

N2 BMT LANE – A FIRST FOR SOUTH AFRICA

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ABSTRACT

After the initial attempt to introduce a Bus & Minibus-Taxi (BMT) lane on the N2 freeway in 1995 the provincial and city road authorities in Cape Town reconsidered the need for enforcing a BMT lane in 2006. In August 2007 the BMT lane on the N2 freeway was re-launched, this time taking into account the lessons learnt from the first attempt. The section of the N2 reserved for BMT vehicles is 11 kilometers long and runs between the Borchards Quarry interchange and the Black River Parkway interchange on the inbound carriageway during the morning peak period.

This paper describes the issues that were addressed in preparing for the implementation of the BMT lane (law enforcement, communication and technical), presents the results of the before and after study and ends with a conclusion regarding the success or not of the BMT lane.

1. INTRODUCTION

In December 1995 the first attempt was made to introduce a Bus Minibus Taxi (BMT) lane on the N2 freeway in Cape Town. The length of the BMT lane was approximately 7 kilometers, running on the inbound carriageway from Vanguard interchange to just before the Raapenberg interchange – refer to Figure 1. The BMT lane was located in the median lane of the three lane carriageway.

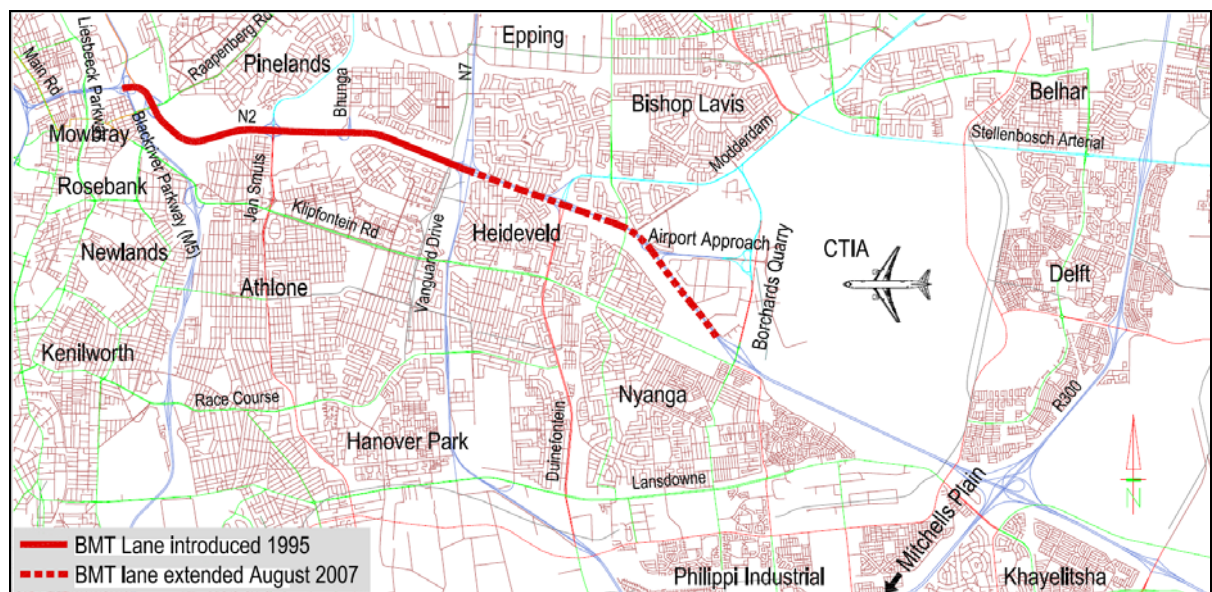


Figure 1 N2 BMT Lane

Following some initial success it soon became evident that law enforcement was the glue around which the success of the BMT lane depended. On-site law enforcement was undertaken by officers pulling vehicles off that were travelling illegally in the BMT. Unfortunately only one location was available where transgressing vehicles could safely be stopped and one location to enforce the full 7 kilometers of BMT lane can be considered wishful thinking. The final nail in the coffin for the enforcement of the BMT lane was the withdrawal of the Department of Public Prosecutions (DPP) support resulting in the withdrawal of all fines that had been issued.

In March 2004 the upgrading (to three lanes) and rehabilitation of the inbound carriageway between Borchersds Quarry and Vanguard interchange commenced. The Provincial Government Western Cape and the City of Cape Town jointly made the decision to consider the re-introduction of the BMT lane between Vanguard interchange and Raapenberg interchange and to use the new third lane that would be constructed as part of the upgrading and rehabilitation to extend the BMT further back towards the dormitory towns of Mitchells Plain and Khayelitsha. This extension would allow for a continuous BMT lane of 11 kilometers.

The re-introduction of the BMT lane would need to consider using Intelligent Transport Systems (ITS) to aid in the law enforcement and all elements of the BMT lane operation would need to have the sanction of the DPP prior to its opening.

2. BMT LANE STRATEGY

The BMT lane strategy comprises four legs (described in the four sections below).

2.1 Business case

In order to get political and law enforcement acceptance for the reintroduction of the BMT lane the benefits that would accrue to BMT vehicles and commuters needed to be spelt out. At the same time there was the expectation that the reservation of the third lane for BMT vehicles would result in additional travel time delays to the general motorist. Aspects that required consideration included inter-alia current operation (to establish a base line), end treatment of the BMT lane, expected travel times savings/increases and time of reservation. The development of the business case was completed in August 2006.

2.1.1 Current operation along N2 (inbound)

The number of morning peak hour vehicles and commuters, by volume and modal split, using the different sections of the N2 are set out in Table 1 (note the numbers are based on counts that were influenced by downstream congestion).

Table 1 Vehicle / commuter volumes and modal split

Road section	General	Bus	Taxi	Modal split	
				Private	BMT
<i>Vehicles</i>					
Borchersds Quarry to Airport	2 560	90	240	88.8%	11.2%
Vanguard to Bhunga	3 520	115	380	87.5%	12.4%
Raapenberg to M5	3 000	80	335	87.7%	12.1%
<i>Commuters</i>					
Borchersds Quarry to Airport	4 530	4 890	3 420	35.3%	64.7%
Vanguard to Bhunga	6 040	4 670	5 300	37.8%	62.2%
Raapenberg to M5	5 730	3 860	4 950	39.4%	60.5%

A travel time survey was done in 2004 from Mew Way interchange by Khayelitsha to the Liesbeek Parkway, the first interchange after the end of the BMT lane. The average travel time during the morning peak hour for all vehicles was 48 minutes 3 seconds.

2.1.2 End treatment of BMT lane

The position of the end of the BMT lane was considered critical to the success and acceptance of the BMT lane operation. At the time enforcement of the BMT lane was halted following the first opening in December 1995, the BMT lane ended just west of Black River Parkway (M5) in the bottleneck area caused by high on-ramp volumes from the M5 followed by high off-ramp volumes to Liesbeek Parkway (weaving taking place over a distance of some 250 metres). This bottleneck area restricted the upstream capacity of the three lanes on the N2 to around 4 300 vehicles in the morning peak hour. Retaining the end of the BMT lane west of the M5 would mean that the capacity of the three lanes will not be utilised, as the BMT vehicles are expected to use in the vicinity of 40% of the median lane capacity. Assuming that the capacity of the shoulder and centre lane does not change significantly after the introduction of the BMT lane the capacity on the N2 entering will reduce to 3 600 vehicles per hour (down by 700).

Moving the end of the BMT lane back by 700 metres will allow the general vehicles to move into the median lane prior to the bottleneck area and thus the 4 300 capacity on the N2 will still be fully utilised.

2.1.3 Expected travel time savings/increases

Using an assumed average travel speed of 80 km/h for BMT vehicles it was expected that BMT vehicles would achieve an average travel time saving of around 29 minutes. It was also expected that the reservation of the BMT lane would reduce the capacity for general vehicles and that general vehicles would experience an increase in travel time of around 11 minutes during the morning peak hour.

2.1.4 Time of BMT lane reservation

In December 1995 the time of reservation for the BMT lane was 06:00 to 09:00. As part of the business plan the time of reservation was also investigated to establish if 11 years later the original time of reservation was still relevant or even if the BMT lane should be reserved permanently for 24 hours a day, 7 days a week.

It was recommended that the BMT lane reservation should remain in place only for the morning peak period as the business travel demand between the morning and afternoon peak periods justified 3 lanes. The time of start of the reservation was adjusted to 05:30 using the existing speed profiles on the road as a guide and influenced by the expectation that the longer travel time for general traffic would translate into motorists starting their commute earlier in the morning in order to get to work at the same time.

2.2 Law enforcement strategy

Given the lack of suitable locations to undertake law enforcement on the road and having had preliminary discussions with the DPP it was decided that Intelligent Transport Systems offer the greatest potential for the successful enforcement of the BMT lane. A system using both Closed Circuit Television (CCTV) and Automatic Number Plate Recognition (ANPR) technology was proposed with 17 stations being set up along the length of the BMT lane at an average spacing of 750 metres. The ANPR cameras would be dedicated to the enforcement of the BMT lane.

The CCTV cameras would be available for 24 hour safety and security monitoring when not supporting the enforcement of the BMT lane. The images captured by the system would be stored at a control room where the CCTV cameras would be used by an officer to certify that there were no incidents on the N2 that could justify a general vehicle travelling in the BMT lane. In the control room software would screen the registration numbers of vehicles against a list of buses and minibus-taxis. Should no match be found then the image is screened to insure quality and to establish if the vehicle is legally allowed to use the BMT lane, i.e. registration number captured and added to the list of approved vehicles. Once the screening has been completed the images enter the existing process for certifying and issuing of fines.

The last leg of the enforcement strategy was to ensure that all road signs and marking were in compliance with the South African Road Traffic Signs Manual (SARTSM). The symbols used on the signs allow minibuses and buses with a minimum 9 + 1 occupancy.

2.3 Communication strategy

The objective of the marketing strategy was to develop a set of communication tools that would raise awareness of the BMT lane, educate the drivers/commuters who would use or not use the BMT lane, inform the public on the law enforcement measures and maintain ongoing information and communication.

The strategy focused on 3 time specific periods:

- 2 Months prior to the opening – using print and electronic media, distribution of a Background Information Document and consultation with Interested & Affected Parties.
- Opening of the BMT lane plus 1 month - using print and electronic media, drive time news and reports, toll free number, high visibility traffic police presence, roadside information and education.
- Post opening for 6 months – maintain information stream report on compliance and prosecutions, maintain media campaign and maintain road traffic reports.

2.4 DPP approval

The final task to be undertaken before starting to implement the law enforcement strategy was to obtain DPP support for the Business Case, Law Enforcement Strategy and Communication Strategy. Once the DPP's approval was obtained the detailed design and award of the ITS tender commenced.

3. BEFORE AND AFTER STUDY

The BMT lane was officially opened by the MEC for Transport on 7 August 2007 with the first day of operation on 8 August 2007.

Traffic surveys, including travel time surveys, traffic counts by lane by mode and visual observations (at four locations), were undertaken on four separate days one month prior to the opening of the BMT lane and on three separate days two months after the opening.

From the before study and from historical observations on operation along the N2 since 1995 it was clearly visible that, after the original attempt to enforce the BMT lane failed, minibus-taxis looked for and often created their own path of least resistance through the traffic, this included multiple weaving actions between traffic lanes. The before survey

measured only travel times in the existing lanes and did not measure the travel times of these taxis.

3.1 Travel time comparison

The results of the morning peak hour travel time surveys are summarised in Table 2 below. It is significant to note that the BMT vehicles experience an average travel time saving of just over 19 minutes after the BMT lane was opened. It is equally important to note that, against all expectations, the general traffic that is not allowed to use the BMT lane also experienced improved travel times. The general vehicles experience an average travel time saving of just over 5 minutes during the morning peak hour.

Table 2 Comparison of travel times

Pre-BMT Lane opening		Post-BMT Lane opening			
All vehicles		General vehicles		BMT vehicles	
Date	Time (m:s)	Date	Time (m:s)	Date	Time (m:s)
17-Jul-07	31:18	18-Sep-07	28:02	18-Sep-07	13:27
18-Jul-07	39:32	10-Oct-07	30:06	10-Oct-07	14:23
19-Jul-07	27:01	11-Oct-07	25:52	11-Oct-07	14:06
26-Jul-07	35:09				
Average travel time	33:15		28:00		13:59
Travel time savings - general vehicles =				05:15	
Travel time savings - BMT vehicles =				19:16	

Of interest is that the average travel time used in the business case was significantly longer than the average travel time determined during the before study, 48 minutes 3 seconds versus 33 minutes 15 seconds. However the shorter average travel time during the before study does not change the fact that the BMT vehicles are experiencing a substantial travel time saving when using the BMT lane.

3.2 Travel speed comparison

The average travel speeds during the morning peak hour along the full length of the BMT lane are shown on Figure 2 below.

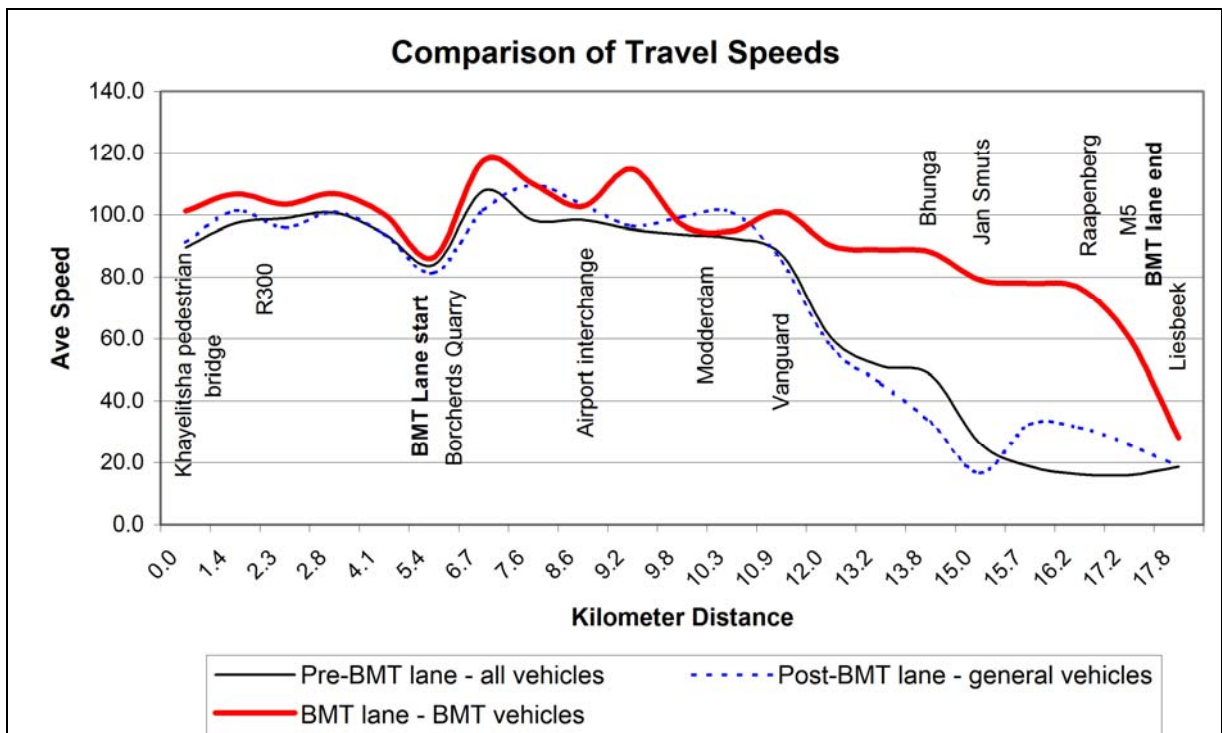


Figure 2 Comparison of travel speeds

Figure 2 clearly indicates the sections of the N2 freeway over which BMT vehicles are being provided with a travel advantage with the section Vanguard and Liesbeek Parkway interchanges standing out. For interest the high BMT speeds between Borcherds Quarry and Modderdam interchanges has resulted in the Traffic Department undertaking speed enforcement. Over a three month period more than of 4 000 speeding fines were issued (all to taxis) with the highest speed being 150 km/h.

The improved travel times for general vehicles is ascribed to improved flow conditions over two sections: between Borcherds Quarry and Vanguard interchanges and between Jan Smuts and Liesbeek Parkway interchanges. Between Borcherds Quarry and Vanguard interchanges the opening of the BMT lane coincided with the opening of the third lane (a result of the rehabilitation/upgrading contract). The removal of the buses and taxis to the BMT lane has provided additional capacity for the general vehicles. Between Jan Smuts and Liesbeek Parkway interchanges the improvement in travel conditions that allows higher average travel speeds can only be ascribed to the BMT lane removing the need for taxis to choose/force the path of least resistance (by multiple weaving).

3.3 Vehicle and commuter volumes

For the purposes of this paper the focus is on the N2 section between Vanguard and Raapenberg interchanges.

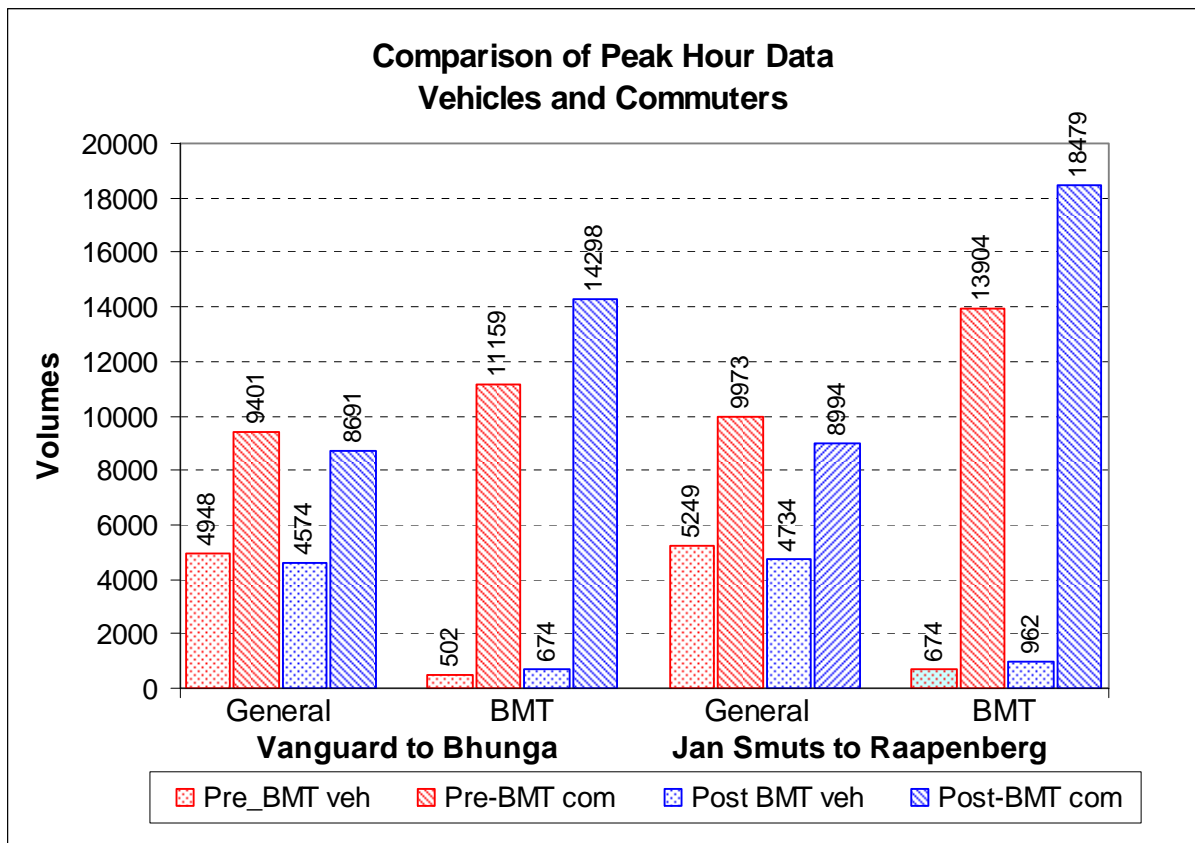


Figure 3 Peak hour- General vehicles and commuters

From Figure 3 it can be seen that between Vanguard and Raapenberg interchanges the number of general vehicles travelling along the N2 during the morning peak hour decreased slightly. This has naturally also resulted in a reduction in the number of commuters that travel this section of the N2 in general vehicles. The average number of commuters travelling in general vehicles through the section between Vanguard and Raapenberg interchanges has dropped by between 7.6% and 9.8% during the morning peak hour.

The number of BMT commuters has shown significant growth in the morning peak hour with the number of BMT commuters increasing by between 28.1% and 32.9%. Overall the total number of commuters (general commuters and BMT commuters) increased by between 12% and 15%.

A comparison of the total before and after vehicle and commuter volumes, between Jan Smuts and Raapenberg interchanges, provides some interesting statistics.

Table 3 Comparison of modal split for peak hour

Modal split	Before opening			After opening		
	General	BMT	Total	General	BMT	Total
Vehicles	86.6%	13.4%	5 923	83.1%	16.9%	5 696
Commuters	41.8%	58.2%	23 877	32.7%	67.3%	27 473

The implementation of the BMT lane has resulted in a significant change in the modal split during the morning peak hour and has resulted in the commuter capacity of the N2 increasing by almost 3 600 commuters (an increase of 15%), this without increasing the number of vehicles travelling on the N2.

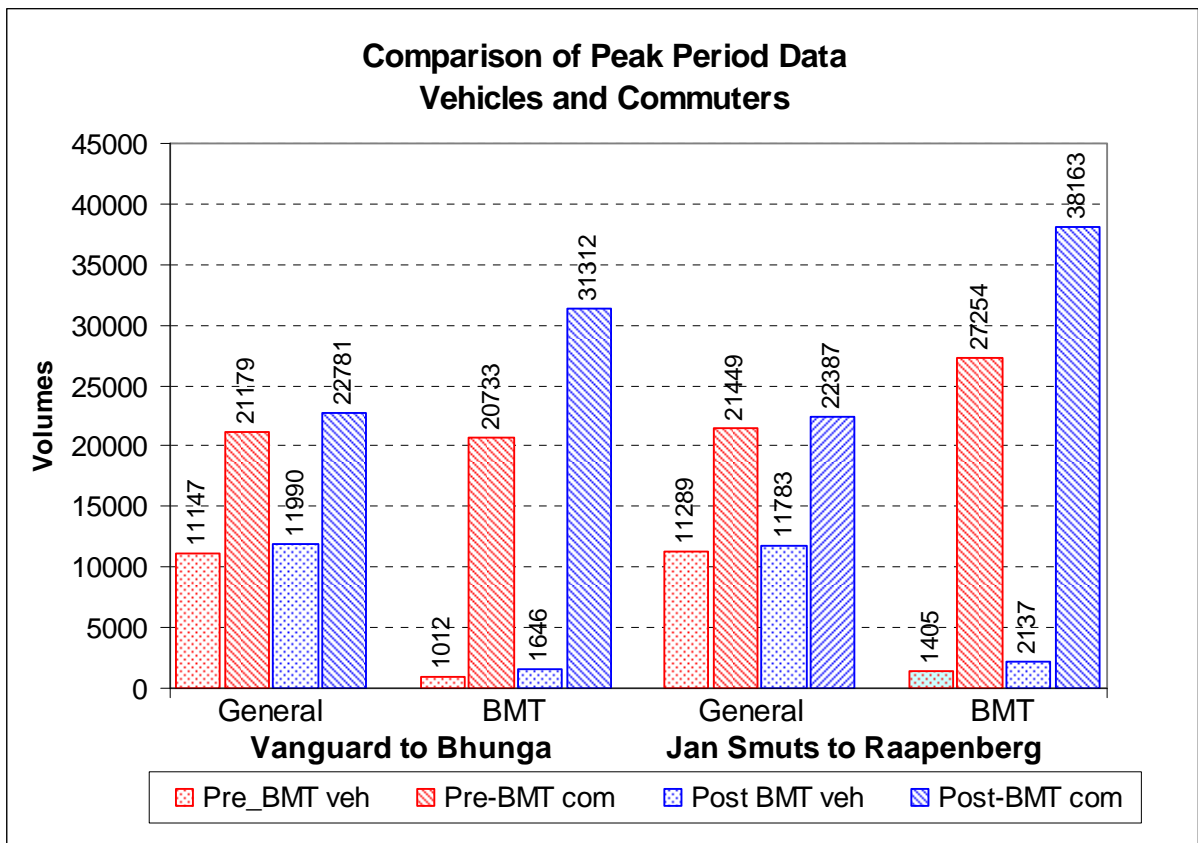


Figure 4 Peak period- General vehicles and commuters

From Figure 4 it can be seen that for the morning peak period the total number of general vehicles and thus commuters was slightly higher after the opening of the BMT lane. This would indicate that although the reservation of the BMT lane has reduced the capacity available for the general vehicles, the improved traffic flow achieved by providing a separate lane for the BMT vehicles has compensated. General vehicles and commuters have grown by between 4.4% and 7.6%.

The BMT commuters have shown significant growth of between 40.0% and 51.0%. Overall the total number of commuters (general commuters and BMT commuters) increased by between 24% and 29%.

From observation and discussion with Traffic Authorities it has been determined that the growth can be attributed to BMT vehicles re-routing to the N2 due to the travel time savings over their original route, additional trips that can be achieved due to the reduced travel time, additional services and possibly stealing passengers from the rail service.

Table 4 Comparison of modal split for peak period

Modal split	Before opening			After opening		
	General	BMT	Total	General	BMT	Total
Vehicles	88.9%	11.1%	12 694	84.6%	15.4%	13 920
Commuters	44.0%	56.0%	48 703	37.0%	63.0%	60 550

For the morning peak period the implementation of the BMT lane has resulted in the number of commuters travelling on the N2 to increase by 11 847 (24.3%) with vehicles only increasing by 1 226 (9.7%).

3.4 Vehicle distribution in BMT by time of day

Using the data collected the BMT lane usage between 06:00 and 09:00 has been plotted.

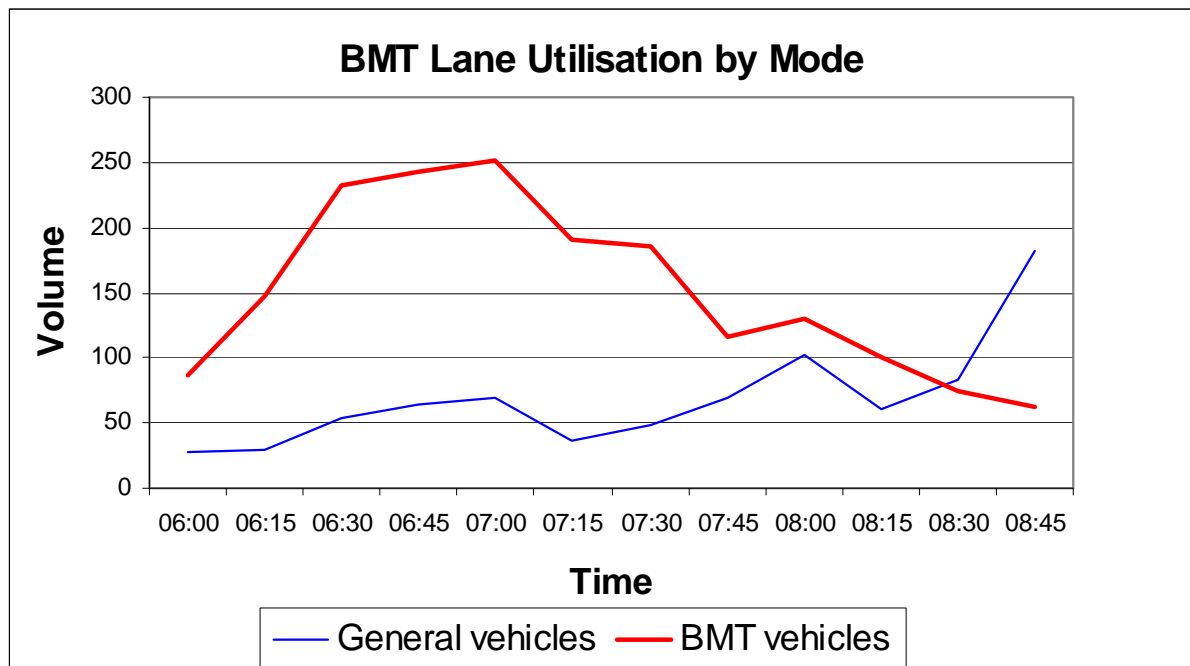


Figure 5 BMT lane utilization by mode

From Figure 5 the number of general vehicles using the BMT lane illegally increases significantly towards the end of the period of the reservation as the number of BMT vehicles decreases. In line with international findings it would appear that as the number of legal vehicles decreases there is an increased perception by the general motorist that the lane is under-utilised and thus an increase in the number of transgressors.

3.5 Observations

From observation during the surveys and also from discussion with traffic officials the following comments can be made regarding the operation of the BMT lane:

- Traffic flow along the N2 is more relaxed without the taxis competing with the general vehicles for road space.
- Queuing has not increased significantly between the queues observed during the before study and the queues observed during the after study.
- Although the BMT lane has been in operation for a short period the opinion of the traffic officials is that safety has not been noticeably compromised except on the section between Borchards Quarry and Modderdam Road where the high speeds by taxis are experienced. It must be noted that no accidents have yet been reported that can be attributed to these high travel speeds.
- Weaving to/from ramps along the length of the BMT has not created noticeable problems.

3.6 Operation of the ITS system

In the initial period following the opening of the BMT lane there were a number of teething problems that limited the effectiveness of the law enforcement through the ANPR cameras (not the least of these problems was cable theft). These problems have since been resolved. In January 2008 the traffic department introduced patrols along the N2 and started pulling illegal vehicles off at the one location where they could do so safely. Since

the implementation of the patrols observation has shown a decrease in the number of vehicles using the BMT lane illegally (further studies are required to quantify this). Unlike a speed enforcement camera there is no flash to indicate that the registration number of a transgressing vehicle has been captured and it is a preliminary conclusion that some form of visible policing is still required to support the enforcement using the ANPR.

4. CONCLUSIONS

Based on the data collected it can be concluded that the re-introduction of the BMT lane has achieved its objectives of providing BMT commuters with a significant travel time saving and promoting the use of road-based public transport along the N2. Without increasing the number of vehicles the implementation of the BMT lane has resulted in the number of commuters using the N1 has increased by almost 12 000 (24.3%) during the morning peak period with no disbenefit to general vehicles as a result of less friction between the general and BMT vehicles.

An unexpected negative result of the reservation of the BMT has been the high speeds experienced on sections of the BMT lane where vehicle density is relatively low.

Throughout the planning and implementation of this project it was stated that the law enforcement strategy will dictate the success or failure of the operation of the BMT lane. After six months of operation it is considered that that statement is still applicable.

5. REFERENCES

- [1] BKS (Pty) Ltd, August 2006, report title "Operation of Bus/Minibus Taxi Lane on the N2, Third Draft"