THE REGULARIZATION AND DESIGN OF THE MWIKI BUS TERMINUS

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B65/3285/2010

A Planning Development Project Submitted in Partial Fulfillment for the Requirements of the Degree of Bachelor of Arts in Urban and Regional Planning

Department of Urban and Regional Planning

University of Nairobi
MAY, 2014
DECLARATION

This planning Development project is my original work and has not been presented for a degree in any other university.

Signature Date

…………………………………………….                …………………………………………….

OTIENO ISDORA AWINO
(Candidate)

This Planning Development Project has been submitted for examination with my approval as the University supervisor

Signed Date

…………………………………………….                …………………………………………….

MR. ZACHARIA MALECHE
(University supervisor)
DEDICATION

I dedicate this Development Project to the Almighty God and to my entire family, ‘Joka’Sila’
ACKNOWLEDGEMENT

My earnest gratitude goes to the almighty God for this far he has brought me, for patience and perseverance he instilled in me and his grace and mercies which made this Development project a success.

It is with sincere gratitude that I thank all those who had an input in this research project. Much gratitude goes to my supervisor Mr. Maleche for his wonderful insights, Dr. Opiyo, Dr. Mwangi and Mr. Karisa who were the project coordinators.

I would also like to appreciate my classmates for walking with me through my entire degree course. Special thanks also go to my family and friends.
ABSTRACT
The existing informal Mwiki bus terminus has been a major contributor to traffic congestion and delays along the Kasarani-Mwiki road. It has also been of economic value to the people of Mwiki. This project therefore is geared towards the regularization and design of the Mwiki bus terminus to ensure that efficient traffic flow around the Mwiki bus terminus and along the Major Kasarani-Mwiki road. There is also interest in the incorporation of the bus terminus amenities to improve the satisfactory operations of the bus terminus.

The design process entailed a series of steps including problem identification (through a prior research project undertaken), a detailed situational analysis and interpretation, design of alternative proposals and choice of the preferred alternative, a detailed schedule for the project implementation, monitoring and evaluation is also incorporated.

The development project is based on the regularization and design of the Mwiki bus terminus as it effectively addresses the problems in the area.
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<th>Full Form</th>
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<tbody>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>G.o.K</td>
<td>Government of Kenya</td>
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<tr>
<td>KeNHA</td>
<td>Kenya National Highways Authority</td>
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<tr>
<td>KeERRA</td>
<td>Kenya Rural Roads Authority</td>
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<tr>
<td>KNHPC</td>
<td>Kenya National Housing and Population Census</td>
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<tr>
<td>KURA</td>
<td>Kenya Urban Roads Authority</td>
</tr>
<tr>
<td>MWISACCO</td>
<td>Mwiki Savings and Credit Cooperative Organizations</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
</tr>
<tr>
<td>NMT</td>
<td>Non-Motorized Transport</td>
</tr>
<tr>
<td>PSV</td>
<td>Public Service Vehicle</td>
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<tr>
<td>SACCOs</td>
<td>Savings and Credit Cooperative Organizations</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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CHAPTER ONE

INTRODUCTION

1.1 Statement of the Research Project Title
‘IMPLICATION OF THE INFORMAL BUS TERMINUS ON TRAFFIC FLOW ALONG THE KASARANI-MWIKI ROAD’

1.1 Summary of the main findings

1. High rate of urbanization
As the high rate of urbanization rises in Mwiki area, the level of human activities in this area has had to increase in equal measure. This then has dictated that people, goods and services have to be moved from one place to another daily. These have therefore increased the demand for transport facilities and have resulted to high volumes of traffic generated. Therefore the planning of Mwiki area should take into account the urbanization trends which directly influence the Mwiki area environment.

2. Inadequate road space
The Kasarani-Mwiki road is a collector street and provides a major traffic connecting channel between Thika Road and Kangundo Road. The road therefore carries heavy traffic from and to the residential neighborhoods, the Kasarani-Mwiki road was originally an 30m road but has been encroached into by the residential, industrial and commercial land uses hence the road now measures about 18m wide (field survey, 2013). It is a single carriage road with two lanes each 3.4 m wide. Due to the large population served by the road, it has been experiencing traffic snarl-ups as it is unable to properly serve the ever growing population and this has led to frequent traffic congestion along the entire Kasarani-Mwiki road.

Because of the increase in population in the catchment area and the limited space of the existing road, majority of the travelers rely on NMT modes of travel. The design of the road has no provision for these modes of travel therefore all the modes of travel compete for the same carriage way. This exaggerates the congestion of traffic along the road and therefore leads to frequent traffic jams, frequent accidents, movement delays by users and travelers among others.

3. Informal activities within Mwiki area

i. The Mwiki Bus terminus
The Kasarani-Mwiki road is a collector street with a single carriageway and two lanes (each lane 3.4 m and a total of 18m road reserve) use by both the public and private means of transport. Traffic carried from both sides of the road includes private and private vehicles and NMT (bicycles, handcarts and pedestrians) which carries goods (e.g. clothing, hardware goods and food etc.) people and other services. The Mwiki area has a population of about 39,156 (KNBS, 2009), which is expected to grow even more, hence the probability of higher increase in demand for public transport facilities.

The private means of transport access the Kasarani-Mwiki road through the numerous access routes emanating from the residential neighborhoods; such feeder roads include; the ACK road, Karura Forest road, Deliverance road and Red Soil road among others, while the public means of
transport dominate the main Kasarani-Mwiki road. The feeder roads meet the Kasarani-Mwiki road at various points, bringing in and filtering out a huge population and their goods. At these nodes, there is information that traffic began stopping informally to pick and drop people coming from the hinterland. Such nodes include Hunters, Sunton, Mwiki, Equity and Maji Mazuri among others. Since the Mwiki node is the furthest of them all and holds a larger population than other centres, overtime it has grown and enlarged in size to form the Mwiki informal bus terminus, there has also been the attraction of business activities which have grown to develop the Informal Mwiki market due to the high demand for goods and services within close proximity.

The Mwiki informal bus terminus suffers from unclear planning, there is no specific land space set aside for it therefore no clear planned parking organization at this point. Most of the public service vehicles (PSVs) park in a disorderly manner around the informal bus terminus. The vehicles therefore tend to interfere with the traffic flow as it occupies the main carriageway of the Kasarani-Mwiki Road. This directly interferes with traffic flow along the entire road. The area lacks any built facility to provide any essential services and amenities such as sanitary facilities, catering facilities or any other supporting functions related to terminus use.

The terminus mainly serve the residence and the business community around the informal Mwiki market, because of these, the vehicles serving the market which has no separate parking provisions tend to be parked at the Mwiki Informal bus terminus. This exaggerates the traffic congestion of the area and increases the traffic flow problem along the Kasarani-Mwiki road even further. The continuation of this un-organized situation around the bus park and the market could have far reaching disadvantage to efficient traffic flow along the entire Kasarani-Mwiki road.

The buses and the matatus using the terminus tends to pick and drop people and goods randomly without any clear order mainly because there are no designated points for alighting and embankment of vehicles. Passengers also tend to spread out in confusion around the area as a result the vehicles stop several times therefore taking long to pick enough passengers before continuing with the journey. In the situation vehicle crews tend to block each other in an effort to maximize their earnings; this further significantly slows the general flow of traffic along the entire Kasarani-Mwiki road.

ii. **The Mwiki Informal market**

The market dominated the Kasarani-Mwiki road and its feeder roads at the Mwiki informal bus terminus point. The market lacks a clear boundary defining its limits of operation. This leads to the problem of insecurity experienced for traders and their goods as they are forced to move with them from one place to another to avoid vandalism and theft. The market has no effective and efficient entry points hence the traders and customers access the market mainly through the Kasarani-Mwiki road and the feeder roads where the market is located. The market has no parking spaces for vehicles. Most vehicles serving the market are forced to share the informal bus terminus created around this point for the PSVs moving slowing the Kasarani-Mwiki road leading to further slowing down of traffic.
4. Poor access and circulation within the Mwiki Bus terminus area.
The Mwiki bus terminus is located along the Kasarani-Mwiki road at Mwiki area. The informal bus terminus emerged as a result demand for travel means by the residence and the demand of transport of goods by the market. Increase in development around this area has led to people stopping to board or alight from vehicles at this point.

The emergence of the informal bus terminus attracted more other development activities around this point especially the business activities. This was what led to the development of the Mwiki market in close proximity to the informal bus terminus. Both activities (informal market and bus terminus) were specifically responding to the demand of service by the new developments around this point. Their continued operation at this point therefore accelerated the traffic congestion along the Kasarani-Mwiki road generally and therefore may be considered as the principle contributor to the traffic congestions, delays and traffic jams experienced along the entire Kasarani-Mwiki road.

When this happens they reduce the traffic flow along the Kasarani-Mwiki road, reduce circulation of pedestrians and motorists within the informal market and bus terminus area. The market operates informally and the organization of the functions of the market activities and the space use within the market is totally informal. The order of organization of space use does not follow any specific spatial plan. This has led to poor circulation, poor service provision and a lot of conflict in the use of space. Circulation is not planned and therefore a lot of conflict in movement and operation within the market is characterized with frequent pushing back and forth within the market and its surrounding and therefore the market does not operate efficiently.

5. Inappropriate road network design
Apart from the Kasarani-Mwiki road being a single carriageway, it forms T-junctions with different feeder roads (Karura Forest road, ACK road, deliverance road and Red Soil road among others). When vehicles approach or leave the Kasarani-Mwiki road, they are forced to slow down before negotiating corners and during this process there is impeded traffic flow as other vehicles have to wait until the vehicle negotiating the corner completely doing so.

6. Poor road condition
The road surface quality of the Kasarani- Mwiki road and its feeder roads is poor. The main Kasarani- Mwiki road has a lot of pot holes which not only cause the vehicles to slow down when passing near or across them but also the operational costs of the vehicles are increased i.e. in case of traffic jams the vehicle operators are forced to apply instant breaks which requires constant maintenance as repairs has to be done frequently, these extra costs will not be incurred if the road surface was smooth and hence the traffic jam would be absent.

During rainy seasons both the main road and the access routes are rendered impassable. The access roads are un-tarmacked as such during rainy seasons the mobility and circulation within the market is reduced with the sellers are forced to move next to the road in order to get customers who alight at the terminus.

Though the locals try to fill the pot holes along the main Kasarani – Mwiki road, this is not enough to fully mitigate the problem associated with poor road condition i.e. the community use
local materials at their disposal such as soil and stones which quickly wears off. The road therefore calls for proper planning, construction and maintenance.

7. **Inadequate infrastructure and amenities**

The Mwiki bus terminus and market are not recognized by the Nairobi City County Government as formal activities as a result they have not been provided with essential amenities and maintenance and as such the two informal activities are seen to cause a lot of problems within their vicinity. For example the lack of storage facilities for the market sellers causes them to carry their goods from their homes to the market and back. This process is time consuming and cumbersome. The lack of designated passengers/ goods alighting and picking areas also cause chaos as the passengers often spread along the road causing the vehicle operators to stop many times to pick and drop them and in the process obstructing other road users hence causing traffic jam along the entire Kasarani- Mwiki road.

The only amenity within the area is a washroom which is privately owned and cannot serve the entire population within the area hence the users are forced to use the washrooms within the nearby residences. This has led to poor waste water disposal, heaps of garbage everywhere and high prevalence of diseases within the area.

8. **Lack of institutions managing Urban transport and market systems**

There is no clarity on who manages the bus terminus and market and the Kasarani- Mwiki road. There is the confusion of responsibilities of different bodies of institutions found within the area which include; KURA, traffic police, market superintendent, City Inspectorate department, County and City Planning Authority and the community. There is no clear measures to ensure coordination among them therefore there is conflicting decisions on the same issues tend to arise and as such no effective implementation of market and transport development goals can be implemented within the area of their jurisdiction.

1.3 **Summary of the main recommendations**

1. **Development of dual carriage way and re-designing of Kasarani- Mwiki road**

The Kasarani- Mwiki road is serving a large hinterland which is undergoing a very rapid growth and development. This area therefore generates very high rate of traffic. The current road is inadequate to meet the demand of transportation both in terms of design and capacity to accommodate all the travel modes along it. The study therefore recommends its upgrading to a dual carriage road so that it can satisfy the demand. This would involve the re-designing of the road infrastructure and facilities so that the junctions are properly designed to reduce the direct access to and from the main Kasarani- Mwiki road. This should also include the separation of the different travel modes and provision of facilities for pedestrians and cyclists etc. with appropriate positioning of pedestrian fly-over to reduce congestion.

It was also noted that there are many emerging developments along this stretch of Kasarani-Mwiki road (some concentrated along the T-Junctions) most of these new developments tend to generate increased traffic onto the main road but also because of their close proximity to the road, they generate a lot of cross movements along the it. This tends to increase traffic volumes and create more traffic jams but also creates more incidents of accidents along the road. It is
therefore recommended that as the main road gets upgraded, the connections of the feeder roads off and onto the road should be re-designed to reduce the conflict in traffic flow and also provide appropriate pedestrians over-pass to minimize cross movement and reduce incidents of accidents.

2. Planning for the regularization of Mwiki Bus terminus and market
In response to the increasing growth of developments within the Kasarani- Mwiki neighborhood, it was noted that new traffic points have developed along the main road, particularly the development of the Mwiki informal bus terminus and its associated informal market. These have significantly increased problem of traffic flow along the Kasarani- Mwiki road and has created a highly disorganized and un-planned activities around the Mwiki point. It is recommended therefore that the informal bus terminus and market should be regularized and planned so that they both function efficiently with minimum disruption of traffic flow on the main Kasarani-Mwiki road.

3. Common provision of public amenities
In view of the informal bus terminus and market are at close proximity to each other, it would be preferred that they are planned to share common facilities as much as possible. Such common facilities would include sanitary facilities, water points, and garbage collection points among others. First, the land has to be set aside to accommodate the two functions, reorganize their essential services to the neighborhood community and either section should be planned properly with a clear functional layout of activities and provision of adequate services and amenities.

4. Establishment of clear and coordinated institutional structures
In view of the unclear situation regarding the responsibility of the management of the Kasarani-Mwiki road, the Mwiki bus terminus and the market along the road. It is recommended that efforts should be made to create a clear coordinated structure of institutional arrangement for the efficient management of the terminus, market and the Mwiki neighborhood.

1.4 Statement of the development project title chosen for implementation
‘REGULARIZATION AND DESIGN OF THE MWIKI BUS TERMINUS’

1.5 Reason for the choice made on the development project title
One of the most important aspects that arose from the study was that while land use and transport are strongly interdependent, solutions (to transport problems) that were sought in Kenyan most cases manifested ignorance of this fact. In the study area, it was noted that the lack of planned bus terminus/ parking within the area of study was the major cause of traffic congestion along the entire Kasarani-Mwiki road.

It was also noted that the lack of a designated bus terminus/parking area had an influence to the development and sustainment of the informal Mwiki market which has also had an influence on the traffic flow within the Mwiki area. It was on this basis that the researcher found the option of Re-organizing the land uses and introducing the a formal bus terminus along the Kasarani-Mwiki road. This would help to realize the reduction of the traffic congestion experienced along the Kasarani-Mwiki road.
1.6 Location and area coverage of the development project
The proposed project will be regularized within Mwiki area; it will occupy an area of about 1 hectare. This location is ideal because of the high traffic generated from both the households and the commercial activities and the area is also easily accessible from the residence. A 1ha bus terminus will accommodate about 50 vehicles.

1.7 Objectives of the development project
i. To review the existing site situation and the planning regulations for the Mwiki bus terminus.
ii. To prepare a site plan and design for a bus terminus at Mwiki
iii. To develop plans, drawings and spatial models for the Mwiki bus terminus
iv. To develop an implementation schedule.
v. To develop a monitoring and evaluation framework

1.8 Assumptions of the development project
The development project will assume that:

a. The operation of the informal bus terminus at Mwiki has confirmed the need of facilities at the point along the Kasarani- Mwiki road
b. The regularization of its operation would therefore significantly improve the traffic flow situation along the main road.

1.9 Scope of the development project
The project seeks to regularize and design the Mwiki informal bus terminus as a bid to minimize the traffic congestion which regularly occurs in Mwiki area and the entire Kasarani Mwiki road. This plan therefore is geared towards developing a site plan for the regularization of the Mwiki bus terminus as a demonstration of the appropriate plan typology that can be adopted to enhance traffic flow along the Kasarani-Mwiki road and also providing a typical model of Mwiki bus terminus that can be emulated within Nairobi and other towns. The scope of this project will also include information required for the development of a bus terminus which will relate to the existing site conditions, existing developments and their conditions.

The project chapters are organized as follows:

Chapter 1: Introduction
The section includes the summary of the research project main findings and recommendation, statement of the development project title, justification of the development project, location and the area coverage of the development project area, objective and the assumptions of the development project and the methodology of the development project.

Chapter 2: Review of Policy Guidelines
This chapter will include; the review of relevant planning policies, plans and design guidelines and standards (national, regional, urban etc.) providing guidelines on the planning design and
implementation of the development project. References will be made on planning and design standards, regulatory guidelines, Handbook manuals and other requirements that will guide the implementation of similar projects. References to various case studies will be done to analyze the past experiences inform of best practices or failed cases on the implementation of similar projects and lessons learnt.

This chapter will also include the statement of the conceptual framework or theoretical principles that may guide the design and implementation process of the project and models of the development project solutions

**Chapter 3: Situational Analysis of the project area**

It will include; the locational context of the project area (regional, sub-regional, local, neighborhood, detailed study context of the project area), background of the study area, history and development of the area, landscape and environmental characteristics of the area, population characteristics of the area, land use analysis and institutional, legal and financial issues of the development of the development project area.

**Chapter 4: Project Planning, Design and Implementation**

It will include the planning and the design of the project, development of spatial plans including the design of alternatives, evaluation of alternative proposals (plans, drawings and spatial models at various scales), site planning, design and development process stages. It will also include the design formulation stage and the development of detailed action plans, and implementation strategies.

It will also include implementation schedule; time frame, phasing, costing and resource requirement, actors and implementation strategies.

**Chapter 5: Monitoring and Evaluation**

This chapter will include the detail and program development components of the project such as action planning and budgeting in line with the implementation of the project. It will also isolate the main implementation agencies and the environmental Management plan.

**1.10 Development Project Methodology**

This part will detail out the data needs and requirement per objective, data sources, and methods of data collection, analysis procedures and the representation methods that will be used in this development project

1.10.1 Data Needs, Requirements and Sources

The data needed will include; review of the existing site condition including the land tenure, site capacity, existing site situation (existing spatial arrangement of functions). Data required will also include site analysis inventory including the topographical analysis, climatic, soils, geology and the drainage of the project site; and land use analysis of the existing land uses on the site and off-site (land-use pattern of the project area). Sources of data these data will include; records of
the chief of the area of study, data from the area residents who have stayed there for long, researcher’s own observation on the amenity provision within the area of study and the different categories of activities within the area etc., secondary sources especially relevant literature related past plans on the organization of activities within the area will involve the use of actual topographical and cadastral maps from the survey of Kenya.

The planning regulation: this will include the legal guidelines and provisions concerning planning and design for a bus terminus. This regulations and policies will comprise of zoning regulation, planning standards for various land uses and development control data which will be obtained from the City County of Nairobi offices, Physical Planning Handbook, the Building Code, relevant Acts of parliament like the Physical Planning Act and the County Government Act. These regulations will give the development project a base and will also help in the understanding of the dimension in which the project will follow. The planning standards information such as plot ratios, ground coverage, setbacks among others shall be needed. This information will be obtained from layout design manuals, Physical Planning Handbook among others. Information from the relevant case studies which can be adopted for the development project will be obtained from the relevant secondary data sources.

1.10.2 Method of data collection
The data collection methods for this will include both primary and secondary data collection techniques and methods.

a) Primary data collection methods: This will entail; field observation and measurements, interview of bus terminus users e.g. the bus operators and the passengers at the site. Direct observations will be used to assess the surrounding land uses and measurements will be taken of the bus terminus area through the use of a tape measure, there will also be the observation of the organization of other activities within the site. Photography will also be incorporated.

b) Secondary data collection methods: this will include the review of existing policies, statutes and standards pertaining to bus terminuses planning and their development in the country, zoning regulations and the institutions responsible for the development of the project area within the city and future plans for such establishments.

Possible case studies will be reviewed to get guidelines which this development project can emulate

1.10.3 Data Analysis Methods

Data analysis involved the use of various techniques to evaluate and synthesize data to answer the development project objectives. The analysis of the terminus users’ questionnaires will be analyzed in an endeavor to establish the varied challenges within the area of study. Excel and SPSS analysis will be used to analyze quantitative data from the quantifiable answers from the questionnaires. Structured analysis will be used for the analysis of the qualitative data based on the field notes, sketches, interviews and questionnaires which will be administered in the field,
this analysis will aid the researcher to focus on particular aspects being studied. Spatial data will be analyzed using GIS tools (the GIS attribute tools) to indicate the different organization uses within the study area; illustrative analysis was done using the photographs.

1.9.4 Data Presentation Methods
The data derived from the above study included continuous and categorical data; categorical data will be those in absolute form (whole numbers) such as months, gender, while the continuous data will include those that have decimals and fractions e.g. distances of 5.6 km among others. Continuous data will be presented using line graphs and descriptions while categorical data will be presented through pie charts and bar graphs among others. Spatial data will be presented inform of maps and photograph and models (2D and 3D models) which will be used for illustration purpose, there will also be the presentation of the research project as a compiled written report.
<table>
<thead>
<tr>
<th>Objective</th>
<th>Data need</th>
<th>Data source</th>
<th>Data collection method</th>
<th>Data analysis and presentation method</th>
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</thead>
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<tr>
<td>To review the existing site situation and the planning regulations for the Mwiki bus terminus.</td>
<td>- Physical characteristics, biological data and Socio-cultural data (land use and tenure, land use regulations, public infrastructure, buildings) - Relevant planning principles and standards - Land use organization including the space use</td>
<td>- Official records of the area - Plans drawing of the area - Primary source (e.g. field survey.)</td>
<td>Observation Photography Sketches Review of relevant secondary literatures Interviews Measurements</td>
<td>Written report Sketches Maps Charts Tables</td>
</tr>
<tr>
<td>To prepare a site plan and design for a bus terminus at Mwiki</td>
<td>- Project area use organization. - Planning standards for various land uses - Planning regulation</td>
<td>- Policy guidelines - Plans - Site operators</td>
<td>Review of Legal policies and plans, institutional framework for transportation and land use</td>
<td>Site plan in form of a map Spatial layout of functions and activities</td>
</tr>
<tr>
<td>To develop plans, drawing and spatial models for the Mwiki bus terminus</td>
<td>- Relevant planning principles and standards - Land use compatibility and space needs - Land use budget</td>
<td>- Policy guidelines - Plans - Review of findings on site characteristics</td>
<td>Mapping, design 3D and 2D representations</td>
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<tr>
<td>- To development an implementation schedule - Monitoring and evaluation framework</td>
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<td>- Proposed project Recommendation which leads to effective bus terminus. - Case studies</td>
<td>- Review of project proposals and case studies</td>
<td>Written report</td>
</tr>
</tbody>
</table>

*Source: Author. 2014*
CHAPTER TWO

REVIEW OF POLICY GUIDELINES

2.1 Overview
This chapter will include; the review of relevant planning policies, plans and design guidelines and standards (national, regional, urban etc.) providing guidelines on the planning design and implementation of the development project. References will be made on planning and design standards, regulatory guidelines, Handbook manuals and other requirements which will guide the implementation of similar projects. References to various case studies will be done to analyze the past experiences inform of best practices or failed cases on the implementation of similar projects and lessons learnt.

This chapter will also include the statement of the conceptual framework or theoretical principles that may guide the design and implementation process of the project and models of the development project solutions

2.2. Policy and Regulatory Guidelines

- **The Kenyan Vision 2030**
The vision 2030 has given an emphasis on access and efficiency of transport networks especially for people in the disadvantaged areas. According to the vision 2030 the transportation and communication sector had experienced a strong growth from 3.5% in 2003 to 10.8% in 2006. This policy thus gives an emphasis to the increase in the transport networks but does not take into consideration the development of other requisite facilities of transportation e.g. bus termini, bus stops and station etc.

The economic pillars of the vision 2030 emphasizes the need to empower the poor and the needy of the macroeconomic development for economic stability, however little are discussed on the micro-economic level of development and the informal sector in the achievement of the end goals of the plan. This therefore has excluded the large number of economic actors’ such as the public transport operators along the Kasarani-Mwiki road.

- **Nairobi Metro 2030**
The policy was formulated in line with the Vision 2030 and focuses on fifteen local authorities within the Nairobi Metropolitan area and aims at turning the region into a globally competitive business, industrial and services region. This plan aims to manage the rapid urbanization that has taken place in the Nairobi region together with the surrounding regions. It is a regional development policy which plans for Nairobi as an urban region that is undergoing rapid growth and spreading out to its hinterlands so as to control its developments. It also acknowledges transport as a key component in creating a competitive business environment as well as a viable means through which other economic and social objectives will be achieved. This therefore creates the need for an efficient transport system which minimizes travel time and distance. The strategy thus suggests a raft of policy intervention areas which include promotion of public
transport, mobility and freedom of movement especially in the congested corridors such as the Kasarani- Mwiki Road.

  The vision of the land policy is to guide the country towards a sustainable and equitable use of land. It was formulated to address the critical issues of land such as administration, access to land, land use planning, restitution of historical injustices, environmental degradation, conflicts, unplanned proliferation of informal urban settlements, outdated legal framework, institutional framework and information management.

  The policy points out that Land use plans are usually prepared at national, regional and local levels on the basis of predetermined goals. The purpose of physical development plans is to provide development patterns meant to integrate rural and urban development. Further, such plans provide strategies for human settlement in terms of service centres, growth centres, transport and communication network, environmental conservation and rural development. This policy also recognize that land use planning is essential to the efficient and sustainable management of land and land based resources. Hence this development plan will ensure that the land as a resource is equally used sustainably through the provision of an ample avenue which will ensure efficient movement of people and their goods and at the same time curb unplanned proliferation of informal urban activities e.g. the Mwiki informal bus terminus and ensure the conservation of the environment.

- **The National Urban Development Policy (2012)**
  The policy acknowledges planning as an important tool for urban developments. It indicates that planning provides an avenue of coordinating and integrating sectorial plans and activities and supports the systematic implementation of urban development programs. It also provides a platform for public mobilization and participation in urban development, while seeking to optimize resource allocation and utilization.

  The policy also stipulates that the urban transportation sector faces various challenges which include long waiting hours, poor safety and security standards, high costs for both passengers and goods; limited integration; and unexploited regional potential of the transport system

  To address these challenges, the policy stipulates that the National and County governments will ensure that urban areas and cities prepare and implement an appropriate transportation strategy with emphasis of mass transport, pedestrian and cycling modes. Ensure safe affordable, efficient, comfortable reliable, inter-connected and sustainable transport systems in urban areas and cities; they will also ensure that the urban transport systems are properly integrated with land use planning and developments. It will also provide, acquire, set aside, and protect land reserved for transport facilities which include bus terminus and others. Developing transport system that more efficiently supports the economic development of urban areas and is interconnected with the rest of the country and neighboring countries; Ensure that the user-pays-principle will be applied wherever feasible.it will also establish a comprehensive transportation
management information system for all transportation modes; Enforce emission testing in all transport modes; Set standards and guidelines for decommissioning of vehicles, marine vessels, aircraft and trains; and harmonize the roles and mandates of all transportation agencies in the urban sector.

- **The National Transport Policy (2009)**

The policy points out that the challenges besetting the transportation sector include; Poor Quality of Transport Services, inappropriate Modal Split, unexploited Regional Role of the Transport System, Transport System not fully Integrated, Urban Environmental Pollution, lack of an Urban or rural Transport Policy, Institutional Deficiencies, inadequate human resource capacity and lack of a Vision for the Transport Sector.

It therefore points out that addressing these challenges will require that interventions leading to enhanced transport sector performance be pursued. These include integration of transport with national development priorities, increasing investment in transport infrastructure and operations as well as responding to market needs of transport. Other interventions will revolve around the enhancement of transport services and quality, consumer protection, catering for consumers with special needs, ensuring fair competition and integrating information and communication technologies in transport development and operations.

The need to eliminate impediments to non-motorised and intermediate means of transport, enhance transport safety and security, develop and maintain a safe and secure transport system, sustainable utilisation of the environment, integration of transport and land use planning, and appropriate use of weather and climate information as well as development of the requisite human resource capacities are key elements of the way forward for the transport sector. The achievement of these strategies in the project area will ensure that the Mwiki bus terminus has provision for all the users and will be developed with environmentally friendly materials to ensure that the provisions of the policy paper are achieved.

**2.3 Legal Regulatory guidelines**

- **The Constitution (2010)**

The Constitution of Kenya, 2010 outlines that every person has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures and to have obligations relating to the environment fulfilled. Article 43 section 1b gives every person the right to accessible and adequate housing, and to reasonable standards of sanitation. The environmental conditions in Mwiki area do not meet this constitutional requirement as different heaps of waste lies everywhere within the estate, poor drainage channels and poor road condition are prevalent in the area. There is need therefore to come up with strategies of realizing this constitutional right for both current and future generations.
• **Physical Planning Act (1996)**
According to cap 286 section 24(3) of the physical planning act, the general purpose of a local physical development plan is to guide and coordinate development of infrastructural facilities and services for a particular area, in this case the Mwiki area. Much of the regulatory control provision of the Physical Planning Act 1996 has not been applied in the Mwiki area as most of the development were speculatively done by the private land owners and investors.

There is evidence that such a local physical development plan was not prepared for the Kasarani-Mwiki road neighborhood after the adoption of the 1973 Nairobi Metropolitan Growth Strategy policy. Developments in this area therefore has been poorly guided and controlled. Hence this development project will provide for the regularization of the Mwiki bus terminus to control the order, direction and the nature of transportation within the Mwiki area.

• **County Government Act (2012)**
It stipulates that all the plans developed within the county shall be submitted to the county assembly for approval. The act also promote and facilitate citizen participation in the development of policies and plans, and delivery of services in the county.

The act gives the county government the mandate for spatial planning and identifying areas where strategic interventions measures can be taken. It is with the planning framework of the county government and zoning plans of towns that other land uses such as transportation can be handled more so in the informal Mwiki bus terminus area.

• **Urban Areas and Cities Act (2011)**
This Act provides for the classification, governance and management of urban areas and Cities; it provides the criteria of establishing urban areas in order to provide for the principle of governance and participation of the residents and for other connected purposes. The act also provides for the establishment of boards of the cities and municipalities to undertake the provision of services to the people under their jurisdiction. The act also gives the capital city (Nairobi) the mandate to provide infrastructure necessary to sustain the seat of the national government, offices of diplomatic missions, efficient transport network connecting to rural areas, towns and other local, regional and international cities; and commerce and industry. The Mwiki area is part of the capital city of Nairobi hence the development of the Mwiki bus terminus will help in the realization of the goal of the capital city to provide for efficient transportation networks.

• **Environment Management and Coordination Act (1999)**
It indicates that every person is entitled to a clean and healthy environment and has the duty to safe, a clean and guard and enhanced environment. Healthy environment includes the access by any person in Kenya to the various public elements or segments of the environment for recreational, educational, health, spiritual and cultural purposes. EMCA also gives guidelines towards the control of pollution through substance disposal, emission and even noise.
EMCA mainly facilitates the following functions: To protect and conserve the environment, to establish institutions for the purpose of environmental conservation, to come up with action plan for environmental planning and conservation

The development of the Mwiki bus terminus will therefore gear towards the protection of the environment through ensuring that the material used to build it are not hazardous to the environment and ensuring that the sanitation within the area is enhance through the provision of sanitation facilities.

- **Kenya Road Act (2007)**
  It provides for the establishment of the Kenya Urban Roads Authority (KURA) to regulate the developments of roads within the urban areas. It also provides for the powers and functions of the authority.
- **Traffic Amendments Act (2012)**
  Traffic act was formulated to combine all the traffic laws on the roads. It provides the procedure of appointing of the Motor-vehicle Registrar who will be responsible for the registration and licensing of all vehicles. This act also highlights offences related to the use of vehicles on the roads including rules for speeding, driving under the influence of alcohol, reckless driving, use of proper fuels and obeying signals and signs among others. This project will ensure that the appropriate traffic sign are put on strategic place in order to reduce the traffic offenses brought about by negligence of traffic rules.
- **Public Health Act Cap 242**
  This act empowers the local authority to make by-laws towards development of building and sanitation. The local authority also empowers to demolish any development that is not fit for the human habitation. The development and provision of a bus terminus amenities within this area will enhance both the aesthetic value and the environmental value of this locality i.e. it will help minimize the rate of environmental pollution (noise and air pollution) and at the same time ensure that the environment is kept clean and tidy.

2.4 Planning Regulatory Guidelines
This section provides a review of the existing planning standards in relation to the development of a bus terminus, infrastructure services (such as water, electricity, drainage and sewerage systems) and related amenity services such as washrooms and kiosks etc.

- **Physical Planning Handbook 2007**
  The Physical Planning Handbook was prepared to provide guidelines and minimum standards on the process and practice of physical planning. The handbook is to provide a supplemental guidance and standards on the process and practice of land use planning. It is based on the principle of sustainable development which is geared towards striking a balance among: economic development, community development, and ecological development.
The Physical Handbook gives the development requirements of different land uses within the country hence each development that takes place has to adhere to certain standards as outlined in the handbook. However, the handbook may not apply much to the development of a bus terminus due to its provision inadequacy.

- **Disability Discrimination Act and the associated Disability Standards for Accessible Public Transport 2002 (Disability Standards)**

This is an act of parliament in Australia. It gives the mandate to Public Transport Authority of Western Australia to ensure that the transportation facilities are suited with suitable access facilities for the people with disabilities. This generally mean that the provision of a compliant bus stop sign, the establishment of a level hard-stand area (at correct height) and Tactile Ground Surface Indicators (TGSI) at all new and existing bus stop and stations locations.

It is intended that the development of new and existing bus stations and termini locations should have limited impact on all users of public transport, the general public and residents in close proximity to a bus termini location. The development of this design considers the needs of all public transport bus users, especially those groups with enhanced requirements, including:

- Seniors—using a frame, walking stick or motorised chair;
- People with ambulant disabilities;
- People using wheelchairs or scooters;
- People with vision impairment;
- Parents with prams, and
- Other (e.g. Travelers with luggage, etc.)

This act will inform the development project on the necessary provisions that are significant for the people with disabilities.

### 2.5 The concept of a bus terminus

The terminal facility forms an interface between human (passengers) and public transport system. An organized system is always desirable both from the economic point of view as well as passenger safety. It also portrays a positive image/outlook of a city and its infrastructure. Mwiki bus terminus under review has a strategic location but bear the look of being congested and unorganized. The concept of a terminal facility is a very common aspect of land use in planning today, since movement of people, goods and information are the important components of the society. As society undergoes the process of modernization, such movement increase and shift towards motorized transport mode. (Rodrigues et al., 2006). Due to the increase in population and the increase distance of travel between destinations (i.e. the Nairobi CBD and Mwiki area), the movement of the people of Mwiki area has shifted to public transport modes. As a result of high demand of the transport facilities there is the development of the informal bus terminus being studied.
2.5.1 Principles of designing a bus terminus

**Functional termini design principles**

The selection of the appropriate station layout for use in a site or for a particular operational purpose is only the preliminary step towards planning a fully functional terminus. In order for a terminus to function completely, key functional terminus design principles must be considered. The inclusion of functional terminus design principles is aimed at ensuring that the passenger requirements are fully incorporated within bus terminus/station planning and design.

Functional terminus design principles will serve other purposes including meeting current terminus operation demands and future proofing (ensuring station/terminus are able to cope with future predicted passenger demands). Ensuring that the arrangements of key terminus components are correctly incorporated will contribute towards quality outcomes for its design. The inclusion of these design principles is to be done in conjunction with the selection of bus terminus layouts and also consideration of locality, operational and capacity factors. (Translink Transit Authority, 2012). Each of the following principles described in this section will be essential in the design and planning of the Mwiki bus terminus.

i. **Coherence**

The coherence principle is about implementing a legible and consistent theme (visual appearance) at all sites so that passengers find it easy to interpret and navigate. Infrastructure that is easy to interpret helps to make public transport more convenient for passengers.

Terminus design should be given strong character and visual appropriateness with respect to the wider public realm. The design should bring out the relative functional importance of the facility as a place of public transport. The visual appropriateness is especially important for a terminus as it is frequented by people across the whole community. A visual appropriateness can also contribute towards creating an identity for the facility with a sense-of-place in the street environment (Translink Transit Authority, 2012). The Mwiki bus terminus lack legibility in that it has no clear pick up or drop points for passengers and their goods, unclear and complicated passenger transfer paths and way-finding and information signage are lacking. Therefore planning for these facilities can greatly improve coherence of the Mwiki bus terminus.

ii. **Functional arrangement of space**

Termini consist of public and private spaces. Public spaces form the pathway from the point of departure. Private spaces include areas such as retail, management and maintenance facilities, communication and electrical cupboards. For convenience, safety and security, private spaces must not obscure or obstruct paths of travel, sightlines to points of entry, information and decision points, and waiting and seating areas. Access for services not intended to interact with the public should be secure from public space unless the site is constrained (Translink Transit Authority, 2012).

The buses and the matatus using the Mwiki bus terminus tends to pick and drop people and goods randomly without any clear order mainly because there is no designated points for
alighting and embankment of vehicles. Passengers also tend to spread out in confusion around the area as a result the vehicles stop several times therefore taking long to pick enough passengers before continuing with the journey. In the situation vehicle crews tend to block each other in an effort to maximize their earnings; this further significantly slows the general flow of traffic along the entire Kasarani-Mwiki road. Planning and design of the Mwiki bus terminus will not only enhance its functionality but also enhance the traffic flow along the Kasarani-Mwiki road.

iii. Sequence of movement and circulation
The logical sequence of passenger activity should respond to the progressive sequence of actions along the path of travel. Key spaces include the entrance, information and decision points, ticket purchasing or fare validation points, horizontal (walkways, revelators, overpasses) or vertical (lifts, stairs) pathways and waiting and platform areas. This movement should be in a forward direction from the entrance to the point of departure. The layout of a station should consider the passenger sequence of identifying the facility, entering the facility, gathering information and making decision, purchasing tickets before proceeding to the paid area of the terminus (Translink Transit Authority, 2012). Creating a circulation mechanism within the Mwiki bus terminus will reduce the congestion within it.

Passengers must have simple and clearly defined paths and travel which avoid conflict. Paths of travel should be clearly established to meet the requirements of passengers on the dominant side of the pathway, away from opposite flow path (Translink Transit Authority, 2012).

iv. Emergency evacuation circulation
The facility design must include specific requirements for emergency evacuation including appropriate circulation paths, exits and assembly points for the maximum volume of people using the facility at any one point. Efficient signage and way finding is key consideration passenger circulation in an emergency situation. This must be reviewed in the detailed design stage and receive approval by an emergency evacuation specialist (Translink Transit Authority, 2012). Provision of such facilities within Mwiki area will reduce the accidents that frequently occur.

v. Density of occupation
Density in this context refer to the length, width and height of the space within the station/terminus. The density of pedestrians to be accommodated should be within the range of personal comfort and passengers should experience modest restriction without coming into undesirable contact with any person (Translink Transit Authority, 2012). Adequate space provision and clear design of the Mwiki bus terminus can aid in the reduction of its present chaotic nature.

vi. Identifiable entry points
Station facilities needs to be easily identifiable to the public as a place for catching high quality public transport. The facilities should be designed to promote active street frontage with built form that respond to the pedestrian level (Translink Transit Authority, 2012). This can be
achieved in Mwiki bus terminus through the provision of specific entry and exit point clearly provided with signage for way-finding and directions.

vii. Functionality and simplicity
The design of structures, platforms, seating, signage, pavements and other components must be incorporated within the overall design process to achieve highly functional station design outcomes (Translink Transit Authority, 2012). The design of Mwiki bus terminus should therefore provide an integrated and visually simple product to ensure uncluttered, minimal concealed spaces, legible and pleasant architectural pedestrian environments. Maintaining simplicity within the station design assists passengers to interpret and use a facility comfortably and safely.

viii. Operations and maintenance
The components and materials which make up a station should be durable and meet their intended operational requirements. Whole-of-life cost assessments are important considerations for operating and maintaining a station from the short to long-term life expectancy. Components should be functional, self-cleaning, vandal resistant for easy cleaning and readily repairable if damaged. The use of fire aids and fair resistance component must also be included in station infrastructure for safety purposes. Ensuring a quality station environment will increase safety perception and promote community ownership (Translink Transit Authority, 2012).

2.5.2 Planning of a Terminal Facility
Transport terminals are often neglected in debates surrounding the influence that transport infrastructure may exert over economic location and development (Button, 1995). The most important aspects of a bus terminus is the loading area, passenger boarding platforms, the pedestrians access points and the aisle giving access to the area for the busses, off-loading areas and the alighting platforms for the passengers, holding areas for the busses arriving early or standing-by to keep to their schedule. The Mwiki bus terminus has no clear designed parking area, alighting and boarding areas for passengers and even loading areas, parking areas for the public vehicles etc.

Bus terminus capacity
According to the Metric handbook, 1999, the following factors used to determine the capacity of a bus terminus

1. **Number of bays to be incorporated**: determined by the number of services operated from the station; and by how practical it is, related to the timetable, to use each bay for a number of service routes.

2. **Vehicle approaches to the bays**. There are three types of maneuver used to approach a bus terminus such maneuvers include; shunting, where a vehicle only sets down passengers on the concourse before moving off to park or pick up more passengers. This avoids waiting to occupy a pre-determined bay, and reduces effective journey time, **Drive-through bays** are fixed positions for setting down and/or collecting passengers. They are in a line, so a vehicle often has to approach its bay between two stationary
vehicles. In practice it is often necessary to have isolated islands for additional bays, with
the inevitable conflict between passenger and vehicle circulation; ‘Saw-tooth’ layouts
have fixed bay positions for setting down and/or collecting passengers with the profile of
the concourse made into an echelon or saw-tooth pattern. In theory the angle of pitch
between the vehicle front and the axis of the concourse can be anything from 1° to 90°; in
practice it lies between 20° and 50°. The vehicle arrives coming forward, and leaves in
reverse, thus reducing the conflicts between vehicle and passenger circulation, but
demands extra care in reversing.
The choice of maneuvers will be influenced by the size and shape of the available site,
the bus operators’ present and anticipated needs, and in particular the preference of their
staff.

3. **Facilities for passengers:** these will depend entirely upon anticipated intensity of use
and existing amenities. The Mwiki area lacks amenities such as public toilet, café etc.
nearby for the users hence there will be a need to provide them.

4. If, for example, there are already public toilets, a bus and coach information center and
cafés nearby, then these will not be required on the station

5. **Facilities for staff:** there are invariably inspectors who, as well as assisting passengers,
are primarily concerned with organizing the movements of vehicles, and supervising their
drivers and conductors. If there is a depot near the station then staff facilities will be
provided there. If not, canteen and toilets facilities will be needed for staff on the station
site, so that during breaks and between shifts they do not need to get back to the depot
until they return their vehicle for long-term parking.

6. **Facilities for vehicle maintenance:** the inspection, repair and servicing of buses is an
integral part of an operator’s responsibility. Normally such work would be carried out at
a local depot, with a repair workshop together with fuelling, washing and garaging
facilities

2.5.3 Planning and Design standards (United States’ Transit Capacity and Quality of service
manual’)

Since the Kenyan government have no clear provisions for the development of a bus terminus,
the guideline below are adopted from the United States’ Transit Capacity and Quality of service
manual, West Australian bus stop design guidelines and Pedestrian Facility Guide book for
Washington. These guidelines will be used to inform the regularization and design of the Mwiki
Bus Terminus in order to ensure that the current disorganization within the project area is
minimized and at the same time efficient traffic flow along the Kasarani-Mwiki Road is
achieved.

There are various types of bus termini, depending on the capacity and the use. Figure 1 below
describes the different types of bus terminus, giving appropriate examples of such terminuses in
the world.
Building complex has the added advantage in that bus bays where alighting and boarding of passengers are under one roof. Normally the bus bays are at ground level while as passenger waiting area and other terminal facilities are at first floor level. This type of terminal may incorporate shopping arcade. Photo 1.0 shows a typical bus terminal building complex.

Terminal of this type usually the counter for selling tickets and passenger waiting area are within the single storey building. Bus bays are located in-front of the building platform and not covered. Photo 2.0 shows a partially housed terminal complex.

This is an open space bus terminal and there is no specific designated bus bay. Tickets are sell from ticket stalls located within the vicinity of the terminal. This type of terminal lack of or no proper facilities for passenger. Photo 3.0 shows the open space type of bus terminal.
Plate 4: In-front of shop houses

This type of terminal is temporary terminal where the buses stop to take and drop passengers’ in-front of shop houses. Normally tickets are sold through agents and sometimes among through the shop owners. This type of terminal does not provide any facilities for the passengers. Quite commonly, the terminals are located in-front of restaurants. Photo 4.0 shows bus terminal located in-front of shop houses.

The partially housed bus terminus is ideal for Mwiki area since the passengers spend a lot of time waiting for the vehicles to pick them. Therefore a terminal of this type will provide passenger waiting area within the single storey building. Bus bays will be located in-front of the building platform hence the ease of access from the storey building when the travel modes arrive.

2.5.4 Guidelines for the development of a bus terminus.

1. **Bus Berths Design Standards**

   These are spaces where the buses serving areas can board and alight passengers. For most termini, the bus transfer area consists of an off-street bus berthing area near or adjacent to the station building or platform area. For small transit stations, the number of berths (loading areas) is small with a fairly simple access and layout configuration. For larger terminals, numerous berths and more sophisticated designs are applied.

   Figure 2: The typical Berthing types.

   **i. Linear Berth**

   Linear berths are not as efficient as other berth types and are usually used when buses will use the berth for only a short time e.g. an on-street bus stop.

   **Examples**

   Linear (Miami)

   ![Linear Berth Example](Image)
The design of the bus berths should be in such a way that they can accommodate the standard bus which is about 45 feet long. For this development project, a standard linear berths will be efficient since the buses will use the berth for only a short time e.g. an on-street bus stop. The bus berth will have a capacity of two to three bus berths lines which will be efficient to accommodate the busses at Mwiki bus terminus due to the existence of different vehicles which

### ii. Saw toothed Berth
Saw-tooth berths allow independent movements by buses into and out of berths and are commonly used at bus transfer centers.

![Saw toothed (San Diego)](image)

Source: (Transport Reserch Board, 2003)

Angle berths require buses to back out. They are typically used when a bus will occupy the berth for a long time e.g. at an intercity bus terminal.

![Angle (Newark Airport)](image)

Source: (Transport Reserch Board, 2003)

### iv. Drive through
Drive-through berths allow bus stops to be located in a compact area, and also can allow all buses to wait with their front destination sign facing the direction passengers will arrive from e.g., from a rail station exit).

![Drive through (Copenhagen, Denmark)](image)

Source: (Transport Reserch Board, 2003)

The design of the bus berths should be in such a way that they can accommodate the standard bus which is about 45 feet long. For this development project, a standard linear berths will be efficient since the buses will use the berth for only a short time e.g. an on-street bus stop. The bus berth will have a capacity of two to three bus berths lines which will be efficient to accommodate the busses at Mwiki bus terminus due to the existence of different vehicles which
belong to the different SACCOs. It is worth mentioning that with the growing population of the area it has been recommended that for long term use a bigger bus terminus should be developed.

2. **Bus Parking requirements**

The parking space is determined by the maximum number of busses requiring independent pull-in and pull-out spaces. The busses are scheduled to arrive and depart simultaneously. If the busses are scheduled, each bus will have independent parking space.

Dimensions required for the parking of multiple busses at a bus terminus are the same as the layover. This are the dimensions to be used to inform the development of this bus terminus. For saw-toothed bays, the transition areas for either end of the bus should be approximately 32 feet in length and 10 feet in depth. The saw-toothed bays required to accommodate one standard bus should be 174 feet of linear kerb line.

**Vehicles turning points for vehicles within the terminus**

It is necessary to know the critical characteristics of the vehicle in motion, particularly when maneuvering while parking or preparing to load. From the previous study of the development project area, there are various vehicles which use the Kasarani-Mwiki road and at one point they have to negotiate corners when moving into or out of the Kasarani-Mwiki road. In this project a universal turning point specification will be adopted and this will be for the largest commercial vehicle which will also provide adequate spaces for the other vehicles which will use the Mwiki bus terminus. See the figure below.

Figure 3: Geometric turning points for different vehicles

Source: Metric Handbook, 1999
Park and ride facilities

The park and ride facilities are always located at the back of the bus station and are a ways integrated with the bus transfer. The design of these facilities is similar to other off-street parking facilities. Most park-and ride facilities are surface lots, with pedestrian connections to the transit station. Parking structures are used where a substantial number of parking spaces are required. In this situation about 20-25 spaces since this will be a minor terminus which will serve only the community living in Kasarani-Mwiki neighbourhood.

3. Passengers Amenities

Passenger amenities are those elements provided at a bus stop or transit station to enhance comfort, convenience, and security for the transit patron. Amenities include such items as shelters, benches, vending machines, trash receptacles, lighting, phone booths, art, and landscaping. Amenities at most bus stops/terminus or transit stations are placed in response to a human need or a need to address a local condition

Bus terminus Shelter

Shelters are typically used with bus stops or bus terminus that are largely unenclosed to provide protection from rain, wind, and sun. In some cases they may also be heated. The design of shelters is influenced both by local climate and the desired level of amenity. The threshold for level of service provision within the shelters are determined by the average pedestrian space, personal comfort, and degrees of mobility within the space (Rahman & Ahmad, 2003)

The presence of passengers who use wheel chairs, strollers, or bicycles, or carry large luggage or packages should be assessed and suitable provision made in station space. Studies have shown that pedestrians keep as much as an 18-in. (0.5-m) buffer between themselves and the edge of a street curb. This suggests that the effective width of a bus stop/terminus shelter should be computed as the total width minus 18 in. (0.5 m) to accommodate the space also for the disabled.

According to the Australian government, the Public Transport Authority (PTA) has to ensure that a rear facing bus shelter is placed adjacent to the road and a minimum distance of 700 mm must be maintained from the road edge to avoid conflict with buses. The trash receptacles should not be placed on the wheel-chair landing pads but should be placed at about 1.2 m back from the face of the kerbs. They should not impede the traffic flow within the terminus at any time (Jackson, 1994). Trash receptacles should be anchored to the pavements to prevent unauthorized movement, they should also be attached to the side of the shelters as a prefabricated feature, they should not obstruct the drivers’ vision while turning and should not be put in direct sunlight to prevent odour.

Wheelchair bay and bicycle racks

At least one wheel chair bay is required at a bus shelter should a bus shelter be provided. The wheel chair bay must have a minimum width of 1000mm by 1300mm in length.
The space required for a wheelchair to make a $60^\circ$ to $90^\circ$ turn shall have a gradient no steeper than 1 in 40 and shall be no less than 1500mm wide and 1500mm long in the direction of travel.

Figure 4: Space requirement for a wheelchair movement and turning through $90^\circ$

Source: Metric Handbook, 1999

**Bicycles racks**: Bicycle parking should be provided at bus terminus/stations because on-vehicle bicycle storage is limited. Bicycle racks are preferred to lockers except when substantial space and bicycle demand exists because racks provide more storage capacity per square foot and have lower maintenance cost. Covered bike parking and security amenities (such as cameras) may be provided at bus terminus or stations where space and station technology infrastructure are available. Bicycle paths should be designed to provide the most direct route, paved, clearly marked, lighted, and buffered to improve bicycle experiences and discourage people.

Figure 5: Shelter design in the terminus

Figure 6: Bicycle rack in Copenhagen, Denmark

Source: http://www.simplyZesty.com

(Source: TR board, 2003)
Figure 7: Layout design of a bus terminus shelter

Source: Public Transport Authority of WA, 2010 and modified by the author, 2014

- **Seating**
  According to the Australian Standards of the bus terminus seats, they should be about 450mm high and hand rests where possible.

Figure 8: Typical shelter with perch seat

Source: Bus Stop Design Guide, 2005

- **Walkways**

  **Foot path**

  Walkways design depend on factors such as; pedestrian walking speed, Pedestrian traffic density, and walkway width. Desirable pedestrians’ walkways environment should allow space for sufficient walk at a preferred speed, by-pass slower pedestrians, Avoid conflicts with oncoming or crossing pedestrians, and interact visually with surroundings.
These areas should be easily accessed by all the users of terminus. Walking speeds should be freely selected; passing should be possible in all directional streams. In general, the recommendation for footway width in the vicinity of a bus stop is 3m, to allow for queuing and alighting passengers as well as passing pedestrians. Footways should be hard surfaced, well drained and lit.

**Curb ramps**

Provide a connection from the sidewalk to the street for people in wheelchairs, people pushing strollers, children on bicycles, and delivery services. Curb ramps are required at all intersections and crosswalks, including mid-block crossings, and should align with the center of the crosswalk. Utility structures such as manholes, hand holes, and poles must be located outside of sidewalk curb ramp areas.

A typical curb ramp consists of the ramp, side flares, approach, and landing. The slope of the ramp must not exceed a rate of 1:14, or a 1” rise per 14” of length. The flares must not exceed 1:10, although 1:12 is preferred whenever possible. The cross slope must not be greater than 1:64. The minimum width of a curb ramp in Chicago is 4’.

Figure 9: Accessible Ramped Pathway with Landings

![Accessible Ramped Pathway with Landings](image)

*Source: Pedestrian Facility Guide book, 1999*

**Kerb Ramp**

An inclined surface on continuous access path of travel with a maximum rise of 190 mm, a length not greater than 1520 mm and a gradient not steeper than 1 inch located within or attached to a kerb.

Figure 10: Example of bus kneeling; and Ease access radius and transition kerbs

![Example of bus kneeling; and Ease access radius and transition kerbs](image)

*Source: Bus stop design guide, 2005*
Access stairs for a bus terminus

Building Regulations allow that twice the rise plus the going may be between 550 and 700 mm, and permits rises of up to 220 mm and goings of minimum 220 mm in private stairs. On Continental source recommends that twice the rise plus the going should lie between 630 and 660 mm. this development project will ensure that the access stairs are of required heights to allow use by all the users regardless of age or body size.

Figure 11: Staircase with short stairs at top and bottom; Wheelchair ramp of rise 650 mm

Source: Metric Handbook, 1999

Bollards

These are designed for the purpose of restraining vehicles from moving into the pedestrian walkways. Apart from their functional use, the bollards enhances the aesthetics of a place. Bollards designs should be consisted with the site finishing, Mostly in Kenya the bollards colours are always black and white used to improve visibility during the night. It is recommended that the materials used to build the bollards should be strong to withstand the forces of vehicles and should be all weather used.

Information and signage

Enhances the ease of access for entry of people and vehicles. The information which needs to be conveyed by bus signage falls into two groups: That required for driver recognition; and that required for customer/ passenger or pedestrian information. Road signs for the development of the bus terminus will include the pedestrian crossing marking, bus stop signs and parking areas among others.

Bus stop signs should be clearly visible to pedestrians and bus drivers by being located above road traffic, pedestrians and street furniture. The bottom of the sign should not be less than 2.5mabove ground level and the sign not less than 450mm wide and 620mm high. It is recognised that in certain situations higher mounting positions have been successful in deterring vandalism (Bus stop Design guide, 2005).

The information displayed can be useful for passengers who are unfamiliar with the bus terminus. Information to be displayed may include; Stop/Station or Interchange name; Usage of
bus frequencies rather than times, Route information including stops; Journey length of details; and probably fare information.

4. **Trash receptacles**
A bus terminus also has other uses such as restaurants and kiosks. If proper receptacles are not provided for in such places, the sanitation and esthetics of them will have been compromised. The recommendations for installing a receptacle at a bus terminus/station are as follows:

- Anchor the receptacles to the ground to reduce un-authorized movement within the site
- Locate the receptacles away from the wheelchairs landing areas and allow for at least 3 foot separations from other street furniture
- Locate the receptacles at least 2 feet from the back of the curb
- Ensure that the receptacles when adjacent to the roadway, do not visually obstruct nearby driveway or land uses
- Avoid the location of the trash receptacles in the direct sunlight, this may cause the development of foul smell.

Figure 12: information display; and a photo showing the location of trash receptacles

Source: Pedestrian Facilities Guidebook, 1997

Figure 13: Road signs; bollards used to restrain the movement of vehicles into footpaths

Source: Pedestrian facility guidebook, 1997
5. **Lighting and security of the bus terminus**

The road signs should be visible at all times. The information displayed should be readily visible at all times and this can be ensured when there are street lights to be used during the night for the busses which operates up to late in the night. The visual displays should therefore maximize the opportunities for using existing street lighting.

The lighting of a bus terminus can also be used as a remedy for insecurity. Lighting of the terminus during the night can help deter theft or vandalism of other peoples’ properties which would otherwise be done especially during the night.

It is generally recommended that a level of lighting between 0.5 and 2.0 foot candles be provided along pedestrian travel ways, depending on conditions. In the development of the Mwiki bus terminus overhead flood lights will be installed.

2.5.5 Access Hierarchy within a bus terminus

All modes access to a bus terminus cannot be given equal priorities, therefore hierarchy has been established to provide a rationale for station/terminus site planning and design. Accessible design provides benefits that will often assist other passengers, such as parents with young children in strollers or passengers traveling with luggage or other packages, people with disability and generally optimizes conditions for pedestrians (WMATA, 2008)

The diagram below shows the access hierarchy as provided in the Washington Metropolitan Area Transit Authority (WMATA) manual.

---

![Terminus site planning](image)

*Source: WMATA, 2008*
**Pedestrians:** Pedestrians should be provided the highest priority in station site and access planning. At many existing suburban stations, pedestrians must cross bus bays, parking lots, and vehicular lanes to reach the station entrance. For pedestrian pathways connecting to a station site, it is generally recognized that providing a safe and convenient walking environment that includes clear, un-fragmented, and integrated pedestrian paths to the station will encourage more customers to walk.

**Bicycles:** To encourage the use of this efficient and environmental friendly mode of access, bicycles are given priority over all motorized vehicular access.

**Transit:** Since buses generate a higher share of concentrated pedestrian activity on station/terminus sites, the transit mode should be given priority over all other vehicular modes of access.

**Kiss & Ride:** Because a Kiss & Ride facility requires proximity to a station entrance for optimum function, it is afforded a higher access priority than Park & Ride access. Kiss & Ride areas include facilities for passenger drop-offs and pick-ups by automobile, as well as spaces for short-term parking.

**Park and ride:** Park & Ride is considered an important transit mode share to Metrorail and the regional transportation system and should be accommodated. Though park and ride fall at a lower rank in the access hierarchy, in the development project, the park and ride facility would be recommended for passengers’ drop-off and pick-up by automobiles as well as short time parking since they can occupy the back of the terminus as opposed to kiss and ride which are always located at the entrance of the bus terminus.

2.5.6 Other bus terminus amenities
These facilities are required at a bus terminus to enhance comfort, convenience and security for the bus terminus users. These amenities should therefore be placed in response to human needs or to address local conditions. These amenities include:

**Toilets:** they should be placed in close proximity to the terminus i.e. where they can be easily access. To accommodate all users, the toilets should also have provisions for the disabled hence the standard design of a terminus washroom. Such requirements for the (people with disability (PWD)) would include:

- A wide, easily opened doors (with a minimum clear width 900mm, but preferably 1000mm)
- Sufficient space for the PWD to maneuver into the cubicles
- Space around the lavatory to enable the wheelchair user to transfer forward or sideways from wheelchair to the lavatory.
- Hand washing facilities to be within reach for the PWDs
- Spaces for the help to assist in transfer

Since the people with disabilities occupy a small percentage of the total population of Mwiki area, the washrooms to be provided will be in a ratio of 1:4 i.e. 1 for the PWDs and the others for normal people respectively.
**Telephones**: they provide access to transit information and are important for use by the bus patrons

**Route or Schedule information**: they help communicate general information to the users, they assist in guiding first time users and also helps in the identification of the bus stops.

**Vending machines**: provides ready reading materials for the waiting passengers.

**Kiosks or eateries**: these are important aspects of the bus terminus; they provide essential services for the travelers and the vehicle crews at close proximity. In the development of the Mwiki bus these facilities will be planned and provided in close proximity to the users to reduce movement by the users to other area and also reduce the development of informal business activities within the area i.e. due to demand of the facilities. The table below outlines the advantages and disadvantages of various passenger amenities at a terminus.

Table 2: Bus terminus amenities

<table>
<thead>
<tr>
<th>Amenity</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
</table>
| Shelter          | -provide comfort for waiting passengers  
|                  | -provide shelter from climate related elements (sun, glare, wind, rain, snow)  
|                  | -help identify the stop                                                                                                                      | -Require maintenance, trash collection  
|                  |                                                                                                                                             | -May be used by graffiti artistes                                                                   |
| Benches          | -provides comfort for waiting passengers  
|                  | -help identify the stop  
|                  | -Low-cost when compared to installing a shelter.                                                                                             | -require maintenance  
|                  |                                                                                                                                             | - May be used by graffiti artistes                                                                   |
| Vending machines | -provides reading materials for waiting passengers                                                                                           | -Increase trash accumulation  
|                  |                                                                                                                                             | -May have poor visual appearance                                                                     |
|                  |                                                                                                                                             | -Reduce circulation space                                                                            |
|                  |                                                                                                                                             | -They can be vandalized                                                                               |
| Trash receptacles| -Provides space to discard trash  
|                  | -Keep bus stops clean                                                                                                                       | -Maybe costly to maintain  
|                  |                                                                                                                                             | -May be used by customers of nearby land uses                                                        |
|                  |                                                                                                                                             | -May have a bad odor                                                                                  |
| Lighting         | -Increase visibility  
|                  | -Increase perception of comfort and security                                                                                                 | -Require maintenance  
|                  | -Discourages ‘after hours’ use of bus stop facilities by indigents                                                                        | -Can be lost                                                                                            |
| Telephones       | -Convenient for bus patrons  
|                  | -Provides access to transit information                                                                                                      | -May encourage loitering at bus stops  
|                  |                                                                                                                                             | -May encourage illegal activities at the                                                              |
Route or schedule information
- Useful for first-time rides
- Help identify bus stops
- Can communicate general system information

bus stop.
- Must be maintained to provide current information
- May be used by graffiti artistes

Source: WMATA, 2008

2.6 Case Studies
Case study 1: Guildford Friary Bus Station in United Kingdom

Introduction

Guildford is the county town of Surrey, England and the seat of the borough of Guildford. The town is 27 miles (43 km) southwest of central London on the A3 trunk road mid-way between the capital and Portsmouth. Guildford has Saxon roots and historians attribute its location to the existence of a gap in the North Downs where the River Wey was ford by the Harrow Way. The town's access was sufficient that by AD 978 it was home to an early English Mint. On the building of the Wey Navigation and Basingstoke Canal Guildford was connected to a network of waterways that aided its prosperity. In the 20th century, the University of Surrey and Guildford Cathedral, an Anglican cathedral, were added. Due to recent development running north from Guildford, and linking to the Working area, Guildford now officially forms the southwestern tip of the Greater London Built-up Area.

Operational Characteristics of guildford Friary bus station

The Friary Centre Bus Station comprises 15 bus stands, 13 are configured as DIRO (Drive In-Reverse Out) bays along a saw tooth arrangement of boarding and alighting points providing access to and from the main bus station concourse. The remaining two bus stands are set along the southern portion of the bus station in a nose-to-tail formation parallel to the kerb. A further two stands used for Setting Down are located at the southernmost point of the site. These are typically utilized by higher frequency buses such as those serving the Park and Ride facilities. These bays enable passengers to disembark more quickly from the bus upon arrival, in a more favourable location for access to the town centre. They also save passengers from possible delays while waiting for other buses within the apron to maneuver prior to their bus pulling up at its allotted stand.

The bus move around these bays is substantial and allows a generous amount of space for vehicle maneuvering, while also accommodating 5 car parking bays. There is plentiful capacity afforded to layover spaces for buses along the eastern periphery of the apron backing onto the Commercial Road bus island, this space can accommodate up to 7 vehicles. The Commercial Road bus island is connected to the main body of the bus station via a zebra crossing facility at the narrow bus only entrance to the bus apron.

This accommodates 7 Drive Through stands, one of which is operated as a set down bay. The quality of bus access to the existing facility is variable, and related to the performance of adjoining sections of the wider highway network. The inbound access generally functions...
satisfactorily, but on occasion can become a severe bottleneck. Particularly when buses are forced to queue to access the set down bay and obstruct traffic flow. Additionally, vehicles frequently park along the eastern portion of Commercial Road outside Burger King, which in combination with buses queuing to access the set down bay, can lead to delays for bus services and traffic on Woodbridge Road. The Bus apron area and availability of layover space is generous and offers significantly more capacity than is currently utilised. This operating area, besides the slight difficulties encountered entering the site, enables vehicles to maneuver without difficulty. The bus stands along Commercial Road enable efficient bus operations, with adequate spacing between the bays and sufficiently low service frequencies that vehicle maneuvering is straightforward.

There is good provision for buses to exit the station to the west via a bus lane which continues southbound on Onslow Street. But the dimensions of the bus lane at the junction are inadequate for vehicle maneuvering, and in practice as many buses need to join the far-side lane to cross the gyratory the benefits of the bus lane are limited. Buses exiting the station to the west and joining the northbound carriageway of Onslow Street are subject to the same delays as other motorists, which can be considerable at peak times – with heavy traffic queuing back from the junction onto Woodbridge Road. Vehicles originating from Commercial Road and turning left onto Onslow Street merge with vehicles exiting the bus station, where those movements have priority. Buses departing the Commercial Road stands and turning right onto Woodbridge Road are catered for by a signalised junction, which in combination with the no waiting boxes along Woodbridge Road enable reasonable access for departing buses.

The bus terminus capacity and prevailing usage
The approximate capacity of the Friary bus terminus in a day is about 78 bus departures. It has about 6 to 8 departures per hour DIRO (Drive in Reverse Out) and Drive through Stands has about 8 to 12 departures per hour.

Guildford serves as a significant hub for bus activity in the wider Borough area, and for Surrey and North East Hampshire more generally. Of these services 36 originate from and terminate at the bus station, utilising the capacity available for recovery time, driver handovers and comfort breaks and service layovers. From Monday to Friday, peak hour bus departures from the Friary Centre bus station ranged from 77 and 79 on Thursday and Friday respectively, and 78 on Monday, Tuesday and Wednesday

Passenger facilities provision
1. The waiting facilities adjacent to the Friary Centre were found to be adequate, with sufficient information on services provided
2. Efficient drivers facilities
3. Large covered area with some screening from poor weather; and the dated visual appearance of the structure
4. Limited degree of comfort
5. Absence of personal security features
6. The Commercial Road facilities provided within a bus terminus.
Evaluation criteria for an ideal bus terminus location

- Central locations
- Quality of facilities for passengers and passenger safety
- Accessibility to the bus station from generators
- Integration with planning policies
- Land ownership and legibility
- Integration in terms of interchange
- Passenger safety
- Economic and environmental impacts
- Impacts on the urban realm
- Operational functionality
- Quality of operators support facilities
- Disruption caused by construction
- Outline design/initial swept path checks

(MVA, 2011)
Limitations of the Guildford Friary Bus Station

- Onslow Street where the bus terminus is located is frequently congested at both ends
- Persistent congestion on the Bridge Street gyratory and at the pedestrian crossing on Millbrook
- Bus station is not aesthetically pleasing, poor quality of environment
- Bottleneck at the entrance to the bus station
- Bus lane serving the exit to the Bus station is too narrow, and ineffective for services travelling over the Bridge Street gyratory to the West.
- Congestion on North Street (between Woodbridge Rd and Leapale Rd) delays bus services
- Unenforced parking restrictions on the High Street delay bus movements.
- Lessons learnt from the Guildford Friary Bus Station

Accessibility

There is good provision for buses to exit the station to the west via a bus lane which continues southbound on Onslow Street. From the study it is evident that poor access the bus terminus also lead to traffic congestion. In Mwiki area, with clearly defined traffic flow mechanism the congestion caused by the informal bus terminus can be reduced.
Segregation of vehicle and pedestrian traffic:

Within the bus terminus, there should be the separation of the different modes of travel; i.e. cycling paths for the cyclists, pedestrian walkways, ramps and staircases. This allows for a safer environment for the residents, users and the traffic operators and easier circulation around the neighborhood a concept that can be incorporated in the designing of the Mwiki bus terminus.

Separation of the different operations of the bus terminus

The Friary Centre Bus Station comprises 15 bus stands, 13 are configured as DIRO (Drive In-Reverse Out) bays along a saw tooth arrangement of boarding and alighting points providing access to and from the main bus station concourse, parking bays and drive through stands. For this project, the division of the different operation of a bus terminus will significantly minimize traffic congestion along the entire Kasarani-Mwiki road.

Efficient Provision of information

The bus terminus information is adequately relayed through the information Centre, the Posta and giving appropriate direction signage for the users.

Passenger facilities

Within the Guildford Friary Bus Station the amenities for pedestrians include: The waiting facilities adjacent to the Friary Centre were found to be adequate, with sufficient information on services provided, efficient drivers facilities, large covered area with some screening from poor weather; but the dated visual appearance of the structure, limited degree of comfort, absence of personal security features, the Commercial Road facilities provided within the terminus. Mwiki bus terminus do not have the amenities, incorporation of these amenities within the bus terminus will efficiently enhance the operation of the bus terminus.

2.12 Conceptual Framework

From the literature reviewed, certain principles and concepts for locating and designing a bus terminus emerged. The principles included: Coherence of the bus terminus facilities, Functional arrangement of space, Sequence of movement, direct circulation, Cross-path circulation, and emergency evacuation circulation, Density of occupation, Identifiable entry points, Operations and maintenance etc. Moreover, important lessons were deduced from the case studies reviewed. These included: accessibility, segregation of vehicles and pedestrian traffic, separation of the different operation of the bus terminus, efficient provision of information and the provision of the passenger facilities.

Incorporation of the above principles, concepts and lessons from the case studies in the regularization and designing of the Mwiki bus terminus can help in ensuring that the traffic congestion at the location can be significantly reduced and the traffic flow along the entire Kasarani- Mwiki road can be greatly enhanced. Thus, guided by the principles and lessons from the literature reviewed above and the case study, the conceptual framework is summarized by the table below.
Table 3: The conceptual framework

**POLICY GOALS**

Provision of an efficient, reliable and sustainable bus terminus that meets passenger and freight satisfaction within Mwiki area

Bus terminus that provides a reasonable use for all people including those with disabilities

Efficient planned land use and infrastructure and service provision in the Mwiki area.

Transportation strategy with emphasis of mass transport.

Provision of the different facilities for the different modes of transport

Ensure safe, affordable, efficient, comfortable transport facilities

**LESSONS FROM THE CASE STUDY**

- Accessibility
- Segregation of vehicle and pedestrian traffic:
- Separation of the different operations of the bus terminus
- Efficient Provision of information
- Efficient Passenger facilities

**TARGETS**

- Efficient traffic flow along Kasarani-Mwiki road
- Provision of requisite transportation facility
- Provision of amenities for the bus terminus users
- A pleasant living and working environment
- Enhanced quality of life

Source: Author, 2014
CHAPTER THREE

SITUATION ANALYSIS

3.1 Overview
It will include; the locational context of the project area (regional, sub-regional, local, neighborhood, detailed study context of the project area), background of the study area, history and development of the area, site analysis (landscape and environmental characteristics of the area), population characteristics of the area, land use analysis and institutional, legal and financial issues of the development project area.

3.2 Location context of the project area
3.2.1. Regional Context
The project area is located within Nairobi City region. The city lies in the Southern part of Kenya at about 1.19° South of Equator and 36.59° east of the Meridian. Its altitude varies between 1,600 and 1850 metres above sea level. Spatially, the city’s total area is approximately 694 square kilometers.

3.2.2. Local Context
The project area is located 17 km east of the Nairobi Central Business District. It is in Mwiki sub-location, Kasarani division/constituency. The area of study is bounded by Red soil road to the west, the Nairobi-Nanyuki railway line. The total site of the project area is 1.00 hectare.

3.2.3. Neighbourhood
The location of the site is in close proximity to the junction of Kasarani Mwiki road and the Nairobi-Nanyuki railway line. It is within the Mwiki residential neighborhood and also located in close proximity to the Mwiki informal market.
The project area is located in the North Eastern side of Nairobi, in Kasarani constituency.

Source: [http://upload.wikimedia.org/wikipedia/commons/3/33/Nairobi_County.jpg](http://upload.wikimedia.org/wikipedia/commons/3/33/Nairobi_County.jpg)

Mwiki area located within the Kasarani Constituency

Source: IEBC, 2009
Map 5: Contextual map of the project area within area of study

The development project area is sandwiched in between the Mwiki residential neighbourhood to the west, north and east and to the south is the main Kasarani-Mwiki area.

Source: Adapted and modified from Kenya GIS data, 2013
Map 6: The proposed site for the Mwiki bus terminus showing the different land uses

Source: Adapted and modified from Kenya GIS data, 2013
3.2 Existing site situation

The Kasarani-Mwiki Road is a collector street with a single carriageway and two lanes (each lane is 3.4 meters and a total road reserve of 18 meters) used by both the public and private means of transport. Traffic carried from both sides of the road includes private and public vehicles and NMT (handcarts, bicycles, and pedestrians) which carries good (e.g. hardware goods, clothing and food etc.), people and other services. The informal bus terminus is located along the Kasarani-Mwiki road and within Mwiki area.

Figure 15: Cross section of the Kasarani-Mwiki road showing the shared road reserve

Source: Field survey, 2013

The Mwiki informal bus terminus suffers from unclear planning, there is no specific land space set aside for it therefore no clear planned parking organization at this point. Most of the Public service Vehicles (PSVs) in a disorderly manner around the terminus. The vehicles therefore tend to interfere and occupy part of the main carriage way of the Kasarani-Mwiki road. This directly interferes with traffic flow along the road. The area lacks any built facility to provide any essential services and amenities such as sanitary facilities, catering facilities or any other supporting functions related to the terminus use.

The bus terminus mainly serve both the residence and the business community surrounding Mwiki informal market, because of this all vehicles serving the market, which has no separate parking provisions tend to be parked at the Mwiki Informal bus terminus. This exaggerates the traffic congestion of the area and increases the problem of traffic flow along the entire Kasarani-Mwiki road. The continuation of this un-organized situation around the bus park and the market could have far reaching disadvantage to efficient traffic flow along the Kasarani-Mwiki road.

The busses and matatus using the terminus tends to pick and drop people and goods randomly without any clear order mainly because there is no designated points for both alighting and embankment of vehicles. Passengers also tend to spread out in confusion around the area as a result the vehicles stops several times therefore taking long to pick enough passengers before continuing with the journey. In the situation vehicle crew tend to block each other in an effort to maximize their earnings; this further significantly slows the general flow of traffic along the entire Kasarani-Mwiki road.
Map 7: Site condition of the project area

- PEFA church
- Reduced Carriageway of the Kasarani-Mwiki Road
- Vehicles parking along the Kasarani-Mwiki Road
- Commercial land-use near the proposed site
- Poor condition of the access foot path
- Poor condition of the Kasarani-Mwiki Rd.

Source: Adopted and modified from the Kenya GIS data, 2013
3.3 Site analysis

3.3.1 Topography
The study area is located in the eastern side of Nairobi which is generally low (approximately 1600 msl) and flat (Saggerson, 1991). The study area is located on gently sloping ground, which slopes from west to east thus most of the infrastructure facilities and services can be easily developed and maintained.

3.3.2 Geology and Soils
The study area is mainly composed of the phonolites of middle Pliocene rocks, they are found about 2-3 feet below the ground. The area falls under the upper Athi basin where the Athi plains phonolite have weathered into black cotton soil of about 2-3 ft. This type of soil is not usually fertile and supports mostly shrubs as natural vegetation. This soil therefore is appropriate for the development of infrastructure facilities.

3.3.3 Climatic conditions.

**Rainfall:** The area has a bimodal rainfall pattern in which the long rains occur in March-April while the short rains occur between November and December. The average rainfall amount is 30 inches while the average number of rain-days is 90-100 per year. The area, just like any other part of Nairobi, has however a 30% chance of receiving less than 30 inches of rainfall from year to year and a 10% chance of getting less than 20 inches of rain.

Table 4: Average rainfall (mm) based on records for 50 years

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (mm)</td>
<td>48</td>
<td>48</td>
<td>115</td>
<td>195</td>
<td>137</td>
<td>42</td>
<td>15</td>
<td>21</td>
<td>24</td>
<td>52</td>
<td>114</td>
<td>77</td>
</tr>
</tbody>
</table>

*Source: The meteorological Department, 2012*

**Hydrology and Drainage:** The corridor is drained by Gatharaini River, which is a seasonal river and the perennial Nairobi River. The rivers are highly polluted by the industrial and domestic waste and siltation from the agricultural activities along the rivers thus rendering its water unfit for human consumption. The storm water drainage system is inadequate in most of the sections causing damage to the road network and traffic disruptions during the heavy rains. The drains are in a bad state due to evident negligence in management, ignorance and irresponsibility of the residents and the council authorities, poor solid waste disposal and discharge of both industrial and domestic waste water to the water body.

**Temperature:** Mwiki area climate doesn't differ much from the climate of the rest of Nairobi. The daily temperature range of Nairobi average between 10 degrees in May and 15 degrees in February. The average temperature throughout the 24 hours varies from about 17 degrees during July and August to 20 degrees in March. The days are warm and the nights are cool especially in June/July season when the temperatures can drop to 10 degrees. The mean maximum temperature is 24 degrees. According to the master plan, the average temperature for Nairobi was 17 degrees and the mean maximum temperature was 22.6 degrees while the mean minimum temperature is 12.6 degrees. This therefore requires that the development of bus
terminus amenities such as toilets and operators’ offices should neither be too cold or too hot this will be done to enhance users’ comfort.

Table 5: A summary of the temperature characteristics of Nairobi

<table>
<thead>
<tr>
<th>Months</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean max temp</td>
<td>26.8</td>
<td>28.0</td>
<td>27.4</td>
<td>24.6</td>
<td>24.1</td>
<td>23.1</td>
<td>22.3</td>
<td>22.7</td>
<td>25.3</td>
<td>26.2</td>
<td>23.6</td>
<td>25.1</td>
</tr>
<tr>
<td>Mean min temp</td>
<td>13.1</td>
<td>13.4</td>
<td>14.4</td>
<td>14.3</td>
<td>14.2</td>
<td>12.6</td>
<td>11.5</td>
<td>11.8</td>
<td>12.2</td>
<td>13.7</td>
<td>14.4</td>
<td>13.8</td>
</tr>
<tr>
<td>Mean Range</td>
<td>13.7</td>
<td>14.6</td>
<td>13.0</td>
<td>10.3</td>
<td>9.9</td>
<td>10.5</td>
<td>10.8</td>
<td>10.9</td>
<td>13.1</td>
<td>12.5</td>
<td>9.2</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Source: The Meteorological Department, 2012

Wind patterns: The wind generally blows from the North East and to a lesser degree to the South East (monsoon winds). The winds are high in January, February and March and they coincide with a period of higher potential evaporation. The strongest winds occur during the dry season just prior to the long rains with speeds of 20-25 miles per hour especially from midmorning to early afternoon. At other times this ranges from 10-15 miles per hour. The orientation of the structures within the bus terminus will therefore ensure efficient air circulation.

Humidity: The maximum humidity occurs near dawn at the time of minimum temperature, while, the minimum relative humidity will occur during the rainy season. The relative humidity ranges from a daily maximum of 55% in May to minimum of 36% in April.

Sun shine and solar radiation: Nairobi experiences a total of about 2500 hours of bright sunshine per annum, which is equivalent to annual mean of approximately 6.65 hours of sunshine per day. July and August are characterized by cloudiness and during these months the average daily sunshine in Nairobi is 4 hours. There is about 30% more sunshine in the afternoon than in the morning and it follows that westerly exposures receive more isolation than easterly ones. The orientation of the buildings within the terminus site will therefore ensure that appropriate sun lighting based on the sun path is achieved.
Graph 1: Average Monthly Hours of Sunshine

Evaporation: Annual variation of evaporation is expected from consideration of temperature, wind speed, direction and sunshine factors. The peak evaporation periods are during March, followed by January, February and October. The mean annual evaporation is 172mm.

3.3.4 Vegetation
Mwiki area being in the eastern side of Nairobi has black cotton soil with moderate rainfall making it unfavorable for high growth of vegetation. The area of study has a lot of shrubs, a few trees and natural vegetation. Also it has planted flowers and hedges. Since the area was zoned out as an agricultural land and residential area (CCN), therefore the Mwiki area is also composed of some agricultural lands. Most of the existing small scale farms have crops such as maize, beans vegetation among others.

3.4 Population and Demographic Characteristics
3.4.1 Population dynamics
The population of the Mwiki area is 39156 people with 19450 males and 19706 females. Mwiki area covers approximately 18.80 Km² and has a population density of 2082.77 per sq. km on average. The population growth rate for Nairobi and Mwiki area is 3.8% (GoK, 2009). Hence as population of Nairobi changes so is the population of Mwiki neighbourhood. The table below illustrate the trend of population change in Nairobi County over time.

Table 6: Population change over time

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi population</td>
<td>509,286</td>
<td>827,775</td>
<td>1,324,570</td>
<td>2,143,254</td>
<td>3,138,369</td>
</tr>
</tbody>
</table>


The population projections below illustrates those of Mwiki neighbourhood over time. According to it, the population of Mwiki in the next 30 years will be close to 0.2 million hence
when the infrastructure and other resources at Mwiki are not planned for, the population will outgrow them and may even lead to their depletion.

Table 7: Projection statistics for Mwiki area

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>population</td>
<td>39156</td>
<td>40643</td>
<td>48975</td>
<td>59015</td>
<td>71114</td>
<td>85692</td>
<td>103259</td>
<td>124427</td>
</tr>
</tbody>
</table>

Source: Adapted and modified from the KNPHC, 2009

The high population increase within the Nairobi County has been replicated in Mwiki area too. It has exerted a lot of pressure on the available physical facilities like housing, water and sewerage facilities, road etc. this has been amplified with the inability of the city county to properly plan and manage these facilities. These is the main reason for the existence of the informal Mwiki bus terminus and market within the project area. The regularization of the Mwiki bus terminus in this area will greatly reduce the Kasarani- Mwiki road congestion which originated as a result of the high increase in population within Mwiki area.

3.4.2 Socio-economic factors

The Mwiki bus terminus is a public facility, therefore the socio-economic characteristics of the people here is diverse and therefore cannot be clearly articulated. Though majority of the users are of low and medium income level. Most of the activities within the area are informal ranging from hawking and small scale businesses, but majority of the users are the residents. This project will therefore be informed by the socio-economic of the users.

3.4.3 Cultural and political factors

The cultural-political dimension of the people within the project area is diverse. Therefore the planning and design of the Mwiki bus terminus will have to take into consideration the diverse interests of the users in as far as culture and political inclinations are concerned.

3.5 Land use analysis

3.5.1 Residential Land use

Building typologies and densities - Basically the residential buildings are flats of about 4 floors averagely but also some few row housing units. The row housing are composed of old buildings while the up-coming buildings and the new developments are flats. The row houses are composed of about 6-8 units. An example of the different building typology in the area of study is illustrated in Map 8 below.

Building materials – The original residential buildings have tiled roofs, stoned walls, and cemented floors. However, the new building and the up-coming ones are made of iron sheets on the roofs and walls but have cemented floors.

Circulation space – the average distance between the building blocks is 0.5m to 1.5m, while some plots are attached to each other without spaces left. This space serves as the playing area for the children, accommodates clothing lines and is used as resting space by residents while neighbors interact.

Housing conditions - The stone buildings have been dilapidated and the walls are generally dirty. The new buildings are important as they help bridge the gap of housing inadequacy within
the area and Nairobi in general. But further limit the circulation space in the area. The surrounding is also highly littered.

**Drainage and landscaping** – There are no proper drainage channels and being a relatively flat area, there are water pools and so much mud making the environment unpleasant when it rains. The land is also bare and no landscaping has been done at all.

**3.5.2 Commercial land use**
Mwiki market is in close proximity to the development site. It is mainly composed of informal business activities such as hawking and its location is also informal. Activities that take place within the commercial area mainly include retail kiosks, eating points, fruit and vegetable vendors, garages, salons and barber shops, carpentry, M-pesa shop along the main Kasarani-Mwiki road and pockets of urban agriculture etc. The market generates a considerable amount of vehicular traffic loading and off-loading of goods. It also attract a huge number of passengers. Its close proximity to the Kasarani-Mwiki road leads to traffic congestion since it attracts business activities on the road reserve. It also leads to high noise pollution which affects the users of both the informal bus terminus and the residents living in close proximity. The stage-view mini mart in map 8 below represents the commercial land uses within the area of study.

**2.5.3 Educational facilities**
During school days, the population of the informal Mwiki bus terminus is generally high due to the existence of many school going children. Such education facilities include Njeri house (Hair Dressing School), Brookfield secondary school among others. Therefore development of a formal bus terminus will minimize the population congestion that often lead to lateness and high cost of fair spent by the children. The educational facilities within the neighborhood of the proposed bus terminus site is the Njeri house shown in map 8 below.

**2.5.4 Religious facilities**
A number of religious facilities are located with the project area neighbourhood. Such facilities include; ACK church, Deliverance church, Catholic Church among others. They generate a considerable amount of traffic especially during the weekends when all people converge in worship places. The development of a well-planned bus terminus is therefore geared towards easing the traffic congestion along the main Kasarani-Mwiki road.
Map 8: Project area and its neighborhood

Mwiki Informal Bus terminus

Mwiki Informal market

Stage-view mini mart

Formula filling station

Storey residential building

Njeri House (Hair and Beauty College)

Source: Author, 2014

Source: Adapted and modified Kenya GIS data, 2013
3.6 Infrastructure services
The Mwiki area has few infrastructure facilities. They include; power line, roads, storm water drainage channels and water lines. The power line passing within the neighbourhood provides electricity for the commercial, residential and industrial land uses within the neighborhood, street lighting are few hence the area is insecure at night. The area lacks a sewer line so the inhabitants use septic tanks to dispose off their effluents. Storm water is channeled through the drainage channels located along the Kasarani-Mwiki road and eventually into the Nairobi River and the Gatharaini River. These drainage channels are in a dilapidated state and are also filled up with soils and garbage as a result of siltation and also the vegetation.

The project area is fairly accessible and well linked to the neighborhood, majorly the access is from the Kasarani-Mwiki road but the roads from the Kasarani-Mwiki road to the neighborhood are in bad condition hence in-accessible during rainy season. The water distribution within the area is adequate though there are few incidents of water pipes blockage therefore there is need to expand the capacity of the existing water lines and the introduction of sewer lines so as to meet both the current and future needs of the Mwiki area population.

Plate 6: Blocked storm and waste water drainage channel
Plate 7: Power line passing through Mwiki area

Source: field survey, 2013
3.6.1 Traffic flow pattern analysis
The linkages associated with this project include the major road and the feeder roads. The main Kasarani-Mwiki road is passes adjacent to the Mwiki bus terminus. Traffic within Kasarani-Mwiki road is composed of those originating from the residential neighborhoods, the commercial activities, quarrying activities near the project area etc., the traffic emanating from these sites therefore access the Kasarani-Mwiki road through the feeder roads. Public transport is the main mode of travel within the project area and they only dominate the Kasarani-Mwiki road. The figure below illustrates the traffic flow from the Mwiki neighborhood into the main Kasarani-Mwiki road.

Figure 16: Traffic flow from the Mwiki bus terminus neighborhood

Traffic flow through the feeder road
The feeder roads channel traffic from the different land uses within the project area to the main Kasarani-Mwiki road and at the same time filters out traffic from the main Kasarani-Mwiki road into the different land uses. These feeder roads have narrow width therefore the rate at which the channel and filter traffic from the or to the Kasarani-Mwiki road is slow hence they tend to be congested. There expansion therefore will aid to minimize the traffic congestion within them and which is also replicated within the entire Kasarani-Mwiki road. The figure below illustrates the traffic flow from the different feeder roads into and out of the Kasarani-Mwiki road.

Source: field survey, 2013
3.7 Institutional context of project

The key institution governing the Mwiki area is the Nairobi County Government and is governed by the provisions of the Urban Areas and Cities Act of 2011, the County Government Act and the Physical planning Act.

The City County of Nairobi is the authority in charge of all the developments within the city however due to the complexity of the actors and the component of the development project, other stakeholders will be involved and they will include;

- The Department of Physical Planning (Office of the Director of Physical Planning) and the Department of the City Engineers, they will be expected to provide technical expertise for the development of the Mwiki bus terminus to enable its full implementation
- NEMA: Will be expected to ensure environmental standards and sustainability of the bus terminus to be developed as stipulated in the EMCA No. 7 of 1999 is adhered to.
• Nairobi water and sewerage company: Will be expected to provide proper water and sanitary facilities within the project area
• Kenya Power and Lighting Company: Will be expected to provide a proper and efficient lighting system.
• Area Residents: Will be expected to provide their resources in terms of ideas, opinions and labour if need be, to facilitate a participative planning process
• The transport SACCOs are the daily organizers of activities within the current informal Mwiki bus terminus. They will be useful in giving their insight on the traffic flow conditions along the Mwiki bus terminus and the main Kasarani-Mwiki road

Financial: Since the project involves making changes on the urban land and it is a public facility financial availability is vital. The sources of finance for the project will entirely be from the County government, the other sources will include; private institution finances and donors.

3.7 The emerging issues
The emerging issues from this chapter include;

• Increase in the number of population within the neighborhood without the improvement of infrastructure development has resulted to over-exploitation of the facilities that were within the area e.g. the road network capacity is no longer adequate to serve the population at Mwiki and its neighborhoods
• Increase in the population has also increased the demand of other facilities
• The Mwiki area has poor infrastructure services which include water, sewerage and drainage channels etc.
• The residents have adopted different strategies of dealing with the existing problems of inadequacy of facilities within the estate
• The informal Mwiki bus terminus is functional and has attracted various land uses within its vicinity.
• Kasarani-Mwiki road experiences high traffic congestion which include both the passengers/ pedestrians and vehicular traffic
• Increasing traffic congestion slows down traffic flow within the bus terminus area and also the general traffic flow along the Kasarani-Mwiki road.
• There is lack of tenure i.e. the existing bus terminus is informal therefore its regulation will require acquisition of more land near its vicinity.
• The developed project area has a well-drained that can facilitate the construction of a bus terminus
• There is high labour availability (both skilled and unskilled labour) within the area; this can be provided by the high population within the area.
CHAPTER FOUR

PROJECT PLANNING, DESIGN AND IMPLEMENTATION

4.1 Overview

This chapter will include; development of spatial plans including the design of alternatives, evaluation of alternative proposals (plans, drawings and spatial models at various scales), site planning, design and development process stages. It will also include the design formulation stage and the development of detailed action plans, and implementation strategies.

The planning, design and implementation of this project will be based on the issues discussed form the various preceding chapters. The emerging issues from chapters two and three include:

i. Emerging issues from chapter two

From the policy review the emerging issues include; provision of an efficient, reliable and sustainable bus terminus that meets passenger and freight satisfaction within Mwiki area, a bus terminus that provides a reasonable use for all people including those with disabilities, efficient planned land use and infrastructure and service provision in the Mwiki area, transportation strategy with emphasis of mass transport, provision of the different facilities for the different modes of transport and to ensure safe, affordable, efficient and comfortable transport facilities.

The lessons which will inform the development of the bus terminus will include; accessibility, segregation of vehicle and pedestrian traffic, separation of the different operations of the bus terminus, efficient Provision of information, efficient Passenger facilities.

Form the policy review the principles which would guide the design of the Mwiki bus terminus include; Coherence, functional arrangement of space, sequence of movement and circulation, emergency evacuation circulation, density of occupation, identifiable entry points, functionality and simplicity, operation and maintenance.

The targeted outcomes of the development project will include; efficient traffic flow along Kasarani-Mwiki road, provision of requisite transportation facility, provision of amenities for the bus terminus users, a pleasant living and working environment and enhanced quality of life.

ii. Emerging issues from chapter three

- Increase in the number of population within the neighborhood without the improvement of infrastructure development has resulted to over-exploitation of the facilities that were within the area e.g. the road network capacity is no longer adequate to serve the population at Mwiki and its neighborhoods
- Increase in the population has also increased the demand of other facilities
- The Mwiki area has poor infrastructure services which include water, sewerage and drainage channels etc.
- The informal Mwiki bus terminus is functional and has attracted various land uses within its vicinity.
- Kasarani-Mwiki road experiences high traffic congestion which include both the passengers/ pedestrians and vehicular traffic
Increasing traffic congestion slows down traffic flow within the bus terminus area and also the general traffic flow along the Kasarani-Mwiki road.

There is lack of tenure i.e. the existing bus terminus is informal therefore its regulation will require acquisition of more land near its vicinity.

The developed project area has a well-drained that can facilitate the construction of a bus terminus.

The residents have adopted different strategies of dealing with the existing problems of inadequacy of facilities within the estate.

There is high labour availability (both skilled and unskilled labour) within the area, this can be provided by the high population within the area.

4.2 Planning and Design of the project

4.2.1 Land use and tenure

The project site will be about 1.0 hectares of land bounded by a residential neighborhood to the East, West and North and the Kasarani-Mwiki road to the south. The land to be developed is both under freehold and leasehold. The site lies under several plots among which 15 are developed. This is shown in the contextual map of the project location (map 7 above).

4.3 Guiding principles in designing the Mwiki bus terminus

The issues to be addressed by the project are discussed in the SWOT analysis table below;

Table 8: SWOT Analysis table

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>-High number of passengers</td>
<td>-High traffic congestion</td>
</tr>
<tr>
<td>-High number of vehicles</td>
<td>-Poor infrastructure</td>
</tr>
<tr>
<td>-Well drained soils for construction of a bus terminus</td>
<td>-Lack of designated bus terminus space</td>
</tr>
<tr>
<td>-Adequate population to provide both skilled and unskilled labour</td>
<td>-lack of a designed bus terminus</td>
</tr>
<tr>
<td>-Willingness of the Mwiki community to improve the transportation within their area of operation</td>
<td>-High noise and air pollution</td>
</tr>
<tr>
<td></td>
<td>-Lack of local bus terminus development guidelines to guide the project</td>
</tr>
<tr>
<td></td>
<td>-Increasing traffic congestion within the project area and the main Kasarani-Mwiki road slows down traffic flow</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Already existing and functioning bus terminus</td>
<td>-Over exploitation of facilities within the project area</td>
</tr>
<tr>
<td>-High demand of transport facilities</td>
<td>-Lack of tenure</td>
</tr>
<tr>
<td>-Adequate population to provide both skilled and unskilled labour</td>
<td>-informal bus terminus activity</td>
</tr>
<tr>
<td></td>
<td>-Increasing population of the Mwiki area and its neighborhood.</td>
</tr>
</tbody>
</table>

Source: Author, 2014

The development project will be guided by the lessons from the case study in the research project (lessons learnt from the case study) which include;
• Accessibility
• Segregation of vehicle and pedestrian traffic
• Separation of the different operations of the bus terminus
• Efficient Provision of information
• Efficient Passenger facilities

There are two identified alternative strategies that can be used to address the challenges at the Mwiki bus terminus area. Such alternatives are regularization and re-organization of the Mwiki bus terminus and relocation of the Mwiki bus terminus. With the application of the above mentioned principle to the problems experienced at the bus terminus area such as in-accessibility, sharing of the same transport road by the different traffic modes, lack of provision of information within the current bus terminus and the lack of provision of passengers’ facilities. The Figure 17 below provides a summary of the contextual framework that will guide the development and design of the bus terminus:

The planning issues on the project site

• High traffic congestion within the project area and the main Kasarani-Mwiki road slows down traffic
• Poor infrastructure
• Lack of designated and designed bus terminus space
• High noise and air pollution
• Lack of local bus terminus development guidelines to guide the project
• High demand of transport facilities
• Over exploitation of facilities within the project area
• Lack of tenure
• Informal bus terminus activity
• Increasing population of the Mwiki area and its neighborhood.
The planning issues on the project site

- High traffic congestion within the project area and the main Kasarani-Mwiki road slows down traffic
- Poor infrastructure
- Lack of designated and designed bus terminus space
- High noise and air pollution
- Lack of local bus terminus development guidelines to guide the project
- High demand of transport facilities
- Over exploitation of facilities within the project area
- Lack of tenure
- Informal bus terminus activity
- Increasing population of the Mwiki area and its neighborhood.

The approaches to address the identified problems

- Regularization and re-organization of the Mwiki bus terminus
- Relocation of the Mwiki bus terminus

Lessons derived from the case study

- Accessibility
- Segregation of vehicle and pedestrian traffic
- Separation of the different operations of the bus terminus
- Efficient Provision of information
- Efficient Passenger facilities

The design principles derived from the policy review

- Coherence
- Functional arrangement of space
- Sequence of movement and circulation
- Emergency evacuation circulation
- Density occupation
- Identifiable entry points
- Functionality and simplicity
- Operation and maintenance

Principle to guide the regularization and design of the Mwiki bus terminus

- Coherency
- Functional arrangement of space
- Separation of vehicular and pedestrian traffic
- Functionality and simplicity of the bus terminus
- Accessibility

- Operation and maintenance of the bus terminus
- Density of occupation
- Efficient passenger facility
- Operation and maintenance

Source: Author, 2014
4.3.1 Expected output and outcome of the project

The project design is expected to produce the following outputs and outcomes that will impact the project site and its surrounding.

The expected output of the development project will include;

1. A tentative land use budget for Mwiki bus terminus
2. A site plan for the Mwiki bus terminus
3. The development of plans, drawings and spatial models for the Mwiki bus terminus
4. The development of an implementation schedule.
5. The development of a monitoring and evaluation framework

The expected outcome include;

i. Efficient traffic flow, accessibility and circulation. Through the development of a formal bus terminus. The congestion caused on the road by the vehicles which park or constantly stop to pick and drop off passengers and goods along the Kasarani Mwiki road will be substantially reduce hence enhancing traffic flow situation

ii. Minimize challenge of inadequate space use along the Kasarani-Mwiki road. The informal Mwiki bus terminus is located on the road reserve and the disorganization of activities within it has also exaggerated the inadequacy of space within its locality. Therefore its planning will minimalize the challenge of inadequate parking spaces for vehicles and also traffic flow situation will be enhanced

iii. Traffic disintegration e.g. human and motor-vehicles traffic; currently the pedestrians and vehicles share the same road space. The disaggregation of the different spaces for the NMT and the vehicular will not only minimize the traffic congestion of the different modes of travel but also the accidents caused by the mixing of these modes will be reduced evenly.

iv. Generation of employment; the construction of the bus terminus will generate employment to the youths/unemployed in the area.

v. Enhanced quality of life as a result of conducive living environments (free from noise and air pollution)

vi. Economic prosperity; economic boost on a personal level and national level will be achieved resulting to enhanced quality of life and at the same time the formal bus terminus will aid in revitalizing the economy of this area. It will also aid in attracting investors to the area which will boost the economy of the area up as a result of efficient transportation facilities.

vii. High quality landscape: This is a scenario in which external spaces are well-designed and well integrated with the buildings and this can help create a sense of place and strengthen community identity. Well-designed and landscaped bus terminus will improve the aesthetics of its location and also make it human friendly.
4.4 Guiding design principles
The main guiding principles for designing the bus terminus as discussed in chapter two (policy review) include:

- Coherency
- Operation and maintenance of the bus terminus
- Functional arrangement of space
- Density of occupation
- Separation of vehicular and pedestrian traffic
- Efficient passenger facility
- Functionality and simplicity of the bus terminus
- Accessibility
- Operation and maintenance

4.5 Design Alternatives
From the research carried out, the main plausible scenarios for the regulation of traffic flow along the Kasarani-Mwiki road included:

1. Regularization and re-organization of the Mwiki bus terminus
2. Relocation and development of Mwiki bus terminus

The main objective of this project is to regularize and design a bus terminus at Mwiki which will aid in the reduction of the traffic congestion along Kasarani-Mwiki road. It will also enhance the livability of the Mwiki area

Alternative 1: Regularization and re-organization of the Mwiki bus terminus.

The regularization of the bus terminus will involves the rehabilitation of the informal bus terminus activities to formal and retaining their location but at the same time improving the traffic flow conditions within their areas of location and the entire Kasarani-Mwiki road. It will involve the construction of a bus terminus within the same place and providing it with the requisite facilities such as parking area for vehicles, passengers waiting area, passengers alighting / picking areas, goods off-loading and loading areas, areas for goods embankment, sanitary facilities, catering facilities, shops etc.

Re-organization will depend on the features of the site designing. It will involve the removal of all the developments within the project area to acquire sufficient land space and re-planning the land by organizing the bus terminus component on it to ensure efficient traffic flow into and out of the organized bus terminus, efficient traffic circulation access. The new designs on the site will include; additional gardening to improve the quality of air within the bus terminus, putting the bus terminus components in strategic locations, provision of the passenger amenities and sanitary facilities and also improving the management of the bus terminus etc.

This approach is viable for the Mwiki area for only short term and medium term use since the population and the land use activities are increasing in the Mwiki area hence there will be need for a bigger and more efficient bus terminus.
Advantages of regularization and re-organization of the Mwiki bus terminus

- It will enhance traffic flow along the Kasarani-Mwiki road and also reduce the traffic congestion experienced within the Mwiki bus terminus area.
- Regularization and re-organization of the bus terminus components will call for demolition of the entire site. It will be beneficial in that it will lead to the pooling of the local community resources as a way of empowering them i.e. the use of participatory approach.
- It will create job opportunities; the locals within the area shall be involved in both the demolition and redevelopment of the Mwiki bus terminus. This aspect of re-organizing the land uses will also enhance the accommodation of the Mwiki market activities which will be of economic value of the Mwiki residents and the traders.
- The re-organization of the bus terminus components will also enhance the circulation and accessibility of the different parts of the area which are prone to flooding during rainy seasons or poorly accessed due to the narrowness of the roads.
- Less cost of buying land since already the road reserve belongs to the government of Kenya.
- It will provide a faster solution to the traffic congestion problem within Mwiki area
- Enhanced economic value of the area; with efficient transportation, the area will attract investors and which will lead to increase in the economy of the area.
- Conservation of the environment; since the disorganization of the activities at Mwiki bus terminus area has led to the environmental degradation, the re-organization and development of the site of the site will lead to the planting of vegetation which will boost the environment at Mwiki as well as enhancing its aesthetic value
- Provision of a bus terminus to be used by the Mwiki people.

Disadvantages

1. There will be the displacement of some of the people operating or living in the present land uses. This will break family and social ties
2. The displacement of some of the residence form the project site will inevitably lead to the over population of other sites of the city and may lead to the development of informal housing/ business within their areas of settlement
3. It will also lead to the destruction of the natural environmental elements (soils and vegetation) to accommodate building structures
4. Reduction of job opportunities; the displaced will either seek new jobs elsewhere or start all over to look for new customers
5. The road reserve is small yet the population of Mwiki area is growing at an alarming rate hence the bus terminus to be developed along the road might be small to accommodate the future generation.
6. The increasing population and land use activities within the project area will require a bigger in the future.
Alternative 2: Relocation and development of Mwiki bus terminus

In the selection of a site to place the bus terminus certain factors must be taken into consideration. Such factors will include;

**Safety:** Passenger protection from passing traffic, access for people with disabilities, all-weather surface to step from/to the bus, proximity to passenger crosswalks and curb ramps, proximity to major trip generators, proximity of stop for the same route in the opposite direction, Street lighting

**Operating:** Adequate bus terminus space for the number of buses expected at the stop at one time, impact of the bus terminus on adjacent properties, bus routing patterns (i.e., individual bus movements at an intersection), directions (i.e., one way traffic in the case of the Kasarani-Mwiki road) and widths of intersection roads, types of traffic signal controls (signal, stop, or yield), volumes and turning movements of other traffic, width of sidewalks, pedestrian activity through intersections, proximity and traffic volumes of nearby driveways (TCRP report, 2012)

This approach will involve the construction of a new bus terminus within Mwiki area. The relocation of the Mwiki bus terminus will therefore involve the identification of a viable location along the Kasarani-Mwiki road, the site acquisition process as defined by the planning and development control of the CCN, this will then be followed by the planning and organization of the different components of the bus terminus within the identified site. The operation of the bus terminus will include the provision of a bus terminus for the Mwiki people, provision of parking bays for the busses, passenger facilities, information center to guide the operation of the bus terminus and also the matatus operators’ facilities etc.

The original location of the bus terminus site will be used to expand the Kasarani-Mwiki road and ensure that the different modes of transport are provided for e.g. the segregation of vehicular carriage ways, cycling paths for bicycles and the pedestrian walkways.

This approach is viable for the Mwiki bus terminus situation as it will provide a more permanent (long term) solution to the problems of congestion experienced within Mwiki bus terminus area and the main Kasarani-Mwiki road.

**Advantages of this approach**

1. The new location will accommodate a larger bus terminus to be used by the present and future population of the Mwiki area
2. Reduction of traffic congestion along the Kasarani-Mwiki road and its feeder roads
3. It will create job opportunities; the locals within the area shall be involved in the development of the Mwiki bus terminus hence creating jobs for the locals plus the constructors
4. Conservation of the environment; removal of the Mwiki informal bus terminus at its present location will give the site’s vegetation time to rejuvenate due to less human activities at the site.
5. Provision of a bus terminus to be used by the Mwiki people.
Disadvantages

1. Destruction of the soils to accommodate structures
2. It will also lead to the destruction of the natural environmental elements (soils and vegetation) to accommodate building structures
3. Displacement of land uses in the new bus terminus site.
4. High costs will be incurred in buying and the development of the land
5. Identification of a viable site for the bus terminus is difficult (tasking)
6. Disruption of the normal routine of the bus terminus users. The transition period for the users may take a long time.

4.5.1 Choice of the preferred approach

From the analysis, in order to meet both the current and future demands of the residents/pedestrians/ market traders and the vehicle operators an inclusive approach to addressing the traffic congestion problem is needed. From the above discussion, the relocating approach is an effective approach for long term use while the regularization and the re-organization approach will address the short term and medium term need of the Mwiki area. According to the discussion above, the most viable approach to address the traffic snarl-up situation within the study area is the first approach (Regularization and re-organization of the Mwiki bus terminus) since it will facilitate the prompt address of the current situation.

Justification for this approach includes;

- It will enhance traffic flow along the Kasarani-Mwiki road and also reduce the traffic congestion experienced within the Mwiki bus terminus area.
- Regularization and re-organization of the bus terminus components will call for demolition of the entire site. It will be beneficial in that it will lead to the pooling of the local community resources as a way of empowering them i.e. the use of participatory approach.
- It will create job opportunities; the locals within the area shall be involved in both the demolition and redevelopment of the Mwiki bus terminus. This aspect of re-organizing the land uses will also enhance the accommodation of the Mwiki market activities which will be of economic value of the Mwiki residents and the traders.
- The re-organization of the bus terminus components will also enhance the circulation and accessibility of the different parts of the area which are prone to flooding during rainy seasons or poorly accessed due to the narrowness of the roads.
- Less cost of buying land since already the road reserve belongs to the government of Kenya.
- It will provide a faster solution to the traffic congestion problem within Mwiki area
- Enhanced economic value of the area; with efficient transportation, the area will attract investors and which will lead to increase in the economy of the area.
- Conservation of the environment; since the disorganization of the activities at Mwiki bus terminus area has led to the environmental degradation, the re-organization and
development of the site of the site will lead to the planting of vegetation which will boost the environment at Mwiki as well as enhancing its aesthetic value

- Provision of a bus terminus to be used by the Mwiki people.

### 4.6. Site Planning/Design and development Process Stages

The following steps were followed in the regularization and design process of the Mwiki bus terminus.

- **Problem identification/ Field survey**: this was done during the research project. It included the condition of the traffic congestion along the Kasarani-Mwiki road, its causes and effects.

- **Data analysis and synthesis**: this was done to shed more light on the different prospects of the traffic congestion situation along the Kasarani-Mwiki road. These included, lack of designated bus terminus at Mwiki, lack of integration between land use and transport planning, inadequate road space and pathways, Population increase within Mwiki area, no designated market at Mwiki, lack of proper bus terminus legislations and poor enforcement of laws. Poor management of the informal Mwiki bus terminus and market, vehicles making turns at the median of the road

- **Recommendations**: this section proposed intervention measures to help in the minimization of traffic congestion within the Mwiki bus terminus

- **Formulation of development project alternatives**: this was informed by the recommendations made in the research project. Such recommendations include; the development of dual carriage way and re-designing of Kasarani-Mwiki road, planning for the regularization of Mwiki Bus terminus and market, Common provision of public amenities and establishment of clear and coordinated institutional structures

- **Design alternatives**: The preferred model chosen was that which responded effectively, most economical and responds promptly to the traffic congestion problem along the Kasarani-Mwiki road. Regularization and design of the Mwiki bus terminus was therefore the preferred option.

- **Implementation, monitoring and evaluation**: the preferred regularization and design approach of the Mwiki bus terminus chosen would include costing, time frame, stakeholders’ involvement and their roles, checks and balances to find out the approachable alternatives for the regularization of the Mwiki bus terminus in line with the objectives of the development project.
4.7 Development of spatial plans

This project began by looking into the problem of traffic flow along Kasarani-Mwiki road. From the research carried out it was deduced that the development of the informal bus terminus along the Kasarani-Mwiki road was the main cause of traffic congestion experienced. Therefore the main aim of this development project is to minimize the traffic congestion experienced along Kasarani-Mwiki road.

The design layout of the Mwiki bus terminus will involve the consideration of various spatial models which gives an output of an effective plan which regulates the traffic congestion experienced along the Kasarani-Mwiki road. The site layout was divided into the different components of a bus terminus.

The main defining elements of the Mwiki bus terminus were the main Kasarani-Mwiki road which links the area of project to Thika highway and the Kangundo road and the Mwiki neighborhood. The land budget for the main components of the bus terminus will include; circulation requirement of 15% of the total land.

For security reasons, the bus terminus will have specific entry points and exit points for the passengers and the vehicles. There will also be the installation of the CCTV cameras to deter any person from committing any crime within the vicinity. There will be a central passengers waiting area.

The proposed land budget for the bus terminus will be as follows in the table below;
### Table 9: proposed land budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage area</th>
<th>Total area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking area and vehicles</td>
<td>33.14% of 10000.18 m²</td>
<td>3314.43 m²</td>
</tr>
<tr>
<td>circulation areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrian circulation paths</td>
<td>5.11% of 10000.18 m²</td>
<td>510.76 m²</td>
</tr>
<tr>
<td>Gardening (greenery)</td>
<td>15.14% of 10000.18 m²</td>
<td>1514 m²</td>
</tr>
<tr>
<td>Built up area</td>
<td>18.68% of 10000.18 m²</td>
<td>1868 m²</td>
</tr>
<tr>
<td>-passenger shelter &amp; washrooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-restaurant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Office blocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-kiosks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (including areas for future</td>
<td>27.93% of 10000.18 m²</td>
<td>2793 m²</td>
</tr>
<tr>
<td>expansion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>10000.19 m²</td>
</tr>
</tbody>
</table>

**Source:** Author, 2014

4.7.1 Design formulation

The elements to be considered in the designing of the Mwiki bus terminus will include;

- **The bus park:** it will be designed in relation to the line of the vehicle arrival as either parallel, at 45° or at 90°, the length of parking space, the parking options e.g. 1 or 2 buses, the width of parking spaces, the width of arrival lane etc.

- **Bus berth:** there will be the development of two bus berths; one for the alighting passengers and the other for the departure of passengers area. From the discussion in policy review the preferred bus berth was he saw toothed bus berth since it allowed the independent movements by bus into and out of the berths;

- **Passenger amenities:** this will include the passenger waiting areas and their walk ways. The waiting areas will provide for the efficient use by both the disabled and the normal people. It will include the provision of the wheelchair bays and the bicycle racks. The pedestrian/ passenger walkways spaces will be such that they allow the movement in all directions and will be about 3m wide. There will be the provision of the trash receptacles to improve the sanitation and the aesthetics of such areas.

- **Signage and information:** Enhances the ease of access for entry of people and vehicles. The information which needs to be conveyed by bus signage falls into two groups: That required for driver recognition; and that required for customer/ passenger or pedestrian information. Road signs for the development of the bus terminus will include the pedestrian crossing marking, bus stop signs and parking areas among others.

- **Lighting and security of the bus terminus:** the road signs should be visible at all time. The information displayed should be readily visible at all times and this can be ensured when there are street lights to be used during the night for the busses which operates up to late in the night. The visual displays should therefore maximize the opportunities for using existing street lighting.
• The access hierarchy: pedestrians always have the first priority when it comes to accessibility to bus terminus/station sites. At many existing suburban stations, pedestrians must cross bus bays, parking lots, and vehicular lanes to reach the station entrance. This will then be followed by bicycles and the vehicles etc.

4.7.2 Process of making the development Action plans
The process will entail several action plans which include:

• Application for a change of use of the developed areas (residential and commercial) to a transportation land use: The City County of Nairobi has the mandate to control land use and developments so as to ensure proper and orderly developments of the area under its jurisdiction as stipulated in Sec. 29 of the Physical Planning Act Cap 286. PPA also stipulates that no development(s) may take place within the jurisdiction of any local authority without its development permission. It is therefore a requirement that any project requiring development permission should fill in a PPA1 form addressed to the Clerk of the Council as prescribed in the Fourth Schedule. The current use of the area is the informal Mwiki bus terminus which needs to be regularized and designed as presented in the figures 19 and 20 below.

• Preparation of various plans and designs and submission of these for approval: these will include the layout site plan and the building plans for the respective uses. The building plans includes: architectural, structural, building services plans/drainage installation plans and fire protection/installation plans.

• Demolition of the evacuated land uses within the Mwiki bus terminus area to pave way for the regularization and the design of the bus terminus.

• Preparation and organization of the site: this will include activities such as setting out, excavation and earth works; a public notice on the intention to construct and demolish the houses; putting up of construction sign boards as well as hoarding and scaffolding the site.

• Construction of the bus berths, parking area, passenger facilities and installation of utility services: the construction part will entail construction of the sub-structures (foundations) and super structures (floor slab, walls, roofs, and internal finishes). The installation of utility services will entail installation of water supplies, sewerage and foul water drainage, surface water drainage, electrical system. This is illustrated in figure 22 to 30

• Carrying out external finishes and external works: this will entail: walk ways and parking areas, construction of solid waste disposal receptacles, landscaping and rehabilitation of the site and final touch up of environmental aesthetics, erecting of perimeter fence and gates for security purposes.

• Management of the bus terminus at Mwiki: After the finishing of the bus terminus constructions, a certificate of occupation will be issued be the CCN in order for it to operate. The management process will include aspects of monitoring and evaluation to ensure that environmental impacts on the occupation phase are addressed.
Figure 20: Summary of the Development Action plans

Action plan I
Application of use from the existing residential and commercial uses to bus terminus use

Action plan II
preparation of the different designs and submission for approval

Action III
Demolision of the evacuated land uses

Action IV
Construction of the bus terminus components and installation of utilities

Action V
Carrying out external finishes and external work

Action VI
Management of the regularized and designed bus terminus through community capacity building and educating the management and also formulation of policy guidelines

Source: Author, 2014
4.7.3 The Action plans

The site plan

Figure 20 represents the site plan for the area of study; it is composed of green grass ground cover, tarmacked roads, built-up area, tree plantings and vegetation and the different vehicles flow patterns and directions.

The circulation roads are 7 m wide, with two lanes on each road, the bus berths are about 3.5 m wide. It also shows the saw toothed parking bays for the busses and the 14 seater matatus.

The other components of the bus terminus are discussed in figures 21-30.
Figure 21: Site plan for the bus terminus

Source: Author, 2014
Figure 22: The site plan for the passenger facility area

**THE RESTAURANT**
It consists of the cooking area and the eating areas.
The eating area is about 59.5 M² and consists of about 28 tables each holding 4 persons. Hence the total population of the restaurant when in its full capacity is about 112 people.
The kitchen area is composed of the cooking area, the serving area, the chef’s office and the workers’ changing rooms taking a total area of 27.2 M². In addition, the area has a circulation space to allow the users’ operate efficiently.

**THE WASHROOMS**
They are always located next to the kitchen area since both of them share a wet wall i.e. they are suited with water channels. This is important for the ease of plumbing.
The washrooms are in two sets (3 for ladies and 3 for gents respectively), and each set one of the washrooms is suited with facilities for the disabled. In addition, the gents have urinals.

**THE RETAIL SHOPS**
There are a total of eight shops within the passengers’ facility. Each shop has a dimension of approximately measured 2x3 meters and a total area of (8 x 2x3) = 48 M².
The arcades are two; one demarcates the restaurants for the shops while the other one separates the offices from the passenger waiting areas. Each arcade is about 11.9M². In this area they form a free passage for the passenger area users’.
The atrium is an open area which allows lighting and fresh air circulation within the passenger area. They are also two in number each measuring approximately 21.7 M²

**THE OFFICE BLOCK**
The office blocks are spaces used by the bus terminus operators, such as the managers, vehicles crews etc. There are eight office buildings each accommodating four (4) workers for safe and healthy working environment, since each person occupies an area of;

- Work room – 8m² floor area per employee
- Free circulation space – 1.5m² per employee

This enables a 12m² space for the storage furniture and any other use. That is, space occupied by work rooms and circulation area will be 4(8.0+1.5) = 38m². Therefore in this area the total space for offices will be equal to (38 x 8) = 304 M²

**PASSENGERS’ WAITING LOUNGE**
There are two passengers waiting lounges, the passengers’ waiting lounge have two varied types of seats; for the disabled are suited with arm rests and are wider and low in height and those seat for the normal are shared.
The total number of seats are about 200 and the disabled have about 10% of the total seats.
Figure 23: Aerial view of the Mwiki bus terminus

Legend

- **Parking areas**
- **Passengers waiting area**
- **Passenger circulation foot paths**
- **Vegetation**
- **Vehicular circulation area**

*Source: Author, 2014*
Figure 24: 3D representation of passenger built-up area

*Source: Author, 2014*
Figure 25: Segregation of the pedestrian walkways and the vehicle path

Pedestrian walk-ways fitted with gabbro to prevent dust pollution and to enhance their aesthetic appeal.

Vegetation used to separate the pedestrian walk-ways and the main road.

The main road for the motorists, well tarmacked to reduce dust pollution during dry seasons.

Source: Author, 2014
Figure 26: A section of the parking area for the busses and mini-buses

Source: Author, 2014

Figure 27: Representation of a section of the linear bus berth (M)

Source: Adler, 1999
Parking areas for the 14 seater vehicles are shorter than those for the busses.

The parking bays for the 14 seater vehicles are about (3.2 by 5.5) m while parking areas for the buses are about (3.5 by 15.7) M each.
Figure 29: Separated entrance for the vehicles and passengers

Source: Author, 2014
Figure 30: Pedestrian walkways and the crossing areas

*Pedestrian crossing areas within the bus terminus*

*Pedestrian walkways within the bus terminus*

Source: Author, 2014
Figure 31: Landscaping of the project area

Landscaping is done using different kinds of vegetation e.g. flowers, trees and grass.

In this project the trees are well placed to provide shade and the soil vegetation cover (grass) are well trimmed.

Both the trees and the grass creates a cool environment within the bus terminus as well as enhancing its aesthetic value.

*Source: Author, 2014*
4.5.3 Implementation schedule
The implementation of the project will be facilitated by the City County government of Nairobi. This will be done in liaison with the local community, the bus operators and the SACCOs among other stakeholders. The project will also involve the community participation where the local residents and other bus terminus users will be informed and asked for their take in the project to be implemented in their areas of operation. Effecting of the development plan to achieve the set objectives needs a well-planned approach which will ensure a successful and workable output to solve the identified problems. Table 11 below summarizes the implementation strategy for the project.
<table>
<thead>
<tr>
<th>Goals</th>
<th>strategy</th>
<th>programs</th>
<th>Time frame</th>
<th>Actors</th>
<th>inputs</th>
<th>Expected output</th>
</tr>
</thead>
<tbody>
<tr>
<td>To prepare a site plan and design for a bus terminus at Mwiki</td>
<td>-Formulate a regularization and design plan for the Mwiki bus terminus -Identification of the suitable site for the development</td>
<td>Preparation of the spatial site plan and design components of the bus terminus</td>
<td>6 months</td>
<td>The City County government</td>
<td>-By-laws -Finance -Professional expertise -Human resource</td>
<td>Development of a functional bus terminus</td>
</tr>
<tr>
<td>To examine alternative ways of the of location of the Mwiki bus terminus</td>
<td>Identification of the suitable site (side of the road) for the regularization of the bus terminus</td>
<td>Site clearance for the Mwiki bus terminus</td>
<td>6 months</td>
<td>-City County government Mwiki bus terminus Mwiki residents</td>
<td>-Finance -Professional expertise Human resource Land</td>
<td>-Favourable site and location of the bus terminus</td>
</tr>
<tr>
<td>To construct the different components of the bus terminus</td>
<td>Facilitate proper land organization and distribution of the different components to ensure optimal land utilisation.</td>
<td>Construction of the Mwiki bus terminus</td>
<td>1 year</td>
<td>City County of Nairobi Private developers The Mwiki community</td>
<td>-Finance -Professional expertise -Human resource</td>
<td>-efficient and functional bus terminus</td>
</tr>
<tr>
<td>To landscape the site and ensure the conservation of the project area environment</td>
<td>Incorporate environmental components of landscaping to the site</td>
<td>Incorporation of flower hedges at specific places within the bus terminus.</td>
<td>1 year</td>
<td>NEMA City County of Nairobi Mwiki community</td>
<td>-Finance -Professional expertise -Human resource</td>
<td>-Environment conservation -improved aesthetic value of the area</td>
</tr>
<tr>
<td>To ensure the users of the bus terminus appreciation</td>
<td>Sensitization of the bus terminus on the benefits of the regularization of the</td>
<td>Establish the bus terminus regularization committee composed</td>
<td>Continuous assessment</td>
<td>City County of Nairobi NEMA</td>
<td>Finance Professional</td>
<td>Participative planning approach in the design and</td>
</tr>
<tr>
<td>The regularization and design of the Mwiki bus terminus</td>
<td>bus terminus</td>
<td>of elders and chiefs within Mwiki.</td>
<td>CBOs and NGOs The private sector The Mwiki community</td>
<td>expertise</td>
<td>implementation of the bus terminus development plan</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>To provide for adequate management of the bus terminus</td>
<td>Establish organizational structure for management of the bus terminus</td>
<td>Establish the bus terminus management committee -Capacity building of the bus terminus management committee</td>
<td>6 months</td>
<td>-County government -Bus terminus operators -CBOs -Mwiki community -Private sector -SACCOs</td>
<td>Finance Human resource</td>
<td>Well established bus terminus management committee</td>
</tr>
<tr>
<td>To propose land use control mechanisms, monitoring and evaluation guidelines for the Mwiki bus terminus</td>
<td>-Establish spatial guidelines, regulations and management framework for the Mwiki bus terminus</td>
<td>-Development of regulations on the bus terminus components development -Develop regulations on the use of the bus terminus -Community capacity building and awareness -Preparation of monitoring and evaluation schedule</td>
<td>2 years</td>
<td>City county government</td>
<td>Finance Legislative framework</td>
<td>Policy guidelines for the Mwiki bus terminus</td>
</tr>
<tr>
<td></td>
<td>Establish a monitoring framework</td>
<td></td>
<td>1 year Continuous 6 months</td>
<td>NGOs and CBOs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Author, 2014*
4.6 Project phasing
The Mwiki bus terminus project will be done in phases. These phases are outlined in the table 12 below;

Table 11: project phasing in terms of short term and long term

<table>
<thead>
<tr>
<th>Phase</th>
<th>Activity</th>
<th>Short term</th>
<th>Medium term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Application for a change of use of the land from residential to mixed use</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>Preparation of various plans and designs and submission of the same for approval</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phase 3</td>
<td>Preparation of an environmental impact assessment report for the site</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phase 4</td>
<td>Demolition of the evacuated houses</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Phase 5</td>
<td>Lay out and provision of infrastructural route services for the site</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Phase 6</td>
<td>Actual construction of the bus terminus and installation of utility services</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phase 7</td>
<td>Carrying out of external finishes and external works</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Phase 8</td>
<td>Management of the developed Mwiki bus terminus by ensuring community capacity building and equipping of the bus terminus management. Include also the allocation of the different components of the bus terminus</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Phase 9</td>
<td>Allocation of the various requisite facilities of the bus terminus such as washrooms, office spaces etc.</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phase 10</td>
<td>Public awareness of the transportation and economic significance of the Mwiki bus terminus</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Phase 11</td>
<td>Formulation of policy guidelines for similar bus terminus within Nairobi county</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author, 2014

4.7 Financial Requirements
Every project has to be accompanied by financial requirements and human resources. Since the project will run for a period of 1-2 years for its completion, the money required for its development will vary as per the different activities involved; the financial requirements are as stipulated in the table below:

Table 12: Financial requirements

<table>
<thead>
<tr>
<th>Activities</th>
<th>Cost (Ksh)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application for a change of use of the site from residential to mixed use</td>
<td>500,000</td>
<td>1-3 months</td>
</tr>
<tr>
<td>Preparation of plans and building guidelines, obtaining and approval of environmental certificate</td>
<td>1,000,000</td>
<td>6 months to 1 year</td>
</tr>
<tr>
<td>Land clearing, levelling and construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking area, Ksh (3314.43m² * 3700)</td>
<td>12,263,391</td>
<td>1-1.5 years</td>
</tr>
<tr>
<td>Pedestrian, Ksh (510.76 m²* 1100)</td>
<td>561,836</td>
<td>6 months</td>
</tr>
<tr>
<td>Gardening, Ksh. (1514 m²*500)</td>
<td>757,000</td>
<td>1 year</td>
</tr>
<tr>
<td>Built up area</td>
<td>Ksh. (1868 m² * 33,000)</td>
<td>61,644,000</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Other</td>
<td>Ksh. (2793 m² * 600)</td>
<td>1,675,800</td>
</tr>
<tr>
<td>Management of the bus terminus</td>
<td>Ksh. 500,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>66,076,800</td>
</tr>
</tbody>
</table>

*Source: Author, 2014*

### 4.8 Institutional requirements

There are various institutions which are vital in the regularization and design of this bus terminus. These institutions are outlined in the table below;

Table 13: Stakeholders involved in the regularization and design of the bus terminus

<table>
<thead>
<tr>
<th>Actors/ stakeholders</th>
<th>Roles</th>
</tr>
</thead>
</table>
| The city county of Nairobi | -Provide the finance, resources including human resource and professional input in the preparation of the plan  
-Will oversee the approval of the development plans and designs of the proposed regularization plan of the Mwiki bus terminus  
-Authorized by law to oversee the implementation of this project  
-Revenue collection from the bus terminus business  
-bus terminus management (garbage collection and clean ups)  
-Preparation/formulation of policy guidelines for similar old institutional housing estate |
<p>| The director of physical planning | -Pursuant to Physical Planning Act Cap 286 is required to prepare the regularization and design plan required for this project |
| Director of physical planning | -As per the physical planning Act, is responsible for the preparation of the local physical development plan which will involve the pooling of lands at site, providing for a bus terminus. |
| Ministry of roads | -Provide professional expertise guidance in the development of guidelines, standards and regulations for the management of the bus terminus |
| Kenya Urban Roads Authority | -Provide professional expertise guidance in the development of guidelines, standards and regulations for the management of the bus terminus |
| Private investors | -They will assist in raising finances for the project; through their investment which will in the cost recovery |
| Local bus terminus operators | They will provide human resource for the formulation of the bus terminus management committee and provide insights on the desirable bus terminus organization |
| National Environment | NEMA will be in charge of the environmental sustainability |</p>
<table>
<thead>
<tr>
<th>Management Authority</th>
<th>of the project in the approval of the EIA and the continuous monitoring to certain agreements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>National land commission</td>
<td>This is in regard to the national land commission Act of 2012 required to monitor and have oversight responsibility over land use planning in the city county and by extension in Mwiki area.</td>
</tr>
</tbody>
</table>

*Source: Author, 2014*
CHAPTER FIVE

MONITORING AND EVALUATION

5.1 Overview
This chapter outlines the indicators of the project/programmes which will be done regularly to ensure that activities within the site are carried out as planned and in doing so keeping track of the project. The monitoring program is a continuous process, it commences from the inception phase of the project to the post construction phase of the development.

The monitoring in this project will be carried out at specific time intervals in order to keep track of the steps in the development process and also to monitor the public’s reaction and reception of the provided information.

In order to ensure the set objectives are achieved and a workable project is attained, an appropriate monitoring and evaluation system has to be put in place. Monitoring and evaluation puts the project on course to ensure the final intended output is achieved within stipulated time frame intended to be. The process takes place at all levels of development project and uses both formal reporting and informal communications.

5.2 Monitoring and Evaluation Stages of the Implemented Development Project
The monitoring and evaluation will be done in phases. It will be concerned with viewing the project in three phases as indicated below:

- **Mid-term evaluation**
  This will entail careful checking of the progress of each phase of the development to ascertain conformity with the desired target as such any deviation can be addressed early in the development process.

- **Terminal evaluation**
  The end evaluation are undertaken at the completion of the development project phase to ensure that what was set to be achieved is achieved within the stipulated time frame and the necessary changes made if this did not happen.

- **Post implementation evaluation**
  Upon successful completion of the project, post evaluation is done on the effects that the completion of the project is likely to have and as such tools used to identify issues that may arise due to existence of the project.

This process is the basis of measuring the success of the development project. The process identifies actual or potential successes or failures as early as possible and facilitates timely adjustments to the operations. It takes place at all levels of management and uses both formal reporting and informal communications. The representatives of different stakeholders will be engaged in monitoring and evaluation of the project.
5.2.1 Tools and techniques of Monitoring and Evaluation of the Project.
Monitoring is a continuous process that aims to provide management and stakeholders on the ongoing interventions with early indication of compliance with responsibilities, progress, or lack thereof in the achievement of results. Evaluation is about measuring effectiveness, it compares what is happening against what was intended (goals, objectives and targets) and interpreting the reasons for the difference.

There are two methods of evaluation to be used for this project namely:

**Goal achievement matrix:** Goal achievement matrix will be used to evaluate the success and the failures of this project. The goal achievement matrix will be done at the end of every phase of the project or annually. The goals of the project will be analysed and the table filled for the different sectors as shown in the table below;

Figure 32: Goal achievement matrix

<table>
<thead>
<tr>
<th>Goal</th>
<th>Economic context</th>
<th>Social context</th>
<th>Environmental Context</th>
<th>Total Score</th>
</tr>
</thead>
</table>

*Source: Author, 2014*

**Cost-effectiveness evaluation:** this is significant in assessing the project’s costs against the project’s benefits. It compares the relative costs of the project to the outcomes

5.2.2 Objectives of the monitoring and evaluation process
Monitoring and evaluation process are always done to achieve various objectives. These objectives include:

- Ensure the programs and implementations run as planned
- Ensures the organizational learning and development
- Ensure informed decision-making and planning
- Support substantive accountability and;
- Building capacity and capability

5.2.3 Guidelines for the implementation process
For effective evaluation of the implementation process of the project, the following concepts will be used in monitoring of the development project.

- **Reporting**

There will be constant documentation and communication to various stakeholders on the progress of the project. This will aid in the keeping the project on track as pertaining the time frame, goals and objectives of the project
• **Consultation**

Numerous consultations with various professionals and experts to enable an all-encompassing design that is well articulated, such a design will enable the continuous sustenance of the project from the inception up to its completion.

• **Community awareness**

Through community participation approach each and every individual will be constantly informed with the project development progress. This will also be enhanced through the inclusion of the community recommendations into the implementation of the project to ensure the ownership of the project.

• **Concept evolution**

The whole development project implementation space will be allowed for relevant modifications as per the findings of the evaluation process. This shall be done to ensure that any misinterpreted development options are discarded and the better ones are put in place in cases of miscalculation in assumptions made during inception of the project.

5.3 **Site management plan**

The proposed projects will impact on the existing site and environment, there is therefore need to develop a site management plan for the project area. The plan is aimed at mitigating negative impacts on the environment and ensuring sustainable utilization of the developed environments. The table below outlines the possible project impacts during the operational phase of the project as well as the occupation phase and the respective mitigation measure.

<table>
<thead>
<tr>
<th>Expected environmental impact</th>
<th>Activity</th>
<th>Mitigation measure</th>
</tr>
</thead>
</table>
| **Air quality depreciation**  | Site clearance and construction | -landscaping the bus terminus  
-Making available suitable facilities for the collection, segregation and safe disposal of the wastes by:  
-Installing waste receptacles for waste collection during operation  
-Having a sound waste collection plan |
| -Dust and particles matter  
-Surface deposits  
-Bronchial and eye problems |  |  |
| **Vegetation cover depletion** |  |  |
| -Removal of vegetation from the bus terminus site |  |  |
| **Source:** Generation of construction waste |  |  |
| **Environment pollution**  | Solid waste disposal and earth excavations | Establish dust control program and machinery performance  
Development of standards operating procedures, schedules and supervision programs |
| -Visual pollution (from dust emission)  
-Pollution of water |  |  |
| **Land degradation**  | Material excavation and transportation | -Monitor land use trends  
-planting vegetation programs at the project site |
| -Soil loss  
-Soil quality degradation |  |  |
<table>
<thead>
<tr>
<th><strong>Noise pollution</strong></th>
<th>Site clearance and construction - The use of the bus terminus</th>
<th>Buffering of the site using iron sheets through the screening process - Construction works to be limited to day time only - Using equipment with noise suppressing technologies - Providing workers with ear plugs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety and security</strong></td>
<td>Construction and occupation</td>
<td>Access should be restricted to workers during site clearance and construction - The access control to be strictly adhered to during operation/occupation</td>
</tr>
</tbody>
</table>

*Source: Author, 2014*

### 5.4 Relevance of Environmental Management Planning

The environmental management activities will be undertaken during the start of the project up to its completion and finally during the use. The main activities that will be associated with the regularization and design of the Mwiki bus terminus project can be summarized into the following items:

- Securing the land for the regularization of the bus terminus
- Transportation of the construction materials and equipment to the site
- Recruitment of labor force;
- Earthworks;
- Material extraction;
- Crushing and screening of materials;
- Construction of drainage structures e.g. culverts;
- Pavement constructions;
- Construction of erosion protection works;
- Construction of the structures; and
- Landscaping.

Other activities which will come after the project completion will include; routine maintenance and periodic inspection of the progress of the project in relation to the set objectives and identified evaluation issues. Since all the activities within the project site will involve the disturbance of the soil and its natural vegetation, the project will have to undertake an environmental management plan which will serve the following purpose:

- Environmental conservation and sustenance aiding a balance between the proposed development project and the ecosystem
- Ensures safety within the project, within the construction and operational phases
- Provides monitoring indicators for the project’s environmental performance
- Ensures the laborers are free from health risks
- Ensures aesthetics of the environment is preserved
5.5 Contribution of Development Project to Planning Profession in Kenya

The bus terminus is an important requisite transport aspect yet it is unplanned for in many areas of the country yet they contribute economically to the development of the country. The bus terminus at Mwiki is strategically located but inadequately planned for hence characterized by frequent congestion due to poor management and poor investments in this sector. This project will significantly reduce the traffic snarl-up within the project area and along the entire Kasarani-Mwiki road but from the field work carried in the research project there were some factors which caused traffic jams hence need for further research on how to mitigate them.
2. Chicago Department of Transportation. (2007). *Street And Site Plan Design Standards*. Chicago

19. Ong’injo B. (2013). An examination of traffic flow along Jogoo Road, Undergraduate Degree project, University of Nairobi, Kenya.


APPENDICES

Appendix 1: Research Authorization Letter

University of Nairobi
Department of Urban and Regional Planning
School of The Built Environment
P.O. Box 30197, 00100 GPO Nairobi, Kenya
e-mail: durp@uonbi.ac.ke

Ref: UON/CAE/DURP/6 Date: 30th January, 2014

TO WHOM IT MAY CONCERN


This is to certify that the above named person is a registered student for undergraduate degree B.A. in Urban and Regional Planning in this Department, University of Nairobi.

As part of her studies, she is required to carry out research and present a report on the same in the course unit Research Project. Her research topic is “Implications of the Unplanned Bus Terminus on Traffic Flow along Kasarani – Mwiki Road”.

Any assistance accorded her will be highly appreciated.

[Signature]
Dr. Samuel V. Obiero
Chairman,
Department of Urban & Regional Planning
Appendix 2: Questionnaire for pedestrians and residents

UNIVERSITY OF NAIROBI
SCHOOL OF THE BUILT ENVIRONMENT
DEPARTMENT OF URBAN AND REGIONAL PLANNING
B.A. PLANNING (4TH YEAR 2013 RESEARCH PROJECT)

Done by
B65/3285/2010

QUESTIONNAIRE FOR PEDESTRIAN AND RESIDENTS

CONFIDENTIAL PHRASE: A study on the implication of the informal Mwiki bus terminus on traffic flow along the Kasarani-Mwiki road, any information provided towards this research will be treated with utmost confidentiality and used for academic purpose exclusively

Questionnaire No ………… Time of Interview ………………………Date of interview ………………………………

Name (optional) …………………………………………………………………………. Age ………………………………..

Sex; Male ( ) Female ( )

Questions:

1. Where do you live

Within Mwiki (1) Outside Mwiki (2)

2. (a) What category do your households total monthly income (Ksh.) falls under?

< 5000 (1) 5000-10,000 (2) 10,000-20,000 (3)

20,000-30,000 (4) Above 30,000 (5)

(b) Which mode of transport do you use most frequently?

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private vehicle</td>
<td>1</td>
</tr>
<tr>
<td>Bicycle</td>
<td>5</td>
</tr>
<tr>
<td>Foot</td>
<td>2</td>
</tr>
<tr>
<td>Mini-Buses</td>
<td>6</td>
</tr>
<tr>
<td>Bus</td>
<td>3</td>
</tr>
<tr>
<td>Matatus (14 seaters)</td>
<td>7</td>
</tr>
<tr>
<td>Trucks/ Pick-ups</td>
<td>4</td>
</tr>
<tr>
<td>Others (Specify)</td>
<td>8</td>
</tr>
</tbody>
</table>

(c) If using private vehicles where do you park?

Inside the terminus (1) Outside the terminus (2) Within the residential neighborhood (3)

(d) Do you pay for parking? …………

95
(f) How is the parking at the terminus organised? .................................................................

No clear parking order (1) General parking is marked (2)
Proper marked parking lots (3) others (4)

3. What other trips do you take during the week?

<table>
<thead>
<tr>
<th>Trip</th>
<th>Days of the week</th>
<th>Time of the day</th>
<th>Mode of travel commonly used</th>
<th>Encounter with traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To market/Shopping Centre</td>
<td>1-weekdays 2-Weekends</td>
<td>1-Early morning 2-Mid-morning 3-Afternoon 4-Late night 5-Night</td>
<td>1-Private cars 2-Matatus 3-Buses 4-Foot 5-Bicycle 6-Motorcycle</td>
<td>1-Frequent 2-Not frequent 3-Moderate 4-Others</td>
</tr>
<tr>
<td>2. To social places</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. How can you rate the following parameters of the different modes of travel?

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Rates: Excellent (1) Moderate (2) Inadequate (3) Poor (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Motorcycle Bicycle Busses Mini-buses Lorries Matatus</td>
</tr>
<tr>
<td>Comfort</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
</tr>
</tbody>
</table>

5. How can you rate the levels at which different modes of travel cause traffic congestion

Rates: Most traffic (1) Least traffic (2) Moderate traffic (3)

<table>
<thead>
<tr>
<th>Modes of transport</th>
<th>Rates</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private cars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Busses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mini-Buses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorcycles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrians</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lorries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lorries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matatus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. How does the bus terminus affects you?

| Increased access to the area of residence | 1 | High population within the terminus | 6 |
| Attracted informal Activities             | 2 | Traffic congestion                 | 7 |
7. How does market activities affect you?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise pollution</td>
<td>3</td>
</tr>
<tr>
<td>Difficulty in circulation within the market</td>
<td>4</td>
</tr>
<tr>
<td>High rents</td>
<td>5</td>
</tr>
<tr>
<td>Increased access to the area of residence</td>
<td>1</td>
</tr>
<tr>
<td>Attracted informal Activities</td>
<td>2</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>3</td>
</tr>
<tr>
<td>Difficulty in circulation within the market</td>
<td>4</td>
</tr>
<tr>
<td>High rents</td>
<td>5</td>
</tr>
<tr>
<td>Ease of access to the market area</td>
<td>8</td>
</tr>
<tr>
<td>Reduced width of the Kasarani-Mwiki road</td>
<td>9</td>
</tr>
<tr>
<td>Others</td>
<td>10</td>
</tr>
</tbody>
</table>

8. What efforts of improving the sanitation have you observed?

- Filling the pot-holes along the Kasarani-Mwiki road  (1)
- Clearing bushes adjacent to the study area                    (2)
- Demolition of structures next to the road                     (3)
- Others                                                       (4)

9. Who has been involved in such efforts of improving of the condition of the bus terminus area?

<table>
<thead>
<tr>
<th>Group</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport operators</td>
<td>1</td>
</tr>
<tr>
<td>Transport owners</td>
<td>4</td>
</tr>
<tr>
<td>County Authorities</td>
<td>2</td>
</tr>
<tr>
<td>The police</td>
<td>5</td>
</tr>
<tr>
<td>The community</td>
<td>3</td>
</tr>
<tr>
<td>Any other</td>
<td>6</td>
</tr>
</tbody>
</table>

10. What other general problems/challenges do you experience in your daily operation within the bus terminus?

11. In your opinion, what is the solution to the above mentioned challenges?
QUESTIONNAIRE FOR PASSENGERS AND VEHICLE OPERATORS

CONFIDENTIAL PHRASE: A study on the implication of the informal Mwiki bus terminus on traffic flow along the Kasarani-Mwiki road, any information provided towards this research will be treated with utmost confidentiality and used for academic purpose exclusively.

Questionnaire No. ……… Time of Interview ……………………Date of interview …………………………

Name (optional) …………………………………………………………………………. Age ………………………………………

Sex; 1. Male ( ) Female ( )

Questions.

1. Where do you live?
   Within Mwiki (1) Outside Mwiki (2)

2. What is the origin of the journey? …………………………………

3. What is your destination? ……………………………………………

4. How long is this trip? …………………………………………………

5. What brings you to Mwiki bus terminus area?

<table>
<thead>
<tr>
<th>To buy goods</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>To window shop</td>
<td>2</td>
</tr>
<tr>
<td>I live here</td>
<td>3</td>
</tr>
<tr>
<td>To work</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
</tr>
</tbody>
</table>

6. What modes of travel do you use most frequently in this area?

<table>
<thead>
<tr>
<th>Private vehicle</th>
<th>1</th>
<th>Bicycle</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot</td>
<td>2</td>
<td>Mini-Buses</td>
<td>6</td>
</tr>
<tr>
<td>Mode of Transport</td>
<td>Count</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td>3</td>
<td>Matatus (14 seaters)</td>
<td></td>
</tr>
<tr>
<td>Trucks/ Pick-ups</td>
<td>4</td>
<td>Others (Specify)</td>
<td></td>
</tr>
</tbody>
</table>

7. How much fare do you pay (Ksh)?

<table>
<thead>
<tr>
<th>Fare Range</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>50-80</td>
<td>3</td>
</tr>
<tr>
<td>30-80</td>
<td>2</td>
</tr>
<tr>
<td>&lt; 80</td>
<td>4</td>
</tr>
</tbody>
</table>

8. (a) Are you comfortable with the mode of travel you are using now?

Yes (1) No (2) (b) Explain ..............................................

9. How regularly do you use the Mwiki informal bus terminus?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>1</td>
</tr>
<tr>
<td>Monthly</td>
<td>3</td>
</tr>
<tr>
<td>Every week</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
</tr>
</tbody>
</table>

10. What do you carry to and from the bus terminus? (vehicle operators)

<table>
<thead>
<tr>
<th>Carried Items</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goods and people</td>
<td>1</td>
</tr>
<tr>
<td>Goods only</td>
<td>3</td>
</tr>
<tr>
<td>People only</td>
<td>2</td>
</tr>
<tr>
<td>Others (specify)</td>
<td>4</td>
</tr>
</tbody>
</table>

11. (a) Is there a specific place of loading and off-loading of goods?

Yes (1) No (2)

(b) If yes, approximate the size of the loading and off-loading of goods area within the bus terminus?

(c) What are the facilities provided within the bus terminus area?

12. Are their specific places for boarding and alighting of passengers within the bus terminus?

Yes (1) No. (2)

(b) If yes, approximate the size of the loading and off-loading of goods area within the bus terminus?

(c) What are the facilities provided within the bus terminus area?

13. How can you rate the adequacy of the mentioned facilities?

<table>
<thead>
<tr>
<th>Adequacy</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate</td>
<td>1</td>
</tr>
<tr>
<td>Inadequate</td>
<td>2</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
</tr>
</tbody>
</table>

14. (a) Do you belong to a SACCO?

Yes (1) No. (2)

(b) If yes, to which SACCO? .......

(c) How much do you pay to be a member of the SACCO? .............
(d) How much is the operation fee for using the bus terminus? ..........................

(e) Who pays for the SACCOs?

<table>
<thead>
<tr>
<th>Driver</th>
<th>1</th>
<th>Vehicle owner</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor</td>
<td>2</td>
<td>Others</td>
<td>4</td>
</tr>
</tbody>
</table>

15. (a) Is there space put aside for parking of the vehicles?

Yes (1) No. (2)

(b) If yes, what in the size of the spaces?

16. (a) Are there specific places for alighting or boarding of the vehicles?

Yes (1) No. (2)

(b) If yes, what in the size of the spaces?

17. Do you have specific places for the embankment and dis-embankment of goods?

Yes (1) No. (2)

(b) If yes, what in the size of the spaces?

18. How long are vehicles allowed to park in the terminus? ............................

19. How would you rate the condition of the Mwiki informal bus terminus?

<table>
<thead>
<tr>
<th>Excellent</th>
<th>1</th>
<th>Larking</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>2</td>
<td>Poor</td>
<td>5</td>
</tr>
<tr>
<td>Very poor</td>
<td>3</td>
<td>Others</td>
<td>6</td>
</tr>
</tbody>
</table>

20. What are the challenges experienced in accessing and using the Mwiki bus terminus?

| No places for loading and off-loading of goods | 1 | High population within the terminus | 6 |
| Congestion within the area                    | 2 | Traffic congestion                 | 7 |
| Noise pollution                               | 3 | Ease of access to the market area   | 8 |
| Difficulty in circulation within the market   | 4 | Reduced width of the Kasarani-Mwiki road | 9 |
| No parking areas                              | 5 | Others                              | 10 |

21. (a) Have there been efforts made to improve the condition of the bus terminus?

Yes (1) No. (2)

(b) If yes, who has been involved?

(c) How have they been involved in such improvements?
Appendix 4: Questionnaire for traders

UNIVERSITY OF NAIROBI
SCHOOL OF THE BUILT ENVIRONMENT
DEPARTMENT OF URBAN AND REGIONAL PLANNING
B.A. PLANNING (4TH YEAR 2013 RESEARCH PROJECT)

Done by
B65/3285/2010

QUESTIONNAIRE FOR TRADERS

CONFIDENTIAL PHRASE: A study on the implication of the informal Mwiki bus terminus on traffic flow along the Kasarani-Mwiki road, any information provided towards this research will be treated with utmost confidentiality and used for academic purpose exclusively

Questionnaire  No ……… Time of Interview ……………………Date of interview ……………………………

Name (optional) …………………………………………………………………………. Age ……………………………

Sex; Male ( ) Female ( )

Questions

1. What is the name of your business?
2. What is the type of business?

<table>
<thead>
<tr>
<th>Boutique</th>
<th>1</th>
<th>Furniture</th>
<th>4</th>
<th>Kitchenware</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>2</td>
<td>Clothing</td>
<td>5</td>
<td>Hardware</td>
<td>8</td>
</tr>
<tr>
<td>Tailoring</td>
<td>3</td>
<td>Shops</td>
<td>6</td>
<td>Others</td>
<td>9</td>
</tr>
</tbody>
</table>

3. When did you start operating in this market?
4. Do you own the business? Yes (1) No (2)
5. Do you have a permit for your business?
6. If yes, How much did you pay for the permit (Ksh)
7. How much do you earn?

Per month (1) per week (2) per day (3)

<table>
<thead>
<tr>
<th>500</th>
<th>1</th>
<th>500-1000</th>
<th>3</th>
<th>5,000-10,000</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-2000</td>
<td>2</td>
<td>2000-5000</td>
<td>4</td>
<td>10,000</td>
<td>6</td>
</tr>
</tbody>
</table>

8. Where do you live?
9. Where do you purchase your goods from?
10. How much is your daily stock?

<table>
<thead>
<tr>
<th>Stock Range</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 - 1000</td>
<td>1</td>
</tr>
<tr>
<td>1000 - 2000</td>
<td>2</td>
</tr>
<tr>
<td>2000 - 5000</td>
<td>4</td>
</tr>
<tr>
<td>5,000 - 10,000</td>
<td>3</td>
</tr>
<tr>
<td>10,000 - 60,000</td>
<td>5</td>
</tr>
</tbody>
</table>

11. How do you transport your goods to the market?

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mkokoteni</td>
<td>1</td>
</tr>
<tr>
<td>Personal vehicle</td>
<td>3</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>4</td>
</tr>
<tr>
<td>On foot</td>
<td>6</td>
</tr>
</tbody>
</table>

12. What is your total cost of transporting goods?

<table>
<thead>
<tr>
<th>Cost Range</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 - 200</td>
<td>1</td>
</tr>
<tr>
<td>200 - 300</td>
<td>3</td>
</tr>
<tr>
<td>300 - 1000</td>
<td>2</td>
</tr>
<tr>
<td>1000 - 5000</td>
<td>4</td>
</tr>
</tbody>
</table>

13. Where do you store your goods?

<table>
<thead>
<tr>
<th>Storage Location</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>In my house</td>
<td>1</td>
</tr>
<tr>
<td>In a neighbor’s house</td>
<td>3</td>
</tr>
<tr>
<td>A shared store within the market</td>
<td>2</td>
</tr>
<tr>
<td>A personal store within the market</td>
<td>4</td>
</tr>
</tbody>
</table>

14. When do you have good sales?

15. Who are your main customers?

16. How did you acquire the business space?

17. How much space is occupied by your goods?

18. Is the space adequate for the display of your goods?

19. If given a choice, would you change your business location?

20. If yes, which place would you like it to be relocated to?

21. Have there been plans prepared for the market?

22. If yes, what plans?

23. If yes to (23) above, where is the market to be relocated?

24. Which market facilities would you prefer?

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open air market (roofed tops)</td>
<td>1</td>
</tr>
<tr>
<td>Multi-storey building</td>
<td>3</td>
</tr>
<tr>
<td>Open air market (goods aired on the ground)</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
</tr>
</tbody>
</table>

25. Which amenities are provided in the market?

26. Are the amenities provided within the market adequate?

27. Who owns the market land?

28. Who manages the market?

29. How do the formal land use activities affect the market activities?

30. How do the market/ bus terminus land use affect the formal land uses within the area?

31. What are the other general problems/ challenges experienced in your daily operation in the market?
Appendix 5: Interview Schedule

UNIVERSITY OF NAIROBI

SCHOOL OF THE BUILT ENVIRONMENT

DEPARTMENT OF URBAN AND REGIONAL PLANNING

B.A. PLANNING (4TH YEAR 2013 RESEARCH PROJECT)

Done by

B65/3285/2010

INTERVIEW SCHEDULE

CONFIDENTIAL PHRASE: A study on the implication of the informal Mwiki bus terminus on traffic flow along the Kasarani-Mwiki road, any information provided towards this research will be treated with utmost confidentiality and used for academic purpose exclusively

Questionnaire No ……… Time of Interview……….Date of interview ………………………

Name (optional)……………………………. Age ……………………………………….

Sex; Male ( ) Female ( )

Traffic police

1. Are there cases of insecurity within the terminus area?
2. What are the types of insecurity mostly experienced?
3. What is the volume of traffic within the informal Mwiki bus terminus when it is full?
4. What are the problems facing the Mwiki informal bus terminus?
5. What management efforts have been taken to manage traffic along the Kasarani-Mwiki road and within the Mwiki bus terminus?
6. What are the challenges and limitations faced in trying to manage traffic within the Mwiki informal bus terminus area?
7. What are the plausible regulatory remedies that could be considered for the management of traffic within this site?

SACCOs and Vehicle operators

1. Which SACCO do you belong to?
2. How much do you pay to the CCN for the use of this terminus?
3. How much do the matatus operators pay to be a SACCO member?
4. Are you satisfied with the services offered by the CCN?
5. In your opinion, what are the challenges experienced in this terminus?
6. In your opinion, what are the possible solutions to the challenges experienced in this terminus?
CCN (City planning and City Engineering Department)

1. What is the design capacity of bus terminus in Kenya?
2. What are the land use and zoning of the Kasarani-Mwiki area?
3. What conflict exists in the land use activities within Mwiki area?
4. (a) Is Mwiki market and bus terminus a legal market?
   (b) If the market is illegal are their plans of providing a formal market?
5. What services are offered in a bus terminus and market?
6. What are the principles that guide the development of markets and bus terminus in Mwiki area?
7. What are the design/planning oriented causes of traffic congestions (land uses, junctions and road design)
8. What planning efforts can be sought to improve traffic flow along the Kasarani-Mwiki road?

KURA

1. What was the original size of the Kasarani-Mwiki road?
2. What are the main causes of traffic congestion along the Kasarani-Mwiki road?
3. What are the effects of traffic congestion on government operations?
4. Are there past regulatory efforts to curb traffic congestion along the road?
5. What were the strengths and short coming of such efforts?
6. Suggestion on other plausible remedies to curb traffic congestion along this road?

Appendix 6: Observation List

1. The modal split
2. Condition and size of the Kasarani-Mwiki road and the feeder roads
3. Space allocation for market activities
4. What are the different market activities
5. Space occupied by the vehicles within the bus terminus and space allocated for each vehicle
6. Any authority dealing with space allocation
7. Different bus terminus activities represented within the Mwiki bus terminus
8. Conditions of the road junctions (truncation)
9. Amenities within the bus terminus and market
10. Road signs and information
11. Different utilities along the Kasarani-Mwiki road
12. Non-transport activities within the site