REDESIGNING THE MOMBASA-MALINDI HIGHWAY ALONG MTWAPA TOWN FOR SUSTAINABLE URBAN MOBILITY:

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B65/0367/2006

A Development Project submitted in partial fulfillment of the requirements for the award of Bachelor of Arts Degree in Urban and Regional Planning.

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JULY 2010.
DECLARATION
This Development Project is my original work and to the best of my knowledge has not been presented for examination in any institution/university.

Signed ________________________  Date ______________________

MOSES MOREKA NYABICHA
B65/0367/2006

(Candidate)

This Development project has been submitted for examination with my approval as the assigned University Supervisor:

Signed ________________________  Date ______________________

Mr. Charles D. Karisa

(Supervisor.)
DEDICATION

To my family: The best thing that ever happened to me.
ACKNOWLEDGEMENT

The undertaking of this project, has been made possible by the contribution and assistance of many people, both within the university and outside. Special thanks to my supervisor, Mr. C.D Karisa for his guidance, support and encouragement. Thanks too, to the entire staff of Department of Urban and Regional Planning for their concerted effort throughout the course.

Special thanks to Real Plan Consultants for their help in collecting the necessary information that enabled the success of this research. Thanks to my classmates and friends for their constructive critique and moral support.

Last but not least, I thank my family for their encouragement and all manner of support. Above all I give glory to God for sufficient grace and strength.
ABSTRACT

Transport serves, among other functions, accessibility and movement of people and goods from one point to another. In cities and towns in the developing world transportation system has not been efficient especially along highways passing through fast growing towns like Mtwapa. Mtwapa town is developing along the class B8 Mombasa-Malindi highway, the transport system here has not been able to deliver its functions effectively, due to encroachment onto the road by informal activities and other town functions hence resulting to traffic congestion, road accidents and the increasing environmental degradation which in the long run will affect the economic growth of the town.

The Development project seeks to establish a balance between the town activities and the highway activities that will foster sustainable mobility and find a long term solution to the challenges facing Mtwapa town. The integration of transport and land use planning is widely recognized as essential to the achievement of sustainable development. The concept of accessibility or how something/somewhere can be reached from a given point in space can provide a useful framework for this integration. More specifically, a shift of focus in urban transport planning from catering for mobility to catering for accessibility helps us understand how more sustainable transport options can, under certain land use conditions, provide a competitive degree of accessibility that matches less sustainable options. This Development project has used the concept of sustainable mobility as a framework for the interactive design of integrated transport and land use plans along Mombasa-Malindi road in Mtwapa town. The main objective of this project is providing urban transport integration measures where economic, social, and environmental goals could be combined, defined as the achievement of sustainable mobility.

The existing situation focuses majorly on the economic aspects of transportation leaving out the social and environmental goals that an adequate transport system should cater for. Thus, an adequate transport system should strive to ensure, accessibility, equity, comfort, health and safety apart from the economic aspects of finance and time. It should also be reliable and enhance individual choice and responsibility as well as prevent pollution. The existing situation has been evaluated, and alternative plans have been developed.
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## ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>GoK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>CCK</td>
<td>Communication Commission of Kenya</td>
</tr>
<tr>
<td>CCK</td>
<td>County Council of Kilifi</td>
</tr>
<tr>
<td>MWSC</td>
<td>Mariakani Water and Sewerage Company</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMCA</td>
<td>Environmental Management And Coordination Act</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>HH</td>
<td>Household</td>
</tr>
<tr>
<td>KPLC</td>
<td>Kenya Power and Lighting Company</td>
</tr>
<tr>
<td>L.A</td>
<td>Local Authority</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Act</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environmental Management Authority</td>
</tr>
<tr>
<td>NMT</td>
<td>Non Motorized transport</td>
</tr>
<tr>
<td>PPA</td>
<td>Physical Planning Act of 1996</td>
</tr>
<tr>
<td>PPH</td>
<td>Physical Planning Handbook</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Scientists</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
</tbody>
</table>
1.0 CHAPTER ONE: INTRODUCTION.

1.1: Statement of planning research project title


1.2: Statement of Summary of main findings from the research project.

i. Mtwapa lacks an operational development Plan, even though it is one of the most rapid growing town in the coast.

ii. There are uncontrolled developments that are coming up in Mtwapa town especially along the main highway resulting to degradation of the environment.

iii. There is Encroachment of informal business activities in the road reserve.

iv. Main conflict areas are found on junction points where traffic gets into and out of the highway

v. The competition to acquire land along the highway or near the highway was noted to be attributed to high commercial value of the land along the highway, the future speculations of land value along the highway and the general easy of access from the highway.

vi. Negative impacts noted the highway activities have on the developments along it included: pollution (dust and noise), congestion and traffic jams.

vii. There is high rate of change of Land uses along the highway (from residential to commercial and mixed use)

Rapid development of Mtwapa is as a result of:

- Proximity and accessibility to Mombasa town
- Lack of enough and cheap housing in Mombasa town
- Mtwapa's night life
- Mtwapa as a tourist town
- Establishment of industries in the area
Challenges facing Mtwapa town include:

- Lack of proper road network within the town
- Lack of public amenities
- Informal settlement and business activities
- High population growth
- Inadequate services

1.3 Summary of the main recommendations of the research project

i. Redesigning the road reserve to facilitate movement of traffic and people

ii. Provide alternative areas for activities that are encroaching into the road reserve such as open air markets.

iii. Provide bus and matatu terminus to prevent obstructions of matatus on the highway as they pick up passengers.

iv. Separation of local and through traffic to reduce traffic jams on the highway

v. Segregation of walkways from the carriage way

vi. Considering the non motorized transport like carts and bicycles and design for their efficiency

vii. Provide buffer zones to prevent the pollution impacts of the highway activities to the surrounding environment.

1.4 Statement of Development project chosen for implementation

Redesigning the Mombasa-Malindi Highway along Mtwapa Town for Sustainable Urban Mobility:

Reasons for choosing the development Project

Mtwapa is one of the rapidly developing towns along the Mombasa-Malindi highway due to this fast development of the town there is evidence of negative impacts that are associated with the town- highway interaction as shown from the findings of the research project. There is the proliferation of roadside (ribbon) developments along the highway; increase in accidents at
various spots along the highway; various Land use conflicts like the use of the road reserve for informal market activities; encroachment on the highway by land use activities and environmental dilapidation due to increased pollution from the increased road users. These negative impacts are as a result of poor interaction of the town and the highway activities. To achieve sustainable interaction of the highway and town activities that will provide for social, environmental, and aesthetic benefits in Mtwapa town, there is need to redesign the road reserve of Mombasa-Malindi highway along Mtwapa town to facilitate movement of traffic and people and better aesthetics that will bring about a good and sustainable interaction of the town and the highway.

**Location and area coverage of the development project**

The study is limited to 2.5Km along Mombasa – Malindi highway (a spine starting from the Mtwapa Bridge to the Total petrol station), and traversing the first two rows of development on either side of the highway.

**Objectives**

- To enhance transport-land use integration for sustainable mobility
- To provide good pedestrian connections to the transit way.
- To enhance traffic separation and organize turning movements
- To Encourage alternative modes of transportation including walking, cycling and transit
- To enhance better environmental conditions and good aesthetic values along the road reserve.

**Assumptions**

- Mtwapa town will continue to attract growth in the future
- The Mombasa-Malindi Highway will be busier in the future especially in Mtwapa town
- The institutions for implementing the proposals like the CCK will adopt the proposals and provide favorable conditions for there implementation.
- Design can solve transport-land use conflicts and enable realization of sustainable mobility.
## 1.5 Study organization

**Table 1.1 Study organization**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic covered</th>
</tr>
</thead>
</table>
| One     | **Introduction**  
Statement of research project, the finding and recommendations of the research project, statement of development project, objectives, assumptions, justification and scope of the project.  
Project methodology |
| Two     | **Review of Policy Guidelines**  
Policy analysis  
Reference to planning and design standards  
Case study  
Conceptual framework for the project |
| Three   | **Background to the project area**  
Situational analysis  
Site analysis |
| Four    | **Plan formulation**  
Site planning and design process  
Development of plans, drawings and models  
*Implementation Schedule* |
| Five    | Monitoring and Evaluation Stages in the Implementation of the Project  
Guidelines for the Implementation Process |
1.6 Research Methodology
1.6.1 Data Needs and requirements

The data required in this project includes the planning standards for the commercial areas, the existing situational analysis of the study area including the planning problems emerging from the highway-town interaction, the historical background of the area, physiographic characteristics of the study area, demographic characteristics of the population, the existing infrastructure networks and services, and the legislative framework that governs designing of road reserves within the urban areas.

1.6.2 Data Sources

The study will involve the collection of both primary and secondary data. Primary data will be sourced from the field survey, which involves carrying out a site inventory on various site components and resources within the study area. Secondary data will be sourced from the Journals, maps, policy documents (Planning Handbook, Building Code) and the planning research project; this shall be acquired from literature review.

1.6.3 Methods of data collection

Data will be collected using the questionnaires, interview schedules, photography, mapping, key informants and sketching,

1.6.4 Methods data Analysis

Analysis is the computation of certain indices or measures along with searching for patterns of relationship that exists among data groups, the data collected from various sources will be harmonized for generation of Concept plans on the alternative plans and detailed analysis of the possible implementation sites within the study area.

1.6.5 Methods of data Presentation

Various maps, sketches and photographs will be produced for presentation of data regarding the analysis of the study area. Further and final presentation will be in form of text reports, photographs, appropriate charts and graphs and spatial plans.
1.6.6 Limitations

The project experienced the following limitation:

- Lack of some data on the subject of the development project during the carrying out of the research project
- Lack of funds: Lack of funding made the project not attain some important aspects for example the preparation of a three dimensional model.

1.6.7 Definition of Key terms and concepts

*Plot frontage*: the linear length of a plot measured along the property line adjacent to a street or easement.

*Plot line/property line*: any line bounding a plot.

*Plot depth*: the average horizontal distance between the front and the rear property lines, measured in the mean direction of the side property lines.

*Mixed Building*: a mixed building is a building in a commercial district used partly for residential use and partly for commercial use or community facility.

*Urban highways*: these are highways which connect one town to the other or two different sections of the same town. They are usually access free dual carriage roads ad convey traffic at very high speeds.

*Pedestrian walkway*: a surfaced walkway, separate from the traveled portion of a public or private right-of-way or parking lot.

*Streetscape*: all elements of a development or area that are in view from other points along a street

*Traffic Calming* - Traffic management techniques aimed at reducing the impact of traffic on local streets
2.0 CHAPTER TWO: REVIEW OF POLICY GUIDELINES

Overview

This section reviews the existing planning policies and design guidelines and standards in relation to road reserve designing. These acts include the Physical Planning Act, Local Government Act, Environment Management and Coordination Act and The Traffic Act (cap 403)

2.1 Policy Analysis
2.1.1 Transport Policy in Kenya

Kenya has not had a comprehensive transport policy since independence in 1963. Discrete transport policies have been formulated through various national developments.

Basic objectives of roads policies

The development and maintenance of physical infrastructure are prerequisite for economic growth and poverty reduction, as they influence the production costs, employment creation, access to markets and investments.

The impact of Kenya’s road policies is demonstrated by the size of the roads network which is fairly well developed. However, the network’s operating condition has suffered from inadequate maintenance, repair and rehabilitation and the fragmentation of the institutional framework within which it is managed.

The assessment of policies based on transport planning is done on the criteria of:

i. Integration; all road decisions are taken in the context of a coherent integrated transport policy.

ii. Accessibility; making it easy and cheap for the people to reach where they want in regard to aspects of time, cost and comfort.

iii. Safety; the transport system should incorporate the safety of travelers at all times.

iv. Economy; getting good value for money
v. Environmental impact; both the positive and the negative impacts on both the built and the natural environment at the global, regional and local levels.

vi. Tackling road congestion

2.1.2 The Traffic Act (cap 403)

This is the main document in the transport sector in Kenya that makes the provisions for operations of traffic in the Kenyan roads.

The Act:

- Regulates speeds on roads; it prohibits over speeding or driving at speeds of over 50km/h within the boundaries of any trading center, township, municipality or city and states that the highway the relevant authorities should erect and maintain traffic signs as prescribed so as to indicate to drivers where the limits begin and end. (section 42)
- Prohibits vehicles from carrying explosives, ammunition, petroleum or any other inflammable substance from remaining stationery for more than 15 minutes within the boundaries of a trading center, township, municipality or city. (section 53)
- Prohibits obstruction or causing inconvenience or danger to other traffic using the road. Section 46 provides for the conviction of persons causing death on the road by driving recklessly or obstruction.
- Prohibits driving recklessly in public spaces i.e. driving in speeds or in a manner which is dangerous to the public having regard to all the circumstances of the case including the amount of traffic which is actually at the time or which might reasonably be expected to be on the road.
- Prohibits people from playing games to the annoyance, inconvenience or danger of persons using the road and from willfully obstructing the free passage of persons or vehicles passing along the road. (section 90)

Prohibits encroachment and damage to roads and road reserves including pitching of any tent, booth, or stall on a road or making fire on the road. It empowers the highway authority to remove whatsoever placed/erected on a road (reserve) in the contravention of the act.
2.1.3 The Physical Planning Handbook on roads regulation and standards

Urban Road Reserves

Urban road reserves require more generous space provision because of additional street furniture and infrastructural facilities that have to be provided. In most instances, the road has to accommodate multiple functions that have to be independently provided in design. Way leaves for trunk services such as water and sewerage, underground telephone cables and high voltage power lines, when provided along road reserves require additional provision.

Further, the role of the informal sector in job creation in urban areas has now been recognized. Because of the above reasons, the following urban road reserve widths have been recommended in the Physical Planning Handbook.

Table 2.1 Road reserve widths

<table>
<thead>
<tr>
<th>Category</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Distributors</td>
<td></td>
</tr>
<tr>
<td>Major communication routes</td>
<td>60m</td>
</tr>
<tr>
<td>Important through routes</td>
<td>30-36m</td>
</tr>
<tr>
<td>District Distributors</td>
<td></td>
</tr>
<tr>
<td>Spine roads and roads in commercial or industrial areas</td>
<td>25m</td>
</tr>
<tr>
<td>Bus routes</td>
<td>18m</td>
</tr>
<tr>
<td>Local distributor roads with no direct vehicular access to Individual plots</td>
<td>18m</td>
</tr>
<tr>
<td>Local Distributors</td>
<td></td>
</tr>
<tr>
<td>Major access road exceeding 150m in length</td>
<td>15m</td>
</tr>
<tr>
<td>Access road not exceeding 150m in length (normal Residential Street)</td>
<td>12m</td>
</tr>
<tr>
<td>Access Roads</td>
<td></td>
</tr>
<tr>
<td>Cul-dec-Sac or short connecting road not</td>
<td>9m</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>exceeds 60m.</td>
<td></td>
</tr>
<tr>
<td>Service lanes</td>
<td>6m</td>
</tr>
<tr>
<td>Cyclist lanes</td>
<td>3m</td>
</tr>
<tr>
<td>Footpaths</td>
<td>2m.</td>
</tr>
</tbody>
</table>


The standard provision for footpaths shall be 2m wide footway on each side of the carriageway, subject to the following relaxations:

(i) For Cul-de-sac serving less than 10 plots a single footway will suffice.

(ii) Occasional obstructions shall nowhere reduce the footway width below 1.2m.

Pedestrians shall be physically separated from moving vehicles by a barrier such as an up stand kerb, open drain or wide verge.

**Access control and road design**

The road design manual provides that in order to preserve major roads a high standard traffic facility, it is necessary to exercise access control, whereby the right of owners or occupants of land to access is controlled by the Highway authority (Road Design Manual)

The table below shows the desired level of control against functional classification.
Table 2.2 Functional Class and Level of access

<table>
<thead>
<tr>
<th>FUNCTIONAL CLASS</th>
<th>LEVEL OF ACCESS CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DESIRABLE</td>
</tr>
<tr>
<td>A</td>
<td>Full</td>
</tr>
<tr>
<td>B</td>
<td>Full</td>
</tr>
<tr>
<td>B</td>
<td>Full or partial</td>
</tr>
<tr>
<td>D</td>
<td>partial</td>
</tr>
<tr>
<td>E</td>
<td>Partial or unrestricted</td>
</tr>
</tbody>
</table>

*Source: Road Design Manual, 1979 ministry of Works*

**Full access control**

Means that the authority to control access is exercised to give preference to through traffic by providing access connections with selected public roads only and prohibiting direct private access connections.

**Partial access control**

Means that the authority to control access is exercised to give preference to through traffic to a degree in that, in additional to access connections with selected public roads, there may be (some) private access connections.

**Unrestricted access**

This means that the preference is given to local traffic, with the road serving the adjoining areas through direct access connections. However, the detailed location and layout of the access should be subject to approval by the Highway authority in order to ensure adequate standards of visibility, surfacing and drainage among other requirements. Access controls is accomplished either by careful location of access, grouping access to reduce the number of separate connections to the through traffic lanes or by constructing service roads which intersect the individual accesses and joining the through lanes at a limited number of properly located and designed junctions. *(Source Road Design Manual 1979)*
2.1.4 Policy Guidelines on Pedestrianisation

Walking is a form of transport and in this respect is no different from the private car or public transport. For some groups, it is the primary means of moving around their community independently. The right to walk is a fundamental element in a considerable number of public policies. Although its contribution to transport objectives is often underestimated, its importance must not be ignored since walking is the oldest mode of travel and it is universal.

Walkability reflects overall walking conditions in an area. Walkability takes into account the quality of pedestrian facilities, roadway conditions, land use patterns, community support, security and comfort for walking. Walkability can be evaluated at various scales. At a site scale, walkability is affected by the quality of pathways, building access ways and related facilities. At a street or neighborhood level, it is affected by the existence of sidewalks and crosswalks, and roadway conditions (road widths, traffic volumes and speeds). At the community level it is also affected by land use Accessibility, such as the relative location of common destinations and the quality of connections between them.

There are many specific ways to improve walkability. Major categories include:

- Improved sidewalks, crosswalks and paths.
- Improved Non-motorized Facility Management and Maintenance, including reducing conflicts between users and maintaining cleanliness.
- Universal Design (also called Inclusive Design, Accessible Design or just Accessibility) refers to facility designs that accommodate the widest range of potential users, including people with mobility and visual impairments (disabilities) and other special needs. Although Universal Design standards address the needs of people with disabilities, it is a comprehensive concept that can benefit all users. For example, people who are unusually short or tall, carrying packages or pushing a cart are not disabled, but their needs should be considered in facility design. Increased walkway widths and smooth walking surfaces improve convenience for all travelers, not just those with mobility impairments. Curb ramps are important for people using handcarts, scooters, baby strollers as well as wheelchair users.
- Closing a road to through traffic
• Giving right of way to pedestrians and introducing “dead slow” (10Km/h) speed limits
• Limiting parking
• Provide covered walkways, loading and waiting areas, with shade from hot sun and protection from rain.
• Improve pedestrian Accessibility by creating Location-Efficient, Clustered, mixed land use patterns, with good road and path Connectivity, and pedestrian-oriented buildings, reflecting New Urbanism design principles.
• Transportation Access Guides, which provide concise information for accessing a destination by walking and facilities and services for people with special mobility needs.
• Concentrate more activities into walkable Commercial Centers.
• Street furniture and pedestrian facilities (e.g., benches, pedestrian-oriented street light, public washrooms, etc.).
• Design in a pedestrian scale, with shorter blocks, narrower streets, pedestrian-oriented buildings and street furniture.
• Create more Livable communities and more pedestrian-oriented Streetscapes.
• Traffic Calming, Speed Reductions, Streetscape Improvements and Vehicle Restrictions.
• Road Space Reallocation to increase the portion of public rights-of-way devoted to sidewalks.
• Active Transportation Encouragement programs.
• Address Pedestrian Security Concerns.
• High density built form of mixed use.
2.2 Planning And Design Standards

When designing for pedestrians, quite often the ‘devil is in the detail’. This section gives detailed guidance on best practice to design, operate and maintain the road network to provide a better quality walkable environment for all. The main obstacle to walking is difficulty crossing roads. Well designed crossing facilities can make a real difference to safety and convenience. Attention to intersection details can make quite a difference.

2.2.1 Footpath zones

Most footpaths within the road reserve lie between the edge of the roadway and the frontage of adjacent private property. There are four distinct zones within this area and it is important to distinguish between the total width and the width of the zone likely to be used by pedestrians (the through route). When determining the width of the frontage or street furniture zone, a ‘shy distance’ of 0.15 m should apply from any object next to the through route. This area should then be excluded from the through route width as it is unlikely to be used by pedestrians. For example, if a lamp post is near the through route, the shy zone would be the area next to it. This area would then be included in the zone where the lamp post is located and the through-route width would be reduced. In off-road environments the same principles apply, however, one or more of the zones in table 2.3 may be absent or duplicated on the opposite side of the through route.

<table>
<thead>
<tr>
<th>Table 2.3; Zones of the Footpath</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area</strong></td>
</tr>
<tr>
<td>Kerb zone</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Street furniture zone</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Through route (or clear width)</td>
</tr>
<tr>
<td>Frontage zone</td>
</tr>
</tbody>
</table>

2.2.2 Passing places

Where through route width is constrained to less than 1.5 meters wide, passing places should be provided but only where it is not possible to widen the footpath over a longer distance, and never as a low-cost alternative to a full-width footpath. The advantages of passing places are:

- Two wheelchairs can pass each other
- Walking pedestrians can pass stationary pedestrians, such as those waiting to use a crossing or waiting for public transport.

Table 2.4 outlines passing place dimensions and spacing.

<table>
<thead>
<tr>
<th>Reason</th>
<th>Passing place dimensions</th>
<th>Location and spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair users</td>
<td>Minimum through route width 1.8 m.</td>
<td>At least every 50 m, and preferably more frequently, where the footpath is less than 1.5 m wide.</td>
</tr>
<tr>
<td></td>
<td>Minimum length 2.0 m</td>
<td></td>
</tr>
<tr>
<td>Passing pedestrians</td>
<td>Minimum through route width 1.8 m.</td>
<td>As required, according to the RCA's assessment of where pedestrians may wait.</td>
</tr>
<tr>
<td></td>
<td>Minimum length equivalent to the average group of obstructing pedestrians, plus at least 1 m.</td>
<td></td>
</tr>
</tbody>
</table>

[10, 42]

Source: Pedestrian planning design Guide, 2002
2.2.3 Overhead and protrusion clearances

Overhead clearance

To prevent head injuries to pedestrians, footpaths shall have a vertical (overhead) clearance over their entire width (including the street furniture and frontage zones) that is free of all obstructions, such as vegetation, signs and shop awnings. Table 2.5 shows the minimum overhead clearances.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Clearance</th>
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</tr>
<tr>
<td>Absolute minimum*</td>
<td>2.1 m #</td>
</tr>
</tbody>
</table>

* Only acceptable in constrained existing environments.
# The clearance shall never be less than this, even for a short distance.

Source: Pedestrian planning design Guide, 2002

Protrusions

A protrusion is an object projecting into the footpath from the side. Very minor protrusions are acceptable, as long as they are not within the pedestrian through route and comply with the dimensions in table 2.6. Every item, including street lights and traffic lights, protruding into the footpath shall have an element (which can include any mounting post) within 150 mm of the ground, so that the vision impaired who use canes can detect it.

Source: Pedestrian planning design Guide, 2002
2.2.4 Surfaces

All surfaces on which pedestrians walk should be firm, stable and slip resistant even when wet. Sudden changes in height on otherwise even surfaces should be less than five mm. To minimise stumbling hazards, undulations in otherwise even surfaces should be less than 12 mm. Both the above are achieved where the maximum deviation of the surface under a 500mm straight edge is less than five mm (figure 2.2). This also prevents puddles from forming. Dished channels for drainage should not be incorporated within the through route. Figure 2.2—Measuring the maximum deviation of the surface Short, sudden changes in the surface, such as single steps, should be avoided as they are unexpected and can cause pedestrians to trip or catch the front wheels of wheelchairs and baby carriages.

2.2.5 Crossings

Pedestrians cross the road an average of two to three times on every walking trip and may also need to cross railways, waterways or other natural features. Their perceptions of the walking experience largely focus on difficulties crossing roads and any problems with this can cause delays and create a sense of insecurity. Therefore, correctly designing, building and signing appropriate crossing facilities should be a major consideration when developing pedestrian routes. This applies not only to facilities in the road reserve, but also to off-road environments shared with cars, such as car parks.
**General design considerations for pedestrian crossing points**

As an integral part of the pedestrian network, crossings should meet the same minimum standards as through routes on the footpath, especially in:

- The maximum permissible crossfall
- Maintaining adequate overhead clearances and protrusions
- The surface standard (stable and firm, and slip resistant even when wet)
- Not containing grates and covers.

All crossing points should be designed to minimize pedestrians’ crossing distance, which means ensuring:

- They are at right angles to the direction of the road
- The roadway is as narrow at the crossing point as possible.

Where possible, crossings should be located on the pedestrian desire line. Where this is not possible or unsafe, use environmental and/or tactile cues to guide pedestrians to the crossing point. Other road users should be able to predict the route of pedestrians who are about to leave the kerbs.

Street furniture that may obscure visibility should be located well away from the crossing, and vegetation should be regularly trimmed. Parking should be prohibited for at least 15 m either side of the crossing point (although this can be six meters if there is a kerb extension at least two meters deep). To ensure compliance, this may need enforcing every now and then, or additional infrastructure could be installed. Some crossings are raised to the same level as the footpath, while others require pedestrians to change grade. In both cases, it is important to ensure that all types of pedestrian can make the transition between the footpath and the crossing safely and easily. All pedestrian crossing points must be monitored so they continue to be appropriate for the location while operating safely and efficiently. They may need removing if pedestrian numbers have declined substantially and are unlikely to increase, or upgrading if pedestrian numbers have increased.
Crossing point design includes considering the cost and ease of maintenance, repair, reinstatement and replacement, especially in the materials used. It also includes considering the implications of maintenance for pedestrians and other road users.

Over dimension load transport is also an issue in designing pedestrian crossing points, especially on routes commonly used for this purpose. These routes require a ‘design envelope’ 11m wide and six meters high. Where the road edge protrudes into the ‘design envelope’ such as at kerb protrusions, road furniture, signs, poles and other objects should be less than one meter high or be conveniently removed or folded over.

**Measures to guide Pedestrians**

All road users need helpful guidance and direction to inform and warn them of the environment ahead. As pedestrians have different characteristics and routes from other road users, the following four specific measures are required

- Signage showing pedestrian usage
- providing directional information to pedestrians
- channeling pedestrian flows
- informing other road users of the presence of pedestrians
- Indicating to pedestrians and other road users who have priority at crossing points.

**Pedestrian signage strategies**

A planned and cohesive strategy for pedestrian signage usually reduces the number of signs and locations and minimizes maintenance costs, clutter/obstruction and visual blight. Signage strategies should be based on locating signs at the following specific ‘decision points’ on the pedestrian network:

- Likely trip origins, that is, places where people join the pedestrian network such as transport interchanges/stops, car parks and key city approaches.
- Likely trip destinations, as when visits to these locations are over they become trip origins. Examples include tourist attractions, community facilities and retail areas.
- Locations with possible route ambiguity, including major junctions and open areas.
- On long routes where pedestrians may be uncertain that they have chosen the correct direction and need confirmation.
- Zebra Crossings
- Pedestrian foot bridges

The strategy should include all major destinations for pedestrians. Once a destination appears on a sign, it must continue to be signed at every subsequent decision point until the destination is reached. Choosing destinations can be contentious, so community involvement in the process is strongly recommended. Signs should only be installed where they fulfill a need based on pedestrians' expectations. They may be located outside the roadway owing to pedestrian route flexibility and diversity.

**Locating signs**

Sign faces should be located within the normal field of vision of their proposed users. To be most appropriate for people seated and standing, signs intended for viewing close up should be mounted on walls or other structures 0.9 m to 1.5 m above the ground [10]. Figure 2.5 shows fields of vision for different users.

![Figure 2.5: Fields of Vision for Different Users](source: Pedestrian planning design Guide, 2002)
2.3 Case Study

Design Guidelines of the Town of Saugeen Shores

Introduction

The Saugeen Shores Design Guidelines have been developed to provide a common reference and guideline for identifying and enhancing the character of the Town in new development along the Highway 21 corridor and High Street. Residents of the Town value the small town atmosphere, high quality of life, tourism amenities, and cultural heritage of their Town; they are intended to build upon existing policy and to be implemented through policy revision, site plan control and a community action plan.

Objectives

• To define and unify the character of Highway 21 corridor;
• Incorporate good design principles into new development;
• Protect and enhance the natural environment;
• Create a gateway or entrance to the community;
• Improve the streetscape in core areas and extend design elements along Highway 21;
• Incorporate mixed use buildings in the commercial areas;
• Make the corridor accessible and convenient for pedestrians and cyclists;
• Improve traffic circulation and parking functionality.

Figure 2.4: Highway 21 corridor of the Town of Saugeen Shores

Design principles and guidelines

The design guidelines project highlighted the following key areas that needed focus: pedestrian friendliness / accessibility, traffic flow / parking, branding / aesthetics, property standards; and
environment, preservation. They used the principals of unique community, intimate community and the principal of inviting community to arrive at their design guidelines.

**Implementation**

The design vision was presented for community review and feedback at a public workshop in June 2009. Design principles that flow from this vision is outlined as principles, of a unique, intimate, and inviting community express the desired characteristics of the town. Recognizing the diversity of development along the highway 21 corridor, district guidelines have also been developed that identify individual design approaches for each distinct area. These District Guidelines are intended to operate independently. Each Guideline highlights areas of opportunity within the district and makes specific recommendations for Town Council and Staff towards achieving the overall design vision. Some recommendations can be enacted immediately; others may take years to realize. The development of an action plan outlining projects and priorities will help to achieve the vision.

**Lessons**

This case study can inform the development project as the design principals of the case study will be used as the main principals that will be used to achieve the objectives of the redesigning of the highway through Mtwapa town. Mtwapa can also be planned to be a unique community as it is, an intimate community that will blend well with the other communities in the coast, and as an inviting community to help to promote it to grow as a tourist town.

**2.4 The conceptual framework**

Increased accessibility affects the pattern of land uses, when transport access to a parcel of land is improved, the land becomes more attractive and often developed for urban use; as land is developed, the greater amount of activity leads to an increase in travel demands. This increasing demand in turn caused an overload in transportation facilities responded to by a corresponding increase in supply the cycle is repeated again as increased accessibility affects the pattern of land uses. This Transport-Land Use Cycle can be used to explain the development of towns along transportation corridors which bring about accessibility and hence trigger off the transportation land use cycle.
Mtwapa in this case can be said is developing largely due to the accessibility brought about by the Mombasa – Malindi highway and hence resulting to linear developments along the highway. The main purpose of constructing the Mombasa – Malindi Highway was to link up the Mombasa Island with the North-eastern parts of the Coastal region, to facilitate the flow of goods and services between these areas and hence promote the economic growth of the whole Coastal region. Mtwapa Town one of the satellite town of Mombasa lies along this Mombasa – Malindi Highway and it is experiencing rapid growth as a result of easy accessibility brought about by this highway especially to the main Town Mombasa, on the process the Towns activities are affecting the functionality of the Highway in ways that has lead to impairing the functionality of the Highway to move traffic especially along Mtwapa Town.
3.0 CHAPTER THREE: SITUATIONAL ANALYSIS

3.1 Location context of the project area.
Mtwapa is located on the Kenyan coast about 15 km north of centre of Mombasa town, it is located within latitudes $3^\circ 57' 00''$ S and longitudes $39^\circ 44' 40''$ E; the trading centre lies along the Mombasa-Malindi highway which links it to Mombasa, Kilifi and Malindi. This highway is a vital link between Mtwapa and Mombasa city as well as the larger mainland north region.
Location context of the project area Mtwapa Town
3.2 Background of the project area

Mtwapa’s Archeological past

The Jumba la Mtwana ruins, the earliest known settlement in Mtwapa was started as a Swahili Settlement in the year 1350 AD; the settlement was located along the shoreline. (Curator, National Museums of Kenya). The earliest developments were temporary houses made of semi-permanent coral blocks. The walls of these houses were thick to guard against extreme weather conditions. The mortar for the blocks was made of polyps, coconut shavings, and logs, which were heated to a paste. The mortar was then used for plastering the floor. Excavation of the Jumba site began in the year 1954 by a team led by Mr. James Kingsman, it was gazetted as a National Monument in 1972; this settlement covered an area of about 4.5 acres. The site was at that time suitable due to availability of: monsoon trade winds which brought in trade, the sea gate was easily visible from the site ensuring safety from their enemies; the site is a natural harbor and perfect for docking of sea-going vessels transporting goods and the gentle pleasant breeze from the sea. The settlement thrived for about 100 years before it collapsed in the year 1450 AD. The major reasons for the collapse include, rise of diseases, lack of fresh water and decline of barter trade. The Jumba ruins are now a protected area and managed by the National Museums of Kenya having been declared a national monument.

Besides Mtwapa, Kikambala has four other locations namely; Junju, Mavueni, and Takaungu. Mtwapa borders the Indian Ocean to the East and the Mtwapa Creek, which separates it from Mombasa, to the South and to the West. Mtwapa Location is further subdivided into four sub locations namely Kijipwa (30 sq. km), Kidutani (15 sq. km), Kanamai (15 sq. km), and Shimo la Tewa (19 sq. km); Politically, Mtwapa area is located in Bahari Constituency. It is falls under the Shimo la Tewa Ward.
Situational analysis

Storm water drains are not well maintained hence leading to blocking of these drains by waste being dumped in them.

Junction points are the main conflict areas as they attract informal activities and mainly used as motorcycles points to pick up or drop passengers as they are picked or dropped.

The highway is attracting new major investments, due to its economic advantage.

Encroachment of town’s activities into the highway has lead to decline of the efficient of mobility along the highway by both the motorists and the pedestrians.

The narrow highway which is being shared with all road users, the fast moving though traffic, the NMT and the pedestrians leads to increasing rates of accidents along the highway.

There are no clear road use signs to indicate each road user space to avoid conflicts along the carriage way which results to traffic jam and road accidents.

Legend

- General slope direction
- Wind direction
- Sun path
- residential
- commercial
- mixed land use

Encroachment of town’s activities into the highway has lead to decline of the efficient of mobility along the highway by both the motorists and the pedestrians.
3.3.1 Topography

Mtwapa lies at an altitude of 21 m above sea level except for occasional prominent peaks on the western boundary and gently slopes eastwards towards the Indian Ocean. Mtwapa lies in a coastal plain broken by creeks and estuaries giving rise to excellent marine and estuarine swamps, with mangrove forests and untapped potential for marine culture. This has promoted the development of Mtwapa has its topography and the excellent maritime and estuarine swamps have attracted investors into Mtwapa especially in tourist industry. The topography of Mtwapa especially along the highway will not hinder in any way the implementation of the proposals of the project as the gentle sloping topography will enhance easy design, construction and implementation of the proposals of the project.

3.3.2 Drainage

Mtwapa has two creeks which are prominent features that mark the boundary between Mtwapa and Mombasa. These creeks have resulted in excellent maritime swamps. The swamps have mangrove forests and present potential maritime culture. The swamps are composed of marine sediments including coral, limestone, marble, clay stones and alluvial deposits.

3.3.3 Soils

Geologically, the area consists of sedimentary rocks of venue types, like consolidated sand, silts, clays and limestone exposures. Most of the soil formations along the coast are of coral parents. The sediments found in the district were deposited at various stages of geological history.

The distribution of soils reflects the base geology, climate and natural vegetation. There is also a strong correlation between the topography and soils in the Mtwapa area. From West to East, the soils occur in a broad SE-NE oriented pattern which is more or less parallel to the coastline. The geology and soils of Mtwapa have promoted agricultural activities in some parts of Mtwapa, also the condition of earth roads in the area are better due to the kind of soils in Mtwapa.

3.3.4 Climate

The climate of Mtwapa is coastal maritime. It is located about only four (4) degrees south of the equator and is adjacent to the sea hence is characterized by tropical climate generally hot and
humid tempered by sea and land breezes all year round creating substantial wind currents. The wind speed in these parts gets up to between 4.8Km/hr and 10.9Km/hr. (Source Kilifi District Development Plan). The climate has four distinct seasons: Mid December to March are generally dry registering sunny and warm days and cool nights. During April to May the area experiences the long rains, with relatively lower day time temperatures. The months between June and September are generally dry, cloudy and relatively cool. The area receives short rains between October and November. The average total annual rainfall is 1040mm. Apart from monsoon rains, the other dominant feature of the weather along the coastal strip is high temperatures. Temperatures range from a minimum of 21 degrees C to a maximum of 32 degrees C with the annual mean temperature being is 26.4 °C. This therefore makes the daily temperature range broad.

3.3.5 Vegetation
Kikambala Division has two major forest covers. These are the Mtwapa creek in Mtwapa location and Takaungu creek in Takaungu and Mavueni location. The two have a forest cover measuring 525 and 30 Ha respectively, meaning Mtwapa has the largest forest cover in the division. These two major forests in the divisions have mangrove forest. These are the only two gazetted forests. However; in Mtwapa there exists a forest measuring approximately 3 hectares at Mtwapa ruins. The Ruins have a fine woodland setting with indigenous trees like Baobabs, Sycamore and other tree species. Vegetation plays an important role in the social-economic development of Mtwapa. Apart from being a source of fuel, the vegetation does supply raw materials for the timber industry, building and fencing poles.

3.3.6 Population and Demographic Characteristics
Proximity of Mtwapa to Mombasa, location along the Malindi highway and tourism facilities has influenced population of Mtwapa to rise sharply. It is often described as the most vibrant trading, tourist and residential centre within the coast region. Mtwapa has a cosmopolitan population with the town inhabited by locals, inhabitants from other parts of the country and a considerable population of visitors and resident foreigners.
Table 3.1 Population size in Kilifi District in Urban areas

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</table>

Source: Kilifi District development plan (2004-2008)

Figure 3.3

Source: Kilifi District development plan (2004-2008)
3.4 Land Use Analysis

Map 2: Land use map of the Project area
3.4.2 Infrastructure services and Community facilities

Water supply

The key water sources in Mtwapa include piped water supplied by the Kilifi Mariakani Water and Sewerage Company which supplies almost 20,000 liters of water to Mtwapa town every day (source area manager KMWSC), rain water harvesting, wells and boreholes. There area also a number of water vendors operating in the area. The main water line runs along the Mombasa - Malindi Road from which other lines obtain water to serve developments in Mtwapa. The Kilifi Mariakani Water and Sewerage Company (KMWSC) is responsible for construction and maintenance of water lines in Mtwapa. The company charges fees to private individuals needing connections to their properties. Other water supplies in Mtwapa are private companies with boreholes.

Electricity

Electricity is provided by the Kenya Power and Lighting Company (KPLC). Mtwapa is relatively well connected with most homes and businesses good and efficient supply.

Health

Mtwapa is served by one health center that is Mtwapa health center but there are also many private clinics within the town that have come up due to high demand of their services.

Transportation

Mtwapa is served by only one tarmac road the Mombasa-Malindi highway while all other access roads within the town are earth roads, access to some areas of the town is almost impossible by vehicle due to narrow roads of up to four meters. This has resulted to the proliferation of motorcycles as the major mode of transportation used to access the inner parts of the town.

3.5 Land issues

Mtwapa town is within the coastal area that has historical problems on land ownership issues especially the issue of absentee landlords which have promoted the development of informal settlement and squatter settlements. The trading center is developed mainly on private land and the tenant at will land problem is so rampant this system has encouraged informal land transactions which proved difficult to regulate especially in the absence of effective plans and development control regulations. As a result, the centre develops in the typical traditional manner, characterized by narrow roads usually less then 6m and poor housing typologies.
3.6 Institutional, legal, and financial issues of the project area
The major institution in the implementation of the project is the County Council of Kilifi. The Local Government Act gives the Councils the powers and authority to undertake development projects within its jurisdiction, it also has the powers to approve or disapprove any development proposals within its area of jurisdiction. Therefore the County Council of Kilifi will play a pivotal role in ensuring that the design proposals that this project will recommend are fully implemented for the benefit of the people of Mtwapa town. Therefore, the institutional capacity of the County Council of Kilifi is important in ensuring the successful implementation of this project. Such projects require the adequate contribution and coordination of the unique departmental staff in each department of the County Council. These include the department of the Town clerk, the Finance Department, the Town Planning Department, that of the Public Health, the Department of Environmental and the Social Services and Housing Department.

3.7 Emerging issues
Mtwapa is one of the towns in Kenya which is developing at a fast rate, it is within the Coastal tourist belt and also it is endowed with many tourist attraction sites such as Jumba ruins. The development of Mtwapa is moving towards making it one of the best spots for tourist attractions in the coastal province as well as the whole country. Land use issue is very complex in Mtwapa as the form of land use compatibility especially along the main Mombasa-Malindi highway, it is evident that due to lack of any physical development plan to guide the development of the town as resulted to the coming up of uncontrolled developments which are contributing to the deteriorating environmental conditions along the main highway in Mtwapa town. The land tenure systems in Mtwapa are not uniform as they are ranging from the freehold system to the absentee landlords, this has various impacts among them that are evident in Mtwapa include the proliferation of squatter settlement in many part of the town, informal activities encroaching the road reserve, poor housing typologies within the town as the owners dot have title deeds that can protect them to invest on the plots.
4.0 CHAPTER FOUR: PROJECT PLANNING, DESIGN AND IMPLEMENTATION

4.1 Planning and design of project (expected outputs and outcomes of the project)
The highway is expected to be oriented to such a scale as to service the pedestrians, motorists and the investors in Mtwapa town. This is through the provision of pedestrian lanes, traffic calming and bicycle facilities; improve the area's visual character, ambience and community use of space.

It is also expected that through policy guidelines and proposals of the project, future urban development, redevelopment and retrofitting of buildings and other facilities along the highway will incrementally help knit together the transit way and urban fabric.

4.1.1 Development of the Spatial Plan

Site planning/design process stages
Phase 1: Research and analysis

This was done through a research project on planning challenges facing highway towns a case study Mtwapa town during the months of September 2009 to march 2010. From the study it was noted that there is high rate of development especially along the highway in the town of Mtwapa this has lead to encroachment of informal activities into the highway which result to poor traffic flow along the highway.

In site analysis two components were evaluated that is the site location in terms of geographical and functional context, the relation of the project site and the adjacent land uses, utilities, and integration with other networks where also the main area of analysis. The existing conditions at the project site which include the physical attributes like the size, building lines, and the bottlenecks areas along the road where identified.

Phase 2: Program Development

This stage outlines the various users who will be accommodated in, and affected by, the new design of the road in this case the motorists and pedestrians, cyclists and shoppers will all
cooperate to appropriately use the proposed street furniture, street greening, traffic calmers, streetscapes all designed to enhance sustainable mobility along the highway through Mtwapa town.

**Phase 3: Synthesis (Design phase)**

The synthesis or design process will be undertaken in three stages including; conceptual design; preliminary design and design implementation stage.

**Conceptual design**

The actual design of the streetscape, road size and the accompanying policies evolved from the conceptual framework, Guided by the study findings after the research project. The model explains the presentation of land use-transportation conflict in a highway town like Mtwapa, accessibility, land economics and values, competition for location and completion for investments are the major causes of land use-transportation conflicts in highway towns. This leads to the reduced road functionality and sub-optimal town development, however with an integrated planning intervention the situation can be corrected and hence achieve sustainable development of the Mtwapa town.

**Preliminary Design**

From the two alternative proposals the preferred alternative was picked as it was best suited to solve the problems along the Mombasa-Malindi highway in Mtwapa, the preferred plan was selected taking into consideration of all factors, policies, standards and guidelines discussed in the previous chapter.

**Design implementation**

The final drawings and the reports will be used as basis on which the project compliance will be verified by the authority approving the commencement of the project. The compliance will be based on the Kenya planning standards and the urban road design guidelines.
Nil intervention

This is whereby there will be no planning involvement to solve the current situation in the area and the phenomena will be taking its natural course of occurrence. With the rapidly increasing population of Mtwapa town and the rapid urbanization of the coastal area especially towns located along the shore line and connected by Mombasa—Malindi highway, the study area will be experiencing more traffic and more town activities which will promote the encroachment of informal activities into the road reserve. The number of informal business stalls along the highway reserve will have to increase due to the high demand of the services the offer, this chain of activities along the highway will cause the drainage channels along the road to be overwhelmed due to dumping of waste along these channels. Considering the increasing rate of car ownership in Mtwapa, the highway is expected to hold several times the volume of traffic it is holding currently; this will lead to increased traffic congestion and increasing of conflict points along the highway.

Current Situation along Mombasa-Malindi

The road reserve of Mombasa—Malindi highway in Mtwapa

The Implications of the Nil intervention:

- There will be continued obstruction of pedestrian and vehicle along the highway.
- Road accidents due to the as the pedestrians will continue to use the highway at the same time with the vehicles and the motorcycles, there will be lack of segregation between motorized and non-motorized traffic.
- There will be increase of encroachment of informal activities in to the road reserve especially the informal market, the jua kali sector and parking activities.

There is evidence of conflicts along the highway as all types of users are trying to use the narrow carriageway along Mtwapa town. The town activities and land uses are overwhelming the narrow carriageway as shown in the photograph a motorcycle is trying to offload as a person using a cart is also trying to pass by hence obstructing the matatu coming from behind. Such scenarios are very common and the main causes of traffic jams and conflicts. Disposal of garbage and other forms of organic wastes into open storm water drains and along the road reserve have rendered the storm drains useless.

Lack of parking area and developments coming up without providing adequate parking spaces are common in Mtwapa. This leads to parking of vehicles along the road reserve hence pushing the infrastructure boundaries. It is evident that the carriageway of Mombasa-Malindi road needs proper planning and intervention to improve its functionality and quality of life of the users.
Alternative one Redevelopment Approach

This alternative advocates for complete segregation of local traffic, pedestrians and cyclists from the highway. It, therefore, involves the provision of access roads on both sides of the road, exclusive walkways and bicycle lanes respectively along Mombasa – Malindi road.

Through traffic given priority to easy traffic jams and accidents

Street cafes & Street furniture along the pedestrian walkways to improve the character of the street and promote the activities along the highway which will result in economic growth of the whole town

Local traffic and motorcycles using the access lanes hence reducing conflicting with through traffic

Zebra crossing for traffic calming, and provides safe access point to the highway by pedestrians hence preventing accidents

Decorative pedestrian walkways and surface Paving emphasizes pedestrian priority and improves the pedestrian experience along the highway

Traffic lights will ensure traffic calming, enhance easy turning movements, prevents accidents and provide access points to the highway by pedestrians, local traffic and the Motorcycles who area crossing to the other side of the road

In this alternative the size of the road reserve is to be increased from the current 30 meters to 40 meters will necessitate the process of land acquisition from the private land owners along the highway, this is one of the factors will increase the cost of the redevelopment approach to achieve sustainable mobility in Mtwapa town

The approach will impact on the existing developments as the 40M road reserve required is not available, this shows the areas which will be affected

The new 40 M road reserve will have such developments to be demolished to

The approach will impact on the existing developments as the 40M road reserve required is not available, this shows the areas which will be affected

In this alternative the size of the road reserve is to be increased from the current 30 meters to 40 meters will necessitate the process of land acquisition from the private land owners along the highway, this is one of the factors will increase the cost of the redevelopment approach to achieve sustainable mobility in Mtwapa town

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The approach will impact on the existing developments as the 40M road reserve required is not available, this shows the areas which will be affected
B. Alternative two preferred plan: **Shared Use Roadway approach**

This approach aims at the complete and unsegregated inclusion of motorcycles on the roadway in the design and implementation of the integrated transport system. Shared use roadways are roads on which both motor vehicle and bicycles operate. Thus, this approach involves only the segregation of pedestrians from the roadway. This will be achieved through road widening by construction of additional lanes; priority will be given to through traffic to move at a high speed. The motorcycles and the local traffic will be having there lanes. This alternative will provide segregation of pedestrian sidewalks on both sides of the road so as to accommodate persons on wheelchairs. The sidewalks surfaces will be constructed of interlocking bricks since they are firm, stable and slip resistant even when wet. The brick surfaces will also assist the movement of blind pedestrians using guiding canes. The sidewalks will be separated from the roadway by a 150 mm raised curb to prevent cyclists, now using the roadway, from coming onto the walkways. The curbs will be painted black and white to make them more visible. Street lights along the sidewalks will be provided to enhance visibility and security at night or during dark periods of the day. Provision for zebra crossing points along the road for pedestrians willing to change sides of the road is necessary; the zebra crossings will be located within 100m of a continuous stretch of the road without intersecting with other roads and at least 20m away from junctions along the road. Provision of traffic lights at junctions along the road to aid in the efficient crossing of pedestrians in relation to the movements of bicycles and motor vehicles.
4.1.2 Evaluation of the alternatives
Alternative one

Spatial implications of redevelopment alternative on the existing road reserve of the highway and the developments along the highway.

Map 3: Spatial implication of alternative one

This shows the extent the new proposals will affect if it will be implemented; the available right of way of 30M will not fully accommodate the proposed design of redevelopment to provide two access lanes on each side of the highway, which will take up a right of way of 40M.

Legend

- residential
- commercial
- mixed land use

Travelway a B8 Mombasa-Malindi highway

The residential areas coming up after the commercial developments fronting the highway

Area covered by the redevelopment plan showing that it will eat up into existing developments
Alternative two

Spatial implications of Alternative two **Shared Use Roadway approach**

**Map 4: Spatial implication of alternative two**

This shows the extent the new proposals will affect if it will be implemented; this proposal will be accommodated into the available road reserve without affecting many developments along the highway except the informal activities encroaching into the road reserve.

The residential areas coming up after the commercial developments fronting the highway

Area covered by the Shared Use Roadway approach
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<td>Poor standards of living</td>
<td>The population of Mtwapa town increases over the years</td>
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<td>• No benefit</td>
<td>Immobility of the poor</td>
<td>Increased health risks</td>
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<tr>
<td></td>
<td>Encroachment onto the road reserve</td>
<td>Increased environmental pollution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower revenues for CCK</td>
<td>Increased road conflicts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased air pollution</td>
<td>More informal business activities along the road reserve</td>
<td></td>
</tr>
<tr>
<td><strong>Alternative one</strong></td>
<td>Costly as it involves redevelopment of the highway by providing extra access lanes for the provision of segregated local traffic and walkways.</td>
<td>Segregated local traffic and pedestrian walkways</td>
<td>The CCK, decision makers and other relevant political players will adopt this approach and facilitate necessary policies and legislation to support it.</td>
</tr>
<tr>
<td>• Reduces accident levels by segregating local traffic, pedestrians and cyclists from the highway.</td>
<td>Segregated bicycle lanes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maximizes on the available space by providing access lanes on both side of the road.</td>
<td>Street lighting of the walkways</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• The project allows for beautification of the Mombasa-Malindi road and hence attracting new investors into the town.</td>
<td>Traffic lights at road junctions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• The project adequately accommodates the economically viable Boda-boda operation in Mtwapa town.</td>
<td>Beautified Highway boulevard</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have legal complications as the current road related laws and the CCK by-laws do not cater for redevelopment approach on highways.</td>
<td>Reduced road use conflicts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>It has political complexities as it is a radical measure that might affect political players especially those involved in commercial public transport.</td>
<td>Reduced road accident levels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expensive as it requires the training of road users especially motorists and cyclists on how it functions.</td>
<td>Increased accessibility for pedestrians</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased revenues for the CCK</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1: Cost Benefit Analysis of the alternatives
| Alternative two | • Reduces accident levels by segregating pedestrians from the roadway.  
• Cheap as it only involves recognizing cyclists on the roadway and not necessarily constructing for them.  
• Maximizes on the available space by integrating the other road users  
• Viable as it utilizes existing space since the road reserve space is limiting  
• The project allows for beautification of the road reserve  
• The project adequately accommodates the economically viable Boda-boda operation in the Mtwapa town | • Complexity due to need for behavioral change. For this approach to be effective there is need for motorists to have a change in attitude and respect cyclists as co-users of the common carriageway.  
• Political complexities. For its effectiveness it needs the support of national, regional and local levels policy for the inclusion of cyclists on the roadway which are currently lacking. Policy making is a political affair.  
• It requires special traffic legislation to facilitate its effective implementation | • Segregated pedestrian walkways  
• Street lighting of the walkways  
• Traffic lights at road junctions  
• Beautified Mtwapa town.  
• Reduced road use conflicts  
• Reduced road accident levels  
• Increased accessibility of cyclists and pedestrians  
• Increased revenues for the CCK | • The CCK, decision makers and other relevant political players will adopt this approach and facilitate necessary policies and legislation to support it. |
4.2.1 Development of Detailed Action Plans of the preferred plan

a. Crossing Points

The design for this plan advocates for two types of crossing points. The first type of crossing points is those along the road for one to cross from one side to the other. The second type of crossing points is those at junction points between the highway and the other access roads. The two types of crossing points will be specially constructed of Tactile Paving. This will ensure adequate grip for pedestrians crossing the road. Zebra crossing points will be used for crossing along the road for pedestrians willing to change sides of the road. The zebra crossings will be located within 100m of a continuous stretch of the road without intersecting with other roads and at least 20m away from junctions along the road; For efficient crossing at the junctions, traffic lights will be put up to aid in the pedestrians crossing as well as guiding drivers’ and cyclists’ movements into and out of the road. Curb extensions shorten crossing distances and safety for pedestrians, while improving visibility for turning vehicles.

The design of the junctions affects how pedestrians cross junctions. This plan has designed the junctions in a way that promotes slow motor-vehicle speeds by having short corner radii. Figure 4.10 shows the effects of corner radii of junctions on pedestrians. This plan adopts option A as the vehicles will be turning at low speed and this will reduce accident cases at junction points.

<table>
<thead>
<tr>
<th>Figure 4.10: Effects Of Corner Radii On Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>A B</td>
</tr>
</tbody>
</table>

- Pedestrian desire line (---) is maintained.
- Vehicles turn slowly (10 mph – 15 mph).

- Pedestrian desire line deflected.
- Detour required to minimise crossing distance.
- Vehicles turn faster (20 mph – 30 mph).

Source: Pedestrian planning design Guide, 2002
The design of junctions also affects the way motorists interact with the cyclists. This plan has designed the junctions in a way that promotes slow motor-vehicle speeds by having short corner radii as well as vertical deflections (figure 4.11).

The present conditions at junction points have observed none of the above recommendation as shown in this diagram there are junctions of 90° which makes it unsafe for the pedestrians to cross at this points. Using the above recommended plan on the junction points, accidents at these points will be reduced as well as the traffic jams caused due the present T junctions into the highway.
b. Sidewalks

The plan intends to have separate and segregated sidewalks on both sides of the road. The two sidewalks will accommodate through pedestrian-traffic going to whichever direction along the road, each of the two sidewalks will measure 2.5 meters wide. This is not only ample space for two pedestrians passing each other but it will also accommodate persons passing each other on wheelchairs. The sidewalks’ width will provide for a range of pedestrian functions which can include browsing, street cafes, pausing and socializing (Figure 4.13).

![Figure 4.14: The Walkways Accommodate All Pedestrian Functions](image)

The sidewalks’ surfaces will be constructed of natural grey, pre-cast concrete paving flags, 63 mm thick staggered joint, variable sizes: 600x450 mm, 450x450 mm-10%, 300 x 450 mm. They will be laid in an interlocking pattern to make them firm, stable and slip resistant even when wet. The concrete surfaces will also assist the movement of blind pedestrians using guiding canes; the use of diverse paving materials can clearly define public walkways from furnishing zones and private building space; the sidewalks will be gently sloping with height changes of less than five mm. To prevent puddles from forming the maximum deviation of the surface under a 500mm straight edge is less than five mm. The sidewalks will also be separated from the roadway by a 125 mm raised kerb to prevent cyclists, now using the roadway, from coming onto the sidewalks. The kerbs will be painted black and white to make them more visible even at night.
The pedestrians are using the carriageway as shown in the figure 4. They have been pushed onto the road by the informal activities taking place along the road reserve as it can be seen in this photograph, parking of vehicles along the road reserve in a common occurrence in Mtwapa for the lack of proper designated parking areas. Many commercial activities coming up along the highway are not factoring in the provision of adequate parking spaces hence resulting to the present situation which will be solved by the proposed plan for Mtwapa highway. These illustrations could have read much better side by side with the captions: “before” and “After” captions.

The proposed sidewalks will separate the pedestrians from the carriageway, this will improve the pedestrian experience as they walk through the street and also the sidewalks will more provide access to adjacent buildings and other destinations within the town.
c. Street Furniture and Street Lighting

Street furniture and lighting equipment have a major impact on the appearance and the safety of a street and this plan recognizes this aspects. In this case the Street furniture should be integrated into the overall appearance of the road reserve. Most significant of street furniture introduced in this project's plan are outdoor cafe seating area, sitting areas and public notice boards. These notice boards will hold notices, advertisements and even display lost and found items, maps of Mtwapa town indicating to a pedestrian his present location and likely direction to his destination will also be placed at these notice boards.

Street lighting and the Pedestrian-scaled lights can provide illumination and a feeling of safety for all users especially at night, the lighting columns will be strategically placed among the trees lining the walkways so that they do not impinge on available widths of the walkways in the interests of walkways.

d. Cyclist Integration onto the Roadway

This plan intends to accommodate cyclists on the carriageway which is one of this plan’s positive aspects, the plan’s aim is to make all road users aware of other users sharing the road and respect them as equal co-users of the road and also protect one another by following the rules and regulations of the road. Thus the plan will emphasize on traffic calming techniques which will facilitate the sharing of the road with minimal road accidents. Traffic calming will be done by putting signs such as “Share the Road” and “Bicycle Route” signs as one approaches the Mtwapa town from either side of the highway say about half a kilometer before entering the town, this provides notification to motorists that a higher number of bicyclists may be present along the road. Zebra crossing will ensure point where the pedestrians enter the highway safely as they cross from one side of the road to the other.
e. Street greening

Street trees provide shade for pedestrians, and brick furnishing zones visually separate the pedestrian sphere from vehicles. Mtwapa lacks the street greening along the highway and hence promoting the deterioration of the environmental and aesthetics conditions along the road of the highway.

Vegetated planting strips and well-defined sidewalk zones as shown in figure 4.18 Will improve the character of the Mtwapa town.
4.2.3 Proposed Cross Sectoral implementation Framework

There are various stakeholders that need to be involved within the project in order to ensure its success. These stakeholders and their proposed roles have been outlined as follows:

**Table 4.2: Proposed Roles of Stakeholders**

<table>
<thead>
<tr>
<th>STAKEHOLDER</th>
<th>SUMMARY OF PROPOSED RESPONSIBILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The central Government</strong></td>
<td>The central government is expected to formulate and implement road and traffic policies that guide the shared road user strategy.</td>
</tr>
<tr>
<td><strong>County Council of Kilifi</strong></td>
<td>This will be the main implementing institution of this development project. Thus it will fund or source for funds for the implementation as well as provide professional and technical labour input into the project or facilitate the outsourcing of the same.</td>
</tr>
<tr>
<td></td>
<td>The council is also expected to formulate and implement by-laws facilitating the implementation of the project.</td>
</tr>
<tr>
<td></td>
<td>Provision of infrastructure service i.e. electricity for the street lighting, traffic lights, garbage receptacles and street furniture.</td>
</tr>
<tr>
<td></td>
<td>Management of the implemented project as well as collection of relevant revenues from the motorist, boda-boda operators.</td>
</tr>
<tr>
<td><strong>The Road Users</strong></td>
<td>Drivers and motor cyclists using the road will be required to change their behavioral attitude towards other road users especially the NMT and respect them as co-users of a common roadway.</td>
</tr>
<tr>
<td><strong>Public transport drivers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Private vehicle drivers</strong></td>
<td>Pedestrians using the walkways will be required to maintain them by not littering and crossing the road only at designated crossing points.</td>
</tr>
<tr>
<td><strong>Cyclists</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pedestrians</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hand cart pushers</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Mtwapa Business Associations | Conduct public sensitization seminars on the need for an integrated transport system.  
Facilitate the maintenance of the storm drains along the highway |
| Matatu Welfare Association (Mombasa) | Sensitization of their members on the integrated transport system |
| Non-Governmental Organizations and private organizations | This includes technical and material support, particularly in the form of training and the provision of specialized equipment where necessary. |
### 4.2 Implementation Schedule

**Table 4.1: Implementation Framework of the Development Project.**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Strategies</th>
<th>Programmes</th>
<th>Projects</th>
<th>Cost of the projects</th>
<th>Time frame</th>
<th>Actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encroachment of commercial activities onto the road reserve</td>
<td>To open up the walkways on either side of the roadway to 3 meters in order to allow access by pedestrians and beautification</td>
<td>Provide for the 2.5 meter walkways along the road.</td>
<td>Demolition and displacement of structures encroaching onto the road reserve.</td>
<td>3M</td>
<td>1 year</td>
<td>County Council of Kilifi</td>
</tr>
<tr>
<td></td>
<td>To Provide for walkways of 2.5 meters on the both sides of the roadways</td>
<td>Kerbing the walkways to discourage encroachment</td>
<td>Kerbing the road to separate the walkways</td>
<td>4M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To put up measures controlling the encroachment of commercial activities on the designated walkways</td>
<td>Pedestrian sensitization and training programmes on usage of the walkways, disposing of solid waste along the road and crossing areas and how to cross the roads</td>
<td>Stakeholder meetings in order to sensitize and train pedestrians</td>
<td>1M</td>
<td></td>
<td>N.G.O’s</td>
</tr>
<tr>
<td>Lack of walkways hence pedestrian uses the travel way as they move along the highway.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor storm drains along the highway</td>
<td>To improve the conditions of the storm drains</td>
<td>Paving of the drains along Mombasa-Malindi road along Mtwapa town.</td>
<td>Paving of the drains along Mombasa-Malindi highway in Mtwapa town.</td>
<td>4M</td>
<td>1-2 years</td>
<td>County Council of Kilifi</td>
</tr>
<tr>
<td>Inadequate harnessing of the aesthetic potential of the highway.</td>
<td>To undertake landscaping to enhance the aesthetics of the highway.</td>
<td>Landscaping of the highway boulevard by ensuring Street Signage planting attractive flowering plants along the trees lining the road</td>
<td>Landscaping of the highway boulevard along Mtwapa town</td>
<td>5M</td>
<td></td>
<td>Community members</td>
</tr>
<tr>
<td>Garbage disposal along the road reserve and haphazard Littering along the road</td>
<td>To promote the initiative of keeping the reserve clean by providing garbage receptacles along the road.</td>
<td>Providing garbage receptacles along designed road reserve</td>
<td>Locating garbage receptacles along designed road reserve</td>
<td>1M</td>
<td></td>
<td>Non-governmental Organizations</td>
</tr>
<tr>
<td></td>
<td>To promote environmental conservation by the effective management of the highway&amp; boulevard.</td>
<td>Community sensitization and training programmes</td>
<td>Organize the community on training on environmental management and conservation</td>
<td>3M</td>
<td></td>
<td>Private sector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmental conservation and management programmes</td>
<td>Organize community based environmental clean up day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrow Carriageway</td>
<td>To enhance Shared road user carriage way</td>
<td>Widening of the Carriageway</td>
<td>Construction of 4 Km 2x2 carriageway</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------</td>
<td>-------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of provision for pedestrian and cyclists along the highway</td>
<td>To provide for and include pedestrians and cyclists on the roadway.</td>
<td>Providing for a shared-use roadway effectively including pedestrians and cyclists onto the roadway.</td>
<td>Putting street signs indicating the presence of a cyclist’s route along the highway.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unregulated operation of the boda-boda and lack of boda-boda termini</td>
<td>To recognize and provide for the operation of boda-bodas along Highway in Mtwapa.</td>
<td>Providing for traffic calming</td>
<td>Putting of the traffic lights at points where pedestrians are entering the highway and at turning points along the highway.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To harness the advertising potential of the Highway</td>
<td>Providing for Boda-boda termini</td>
<td>Constructions of Boda-boda termini and locating public notice board.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road users’ sensitization and training to adjust to the inclusion of cyclists on the roadway.</td>
<td>Road users’ training programmes on the inclusion of cyclists on the roadway.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Putting up of public notice boards at boda-boda tremini.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**County Council of Kilifi**

**The GoK**

**KRB**

**Non-governmental organizations**

**Private organizations**
5.0 CHAPTER FIVE: MONITORING AND EVALUATION OF THE PLANNING DEVELOPMENT PROJECT

Introduction
In order to ensure the sustainability of the project, there needs to be well laid out monitoring and evaluation mechanisms. The objective of the development project is to identify the expected socio-spatial implications that will be developed as a result of the implementation of the project.

5.1 Monitoring and Evaluation Stages in the Implementation of the Project
The success of this project requires community participation and constant monitoring and evaluation mechanisms to ensure that the expected outputs are realized. Monitoring is an essential part of the planning process. The monitoring of the overall progress of the project and the continual feedback run is necessary as it provides the base for the measurement of the success of the plans. To be successful in the monitoring of the development project, it implies a well defined organizational structure, which has specific position and specific lines of communication to other parts of the organization.

The success of the project will be ensured by the provision of training programmes and road user sensitization forums. The County Council of Kilifi, road users, Boda-boda operators’ associations, matatu owners operation, Mtwapa business owners association and the related community based organizations will be at the forefront in the management and the monitoring the level of success of the project. The success of the project is also dependant on partnership. In order to ensure success of the project partnerships between the local Authorities, the non-governmental organizations and the private sector organizations need to be created, with the focus being the integration of different transport modes prevalent along the Mombasa-Malindi highway.
The expected outcomes, spatially, environmentally, socially and economically and the expected indicators have been described below:

<table>
<thead>
<tr>
<th>Social Dimension</th>
<th>Expected outcomes</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved way of life of the residents along Mombasa- Malindi highway in Mtwapa.</td>
<td>Segregated walkways for pedestrians.</td>
<td></td>
</tr>
<tr>
<td>Increase mobility of the poor and the physically challenged.</td>
<td>Traffic lights and zebra crossing points to guide crossing of pedestrians on the highway</td>
<td></td>
</tr>
<tr>
<td>Increased access to activity sites</td>
<td>A cleaner more attractive Mtwapa town.</td>
<td></td>
</tr>
<tr>
<td>Improved public transportation facilities therefore increase integrity of the users</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spatial Dimension</th>
<th>Expected outcomes</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved organization of the developments along the highway.</td>
<td>Easier movement along the road</td>
<td></td>
</tr>
<tr>
<td>Increased linkage and accessibility of the Mtwapa town</td>
<td>Improved junctions between the access roads and the highway in Mtwapa town.</td>
<td></td>
</tr>
<tr>
<td>Strategically placed road user direction measures and road naming.</td>
<td>Public notice boards displaying maps indicating directions to various destinations.</td>
<td></td>
</tr>
<tr>
<td>Strategically located boda-boda termini for public transportation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of the road reserve</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Economic Dimensions | Employment opportunities for the community in the construction and maintenance of the walkways, drains, boda-boda termini and beautification and cleaning of the road.  
Increased employment through boda-boda operation as well as from increased advertisements.  
Increase revenue collection for the CCK  
Increased cheap and safe access of the poor to their work areas | Employment in the construction works  
Increased operation of the boda-bodas and  
Licensing of the boda-boda operators and charging of advertisement space on the public notice boards.  
More pedestrian users on the walkways  
Improved way of life |
| Environmental Dimension | Reduced usage of motor vehicles along Mombasa-Malindi highway.  
Management of the waste water  
Landscaping of the road reserve  
Provision of a cleaner environment | Increased NMT use  
Improved drains along the road  
Beautification of the highway’s boulevard.  
A cleaner environment |
| Health Dimension | Reduced numbers of deaths and casualties caused by road accidents within Mtwapa town.  
Reduced air and noise pollution  
Increase of good health of the people as they have adequate exercise through walking and cycling. | Low levels of motor vehicle usage along the road.  
Segregated walkways and inclusion of cyclists on the roadway  
Low conflicts among the road users  
Reduced costs on health related diseases |
5.2 Guidelines for the Implementation Process
The harmonious implementation of the project will be ensured by a guideline that will act as an organizational structure for the entire project, which will include the steps, and procedures as outlined below. Community participation will be the core objective in the implementation guideline:

1. The holding of stakeholder meetings and focus group discussions in order to develop the overall project design. Dynamism among the stakeholders and difference in opinions and ideas should be embraced so that all stakeholders may feel that they are part and parcel of the project.

2. Commencement of the road user training programmes and the encouragement of the road users to come on board in the general implementation of the project.

3. Enforcement of the appropriate legal framework in regards to construction or development of the area, that is EMCA provisions, provisions of the local Government act in the granting of development permission of a project before its implementation.

When these guidelines are in place implementation sequence will begin with less technical phases of the project implementation as beautification of the boulevard and landscaping, and the construction of the walkways will commence. This will therefore involve the displacement of some structures encroaching on the proposed walkways. The redevelopment of the drainage systems will also be done at this first phase.

The second phasing of the project will involve the lighting of the walkways and putting up of the traffic lights. Public notice boards, garbage receptacles will also be put up at this second phase.

The third phase will involve the construction of boda-boda termini along the road, road signs indicting the shared road usage and cycle routes along the highway will be strategically put up at this phase.

The long term will involve the perpetual inclusion of all user including the pedestrian and cyclists along Mombasa-Malindi highway in Mtwapa town.

Site and Environmental Management Plan
To ensure that the project proceeded with minimal disruption on the physical environment, the residents along the highway and the general public, an environmental management plan was prepared as shown in table below.
Conclusions and Recommendations

With the general provision of an integrated transport system the problem of accessibility especially of the poor, who cannot afford cars, will be well managed. The segregation of pedestrian walkways and provision of street and traffic lighting as well as zebra crossing areas will lead to reduced accident frequencies along the highway. The inclusion of cyclists on the roadway as well as provision of boda-boda termini will see improved and regulated operations of the boda-bodas. Thus, increased modal choice for the residents of Mtwapa as well enhanced economy of the operators and the County Council of Kilifi. This will also lead to the harmonious co-existence and usage of the roadway between drivers and cyclists as well reduced conflicts between the boda-boda operators and the County Council of Kilifi. The success of this project lies in the hands of the road users, on their ability and willingness to use the highway and respect the different road users using the same road
### Table 5.2: Summarized Site and Environmental Management Plan

<table>
<thead>
<tr>
<th>Potential site and environmental issue</th>
<th>Mitigation</th>
<th>Frequency of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess soil as result of the excavation prior to paving of the drains and walkways</td>
<td>The excess soils from the construction works may be used as landfills for some of the extinct quarries within Mtwapa town example those Quarry site for Bamburi Cement Company. It could also be sold out to potential buyers.</td>
<td>Every time after excavation of two meters of soil in height</td>
</tr>
<tr>
<td>Noise to the adjacent residential areas from construction works</td>
<td>Noise from the construction works will be minimized by using machines which produce less noise and construction works will be restricted to week days and between the official working hours of 8.00 a.m. to 5.00 p.m. when most of the residents are not at home.</td>
<td>Every day of construction</td>
</tr>
<tr>
<td>Management of traffic flow (bicycle and motor vehicle) and pedestrian movement during construction</td>
<td>The construction work will be done in piecemeal along the road so as to cause minimal traffic disruption. Motorcycles, pedestrians and traffic flow during construction will be controlled by traffic guides at the site under construction. Roads signs indicating construction work on progress will also be erected at the site and along the road. To handle pedestrian movement, the construction work will be done in phases starting with one walkway leaving the other to be used by pedestrians.</td>
<td>Every day of construction</td>
</tr>
<tr>
<td>Cyclists’ inclusion and Operation of the Boda-boda termini</td>
<td>Cyclists using the highway will adhere to the same traffic rules as motor vehicles until necessary legislations for inclusion are made. Passengers will only access Boda-bodas at the designated termini. Boda-bodas will not be allowed to pick and drop passengers along the road unless at the termini. Boda-bodas will pay a monthly license fee to the CCK to operate. CCK askaris will enforce the regulations for cyclists’ inclusion.</td>
<td>Daily</td>
</tr>
<tr>
<td>Increasing numbers of road users, especially more NMT oriented</td>
<td>Designated zebra crossings and traffic lights located at junction points along the road will facilitate the harmonious movement of the expected increased traffic flow within the road after implementation. The increasing numbers of pedestrians, cyclists and motor vehicles using this road will also be curbed by implementing this similar project on other frequently used roads in the town thus diverting the demand.</td>
<td>Daily / Every five years</td>
</tr>
</tbody>
</table>


