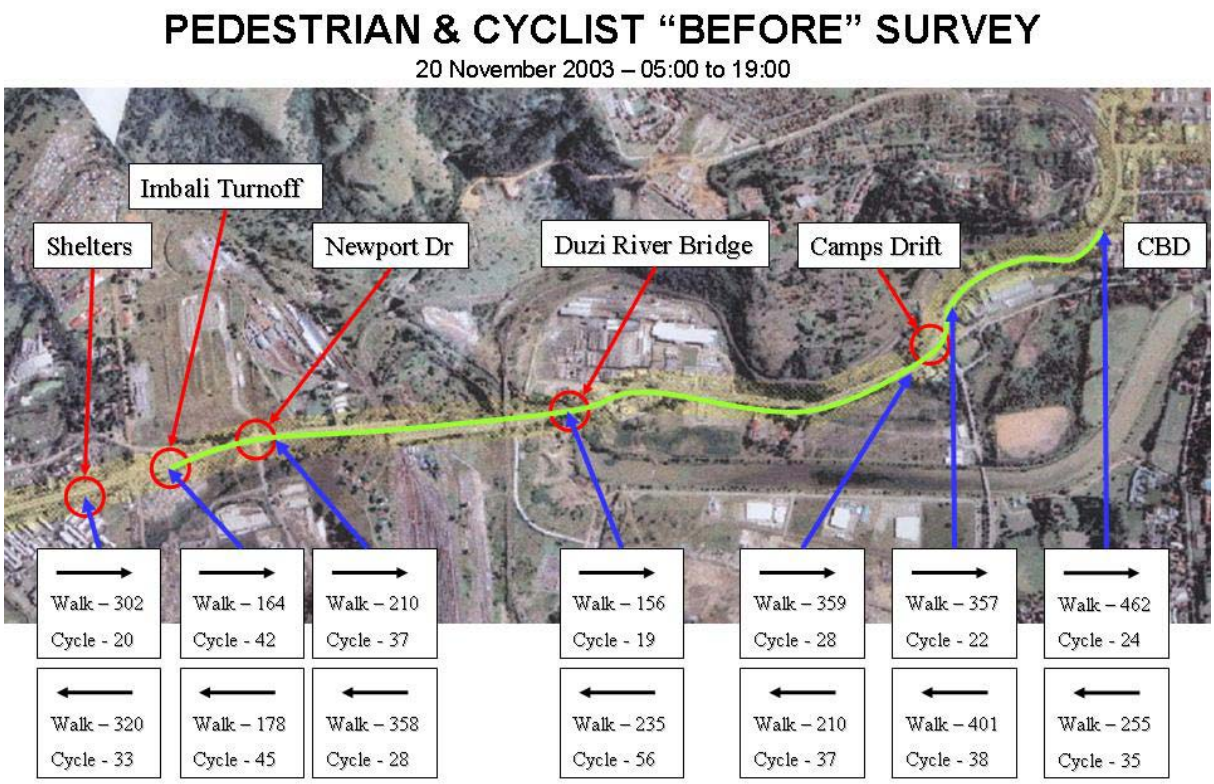
Prior to the design of the path, surveys were undertaken in November 2003 to ascertain the number of people walking and cycling along the portion of the corridor between Edendale Hospital and the CBD. In addition to this pedestrians were interviewed during the peak period in order to ascertain the purpose of the trip, the origin and destination and the time taken for the trip.

Surveys were undertaken from 5:00 till 19:00 at several points along Edendale Road in order to ascertain the quantity of cyclists and pedestrians at various points along the corridor. Basic origin / destination surveys were conducted of pedestrians at the halfway point of the path between 6:00 and 8:00 on the same day.

The results of the surveys are illustrated in figure 2. The surveys showed that the average volume of pedestrian and cycle traffic along the proposed NMT path was 558 pedestrians and 69 cyclists for the 14 hour survey period. The volume of pedestrians thus is a mere 1.6% of observed motorised traffic along the corridor and cyclists a mere 0.2%. Of this traffic an average of 6% of pedestrians and 7% of cyclists were scholars.

The origin/destination showed that the majority of pedestrians interviewed were walking to work in the CBD and the Masons Mill and Camps Drift industrial areas from the residential areas of Dambuza and Imbali. On average those walking from Imbali to the CBD took 1 hour whilst those walking from Dambuza took 1.5 hours. The shortest walking time was 35 minutes whilst the longest was 2 hours.

Figure 2: "Before" Surveys



6 DESIGN

The design of the path was undertaken by the Msunduzi Municipality with Athol Moore of the KZN Department of Transport and Rob Barker of BCP Engineers providing advice and guidance. In order to ascertain the appropriate design three planning and design guidelines for pedestrian and bicycle facilities were consulted. These were the National Department of Transport's (NDOT) draft Pedestrian and Bicycle Facility Guideline (Aug 2002), the Oregon Department of Transportation's Bicycle and Pedestrian Plan (1995), and the World Bank's Guideline for Pedestrian and Bicycle Traffic in African Cities (2001).

6.1 ON-ROAD CYCLE LANES OR SEPARATED BICYCLE PATH

The provision of on-road bicycle lanes along Edendale was one option considered. This would be the cheapest option since all it would involve would be the painting of bicycle lanes in the road shoulder and the provision of signage. Lane width would allow for the provision of such lanes. Between Hullets Aluminium and the CBD the traffic lanes would need to be narrowed to allow for a bicycle lane. Due to the high traffic volumes and speeds along Edendale Road the design team felt that the provision of on-road bicycle paths would be unsafe. Other negative aspects of using on-road bicycle lanes are the risk to cyclists of poor lane discipline and high speeds. The existing emergency lane is used occasionally by fast moving vehicles despite this being illegal. The designation of such lanes as cycle lanes is unlikely to stop this practice.

The World Bank recommends that on-road bicycle lanes are preferable, however where speeds exceed 50km/h or traffic volumes exceed 15,000 vehicles per day, on-road bicycle lanes should not be used. In such a situation full separation of cyclists from motorised traffic must be used but intersections be carefully designed in order to minimise conflicts. Such separate tracks could be

separated bicycle paths, a NMT-only path (mixed pedestrians & cycles) or a mixed traffic service road. The last of these options was found by the World Bank to be very effective in ensuring the efficiency of traffic flow on the main corridor whilst ensuring that the cycle path remains unobstructed since it is used by low speed motorised traffic.

The Oregon Department recommends however that bicycles should always be accommodated within the roadway with no physical barrier between motorised and cycle traffic. The guideline recommends against separated paths parallel to the roadway in order to improve the integration of bicycle traffic with general traffic. This has been found to improve the use of intersections by cyclists and reduce the conflict between cyclists and motorised traffic at access points. It also reduces the incidence of cyclists travelling in the opposite direction to traffic.

The NDOT guideline agreed that there is risk inherent in providing bicycle paths adjacent to roads but indicated that they may be appropriate in certain circumstances. The NDOT guideline gave no indication when such paths would be warranted. The guideline cautioned that the following risk areas be taken into account when designing bicycle paths adjacent to roadways:

- Cyclists entering intersections at high speed;
- Conflicts at driveways; and
- Conflicts with pedestrians, even where separate facilities are provided.

The recommendations of the World Bank guideline were followed and it was decided that an off-street bicycle path would be the appropriate solution along Edendale Road. It was felt that the recommendations of the Oregon guideline were not appropriate outside of the first world context due to differences in driver behaviour between Oregon and South Africa. The cautions given in the NDOT guideline were taken into account and are examined in detail in the following chapters.

6.2 **SHARED USE PATH OR SEPARATE PEDESTRIAN AND BICYCLE PATHS**

The Oregon guideline recommends that shared or multi-use paths provide good pedestrian and bicycle mobility and take into account the fact that pathways provided for cyclists are often used by walkers and joggers. Although the guideline recommends such paths it strongly recommends against building such paths adjacent to a roadway. The reasons for this are:

- Conflicts between cycle and pedestrian traffic
- Conflicts with road furniture
- Cyclists travel the “wrong way” since the two way path is on one side of the road. This is especially dangerous where the path ends since cyclists find themselves on the wrong side of the road and may continue their journey on the wrong side of the road

The guideline does however indicate that shared use paths adjacent to a roadway could be used in the following circumstances.

- Bicycle and pedestrian use is anticipated to be high (no indication given as to what volumes of pedestrians and cyclists would be considered high use)
- The adjacent roadway has high traffic volumes and speeds (>90 km/h) making on-road bicycle paths unsafe
- The path will not cross many driveways or other roads
- There are no alternative parallel routes that could be used for on-street bicycle ways
- The path is continuous throughout the corridor
- The path terminates at each end on roads with good pedestrian and cycle facilities
- The cost is proportionate to the need

The NDOT guideline recommends that where shared-use paths are to be utilised it is preferable to segregate the paths in order to minimise conflict between pedestrian and bicycle traffic. Segregation can be through a physical separation of the two paths or merely through the painting of a continuous white line.

The World Bank guideline recommends that the provision of paths restricted to bicycle use are not possible since pedestrians will use the path unless the volumes of cyclists are high. Shared use

paths are thus inevitable. Should the volumes of pedestrian traffic be great this could negatively impact on the ability of cyclists to use the path. The guideline recommends that when most bicycle traffic consists of long distance trips for commuters mixed use paths are problematic due to the high speed of cyclists. The guideline indicates however that for a 2 meter wide uni-directional bicycle track traffic volumes as high as 600 cyclists per hour can be accommodated at a good level of service. Similarly for a 1 meter wide uni-directional pedestrian path traffic volumes as high as 1,000 pedestrians per hour can be accommodated at a good level of service. Considering that current cycle and pedestrian traffic volumes along Edendale Road are not close to this order of magnitude it is safe to assume that a shared-use track should be adequate. High speed cycle traffic would thus be able to share the same pathway with pedestrians with minimal conflict.

Path with markings for cyclists and line separating pedestrians and cyclists

The proposed path aligned with most of the requirements set out in the Oregon guideline for when a shared use path adjacent to a roadway would be justified. Since no indication was given as to what "high use" is, it was not possible to ascertain whether this criteria was met. Similarly, no guideline was given to determine the value of the need and it was thus not possible to ascertain whether the cost was proportional to the need.

The proposed path partially complied with the second last recommendation. The CBD end of the path terminates into a very lightly trafficked road which allowed ample choice for cyclists for safe routes through the city. Although the residential end of the pathway terminates on a less heavily trafficked road with lower speeds, it was felt that this was not the optimum solution. In order to improve the level of safety for cyclists and pedestrians the path should ideally extend further into the Imbali residential area and be extended past the Imbali intersection in order to tie in to the service roads running parallel to Edendale Road. Budgetary constraints made this impossible. Future extension of the path should however address this in order to improve safety at the residential end of the path.

Although the Oregon guideline recommends against it the design team decided that a segregated, shared use (or multi-use) path would be appropriate. As mentioned previously the nature and speed of traffic along Edendale Road warrants an off-street bicycle path. Providing a bicycle path without providing any pedestrian facilities would be illogical since the surveys indicated that pedestrians outnumbered cyclists significantly. Due to current budgetary constraints it would not be possible to provide a separate pedestrian pathway and current volumes of pedestrians and cyclists do not warrant it. A shared use path would thus be the appropriate solution. The path should however be monitored in order to ascertain whether pedestrian and / or bicycle traffic grows to such an extent that it would warrant a separated path.

Cyclist avoiding pedestrians

6.3 **PATH CROSS SECTION**

The three guidelines recommend the following dimensions for bi-directional shared use NMT paths:

- Minimum width: 2.4 m (Oregon – for areas with very low usage) 3 m (NDOT& World Bank)
- Preferable width: 3.7 m (NDOT), 3.6 m (Oregon), 4.0 m (World Bank)
- allow 0.6 m shoulder on both sides (NDOT & Oregon)
- Separation from roadway: 1.5 m or a physical barrier (Oregon)

The World Bank guideline indicates that high use would be a peak hour volume of 600 cyclists and 1000 pedestrians per hour. This translates to approximately 2,000 cyclists per day and 4000 pedestrians per day on a commuter route. The observed numbers of pedestrians and cyclists along Edendale Road were significantly lower than this at only 65 cyclists and 569 pedestrians per day. This would thus constitute low use even if pedestrian volumes double or cyclist volumes increase 10 fold.

It was believed that due to the nature of the area served and all other factors the path could have medium to high use in the next five to ten years. It was thus not seen as appropriate to use the minimum width as recommended by the Oregon guideline. The preferable width recommended was unaffordable within the budgetary constraints. The minimum with of 3 m was thus used for the path but in the immediate vicinity of intersections the width was increased to 4 m in accordance with the World Bank guideline. This innovation was proposed by the design team since in traffic theory capacity constraints tend to occur in the vicinity of intersections. Additional width would thus be most needed in the vicinity of the intersections. Any future widening of the path to accommodate growth in NMT traffic could easily be done. Alternatively if warranted another path could be constructed on the opposite side of the road should the growth in NMT traffic warrant the separation of pedestrian and cycle traffic.

The roadway has kerbs along the edge of the roadway along most of its length. In addition to this vertical separation the path was horizontally separated from the roadway by 1.5m for most of the route except where existing sidewalks existed or where the width of the road reserve made this impossible. Budgetary constraints meant that guardrails could not be provided where the path was not separated from the roadway. Guardrails were only provided where a high risk area was identified or where there was a need to prevent vehicles from gaining illegal access to properties by utilising the path.

Horizontal separation from roadway

In order to ensure good drainage whilst not affecting the comfort of pedestrians and cyclists the paths were designed with a cross-fall of 2% away from the roadway. This was in accordance with the recommendations of all three of the guidelines.

6.4 **MATERIALS**

The World Bank guideline recommends that cycle paths be a surface dressing or 35mm premix asphalt. This recommendation is made in order to ensure adequate ride quality. Concrete paving blocks (600x600mm) were not recommended due to low ride quality. Surprisingly though the guideline recommends brick pavements for their strength.

The Oregon guideline disagrees with the World Bank due to the fact that the low long term maintenance costs of concrete as compared to asphalt offset the higher construction cost. The strength of concrete also provides a better long term ride quality since it does not become deformed by roots and weeds as asphalt is. The guideline recommends a minimum thickness of 125mm for the concrete slab with saw cut joints.

The NDOT guideline makes no recommendation on the preferable materials that should be used but does recommend against interlinking concrete paving blocks due to the low ride quality these result in. The NDOT guideline recommends either a 15mm premix asphalt or 6mm chip and spray on a 100 mm crusher run base, or a 100mm concrete slab on a compacted in situ gravel base.

All three guidelines stress the importance of the need for a good foundation for the path. Although not intended for vehicles it is inevitable that the path will at some stage be used by a motor vehicle. Often this may be a heavy motor vehicle like a tractor mower. A good foundation is thus essential to give the path sufficient strength to carry such loads.

Due to the relatively low pedestrian and bicycle traffic volumes on the path it was felt that asphalt would degrade and cause low ride quality over time due to the low level of maintenance that could be expected on the path. In addition to this it was felt that the construction of a concrete path would be more labour intensive than an asphalt path.

The design team felt that the recommended minimum thickness of 100mm as recommended by the NDOT guideline was excessive were founding conditions were adequate. Although the recommended minimum would be ideal budget constraints meant that it was not possible to achieve this. After consultation with the experts in concrete road construction in the National Roads Agency it was decided that an 80mm thick slab would be used where founding conditions were good. Where ground was found to be soft a 100mm thick concrete pavement was used. In order to reduce the risk of damage to the path from heavy vehicles asphalt was used where large numbers of heavy vehicles were expected to cross the path. It was felt that the flexibility of an asphalt pavement would reduce the damage caused by heavy vehicles. Only one point on the path warranted this, namely the entrance to the rail marshalling yards in the Masons Mill industrial area.

The concrete was finished with a wooden trowel in order to ensure that the path had adequate surface texture to maintain traction in wet weather.

6.5 **INTERSECTIONS**

Intersections of the path with roads and driveways were identified in all three guidelines as one of the areas of greatest risk in the design of the path. The problems identified in the guidelines and the solutions implemented are detailed below.

All three guidelines identified that there is a risk of vehicles driving and parking on the path and causing damage to the path and obstructing cyclists and pedestrians. This could negatively affect the operation of the path by causing inconvenience or even a hazard to users of the path. When surveying the path minibus taxis were observed parking on the verge near intersections in order to wait for passengers despite adequate public transport lay-bys being provided. Illegal access points for informal vehicle servicing businesses were also observed on the residential end of the corridor.

Closely spaced bollards at Camps Drift intersection during construction

In order to prevent vehicles from using the path illegally the guidelines recommend using bollards. The risk of bollards to cyclists was highlighted and it was recommended that they be painted with reflective paint in order to improve visibility at night. Bollards were used at all intersections and driveways along the path. In order to warn cyclists of bollards in the pathway a “rumble strip” was created in the path by slightly increasing the roughness on the panel prior to the bollards.

The other major area of risk identified by the guidelines is the risk of cyclists crossing streets unsafely. The Oregon guideline recommends that paths be curved slightly close to intersections so that it is not parallel to the roadway in order to improve the visibility of path users. This was not found to be possible on the Edendale NMT path. Neither of the other two guidelines provide recommendations on reducing this risk.

Inadvertently the design team created a solution for this problem. The bollards placed at intersections in order to prevent vehicles accessing the path were over-designed and too many bollards were installed. The gaps between the bollards were as small as 0.5 metres on some intersections. This made it extremely difficult for cyclists to navigate past the bollards without slowing down, stopping or even dismounting. Although this increased the risk of cyclists crashing into the bollards it also greatly reduced the risk of cyclists entering the intersection at speed. Where driveways crossed the path the bollards were not as closely spaced and they could easily

be navigated by cyclists. Due to the fact that there are very few intersections on the route this solution would have a negligible impact on the journey time of cyclists.

6.6 **COSTS AND CONSTRUCTION**

The total cost of construction of the NMT path is set out in table 1. The total cost was R1,469,038 (US $240,000). The design and drawings for the path were done by the municipality and so the cost of this is not included. BCP Consulting Engineers providing expert advice on certain aspects of the design and this cost is therefore the only cost shown related to the design. The contractors were managed by the municipality and thus no cost was recorded for the supervision and management of the contractor.

Table 1: Edendale NMT Path Costs

TASK	**COST**
Pedestrian & cycle surveys (before)	R 9,690
Topographical surveys	R 14,546
Consultants advice on design	R 36,064
Printing contract documents	R 952
Construction of path and related works	R 1,336,966
Signage & road marking	R 47,820
Traffic signal modifications	R 13,000
Pedestrian & cycle surveys (after)	R 10,000
Total cost	**R 1,469,038**

The construction commenced in June 2005 and was completed in October 2005. The community was consulted in the construction process through the employment of a community liaison officer on the project. During the construction 21 labourers were employed of which 15 were unskilled labourers sourced from the community adjacent to the path. These labourers were sourced with the assistance of the community liaison officer.

7 AFTER SURVEYS

Two months after construction of the path surveys similar to those undertaken in 2003 were undertaken. The surveys were done at the same time of year as the previous surveys in order to avoid seasonable variations. Both surveys were conducted on mid-week days in order to avoid anomalies created by weekend traffic. Both pedestrians and cyclists were interviewed in the small sample survey done between 6:00 and 8:00.

The results of the before and after surveys are illustrated in table 2. Figure 3 illustrates the after surveys. The surveys showed that the average volume of pedestrian and cycle traffic along the proposed NMT path increased from 558 to 779 pedestrians and from 69 to 211 cyclists subsequent to the construction of the path. Of the cyclists an average of 5% were scholars whilst 4% of pedestrians were scholars. A 40% increase in pedestrians was thus observed and an incredible 207% increase (a three fold increase) in cyclists was observed.

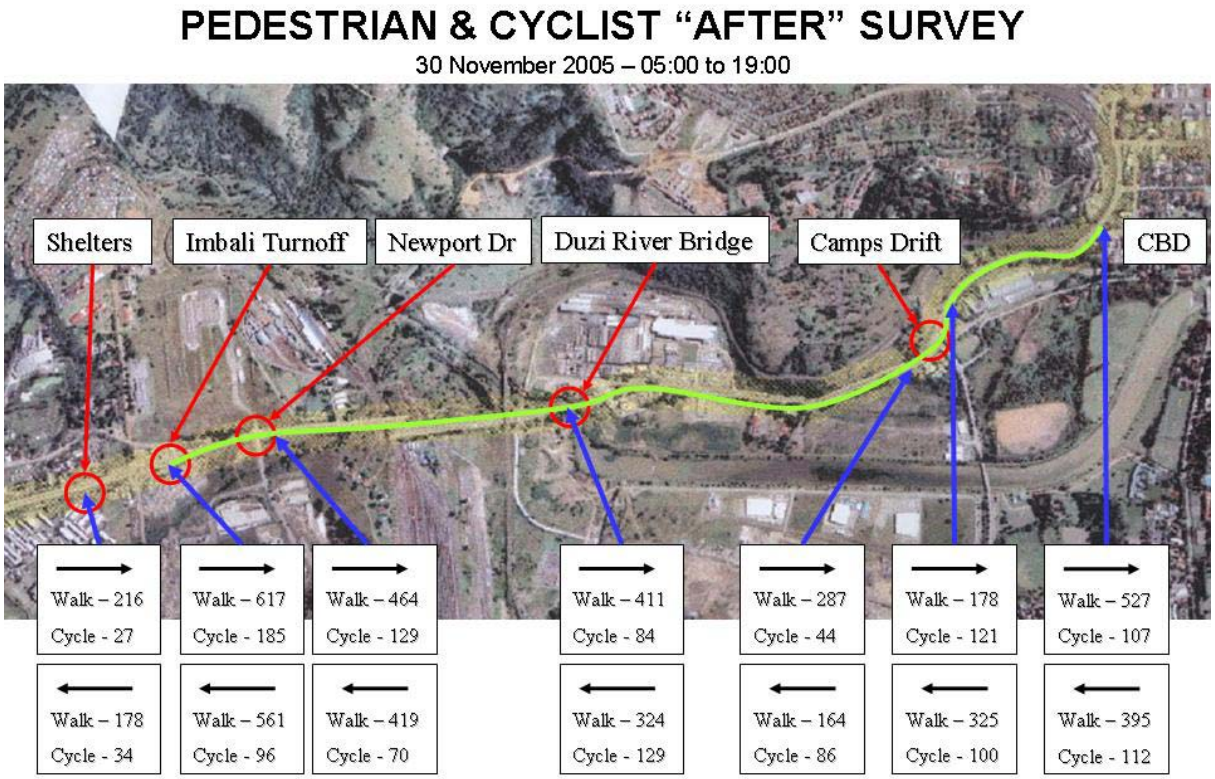
Table 2: Analysis of "Before" and "After" Surveys

		Imbali Turnoff	Newport Drive	Duzi River Bridge	Camps Drift (W)	Camps Drift (E)	CBD	Average
Before survey	Pedestrians	342	568	391	569	758	717	558
	Cyclists	87	65	75	65	60	59	69
After survey	Pedestrians	1178	883	735	451	503	922	779
	Cyclists	281	199	213	130	221	219	211
Difference	Pedestrians	836	315	344	-118	-255	205	221
	Cyclists	194	134	138	65	161	160	142

In order to compare the growth to that observed elsewhere the surveys undertaken between the Imbali intersection and the next intersection along Edendale Road. This section of road has no formal pedestrian infrastructure along it and conditions are not conducive to cycling due to high traffic volumes and speeds. These surveys can thus be used to evaluate whether the increases observed where the NMT path was constructed are mirrored where no NMT infrastructure was provided.

On average the surveys undertaken along this stretch of Edendale Road show that the numbers of cyclists increased by only 9%. It would thus appear that the infrastructure bottleneck along this section of road has constrained the growth in cycling. The three fold increase observed along the cycle track can thus reasonably be assumed to be the result of the construction of the NMT path.

Figure 3: "After" Surveys



The origin/destination survey showed that the majority of pedestrians interviewed were walking to work in the CBD and the Masons Mill and Camps Drift industrial areas from the residential areas of Dambuza and Imbali. A total of 68 pedestrians and 18 cyclists were interviewed. On average those walking from Imbali took 1 hour 10 minutes with a maximum of 1hour 50 minutes and a minimum of 20 minutes. Those walking from Dambuza took 1 hour 20 minutes with a maximum of 2 hours and a minimum of 25 minutes.

Although these surveys gave broad indication of the origin and destination of cyclists and pedestrians they were not sufficiently detailed to allow for any conclusions to be drawn as to whether the construction of the path had any effect on journey times of cyclists and pedestrians, and whether it encouraged people living further away to choose to walk or cycle to work.

All the cyclists interviewed during the O/D surveys were asked why they cycled. Of those that responded 72% indicated that they cycled because the taxi fare was too high whilst 12% indicated

they cycled to keep fit. This shows that the majority of people cycling see it as a viable alternative to public transport.

Observations of the cycle and pedestrian traffic along the path were also taken on 11 January 2005 during the morning peak. In observing the traffic it was noted that there were several people jogging along the pathway. It was not clear whether these persons were jogging to work or were doing so for recreation.

Jogger on pathway

Also observed on the path were street traders at some of the public transport lay byes. Although the traders did not block the pathway they did constrict the flow. This could pose a risk should volumes of pedestrians and cyclists increase. The provision of rudimentary facilities for traders at public transport stops could alleviate this problem.

Street traders

From the observations it was noted that pedestrian traffic did not greatly affect cyclists and most pedestrians kept to their delineated side of the path. Vegetation at the edge of the path did however reduce the effective width of the path by approximately 20 cm.

The observed volumes of pedestrians and cyclists appear to be adequately accommodated by the NMT path without excessive risk of conflict. Of concern were the high speeds at which cyclists travelled on some sections of the path. This could pose a risk to pedestrians. Fortunately on those sections where bicycle speeds are highest the pathway travels along a partially unused service road which has limited motorised traffic. The width of the path is thus wide enough to reduce the risk of conflict.

The path would appear to have sufficient capacity to accommodate significantly more cyclists if pedestrian numbers remained constant. Should the volume of pedestrians increase this could negatively impact on the volume of cyclists that can safely be accommodated.

High speed section along old service road. Note bollards to prevent use by vehicles along the full length of path.

8 CONCLUSION

The three fold increase in cyclists observed subsequent to the construction of the NMT path can largely be attributed to the removal of the infrastructure bottleneck created by the lack of continuous dedicated infrastructure for cycling. Factors such as the increase in public transport fares and the reduction in the cost of bicycles may have contributed to this increase. The quantum of this increase would appear to be less than 10% although most cyclists cite high public transport fares as the reason they cycle.

The impact of the provision of this path supports the need to develop an integrated cycling plan for the Msunduzi Municipality and invest in expending the path and developing a network of cycle friendly routes throughout the city. The annual traffic monitoring programme of the municipality should also be expanded to include pedestrian and bicycle traffic. Similarly all towns and medium sized cities within the province should develop an integrated cycling plan. The pilot has shown that the benefit of “de-bottlenecking” such a planned network can have a major impact on the extent of cycling where potential exists.

Although this pilot project showed that the provision of safe routes for utility cyclists can have a massive impact on the extent of utility cycling it is important to note that other conditions must be conducive to cycling for this to occur. Where there is limited potential for cycling (distances are too great, car ownership is high, topography too steep) the provision of infrastructure for cyclists is unlikely to have much effect on the numbers of cyclists.

9 REFERENCES

Department of Transport, *Pedestrian and Bicycle Facility Guidelines Draft 1.0,* August 2002
World Bank Sub-Saharan Africa Transport Program, *Productive and Liveable Cities – Guidelines for Pedestrian and Bicycle Traffic in African* Cities, January 2001
Oregon Department of Transportation, *Oregon Bicycle and Pedestrian Plan*, 1995
Department of Transport, *National Household Travel Survey 2003*, August 2005