Cost Benefit Analysis of NMT Infrastructure Projects

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1 INTRODUCTION

Non-Motorized Transport (NMT) has immense benefits for individual users, as well as society at large, through improvements to physical health, air quality, the environment, climate change, personal finance, accessibility, mobility and the empowerment of vulnerable groups. Therefore, NMT infrastructure - particularly well-planned, high quality facilities in a comprehensive network - is essential to achieving economic and social equity, especially for the urban poor in developing countries.

Currently, there is no comprehensive holistic method for appraising the various costs and benefits of NMT projects in developing cities. Contemporary tools used in the developed world are thematic, focusing only one specific benefit of NMT, or require impractical amounts of contextual data. To aid the promotion of NMT infrastructure investment, the NMT Project Appraisal Tool (NMT-PAT) was developed to take into consideration the wide range of benefits (health, social, economic and environmental) while not requiring unrealistic amounts of data. The tool utilises common, aggregate transport and economic indicators where possible and provides the ability to use local institutional knowledge to supplement existing data or substitute data that is unavailable. The user can generate meaningful insight into the viability of NMT infrastructure in their city, which would be useful in planning, budgeting and decision-making processes.

This report and its supplement aim to advance the development of NMT-PAT for UNEP's 'Share the Road' programme. This advancement is facilitated by testing its suitability for the African context by analysing four case study scenarios in Nairobi, Kenya. The report begins with a background to the current state of non-motorised transport in Kenya (Chapter 2). An overview of the availability of relevant data in Nairobi follows, as well as a discussion around the options for procuring or substituting necessary data that is absent (Chapter 3). The four case study scenarios are then critically analysed based on NMT's major indicators of societal amelioration and compared by accounting for the scale of each project (Chapter 4). Finally, the applicability of NMT-PAT was further investigated through a Training workshop with local NMT experts and stakeholders in Nairobi (Chapter 5). The output of the project is a more advanced form of NMT-PAT that can analyse and compare multiple, simultaneous ex-ante evaluations of NMT infrastructure investments.

2 EX-ANTE CASE STUDIES

2.1 BACKGROUND

Nairobi, the capital of Kenya occupies a land size of about 684 km^2 (Tibaijuka, 2007) and has a population of about 3.5 million (World Policy Blog, 2014). The population of Nairobi is expected to grow and rapid urbanisation and economic growth provides both opportunities and problems within the urban environment. This has seen congestion soaring and costing the government close to Ksh 1.9 billion every year (Gachanja, 2015).

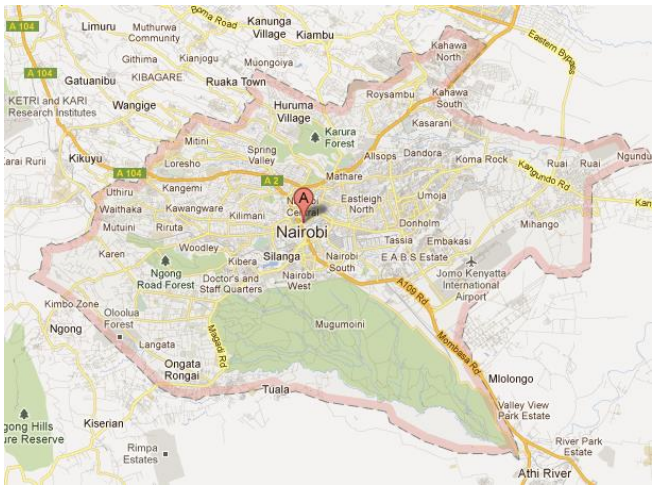


Figure 1: Map showing the boundaries of Nairobi (Source: Google Maps)

Nairobi's traffic conditions consist of congestion and roadways that are not safe for its various users. The Nairobi transport system was designed for a population of around 300,000 people, with the natural increase in population and urban migration, the transport system is forced to cater for over 3 million residents (Gonzales, et al., 2009). The projected population growth of Nairobi is shown in the figure 2.

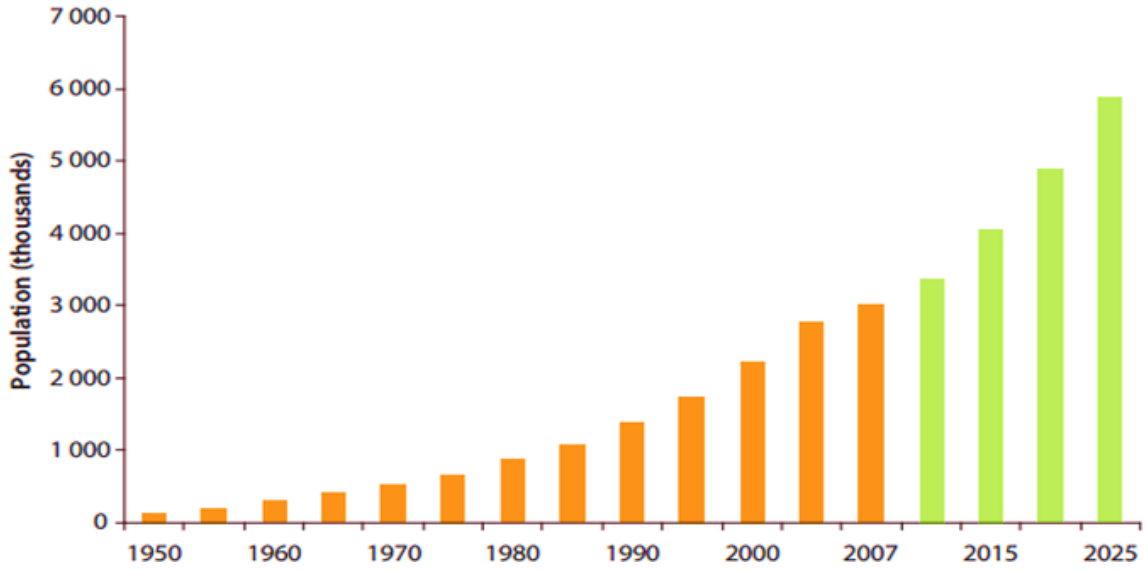
The city has a diverse transport user system which is comprised of matatus, private cars, boda bodas, walking, taxis and bicycles among others. About 6,700, 000 trips are carried out per day for different trip purposes (JICA , 2006). The modal split for Nairobi is given in Table 1 below, and this shows an overwhelming number of non-motorised trips.

Table 1: Modal Split in Nairobi

Mode	Modal Split (2002)[1,2]	Modal Split(2006)[3]
Walking	47%	47%
Two Wheeler	*[4]	1.2%
Matatus	42%	29%
LRT & rail	*	0.4%
Cars/Truck/Taxi	10%	15.3%
Buses	*	3.7%
Other	1%	0.2%

Over the past decade, the number of cars on Nairobi's roads has increased. Projected growth of car ownership showed that private cars in the city were estimated to be 207,339 in 2004, 327,366 by 2010 and 716,138 by 2025. This shows a tremendous growth in private car. In 2008, Nairobi accounted for

Figure 2: Projected Population Growth of Nairobi (Source: KNBS: 2008)



[1] (World Bank, 2002)

[2] Matatus percentage includes all public transport , the car percentage only includes private cars

[3] (JICA , 2006)

[4] No figures were found for these modes

30% of the country's private vehicle ownership. The rapid pace of urbanisation and motorisation has exacerbated congestion and has contributed significantly to air pollution (JICA , 2006). In 2011, Nairobi ranked the fourth most congested city in the world (Klopp, 2015). Flowing from high motorisation is the increase in demand for motorised transport infrastructure thus continuing the marginalisation of non-motorised transport and its infrastructure.

Table 3: Distribution of NMT Infrastructure in Nairobi by Road Class, 1998, Source: (Kayi, 2007)

Road Class	Footpaths (km)	%of Total	Foot/Cycle paths (km)	%of Total
International Trunks	14	34.15	1.4	1.71
Primary	10.2	24.67	31.1	37.97
Secondary	0.8	1.93	24.9	30.4
Access	11.95	28.9	19.1	23.32
Unclassified	4.4	10.64	5.4	6.59
Total	41.35	100	81.9	100

2.2 Non-Motorised Transport Infrastructure in Nairobi

In 2006, KIPRRA reported that the city had 12,145 km of roads and 8% of these roads were classified as paved roads. In 1998, the city had 1,530km of roads and only 8% of these roads were identified to have some form of non-motorised infrastructure. Table 2 shows the distribution of non-motorised infrastructure in Nairobi in 1998.

Given the dominance of walking as a mode of transport, one would expect that the coverage of NMT infrastructure to be extensive. Further, the condition of the infrastructure (1998) also points to the discrepancy in non-motorised maintenance and state. Out of the 123.5 km, only 7.3km were classified to be in good condition (Kayi, 2007), which is a mere 6%.

Table 3 provides a summary of the conditions of the NMT infrastructure in 1998. These findings save as a starting point to ascertain whether there have been improvements and dedication of the fiscus towards NMT infrastructural maintenance and availability between 1998 and 2009.

A report by the International Road Assessment Programme (2009) showed that about 95% of the urban roads in Nairobi have high pedestrian flow, with only 20% having pedestrian foot path. These figures do not present a significant change in the provision of infrastructure between 1998 and 2009. Non-motorised transport users are still underserviced despite their high share in modal share.

A site visit on Mbaghathi[5] road (2015), corroborates the inadequacy and unfavourable conditions of pedestrian walkways and crosswalks. The picture below shows a section of the pedestrian walkway along the corridor.

Figure 3: Pedestrian Walkway along Mbaghathi Road, 2015

Table 2: Conditions of Footpaths and Cycle Lanes in Nairobi, 1998, Source: (Kayi, 2007)

Type of Condition	Footpaths (km)	% of Total	Foot/Cycle paths (km)	% of Total	All NMT Network	% of Total
Good	5.9	14.26	1.4	1.71	7.3	5.92
Inadequate	6.1	14.75	4	4.88	10.1	8.19
Poor	13.9	33.62	21	25.64	34.9	28.32
Very poor	10.25	24.79	55.5	67.76	65.75	53.35
Non-Existent	5.2	12.58	----	----	5.2	4.22
Total	41.35	100	81.9	100	123.25	100

[5] This is not a representative of the state of pedestrian on the whole network but it points to the need for an improvement on the state of the infrastructure.

The quality of the infrastructure and sometimes its absence along some of the major transport corridors, forces non-motorised transport users to resort to using the road dedicated to vehicular traffic thus leading to NMT related road accidents. The International Road Assessment Agency provides a star rating[6] to measure how different road users view road sections. A star rating is only produced on sections of the road where there is demand for use of a facility by each road user type. A study by iRAP (2009) on roads inside Nairobi showed the star ratings shown in Table 4 below. For the purposes of this report, special attention is paid to cyclists and pedestrians and how they viewed the non-motorised infrastructure.

On the 119km of road that was evaluated, both pedestrians and cyclists did not give a 5 star or 4 star rating to the roads. The highest that the roads scored for both pedestrians and cyclists was a 2 star. This indicates a poor quality and service of non-motorised transport infrastructure.

2.3 Summary of Nairobi's transport system and its accompanying problems

The city has a wide range of transport related issues which include but not limited to:

- inadequate integration of city development planning
- poor integration of the transportation network system
- inadequate public transport system to meet the rising travel demand
- long commuter distance and travel time
- high cost of transport compared to low level of income
- inadequate development of non-motorised infrastructure network
- poor safety and high incidence of motor traffic accidents
- increased pollution and deterioration of the urban environment

2.4 Perception and attitude towards NMT in Nairobi: Users and Non-Users

The extent of use of NMT is reflective of social, economic and cultural dimensions in different areas (I-ce, 2000). Further the state of the infrastructure also plays a large role in influencing mode choices. With that in mind, it is important to understand the perception and attitude towards NMT and the environments from which users and non-users come from. It is through understanding these different aspects that policy and strategies to attract or retain NMT users can be developed. Salon and Aligula (2012) in a study in Nairobi found that respondents who did not own bicycles stated that even if they owned a bike they would not cycle as it is not safe to do. However despite the risk associated with cycling, some respondents also indicated that they would cycle as it is affordable. One key outcome from the study was that the provision of proper cycling paths would be a starting point in encouraging cycling as a mode.

2.5 Towards Interventions: Nairobi's NMT Policy

The NCCG recognised the extent of the transport problem in Nairobi and seeks to find solutions to

Table 4: Percentage of network by Star Rating and road user type inside Nairobi, Source: (International Road Assessment Programme, 2009)

Star Rating	Car Users		Motorcycle Users		Bicycles Users		Pedestrian	
	Length		Length		Length		Length	