

BASELINE AND END OF PROJECT SURVEYS FOR MOMBASA WEST ROADS IMPROVEMENT PROGRAMME AND MOMBASA COUNTY PORT ACCESS ROADS



FINAL REPORT

BASELINE SURVEYS FOR MOMBASA WEST ROADS IMPROVEMENT PROGRAMME AND MOMBASA COUNTY PORT ACCESS ROADS



Executive Summary

This report presents the summary findings from bicycle use study within selected roads within Mombasa West and County Port Access Road in Mbaraki. The study was conducted to address the objectives that formed the scope of the study that focused on traffic volumes along the select roads, user satisfaction survey, GHG Emission Inventory and Socioeconomic Surveys. The key findings from the study and recommendations are summarised as follows.

Key Findings:

Traffic Volume Surveys

A total of eleven (11) stations, were chosen for traffic surveys at various key intersections where traffic was expected to enter or exit the project roads. These were located along Mbaraki Road (2 Stations), Kipevu Road (1), Magongo Road (4), Airport Road (3) and Mkupe Jetty (1). Surveyors were located at the stations and manually counted the vehicles for their assigned direction.

Magongo Road (traffic heading to Changamwe from Kona Magongo) (19,335), and Airport Road (traffic heading to Port Reitz Road) (17,513) had the highest Average Daily Traffic (ADT). Magongo Road provided an alternative route to A109 which due to ongoing road construction is not preferred by the road users because of the associated congestion. The highest volume of pedestrian traffic was witnessed along Mbaraki Road at the Intersection to Mbaraki Police (7732 pedestrians daily). This area is closest to the Likoni Ferry crossing and offers an alternative route to the ferry crossing for the residents from Likoni who work within the Island in areas such as Ganjoni, Shimanzi, etc.

There has also been a lot of reorganization of traffic movement due to diversion of traffic that was necessitated by the ongoing road construction works along Magongo Road (A109L). This thus led to a reduction in the traffic observed along the road compared to previous surveys along the same corridor from an ADT of 28,959 vehicles in 2015 to 24,050 vehicles which indicates a 20% decrease. However, there was a greater reduction by up to 128% in inbound traffic. The greatest increase in traffic was observed along Port Reitz Road with inbound traffic increasing by 73% and outbound traffic by 62%. This can be attributed to the improvement of road capacity and also being the preferred alternative route by vehicles avoiding the ongoing road works on A109 (Mombasa – Nairobi Road) which currently has roadworks going on.

During the survey period, double parking, using the wrong side of the road, roadside carwashes, illegal bus stops and parking of trucks along the project roads were observed to be the major cause of congestion along the project roads.

Cargo Volumes

The total volume of cargo moved during the 14-day survey period was 61,904,749.70 ton. 84,950.70 tons of cargo was destined to the CFS stations within Mombasa.

Truck Turnaround and User Satisfaction Surveys

The average daily traffic in and out of the port varies between 2000 and 3500 from Monday to Saturday. The traffic then drops on Sunday.

Truck turnaround times between the port to select Container Freight Stations (CFS) were selected for sampling varied from between 46 minutes for trucks destined to Compact CFS which was the furthest from the Port to 17 minutes for MCT which was the closest among the select CFS. Also,

average truck turnaround times at the Port by the various gates was estimated to be 3.72 hours for transit trucks (import), between 5.26 hours and 4.82 hours for CFS trucks depending on the gate used for entry and exit, 6.97 hours for export trucks and 4.18 hours for bulk cargo trucks. Gate processing times was also established to be 27 minutes at Gate 18, 17 minutes at Gate 20 and 28 minutes at Gate 22.

A total of 532 road users were also interviewed over a 5-day period to establish their satisfaction levels with the current state of the project roads that they used frequently. Sixty-eight percent (68%) of the respondents resided in Mombasa West. Most roads in and around Mombasa West are still under construction, therefore travel time, number of accidents, cost of travel and traffic jams have increased. 51% of the road users were satisfied/very satisfied, while 19% were neutral while 31% were dissatisfied/very dissatisfied.

Cargo Dwell Times

Purposive sampling was used to identify the CFS stations that would participate in the study. Truck number plates and time was captured when the CFS trucks exit the port gates, this was then compared to the time the truck arrived at the CFS station. Below are the target CFS stations identified for the study. Only 2 of the CFSs availed data for the purposes of the survey. Awanad had an average dwell time of 20 days in 2019, up from 10 days in 2018. MCT dwell time increased from 11.14 days in 2018 to 11.14 days in 2019.

Socioeconomic Surveys

A total of 642 Household respondents and 212 businesses were sampled for the socioeconomic surveys. The aim of the surveys was to establish a baseline on the adequacy and impacts of the current state of the roads to their livelihood and day to day use of the facilities.

For the household surveys a total 300 female and 342 male respondents were sampled, majority of the respondents (40%) attained secondary school education as their highest level of education. 61% of the respondents were household heads while others were related to the household head. Sixty four percent of the respondents moved into the settlement before the road construction began. Seventy four percent (74%) are rent paying tenants and 69% work around Mombasa west. These respondents indicated that there had been a change in rent, 54% also indicated that land values had also increased. However, majority of the respondents indicated that there had been no change in income levels (59%), business opportunities (52%) or job opportunities (62%). They also indicated that there had been an increase in pedestrian congestion on the roads, traffic jams and also an improvement in access to transport. This was also accompanied by an increase in the price of goods and services. With respect to negative impacts of the roads, majority of the respondents said that the roads have affected crime (67%), noise pollution (69%), air pollution (58%) and accidents (61%). However, majority of the respondents (59%) also felt that their health had not been affected.

212 businesses were surveyed in May 2019. 69% of the businesses had been in operation before the construction of Magongo Road, Airport Road and Port Reitz Road. The surveyed businesses had been in operation for an average of 7 years. 30% of the respondents were retail outlets (shops and kiosks) that were being operated along the project roads. 38% of the respondents who were interviewed during the surveys were shop owners. 89% of the respondents indicated that congestion had decreased along the project roads. This can be attributed to the completion of Port Reitz, Airport Road and sections of Magongo Road. 77% felt that there was also a decrease in congestion

GHG Inventory

The total GHG inventory for road transport destined to countries within the EAC the Survey period is $3,386,306,196.00 \text{ kg CO}_2$ emissions and $12,076,796.16 \text{ kg NO}_x$ emissions. The average daily emission is estimated at $1,252,332.17 \text{ kg CO}_2$ and $4,466.27 \text{ kg NO}_x$ emissions from a total of 2704 trucks captured during the survey period. The total distance over which freight cargo was transported was 3,430,908 km. This cargo was destined to various locations in Kenya, Uganda, Tanzania, South Sudan, Somalia, Sudan and Rwanda.

The Consultant also collected data with respect to the total GHG inventory for road transport destined to the various CFS Stations located within Mombasa County, EPZ in Nairobi and Military supplies during the survey period. The average daily emission is estimated at 18,966.74 kg CO_2 emissions and 67.64 kg NO_x emissions. The total emissions to these destinations during the survey period for the 3582 truck that captured was 67,919,911.50 kg CO_2 emissions and 242,227.04 kg NO_x emissions. The total distance covered by the trucks to these destinations during the survey period was 68,814.50km transporting a total of 84,950.70 tons of freight cargo to the various destinations within Mombasa County.

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Abbreviations and Acronyms

| Abbreviation/Acronym | Name |
|----------------------|--|
| ADT | Average Daily Traffic |
| AADT | Average Annual Daily Traffic |
| BC | Black Carbon |
| BRT | Bus Rapid Transit |
| CBD | Central Business District |
| CAFE | Corporate Average Fuel Economy |
| САРІ | Computer-Assisted Personal Interviews |
| CCAC | Climate and Clean Air Coalition |
| CFS | Container Freight Station |
| CGM | County Government of Mombasa |
| СО | Carbon Monoxide |
| CO2 | Carbon Dioxide |
| DMU | Diesel Multiple Unit |
| EAC | East African Community |
| ECT | Empty Container Terminal |
| EMII | Electric Multiple Unit |
| EPZ | Export Processing Zone |
| GHG | Greenhouse Gas |
| HGV | Heavy Goods Vehicles |
| Н | Household |
| HIS | Home Interview Survey |
| JICA | Japan International Cooperation Agency |
| КМА | Kenya Maritime Authority |
| KeNHA | Kenya National Highways Authority |
| KNBS | Kenya National Bureau of Statistics |
| КРА | Kenya Ports Authority |
| KRA | Kenya Revenue Authority |
| MCG | Mombasa County Government |
| MGR | Metre Gauge Railway |
| NACOSTI | National Commission for Science, Technology and Innovation |
| NCCAP | National Climate Change Action Plan |
| NCTTCA | Northern Corridor Transit and Transport Coordination Authority |
| NOx | Nitrous Oxide |
| PCU | Passenger Car Unit |
| PIT | Project Implementation Team |
| PM | Particulate Matter |
| ROW | Right of Way |
| SGR | Standard Gauge Railway |
| TEU | Twenty-Foot Equivalent Unit |
| TMEA | Trademark East Africa |
| TOR | Terms of Reference |
| TVS | Traffic Volume Survey |
| UNEP | United Nations Environmental Programme |
| VCR | Volume Capacity Ratio |
| VOC | Volatile Organic Compound |

1. Introduction

1.1 Introduction

The Port of Mombasa is the principal gateway to the Eastern Africa Region and serves a wide hinterland including the EAC countries of Kenya, Uganda, Rwanda, Burundi and Northern Tanzania. The efficiency of the Port therefore has a major impact on the economies of the countries it serves and can unlock the region's growth potential. However, if underdeveloped and with poor road access, it will remain a key constraint to trade and economic growth of the region.

Over the years, the Port has recorded significant growth in traffic volumes with an average 7.2% annual growth in the last 10 years from 13.281 million tonnes in 2005 to 24.875 million in 2014. Containerized traffic has also grown by 9.8% annually to 1,012,002 TEU in 2014 from 436,671 TEU in 2005. This traffic is projected to rise to 50 million tons by 2030. This growth has put a strain on the existing port infrastructure and thus necessitating investment to improve operations and service delivery.

However, the effect of the improved efficiency and capacity within the port has not been matched with infrastructure provision serving the port within the hinterland. Congesting within the port has over time spilled over to the hinterland as Heavy Goods Vehicles (HGV) numbers that need to access the port have increased over time. This is as road transport has contributed to more than 95% of overall Port Traffic. Rail transport services by use of the Metre Gauge Railway (MGR) had dwindled over time to contributing to less than 10% of total offtake. Inland Container Freight Stations (CFS) have also been developed along the corridors leading to the port and other locations within Mombasa County. By law, they are supposed to be situated within 10km of the Port. This siting further aggravates the congestion and also contributes to degradation of the existing infrastructure. To this effect, TMEA has been increasingly expanding its program of support to cover the hinterland to also help alleviate congestion within the County.

1.2 Problem Statement

Congestion on the Mombasa Port access roads has over the years been documented due to the adverse impact it has had on port operations and also the County over the years. In particular, the Mombasa Gate City Master Plan observes that 72% of the 7,238 vehicular traffic transiting the Mombasa - Mariakani and areas surrounding the main port accesses were HGVs. A109 leading from the Mombasa Central Business District (CBD) to Mainland West, for instance, gets congested as a result of HGV heading into and from the Port at Changamwe Roundabout, Airport Road and Magongo Road. The congestion problem is further exacerbated by the parking of lorries along the road, heavy industrial activities in sections of Changamwe and Port Reitz and the general physical layout of the City with most essential services e.g. employment and government offices located in the island and residential in the mainland.

The congestion reduces the efficiency of the transportation of goods and subsequent delays have a negative impact on the value of goods for customers in the region. The local communities also utilizing the roads are negatively affected by poor access to various destinations such as places of work, markets, hospitals and government offices. The inconveniences caused also lead to loss of productivity in the workplace and an increased risk of accident. This thus necessitated the need of an intervention through road expansion and traffic management.

1.3 Project Background

TradeMark East Africa (TMEA) is funded by a range of development agencies with the aim of growing prosperity within the East African region through trade. TMEA aims at increasing trade through unlocking economic potential through increased market access, enhanced trade environment, and increased business competitiveness.

As the Port of Mombasa is the principal gateway into the Eastern Africa region, serving EAC Countries of Kenya, Uganda, Rwanda, Burundi and Northern Tanzania, the efficiency of the Port therefore has a major impact on the economies of the countries it serves and can unlock the region's growth potential. This thus underscores the need to increase investments that shall lead to improved efficiency and access to the port.

The Port of Mombasa has over the years recorded significant growth in traffic volumes. In the last 10 years, traffic increased on average by 7.2% per annum from 13.281 million tonnes in 2005 to 30.35 million in 2017. Container traffic grew faster on average by 9.8 per cent per annum rising to 1,190,000 TEU in 2017 from 436,671 TEU in 2005. The traffic is projected to rise to 50 million tons by 2030. This high growth is putting a strain on existing port infrastructure, necessitating costly investments to improve operations and service delivery. Given the importance of Mombasa Port to the region and the urgency of the needs, TMEA already has about \$94 million invested at the Port to improve capacity and performance. However, the congestion at the Port spills past the port gate.

Port traffic had dramatically increased the number of Heavy Goods Vehicles (HGVs) because road transport offtakes was more than 95% of the overall Port traffic. These HGVs are generally slow leading to congestion and significant transportation management problems, both for local traffic and for corridor traffic. Inland Container Freight stations have also been developed along the roads leading to the Port and as heavy goods vehicles turn to access these facilities, they cause congestion and unprecedented damage to the road infrastructure. Therefore, TMEA is increasingly expanding its programme of support outside the Port itself to address the congestion in urban Mombasa. TMEA and the Government of Kenya set out to improve selected roads in the Mombasa West area through capacity improvements interventions including; dualling, service road introductions and junction improvements in order to improve traffic flow and development of designated truck holding areas to eliminate road site parking within the target roads.

1.4 Objective

The main purpose of the assignment was to conduct a study on traffic and operational movement of cargo and vehicular traffic along selected roads within the Mombasa West Urban metropolis and Mombasa County Port Access Roads in Mbaraki area in addition to socioeconomic surveys within the target areas. It will also seek to investigate the possible causes of congestion at various nodes. The detailed scope of the survey was to:

- a. Document the current vehicle traffic and cargo volumes for both directions for the targeted roads described in the TOR.
- b. Obtain data on the time heavy commercial vehicles take to move from the Port of Mombasa up to a select group of Container Freight Stations (CFS) in Mombasa. This survey will enable TMEA and major port users get an understanding of the travel times involved for the relatively short distances and possible travel delays along the routes as well as the operating environment it takes for heavy commercial vehicles to move through the road network in this area in different hours of the day (during peak and slack hours).

- c. Identify and analyse the average cargo dwell time amongst the select Container Freight Stations within the target study sample (broken down per CFS) for non-client nominated cargo.
- d. Identify the key traffic bottlenecks within the Mombasa West road network and Mombasa County Port Access Roads in Mbaraki area and procedural causes of delays at the port gate that lead to issues of traffic congestion and make observations how best the highlighted bottlenecks will be addressed.
- e. Review, assess and highlight procedural causes of delay associated with movement of heavy commercial vehicles within this area.
- f. Given, that the target area also hosts a significant population and is characterized by urban commuter traffic, the survey will also seek to provide an assessment of traffic levels associated with passenger cars, motorcycles including tuk tuks and pedestrians.
- g. Determine the time it takes to queue (from joining the queue to entering the port area), time it takes for gate processing at gates 18/20, 22, 20 and 12 respectively.
- h. Ascertain the socioeconomic impacts of the Mombasa West Road Improvement Programme and Mombasa County Roads to households and businesses within the targeted project areas.

2. Traffic Study

2.1. Introduction

The Consultant was tasked with conducting traffic surveys in order to establish current vehicle traffic volumes for both directions on the target roads. Also, the consultant was required to identify key bottlenecks within the Mombasa West Road Network and Mombasa County Port Access Roads within Mbaraki and also make observations on how best these causes could be addressed. The consultant was also required to analyse existing study reports to establish changes in the vehicle traffic volumes along the select roads.

In view of the activities outlined above, the Consultant carried out traffic census studies at strategic locations along the project road. Classified Traffic Counts were conducted by the Consultant on the project roads during the month of May 2019. The objectives and scope of the Traffic Study was to determine the nature of traffic in terms of volumes and traffic composition. This data shall be used to evaluate the usage of the roads and shall form the baseline for the evaluation. The consultant also compared the results of the previous traffic surveys carried out along the project roads to ascertain the impact of the road improvement projects that had been completed on traffic volumes along the project roads.

2.2. Previous Traffic Survey Data

2.1.1. Design and Construction of Kipevu Road in Mombasa, Final Design Report April 2018, H Young and GIBB International

KPA contracted H Young and GIBB International (Joint Venture) for the design and construction of Kipevu Road from Changamwe Roundabout to Gate 18 in 2016. The project road is 1.2 km and was originally a four-lane bitumen dual carriageway that was constructed on or around 1991. The road has a ROW of approximately 40m. currently, improvement works are ongoing along the corridor and thus there is traffic diversion.

From this survey, the Average Daily Traffic (ADT) along Kipevu Road was 4,625 vehicles with the highest traffic observed being from motorcycles. During this survey, most of the freight traffic was also observed during the night.

| Vehicle classification | 12 Hr ADT (2017) | 24/12 Hr Ratio | 24 Hr ADT (2017) |
|------------------------------|---------------------|-------------------|---------------------|
| Motorcycles | 1243 | 1.42 | 1,764 |
| Cars | 439 | 1.26 | 552 |
| P/ups Jeeps,4wd | 250 | 1.52 | 381 |
| Matatu / minibus/small buses | 58 | 2.00 | 112 |
| Bus | 1 | 1.50 | 2 |
| Light Truck | 18 | 1.18 | 22 |
| Medium Trucks | 20 | 1.18 | 24 |
| Heavy Trucks (3,4 axle) | 54 | 2.18 | 118 |
| Artics/Draw bar Trucks | 707 | 2.33 | 1,650 |
| Grand Total | 2789 | | 4,625 |

Table 1: Kipevu Toad ADT (2017)

Source: H Young and GIBB International, Design and Construction of Kipevu Road in Mombasa, Final Design Report April 2018

2.1.2. Design and Construction of Port Reitz/Moi International Airport (C110) Access Road Traffic Survey Report, December 2015, Howard Humphreys (East Africa) Limited

KeNHA contracted the consultant to undertake traffic surveys for the project as well as utilize data from other sources to establish the AADT. Manual traffic counts were conducted for one week along the project roads and two minor intersections.

Table 2: Summary of Baseline Traffic Volumes

| | Motor | | P/ups Jeeps | Matatu / | Small | Large | Light | Medium | Heavy | | | |
|------------------------|--------|------|----------------|----------|-------|-------|--------|--------|--------|--------|-------|-------|
| Section /Carriageway | cycles | Cars | 4wd | Minibus | Buses | Buses | Trucks | Trucks | Trucks | Artics | Other | Total |
| MAGONGO ROAD | | | | | | | | | | | | |
| Changamwe - Magongo | | | | | | | | | | | | |
| (Main road) | 1792 | 1756 | 944 | 1417 | 38 | 155 | 233 | 82 | 21 | 18 | 3 | 6458 |
| Magongo- Changamwe (| | | | 100000 | 10 | | 10.00 | | | | | |
| Main road) | 1582 | 1414 | 1000 | 1719 | 66 | 62 | 198 | 156 | 73 | 34 | 3 | 6307 |
| Changamwe - Magongo | 2172 | 2621 | 1000 | 1267 | | | 126 | 0.6 | | 601 | 170 | 0.001 |
| (Service road) | 21/2 | 2021 | 1200 | 130/ | 92 | 80 | 120 | 80 | 81 | 081 | 1/0 | 8081 |
| Magongo- Changamwe | 1640 | 2041 | 1426 | 1052 | 0.2 | | 20 | 00 | | | 76 | |
| (Service road) | 1040 | 2041 | 1420 | 1255 | 65 | 80 | /8 | 99 | 00 | 000 | /0 | /513 |
| CII0 ROAD | | | | | | | | | | | | |
| To Airport (Main road) | 945 | 1678 | 876 | 133 | 22 | 7 | 30 | 21 | 6 | 8 | 4 | 3728 |
| From Airport (Main | | | | | | | | | | | | |
| road) | 796 | 1442 | 857 | 111 | 58 | 7 | 27 | 22 | 8 | 4 | 4 | 3337 |
| To Airport (Service | | | | | | | | | | | | |
| road) | 2573 | 1537 | 712 | 425 | 82 | 35 | 56 | 60 | 102 | 807 | 67 | 6456 |
| From Airport (Service | | | | | | | | | | | | |
| road) | 3953 | 727 | 922 | 724 | 37 | 26 | 58 | 58 | 120 | 1023 | 175 | 7823 |
| PORT REITZ ROAD | | | | | | | | | | | | |
| From Port Reitz | 1441 | 484 | 353 | 53 | 8 | 26 | 41 | 43 | 102 | 922 | 156 | 3630 |
| To Port Reitz | 1553 | 755 | 338 | 54 | 8 | 33 | 46 | 44 | 88 | 911 | 61 | 3892 |
| PORT REITZ LOOP ROA | D | | | | | | | | | | | |
| Both Directions | 4287 | 389 | 273 | 43 | 0 | 0 | 9 | 1 | 3 | 6 | 2 | 5014 |

The outcomes of the traffic counts can be summarized as per Table 2;

Source: Howard Humphreys (East Africa) Limited, Design and Construction of Port Reitz/Moi International Airport (C110) Access Road Traffic Survey Report, December 2015

From the survey results, it is notable that the Magongo Road – Changamwe corridor had the most traffic as most user preferred to divert to this direction to avoid congestion on Nairobi – Mombasa Road (A109). The relatively high number of Heavy Goods Vehicles along the project road is mainly due to the activities at the Port of Mombasa and the Container Freight stations located mainly along the Port Reitz Road. However, this is not the case currently as there are ongoing road improvement works along Magongo Road.

2.1.3. Dualling of Magongo (A109L) Road: Phase II, Detailed Engineering Design Report November 2018, Atkins

The project involves the dualling of Magongo (A109L) road starting approximately 300m from the Magongo (A109L) road/Airport access (C110) road intersection through Magongo road to terminate at the Railways crossing just before the A109L/A109 road junction at Kwa-Jomvu (a length of approximately km 4.0). The project includes necessary improvement of the Bomu Hospital/ Refinery Road junctions to necessitate proper function of the project road.

Traffic surveys were carried out to determine the type and volume of existing traffic along the project road.

Table 3: AADT (2018) Traffic along Magongo Road

| Section /Carriageway | M/cycles | Cars | P/ups | Matatu / Minibus | Small Bus | L.Bus | LGV | MGV | HGV(3-4Axles) | HGV (5+ Axles | Other | Total |
|--|----------|------|-------|------------------|-----------|-------|-----|-----|---------------|---------------|-------|-------|
| MAGONGO ROAD | | | | | | | | | | | | |
| Kwa Jomvu - Changamwe | 3193 | 910 | 590 | 1044 | 41 | 70 | 171 | 349 | 229 | 1696 | 49 | 8342 |
| Changamwe - Kwa Jomvu | 3107 | 1350 | 676 | 1226 | 51 | 47 | 275 | 231 | 140 | 1851 | 55 | 9008 |
| Kwa Jomvu – Changamwe (service Road 1) | 1331 | 177 | 94 | 84 | 11 | 7 | 30 | 61 | 34 | 389 | 14 | 2231 |
| Changamwe – Kwa Jomvu (Service Road 1) | 835 | 170 | 118 | 90 | 8 | 4 | 37 | 52 | 32 | 350 | 19 | 1716 |
| Kwa Jomvu – Changamwe (service Road2) | 1533 | 613 | 413 | 1138 | 21 | 22 | 38 | 55 | 27 | 174 | 5 | 4038 |
| Changamwe - Kwa Jomvu (Service Road2) | 1698 | 381 | 177 | 1231 | 16 | 7 | 41 | 46 | 20 | 192 | 14 | 3823 |

Source: Atkins, Dualling of Magongo (A109L) Road: Phase II, Detailed Engineering Design Report November 2018

There was a significant increase in traffic volume between the traffic collected between 2015 and 2018 that was largely attributed to the on-going construction of road A109 between Changamwe and Kwa Jomvu which has seen a sizeable traffic divert to Magongo Road to avoid the congestion caused by the ongoing construction works.

2.1.4. Summary of findings

From the foregoing;

- 1. It is noteworthy that the Magongo Road Changamwe corridor had the most traffic as most users used it as a diversion to avoid the ongoing roadworks along Nairobi Mombasa Road (A109), and the associated congestion. The relatively high number of Heavy Goods Vehicles along the project road is mainly due to the activities at the Port of Mombasa and the Container Freight stations located mainly along the Port Reitz Road. However, this is not the case currently as there are ongoing road improvement works along Magongo Road.
- 2. In addition, analysis on traffic variations from this secondary data review showed that Magongo road did not have a clearly defined peak hour; this is consistent with the road function as transit route as opposed as serving the local traffic. The only slight increase in traffic is experience in between 0730hrs to 0830hrs especially on the Changamwe to Kwa Jomvu direction and much smaller increase between 1700hrs and 1900hrs, which was attributed to the influence of the local traffic as people head to and from work as well as the transit vehicle starting, their journey in the morning and late evening. The weekly traffic variation indicates that the traffic along the road is low during the weekend then gradually increasing from Monday to peak towards the end of the week
- 3. During the time of undertaking these surveys, freight traffic volumes was higher at night compared to the rest of the daytime. This was attributed to the relatively reduced

local traffic volumes from private cars and matatus that were destined to the residential estates located in Port Reitz, Magongo, Chaani, Miritini, etc.

4. In totality, the ongoing works have had the net effect of easing the flow of traffic along the selected project roads

2.3.Traffic Survey Methodology

The Consultant undertook the manual traffic surveys at Kipevu Road, Magongo Road, Port Reitz Road Airport Road Intersection, A109/Magongo Road Intersection, Mkupe Jetty, Magongo Corner and Mbaraki Road as highlighted in Table 5 below along the selected corridors, capturing directional information, including pedestrian counts and freight traffic.

The Consultant undertook 24-hour (from 6AM to 6AM the next day) counts and summarized the result in 15-minute intervals per hour. These surveys were undertaken for a 14-day period between May 6-19, 2019. Traffic classification was necessary to establish the level of utilization, distribution and supply of traffic. The vehicle classes utilized for the Traffic Survey are as follows:

| Vehicle Category Description Container Trucks: | | | | | | | | |
|--|--|--|--|--|--|--|--|--|
| Container Trailers | All trucks transporting removable containers (20ft and 40ft). | | | | | | | |
| Bulk Trailers | All trucks transporting bulk cargo | | | | | | | |
| Fuel Tankers | All commercial fuel transporting vehicles | | | | | | | |
| Light trucks | Pickups, lorries and small trucks carrying goods of capacity up to 8T (detailed categorization of trucks to be agreed during inception phase with TMEA and NCTTCA) | | | | | | | |
| Medium trucks | Trucks with equivalent carrying capacity from 8T up to 15T (detailed categorization of trucks to be agreed during inception phase with TMEA and NCTTCA) | | | | | | | |
| Break Bulk | All other trucks larger than medium trucks | | | | | | | |
| Empty trucks/tractors | The consultant will identify and segregate data to distinguish the number of empty /tractors for each of the specified categories. | | | | | | | |
| Commercial Buses: | | | | | | | | |
| Coach | All commercial buses transporting 45 or more passengers | | | | | | | |
| Coaster | All commercial buses transporting max 30 passengers | | | | | | | |
| Minibus | All buses transporting 8 to 14 passengers | | | | | | | |
| Personal vehicles: | | | | | | | | |
| Sedans, Station Wagons | Passenger vehicles of capacity of up to 7 passengers | | | | | | | |
| and Mini-vans | | | | | | | | |
| Pick-ups | Passenger pickups – Not carrying goods | | | | | | | |
| Tuks tuks | Passenger vehicles – Not carrying goods | | | | | | | |
| Motorbikes | | | | | | | | |
| Pedestrian Counts | | | | | | | | |

Table 4: Vehicle Category Description

Source: Request for Proposals (RFP) For Consultancy Services for the Baseline and End of Project Surveys for Mombasa West Roads Improvement Programme and Mombasa County Port Access Roads

During the undertaking of the cross-sectional traffic volume surveys, pedestrian surveys were also undertaken. Traffic flow data was captured continuously recording the passing traffic by manual tally counting. The directional traffic was recorded by trained Enumerators. Each location had a trained supervisor who acted as the first quality control point for the surveys.

This classification facilitated reasonable estimation of both Passenger Car Unit (PCU) for comparison with the existing data.

2.4. Traffic Survey Locations

A total of eleven (11) stations, stations were chosen for traffic surveys at various key intersections where traffic was expected to enter or exit the project roads.

Surveyors were located at the stations and manually counted the vehicles for their assigned direction.

| | Survey Location | Survey Period | Remarks |
|----------|---|------------------|--|
| 1 | Mbaraki at Mbaraki Police Station | 14 days | This census point captured all the traffic entering and leaving the junction from Nyerere Road into the County Access Road connecting the ferry to Mbaraki Road via Kencont and also to the Berths where Clinker is handled at the Port. |
| 2 | Mbaraki at Kencont | 14 days | This census point captured all the traffic entering and leaving the intersection at Mbaraki Road going towards the Naivas Likoni (formerly Nakumatt Likoni) and also Gulf Oil |
| 3 | Kipevu Road at Changamwe Roundabout | 14 days | This census point captured all traffic leaving and entering Kipevu Road. |
| 4 | Magongo Road (A109L)/ Airport Road (C110) Junction at Shell Magongo Road | 14 days | This census point captured the traffic entering, passing or leaving the junction from the Airport Access Road (C110), Magongo and Changamwe directions. |
| 5 | Magongo Road (A109L) at Mskiti Noor | 14 days | This census point captured the traffic passing the location via the overpass along A109L |
| 6 | Magongo Road (A109L)/Refinery Road Junction | 14 days | This census point captured traffic entering, leaving or passing the intersection towards the Refinery, Magongo Mainland and Changamwe. |
| 7 | Airport Road (C110)/Bomu Hospital Road Junction | 14 days | This census point captured the turning movement at this junction traffic passing, entering or leaving the junction from Bomu Hospital, Airport and Magongo directions |
| 8 | Airport Road (C110)/Port Rietz Road Junction | 14 days | This census point captured the traffic passing, entering or leaving the junction from Airport, Magongo and Port Reitz directions |
| 9 | Airport Road (C110) near the landing of the Overpass | 14 days | This census point captured the traffic passing the location via the overpass at C110 |
| 10 | Magongo Road (A109L) at Kona Reli | 14 days | This census point captured the traffic passing, entering or leaving the junction towards Magongo Mainland/Changamwe, and Jomvu |
| 11 | Mkupe Jetty | 14 days | This survey point captured all traffic entering and leaving the intersection towards the SGR Station and Kona Reli |
| <u> </u> | | Sou | irce: Field Surveys, 2019 |

Table 5: Location of the Traffic Surveys

Figure 1 maps out the survey locations as described in Table 5.



Figure 1: Location of the Traffic Surveys Source: Field Surveys, 2019

2.5. Normal Traffic Volume and Composition

Traffic analysis was undertaken for each census station and the results used to describe traffic characteristics along the project roads. The Average Daily Traffic (ADT) was calculated as the average flow for the 14 days, in which traffic counts were carried out. The summary of the baseline traffic volumes along the project roads is summarized in Table 6. Magongo Road (between Changamwe and Kona Magongo), Airport Road and Port Reitz Road had the highest ADT. Magongo Road provided an alternative route to A109 which due to ongoing road construction is not preferred by the road users because of the associated congestion.

2.6. Traffic Characteristics on the Project Roads

Table 6 summarizes the traffic characteristics along the various project roads. It is notable that the highest volume of pedestrian traffic was witnessed along Mbaraki Road at the Intersection to Gulf Oil. This area is closest to the Likoni Ferry crossing and offers an alternative route to the ferry crossing for the residents from Likoni who work within the Island in areas such as Ganjoni, Shimanzi, etc.

There has also been a lot of reorganization of traffic movement due to diversion of traffic that was necessitated by the ongoing road construction works along Magongo Road (A109L). This thus led to a reduction in the traffic observed along the road compared to previous surveys along the same corridor from an ADT of 28,959 vehicles in 2015 to 24,050 vehicles which indicates a 20% decrease. However, there was a greater reduction by up to 128% in inbound traffic.

From the Figure 2, Airport Road at Port Reitz Junction and Magongo Road at Kona Magongo had the highest traffic volumes.

2.7. Comparison of Survey Results with Past Surveys

From the secondary data review, the consultant was able to compare the findings from the previous surveys undertaken along the project roads and it is noteworthy that there has been a decrease in inbound traffic (Changamwe – Mainland) by 128% between 2015 and 2019 and 120% between 2017 and 2019. The greatest increase in traffic was observed along Port Reitz Road with inbound traffic increasing by 73% and outbound traffic by 62%. This can be attributed to the improvement of road capacity and also being the preferred alternative route by vehicles avoiding the ongoing road works on A109 (Mombasa – Nairobi Road) which currently has roadworks going on.



Figure 2: Variation of Traffic Along Project Roads

Source: One Thousand Alternatives

| Survey | Kipevu Rood (ADT) | Magongo | Magongo | Airport | Airport | Port Reitz | Port Reitz | Port Reitz |
|----------------------------|----------------------|-----------|------------|-----------|------------|------------|------------|------------|
| | Koau (AD1) | (Inbound) | (Outbound) | (C110) | (C110) | (Inbound) | (Outbound) | Road |
| | | | | (Inbound) | (Outbound) | | | |
| Design and Construction | | | | | | | | |
| of Port Reitz/Moi | | | | | | | | |
| International Airport Road | - | 15,139 | 13,820 | 10,184 | 11,160 | 3,892 | 3,630 | 5,014 |
| (C110) Access Road, | | | | | | | | |
| December 2015 | | | | | | | | |
| Baseline Survey for the | | | | | | | | |
| Mombasa West Road | 10,097 | 6,639 | 17,411 | 12,568 | 13,179 | 14,175 | 9,458 | - |
| Improvement Project | | | | | | | | |
| Change | | -8,500 | 3,591 | 2,384 | 2,019 | 10,283 | 5,828 | |
| (%) | | (-128%) | (21%) | (19%) | (15%) | (73%) | (62%) | |
| Design and Construction | | | | | | | | |
| of Kipevu Road in | 4,625 | - | - | - | - | - | - | - |
| Mombasa, April 2018 | | | | | | | | |
| Baseline Survey for the | | | | | | | | |
| Mombasa West Road | 10,097 | 6,639 | 17,411 | 12,568 | 13,179 | 14,175 | 9,458 | - |
| Improvement Project | | | | | | | | |
| Change | 5,472 | | | | | | | |
| (%) | (54%) | | | | | | | |
| Dualling of Magongo | | | | | | | | |
| (A109L) Road (Phase II), | - | 14,611 | 14,547 | - | - | - | - | - |
| November 2017 | | | | | | | | |
| Baseline Survey for the | | | | | | | | |
| Mombasa West Road | 10,097 | 6,639 | 17,411 | 12,568 | 13,179 | 14,175 | 9,458 | - |
| Improvement Project | | | | | | | | |
| Change | | -7,972 | 2,864 | | | | | |
| (%) | | (-120%) | (16%) | | | | | |

Table 6: Comparison of Findings from Previous Surveys

Source: One Thousand Alternatives

2.8. Causes of Congestion observed along the Project Roads

During the survey period, double parking, using the wrong side of the road, roadside carwashes, illegal bus stops and parking of trucks along the project roads were observed to be the major cause of congestion along the project roads.

The lack of bus stops at key high traffic areas led to matatus and long-distance buses opting to load and off-load along the roadside and thus obstructing the free flow of traffic. Some of these pick-up points especially are located in areas such as around the Shell and Airport Road overpasses, Msikiti Noor and Kona Magongo. Some truck drivers also opted to park along the road to either buy refreshments, pick up passengers thus resulting in congestion as cars manoeuvre around them. Boda boda riders also opted to use the wrong side of the road to access Bomu Hospital Road from Airport Road thus causing vehicles to slow down and use only one lane on the carriage way to avoid collision with the oncoming boda boda and tuk tuk traffic using the wrong side of the road. Along the Port Access Road in Mbaraki, a car wash run by local youth operated within the road reserve and was frequented by tuk tuk and boda boda operators.

In addition, due to lack of easy access to the Shell Petrol Station from Magongo Road especially for vehicles that had to use the roundabout, many drivers opted to cut through traffic to access the facility as opposed to using the access off Airport Road.

Some of the causes of congestion are illustrated by the Figure 3.

| | | | | | | Table 7: Summary of | Baseline AD | T Volumes | | | | | | | | |
|--|----------------------|----------------------|----------------------|---------------------|---------------------|--------------------------|-------------|-------------|-------------|--|-------------|------------|-----------------|--------------|-----------------|-----------|
| | Containe r Trucks | Bulk Trailer s | Mediu m Trucks | Light Truck s | Fuel Tanker s | Tractor/Empt y Trucks | Coach | Coaste r | Minibu s | Station wagons , Sedans and Mini- vans | Pickup s | Tuk tuk | Motorcycle s | Bicycle s | Pedestrian s | TOTA L |
| Bomu Road @ Airport Road Junction | | | | | | | | | | | | | | | | |
| Inbound to Bomu Hospital | 128 | 180 | 171 | 26 | 74 | 207 | 21 | 65 | 522 | 755 | 160 | 362 | 2336 | 74 | 1058 | 6139 |
| Outbound from Bomu Hospital | 496 | 246 | 146 | 37 | 93 | 268 | 51 | 26 | 600 | 963 | 169 | 560 | 2581 | 82 | 864 | 7181 |
| Kipevu Road | | | | | | | | | | | | | | | | |
| Inbound to the Port | 144 | 120 | 58 | 17 | 134 | 190 | 0 | 4 | 22 | 419 | 81 | 37 | 1042 | 12 | 1531 | 3810 |
| Outbound to Changamwe Roundabout | 1249 | 520 | 39 | 25 | 146 | 813 | 1 | 6 | 55 | 688 | 118 | 40 | 1090 | 12 | 1484 | 6287 |
| Mbaraki @ Kencont | | | | | | | | | | | | | | | | |
| Inbound from Mbaraki Road | 130 | 5 | 50 | 138 | 35 | 0 | 6 | 9 | 404 | 1781 | 330 | 3770 | 337 | 514 | 1844 | 9353 |
| Outbound to Mbaraki Road | 148 | 21 | 34 | 83 | 39 | 1 | 2 | 9 | 373 | 1361 | 195 | 1990 | 291 | 465 | 2380 | 7392 |
| Mbaraki @ Mbaraki Police | | | | | | | | | | | | | | | | |
| Inbound from Mbaraki Road | 35 | 51 | 26 | 76 | 61 | 0 | 11 | 3 | 34 | 883 | 135 | 2024 | 129 | 467 | 3310 | 7245 |
| Outbound to Mbaraki Road | 49 | 54 | 25 | 98 | 100 | 1 | 9 | 3 | 30 | 1011 | 426 | 2282 | 155 | 1307 | 4422 | 9971 |
| Mkupe Jetty @ SGR Junction | | | | | | | | | | | | | | | | |
| Inbound to SGR | 4 | 1 | 40 | 34 | 1 | 0 | 1 | 2 | 17 | 150 | 35 | 33 | 649 | 12 | 1143 | 2122 |
| Outbound from SGR | 1 | 7 | 53 | 17 | 2 | 10 | 4 | 4 | 10 | 232 | 28 | 22 | 582 | 11 | 1085 | 2077 |
| Inbound from Kona Reli | 35 | 12 | 62 | 48 | 5 | 38 | 4 | 1 | 30 | 100 | 46 | 33 | 880 | 19 | 1230 | 2643 |
| Outbound to Kona Reli | 52 | 19 | 47 | 38 | 16 | 8 | 2 | 2 | 70 | 158 | 40 | 39 | 950 | 20 | 1665 | 3125 |
| Airport Road Overpass @ after Bomu Junction | | | | | | | | | | | | | | | | |
| Inbound to Airport | 10 | 18 | 23 | 18 | 20 | 19 | 7 | 89 | 40 | 1427 | 117 | 50 | 105 | 1 | 2 | 1948 |
| Outbound from Airport | 8 | 4 | 13 | 14 | 12 | 11 | 14 | 64 | 43 | 1397 | 115 | 17 | 106 | 1 | 3 | 1824 |
| Airport Road @ Port Reitz Junction | | | | | | | | | | | | | | | | |
| Inbound to Port Reitz Road | 1137 | 324 | 133 | 325 | 355 | 309 | 248 | 321 | 1966 | 3972 | 559 | 2548 | 2421 | 97 | 2798 | 17513 |
| Outbound from Port Reitz Road | 338 | 329 | 143 | 215 | 338 | 271 | 135 | 302 | 492 | 3131 | 585 | 1376 | 1744 | 60 | 1086 | 10544 |
| Inbound to Shell | 322 | 259 | 107 | 176 | 170 | 227 | 131 | 54 | 1580 | 5227 | 614 | 1788 | 2405 | 120 | 3724 | 16903 |
| Outbound from Shell | 890 | 240 | 242 | 186 | 253 | 281 | 219 | 834 | 958 | 3545 | 704 | 1856 | 2215 | 145 | 1288 | 13856 |
| Inbound to Airport | 30 | 68 | 41 | 84 | 55 | 63 | 0 | 644 | 96 | 1813 | 309 | 868 | 2645 | 173 | 2660 | 9547 |
| Outbound from Airport | 44 | 40 | 32 | 106 | 33 | 71 | 27 | 272 | 478 | 1681 | 245 | 810 | 2204 | 110 | 1370 | 7521 |
| Magongo Road Overpass @ Mskiti Noor | | | | | | | | | | | | | | | | |
| Inbound to Mainland | 8 | 2 | 19 | 29 | 16 | 13 | 2 | 6 | 19 | 541 | 68 | 102 | 289 | 2 | 4 | 1121 |

| | Containe r Trucks | Bulk | Mediu | Light Truck | Fuel | Tractor/Empt | Coach | Coaste | Minibu | Station | Pickup | Tuk tuk | Motorcycle | Bicycle | Pedestrian | TOTA |
|-----------------------------|----------------------|------|--------|----------------|------|--------------|-------|--------|--------|---------|--------|------------|------------|---------|------------|-------|
| | 1 II UCKS | s | Trucks | s | s | yntucks | | - | | , | | tuk | | | | |
| | | | | | | | | | | Sedans | | | | | | |
| | | | | | | | | | | Mini- | | | | | | |
| Outbound from Mainland | 71 | 22 | 47 | 48 | 44 | 37 | 7 | 19 | 34 | 632 | 96 | 164 | 275 | 9 | 5 | 1508 |
| | | | | | | | | | | | | | | | | |
| Magongo Road @ Kona Magongo | | | | | | | | | | | | | | | | |
| Outbound to Shell | 878 | 14 | 349 | 314 | 386 | 74 | 261 | 245 | 4408 | 5063 | 634 | 2658 | 1890 | 237 | 1924 | 19335 |
| Inbound from Shell | 28 | 2 | 17 | 26 | 7 | 5 | 3 | 2 | 2436 | 534 | 154 | 848 | 2347 | 232 | 1300 | 10389 |
| Outbound to Kona Reli | 7 | 0 | 22 | 15 | 9 | 2 | 2 | 0 | 1062 | 445 | 161 | 640 | 3527 | 276 | 1205 | 9709 |
| Inbound from Kona Reli | 5 | 49 | 96 | 44 | 20 | 6 | 15 | 6 | 882 | 713 | 280 | 730 | 2597 | 164 | 1674 | 7933 |
| Outbound to Mainland | 96 | 19 | 40 | 85 | 61 | 8 | 11 | 3 | 2182 | 801 | 163 | 712 | 2134 | 140 | 1237 | 9282 |
| Inbound from Mainland | 189 | 156 | 44 | 77 | 74 | 18 | 2 | 17 | 2296 | 540 | 164 | 844 | 2878 | 120 | 2031 | 11179 |
| Outbound to Refinery Road | 65 | 5 | 19 | 31 | 14 | 6 | 5 | 2 | 4872 | 811 | 233 | 1696 | 3333 | 292 | 1098 | 12483 |
| Inbound from Refinery Road | 42 | 30 | 31 | 46 | 122 | 6 | 12 | 8 | 82 | 236 | 52 | 212 | 2080 | 112 | 1176 | 5560 |
| Magongo Road @ Kona Reli | | | | | | | | | | | | | | | | |
| Inbound from Mkupe Jetty | 846 | 485 | 152 | 212 | 351 | 361 | 9 | 8 | 234 | 733 | 199 | 290 | 1227 | 30 | 1842 | 6978 |
| Outbound from Mkupe Jetty | 1205 | 233 | 107 | 103 | 334 | 392 | 9 | 6 | 232 | 293 | 129 | 282 | 1508 | 48 | 1526 | 6406 |
| Inbound from Jomvu | 571 | 107 | 44 | 94 | 98 | 164 | 3 | 8 | 1108 | 412 | 245 | 1100 | 1815 | 112 | 1674 | 8504 |
| Outbound to Jomvu | 396 | 149 | 76 | 105 | 124 | 169 | 12 | 0 | 1518 | 885 | 374 | 638 | 1811 | 141 | 1607 | 8419 |
| Inbound to Mainland | 273 | 179 | 35 | 47 | 81 | 78 | 0 | 0 | 1308 | 234 | 94 | 380 | 2289 | 39 | 1682 | 6720 |
| Outbound from Mainland | 1328 | 892 | 330 | 369 | 408 | 359 | 8 | 21 | 1770 | 1114 | 363 | 1258 | 1703 | 100 | 1730 | 11753 |
| Magongo Road @ Shell | | | | | | | | | | | | | | | | |
| Inbound to Changamwe | 82 | 16 | 156 | 190 | 153 | 7 | 176 | 143 | 2682 | 2838 | 567 | 1740 | 2063 | 353 | 1609 | 13540 |
| Outbound from Changamwe | 75 | 77 | 17 | 51 | 26 | 50 | 15 | 18 | 876 | 1292 | 70 | 748 | 849 | 66 | 1640 | 5868 |
| Inbound from Airport | 494 | 350 | 119 | 144 | 257 | 262 | 194 | 23 | 310 | 6101 | 1012 | 2834 | 2469 | 151 | 1509 | 17684 |
| Outbound to Airport | 322 | 259 | 107 | 176 | 170 | 227 | 131 | 54 | 1580 | 5227 | 614 | 1788 | 2405 | 120 | 1972 | 16903 |
| Outbound from Mainland | 23 | 5 | 63 | 27 | 11 | 1 | 9 | 32 | 1796 | 1120 | 179 | 986 | 3080 | 333 | 2101 | 11730 |
| Inbound to Mainland | 144 | 37 | 31 | 25 | 76 | 17 | 48 | 33 | 3178 | 3320 | 243 | 1096 | 2041 | 178 | 686 | 11152 |

Source: Traffic Volume Surveys 2019

| | Heavy Goods Vehicles | Empty Trucks/Tractors | Public Service Vehicles | Personal Vehicles | Motorbikes | Non- Motorized Transport | TOTAL |
|---|----------------------------|--------------------------|-------------------------------|----------------------|------------|--------------------------------|-------|
| Bomu Road @ Airport Road Junction | | | | | | | |
| Inbound to Bomu Hospital | 579 | 207 | 608 | 1277 | 2336 | 1132 | 6139 |
| Outbound from Bomu Hospital | 1018 | 268 | 677 | 1692 | 2581 | 946 | 7182 |
| | | | | | | | |
| Kipevu Road | | | | | | | |
| Inbound to the Port | 473 | 190 | 26 | 537 | 1042 | 1543 | 3811 |
| Outbound to Changamwe Roundabout | 1979 | 813 | 62 | 846 | 1090 | 1496 | 6286 |
| | | | | | | | |
| Mbaraki @ Kencont | | | | | | | |
| Inbound from Mbaraki Road | 358 | 0 | 419 | 5881 | 337 | 2358 | 9353 |
| Outbound to Mbaraki Road | 325 | 1 | 384 | 3546 | 291 | 2845 | 7392 |
| | | | | | | | |
| Mbaraki @ Mbaraki Police | | | | | | | |
| Inbound from Mbaraki Road | 249 | 0 | 48 | 3042 | 129 | 3777 | 7245 |
| Outbound to Mbaraki Road | 326 | 1 | 42 | 3718 | 155 | 5729 | 9971 |
| | | | | | | | |
| Mkupe Jetty @ SGR Junction | | | | | | | |
| Inbound to SGR | 80 | 0 | 20 | 218 | 649 | 1155 | 2122 |
| Outbound from SGR | 80 | 10 | 27 | 282 | 582 | 1096 | 2077 |
| Inbound from Kona Reli | 162 | 38 | 35 | 278 | 880 | 1249 | 2642 |
| Outbound to Kona Reli | 172 | 8 | 74 | 237 | 950 | 1685 | 3126 |
| | | | | | | | |
| Airport Road Overpass @ after Bomu Junction | | | | | | | |
| Inbound to Airport | 89 | 19 | 136 | 1594 | 105 | 3 | 1946 |
| Outbound from Airport | 51 | 11 | 121 | 1529 | 106 | 4 | 1822 |

| Table 8: Summary | of Baseline AL | T Volumes by | Vehicle Category | as per Table 4 |
|------------------|----------------|--------------|------------------|----------------|
| | ~ | | | 1 / |

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| | Heavy Goods Vehicles | Empty Trucks/Tractors | Public Service Vehicles | Personal Vehicles | Motorbikes | Non- Motorized Transport | TOTAL |
|-------------------------------------|----------------------------|--------------------------|-------------------------------|----------------------|------------|--------------------------------|-------|
| | | | | | | | |
| Airport Road @ Port Reitz Junction | | | | | | | |
| Inbound to Port Reitz Road | 2274 | 309 | 2535 | 7079 | 2421 | 2895 | 17513 |
| Outbound from Port Reitz Road | 1362 | 271 | 929 | 5092 | 1744 | 1146 | 10544 |
| Inbound to Shell | 1033 | 227 | 1765 | 7629 | 2405 | 3844 | 16903 |
| Outbound from Shell | 1811 | 281 | 2011 | 6104 | 2215 | 1433 | 13856 |
| Inbound to Airport | 277 | 63 | 740 | 2990 | 2645 | 2833 | 9547 |
| Outbound from Airport | 255 | 71 | 777 | 2736 | 2204 | 1480 | 7521 |
| | | | | | | | |
| Magongo Road Overpass @ Mskiti Noor | | | | | | | |
| Inbound to Mainland | 74 | 13 | 27 | 711 | 289 | 6 | 1120 |
| Outbound from Mainland | 232 | 37 | 60 | 892 | 275 | 14 | 1510 |
| | | | | | | | |
| Magongo Road @ Kona Magongo | | | | | | | |
| Outbound to Shell | 1941 | 74 | 4914 | 8355 | 1890 | 2836 | 20010 |
| Inbound from Shell | 79 | 5 | 2441 | 1535 | 2347 | 3614 | 10021 |
| Outbound to Kona Reli | 53 | 2 | 1064 | 1246 | 3527 | 1481 | 7374 |
| Inbound from Kona Reli | 212 | 6 | 903 | 1723 | 2597 | 1838 | 7279 |
| Outbound to Mainland | 300 | 8 | 2196 | 1676 | 2134 | 3657 | 9971 |
| Inbound from Mainland | 539 | 18 | 2314 | 1548 | 2878 | 2383 | 9680 |
| Outbound to Refinery Road | 424 | 24 | 206 | 926 | 2187 | 4106 | 7872 |
| Inbound from Refinery Road | 251 | 5 | 150 | 614 | 2532 | 3597 | 7148 |
| | | | | | | | |
| Magongo Road @ Kona Reli | | | | | | | |
| Inbound from Mkupe Jetty | 2046 | 361 | 251 | 1222 | 1227 | 1872 | 6978 |

| | Heavy Goods Vehicles | Empty Trucks/Tractors | Public Service Vehicles | Personal Vehicles | Motorbikes | Non- Motorized Transport | TOTAL |
|---------------------------|----------------------------|--------------------------|-------------------------------|----------------------|------------|--------------------------------|-------|
| Outbound from Mkupe Jetty | 1981 | 392 | 247 | 705 | 1508 | 1574 | 6406 |
| Inbound from Jomvu | 914 | 164 | 1119 | 1757 | 1815 | 1786 | 7554 |
| Outbound to Jomvu | 850 | 169 | 1530 | 1897 | 1811 | 1748 | 8004 |
| Inbound to Mainland | 615 | 78 | 1308 | 708 | 2289 | 1721 | 6720 |
| Outbound from Mainland | 3328 | 359 | 1799 | 2735 | 1703 | 1830 | 11753 |
| | | | | | | | |
| Magongo Road @ Shell | | | | | | | |
| Inbound to Changamwe | 596 | 7 | 3000 | 5145 | 2063 | 1962 | 12773 |
| Outbound from Changamwe | 245 | 50 | 909 | 2110 | 849 | 1706 | 5868 |
| Inbound from Airport | 1364 | 262 | 526 | 9948 | 2469 | 1660 | 16229 |
| Outbound to Airport | 1033 | 227 | 1765 | 7629 | 2405 | 2092 | 15151 |
| Outbound from Mainland | 129 | 1 | 1837 | 2286 | 3080 | 2434 | 9765 |
| Inbound to Mainland | 314 | 17 | 3259 | 4659 | 2041 | 864 | 11152 |

Source: Traffic Volume Surveys 2019



Matatu picking passengers at Shell along Airport Road



Pick up parked along Magongo Road at KCB



Mskiti Noor



Matatu picking up T dropping passengers at E



Motorcycle using the wrong side of the road along Airport Road



Handcart left unattended along the road opposite Shell along Airport Road



Delivery truck parked along the road at Mskiti Noor along Magongo ROad

Figure 3: Photo plate showing some of the causes of congestion along the project roads

Source: Field Survey May 2019



Truck parked along the Bomu Hospital Access Road

3. Truck Turnaround and User Satisfaction Surveys

3.1. Truck turnaround time (Inside the port)

A team of 64 enumerators using both manual data capture forms and CAPI (Mobile data collection) were stationed at gate 10, 12, 18/20 and gate 22. Using census methodology, the survey team recorded ALL truck number plates, date, time and type of trucks data for all trucks entering and leaving the port 24 hours a day for 14 days between 6th and 19th May 2019. The team included 12 supervisors covering 3 shifts (24 hours). The average daily traffic in and out of the port varies between 2000 and 3500 from Monday to Saturday. The traffic then drops on Sunday.



Figure 4: Average Daily Traffic Source: Field Surveys, 2019

Total number of trucks recorded

The below table summarizes all data captured during the two-week survey.

| | Table 9: Total number of recorded trucks | | | | | | |
|-------------|--|-------|-------------|--|--|--|--|
| Gates | IN | OUT | Grand Total | | | | |
| 10 | 2017 | 2119 | 4136 | | | | |
| 12 | 2138 | 641 | 2779 | | | | |
| 18 | 173 | 7075 | 7248 | | | | |
| 20 | 130 | 818 | 948 | | | | |
| 22 | 14419 | 6308 | 20727 | | | | |
| Grand Total | 18877 | 16961 | 35838 | | | | |

Source: Field Surveys, 2019



Figure 5: Summary of captured traffic per gate Source: Field Surveys, 2019

Turnaround time

The following turn around movements and average turnaround time was calculated from the field surveys.

| Table 10: Average | Truck turnaround | time at the | port |
|----------------------|------------------|---------------|------|
| 1 4010 101 11001 age | 1 | conte al cite | 2012 |

| Trucks | Entry gates | Exit gates | Average turn around |
|----------------------------|-------------|------------|---------------------|
| Transit trucks (import) | 22 | 18 | 3.72 hours |
| CFS Trucks | 22 | 20 | 5.26 hours |
| CFS Trucks | 22 | 22 | 5.19 hours |
| CFS Trucks | 10/22 | 10 | 4.82 hours |
| Export Trucks | 22 | 22/18 | 6.97 hours |
| Bulk Cargo trucks | 12/22 | 22/18 | 4.18 hours |

Source: Field Surveys, 2019

Gate processing time (exit)

Gate processing time was measured from the time the truck registers their documents with customs at the exit point until the time the truck exits.

| <i>Table 11: Gate Processing Time at Exit Gates</i> |
|---|
|---|

| Gate | Average processing time in minutes |
|---------|------------------------------------|
| Gate 18 | 27 Minutes |
| Gate 20 | 17 Minutes |
| Gate 20 | 28 Minutes |

Source: Field Surveys, 2019

3.2.Truck turn around to CFS stations

Purposive sampling was used to identify the CFS stations that would participate in the study. Truck number plates and time was captured when the CFS trucks exit the port gates, this was then compared to the time the truck arrived at the CFS station. Below are the target CFS stations identified for the study

- 1. Siginon- APM Terminals (Miritini- Mkupe road)
- 2. Compact CFS (Miritini- Furthest from the Port)
- 3. Regional CFS (Accessed through Port Reitz and A109)
- 4. Awanad (Accessed through A109)
- 5. MCT (Port Reitz- Closest to the Port)

The following:

| Table 12: Truck Turnaround Times at CFSs | | | | |
|--|-------------------------------------|--|--|--|
| CFS Station | Turnaround from Port to CFS station | | | |
| Awanad | 22Minutes | | | |
| МСТ | 17 Minutes | | | |
| Siginon APM | 36 Minutes | | | |
| Regional | 43 minutes | | | |
| Compact | 46 minutes | | | |
| | | | | |

Source: Field Surveys, 2019

3.3.CFS Dwell time

The consultants obtained data for January 2018 and January 2019 from the CFS stations. Two out of the 5 CFS stations provided the data as at 31st October 2019.

| CFS Station | Dwell time January 2018 | Dwell time January 2019 |
|-------------|-------------------------|-------------------------|
| Awanad | 10 Days | 20 Days |
| MCT | 11.14 Days | 11.2 days |
| Siginon APM | Yet to provide | |
| Regional | Yet to provide | |
| Compact | Yet to provide | |

Source: Field Surveys, 2019

3.4.User Satisfaction surveys

The initial user satisfaction survey was conducted earlier during the survey period in May 2019 focussing on the satisfaction of CFS truck drivers on the Port Reitz/Airport road (Completed road). Results of the initial survey are shared in the next section of this report.

This section presents the results of the user satisfaction survey was carried out for 5 days between 9th August and 15th August 2019. This is a repeat of the initial user satisfaction survey focussing on motorized and non-motorized road users for the **completed road** section (Port Reitz/Airport Road) and the **incomplete/under construction roads** (Magongo Road, Jomvu-Miritini-Mkupe Road, Kipevu Road and Mbaraki access Road).

During the survey, a team of six enumerators interviewed 532 road users over 5 days. 233 were non-motorized transport (NMT) & pedestrians while 299 were motorized transport comprising of motorcycles, public transport operators and private vehicles. The team randomly interviewed the various road users who consented to the interview.

- Sixty-eight percent (68%) of the respondents reside in Mombasa West.
- Four hundred (400) respondents were male (75%) and 132 females (25%).
- Thirty five percent (35% = 185) were pedestrians and the rest were other road users broken down as per the below pie chart.
- Ninety three percent (93%) of the respondents were Kenyan.
- Fifty percent (50%) of the respondents were secondary school graduates.
- The average age of the respondents was 32 years old.
- 32 % of the respondents were formally employed while 35% were self-employed.



Figure 6: Gender of Road Users interviewed and Road User by Mode

Source: Field Surveys, 2019

The below tables show the various categories of road users broken down per road.

| | Bicycle Rider | Pedestrian | Matatu Driver/Bus Driver | Taxis (Motor vehicles) | Tuk driver | Motorcycle Taxi (Boda boda) | Private vehicles | Light Truck/Pickup | Others, specify | Grand Total |
|------------------------------------|------------------------------|------------|--------------------------------|------------------------------|---------------|-----------------------------------|---------------------|-----------------------|--------------------|----------------|
| Incomplete | Incomplete Roads (Total=328) | | | | | | | | | |
| Jomvu- Miritini- Mkupe Jetty | 2 | 12 | 3 | | 3 | 5 | 3 | 3 | | 31 |
| Kipevu Road | 14 | 24 | 5 | 3 | 8 | 8 | 6 | 5 | | 73 |
| Magongo Road- A109 | 19 | 93 | 13 | 7 | 13 | 12 | 16 | 2 | | 175 |
| Mbaraki | 5 | 27 | | 2 | 7 | 3 | 4 | 1 | | 49 |
| Completed Road (Total=204) | | | | | | | | | | |
| Port Reitz/Airport Road | 8 | 29 | 27 | 26 | 36 | 23 | 25 | 29 | 1 | 204 |
| Grand Total | 48 | 185 | 48 | 38 | 67 | 51 | 54 | 40 | 1 | 532 |

Table 14: Respondents by Location and Mode

Source: Field Surveys, 2019

3.4.1. What was affected

The respondents were asked if security, traffic jams (congestion), number of accidents, cost of travel and travel time was affected. Respondents were asked whether the road has affected any of the above, **only the ones who responded YES got a follow up question** on whether it has increased, decreased or remained the same.

Below is a summary of the responses of how the above was affected. While Port Reitz/ Airport road is completed, Magongo Road and Kipevu road is under construction, Miritini/Mkupe and Mbaraki are at the planning phase (no road construction going on at the moment).



Figure 7: What has changed

Source: Field Surveys, 2019

| Completed Road | Increased | Remained the same | Decreased | Grand Total |
|--|---------------------------------------|--|---------------------------------------|---|
| Travel time | 59% | 0% | 41% | 100% |
| Cost of travel | 99% | 0% | 1% | 100% |
| No of accidents | 96% | 1% | 3% | 100% |
| Traffic Jams | 57% | 0% | 43% | 100% |
| Security | 90% | 1% | 9% | 100% |
| , | | | | |
| Incomplete Roads | Increased | Remained the same | Decreased | Grand Total |
| Incomplete Roads Travel time | Increased 78% | Remained the same 8% | Decreased 14% | Grand Total |
| Incomplete Roads Travel time Cost of travel | Increased 78% 79% | Remained the same 8% 8% | Decreased 14% 13% | Grand Total 100% 100% |
| Incomplete Roads Travel time Cost of travel No of accidents | Increased 78% 79% 33% | Remained the same 8% 8% 9% | Decreased 14% 13% 58% | Grand Total 100% 100% |
| Incomplete Roads Travel time Cost of travel No of accidents Traffic Jams | Increased 78% 79% 33% 61% | Remained the same 8% 9% 9% | Decreased 14% 13% 58% 30% | Grand Total 100% 100% 100% 100% |

Table 15: Summary Table of What has Changed

Source: Field Surveys, 2019

Completed road: Port Reitz/Airport Road

Incomplete Roads: Kipevu, Miritini Mkupe, Magongo Road and Mbaraki Road

Table 16: Summary table of what was affected

| Affected | |
|-----------------|---|
| Travel time | 78% of the users who frequently use the incomplete roads stated that |
| | there is an increase in travel time, compared to 59% on the completed |
| | roads. |
| Cost of travel | 79% of the users who frequently use the incomplete road stated that there |
| | is an increase in cost of travel, compared to 99% on the completed roads |
| No of accidents | 33% of the users who frequently use the incomplete roads stated that |
| | there is an increase in the number of accidents, compared to 33% on the |
| | completed roads |
| Traffic jams | 61%% of the users who frequently use the incomplete roads stated that |
| | there is an increase in travel time, compared to 57% on the completed |
| | roads |
| Security | 65% of the users who frequently use the incomplete roads stated that |
| | security has improved, compared to 90% on the completed roads |
| | Source: Field Surveys, 2019 |

Road construction is still going on at Kibarani/Makupa Causeway. Although this study **did not** focus on this section of the road, it is a critical link to Mombasa Island, most road users are affected by this construction as they travel to the central business district across the cause way. The Kibarani road works stretching to Makupa increases travel time and cost to Mombasa West.

3.4.2. Does the road have sufficient facilities?

The respondents were asked if the road has sufficient space or facilities. The below graph summarizes the results.



Figure 8: Sufficiency of the Incomplete Road

Source: Field Surveys, 2019





Source: Field Surveys, 2019

Table 17: Summary of findings on the sufficiency of the road

| Is the following Sufficient | All the below figures are an addition of agree + strongly agree |
|------------------------------------|---|
| Road size | 97% of the respondents who use the completed road either agree or strongly agree that the road size is sufficient compared to 57% for the incomplete roads. |
| Signage | 91% of the respondents who use the completed road either agree or strongly agree that the road signage is sufficient compared to 40% for the incomplete roads. |
| Parking space | 96% of the respondents who use the completed road either agree or |
| (Matatus/Bus Stop) | the incomplete roads. |
| Turning points | 97% of the respondents who use the completed road either agree or strongly agree that the turning points are sufficient compared to 46% for the incomplete roads. |
| Pedestrian walkways | 96% of the respondents who use the completed road either agree or strongly agree that the pedestrian walkways are sufficient compared to 48% for the incomplete roads. |
| Non-Motorized | 96% of the respondents who use the completed road either agree or |
| Transport | sufficient compared to 38% for the incomplete roads. |
| Road crossing | 64% of the respondents who use the completed road either agree or strongly agree that the road crossing facilities are sufficient compared to 47% for the incomplete roads. |
| Facilities for physically impaired | 70% of the respondents who use the completed road either agree or strongly agree that facilities for physically impaired are sufficient compared to 33% for the incomplete roads. |

Source: Field Surveys, 2019

3.4.2 Overall User Satisfaction

Sixty-six 66% of the road users who frequently use the completed road were satisfied/very satisfied compared to 41% for the incomplete roads. Except for Port Reitz Road which was recently expanded and completed, 59% of the road users on Magongo Road, Miritini, Kipevu and Mbaraki roads are either neutral or dissatisfied/very dissatisfied compared to 34% for the completed road.



Figure 10: Overall User Satisfaction of the Road

Source: Field Surveys, 2019





Source: Field Surveys, 2019



Figure 12: Overall Satisfaction with the Incomplete Roads

Source: Field Survey, 2019

Overall Satisfaction for the various road users

Table 18: Summary Table of Overall Satisfaction by Road Users

| Overall Satisfaction | All the below figures are an addition of satisfied + very satisfied |
|-----------------------------|---|
| Bicycle riders | 100% of Bicycle riders who use the completed road were either |
| | Satisfied or very satisfied compared to 43% for the incomplete roads. |
| Overall Satisfaction | All the below figures are an addition of satisfied + very satisfied | | |
|-----------------------------|---|--|--|
| Light Truck/Pickup | 34% of Light truck/pickup drivers who use the completed road were | | |
| drivers | either Satisfied or very satisfied compared to 45% for the incomplete | | |
| | roads. | | |
| Matatu Driver/ Bus | 59% of public transport drivers who use the completed road were | | |
| Driver | either satisfied or very satisfied compared to 33% for the incomplete | | |
| | roads. | | |
| Motorcycle taxi | 83% of motorcycle taxi riders who use the completed road were either | | |
| riders | satisfied or very satisfied compared to 29% for the incomplete roads. | | |
| Pedestrians | 93% of pedestrians who use the completed road were either satisfied | | |
| | or very satisfied compared to 46% for the incomplete roads. | | |
| Private Vehicles | 76% of private vehicles drivers who use the completed road were either | | |
| drivers | satisfied or very satisfied compared to 52% for the incomplete roads. | | |
| Taxis (Motor | 58% of taxi drivers who use the completed road were either satisfied or | | |
| Vehicles) drivers | very satisfied compared to 43% for the incomplete roads. | | |
| Tuk tuk drivers | 58% of tuk-tuk drivers who use the completed road were either | | |
| | satisfied or very satisfied compared to 32% for the incomplete roads. | | |
| Source: Field Survey, 2019 | | | |

The survey was designed to measure the satisfaction of the various road users. The completed road (Port Reitz/Airport road) has improved security while vehicle congestion (traffic jams) have improved marginally. The number of accidents, cost of travel and travel time has not improved. This is due to the fact that most of the other roads linking to the Port Reitz/Airport road are still under construction.

The same sentiments on traffic jams and number of accidents were echoed in the CFS truck drivers survey results in the next section. Although vehicles move faster through the completed road section, vehicles still have to go through the incomplete road sections. The above result table shows that general satisfaction is relatively lower for Light trucks, matatus, taxis and tuk-tuks, since they constantly have to navigate the incomplete road sections.

3.1. User Satisfaction survey (CFS Trucks only)

The user satisfaction survey was administered in April 2019 targeting 187 CFS truck drivers at Gate 20. This gate was selected because it processes the majority of the CFS trucks. All trucks exiting through Gate 20 carry containers destined for Container Freight Stations (CFS).

More than 40 interviews were left incomplete as the drivers had to leave before the interview was complete, the data was however not included in the final analysis. This survey focussed on truck drivers only and the questions were tailored to measure the user satisfaction of the completed Port Reitz/Airport road. Eighty-eight 88% (165 of 187) of the drivers come to the port at least once per day. The respondents have been truck drivers for an average of 9 years. Thirty-eight (38%) of the respondents often use Port Reitz/Magongo road. Due to the partial closure of Kipevu road, over 90% of the CFS trucks enter through gate 22 (Port Reitz) and leave the port through Gate 20 (Kipevu).



Figure 13: Preferred entry and exit Gates by Truck Drivers Source: Field Surveys, 2019

The following data summarizes their satisfaction with the completion of Port Reitz/Airport roads.

CFS truck drivers when asked about the impact of the Port Reitz/Airport road were satisfied with the road size, quality of road and improved security. Drivers indicated that there has been marginal improvement traffic jams and the number of accidents, this can be attributed to the various ongoing road works on the frequently used roads, the Mombasa-Nairobi road A109 and Magongo road.

| | Reduced Accidents | Delays due to traffic jams reduced | Improved Security | Road Very Well done | Road size adequate |
|-------------------|----------------------|---|----------------------|------------------------|-----------------------|
| Strongly agree | 3.21% | 10.70% | 4.81% | 6.95% | 4.28% |
| Agree | 41.71% | 38.50% | 64.71% | 80.75% | 82.89% |
| Neutral | 12.83% | 5.88% | 11.23% | 6.95% | 6.95% |
| Disagree | 18.72% | 25.67% | 8.02% | 3.74% | 4.28% |
| Strongly disagree | 20.86% | 19.25% | 2.14% | 1.60% | 0% |
| Not sure | 2.67% | 0% | 9.09% | 0% | 1.60% |
| Grand Total | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

| Table 10: | Impact | of the d | completion | of Port | Rietz | Road | and Air | mort Road |
|-----------|--------|-----------|-------------|---------|-------|------|---------|-----------|
| 1000 19. | impuce | j inc c | Jonipiction | 011011 | mou | nouu | unu 111 | porthouu |

Source: Field Surveys, 2019

Majority of the CFS truck drivers were satisfied with the Pedestrian space on the road, parking, junctions and signage. They however stated that the road does not have sufficient space for the physically impaired road users.



Figure 14: Opinions on the completion of Port Rietz and Airport Roads Source: Field Surveys, 2019

| | Adequate Signage | Sufficient Junctions | Road/parking space sufficient | Facilities for Physically impaired | Sufficient space for Pedestrian and NMT |
|-------------------|---------------------|-------------------------|-------------------------------------|---|--|
| Strongly agree | 3.21% | 0.53% | 1.08% | 1.60% | 0.53% |
| Agree | 78.61% | 62.57% | 64.86% | 17.65% | 76.47% |
| Neutral | 6.95% | 13.37% | 9.19% | 16.04% | 4.81% |
| Disagree | 9.63% | 20.32% | 22.70% | 49.73% | 14.44% |
| Strongly disagree | 0% | 0.53% | 0.54% | 10.70% | 3.21% |
| Not sure | 1.60% | 2.67% | 1.62% | 4.28% | 0.53% |
| Grand Total | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

Table 20: Impact of the completion of Port Rietz Road and Airport Road

Overall satisfaction

The following is the overall satisfaction after the completion of Port Reitz and Airport road. The CFS truck drivers were satisfied with the quality and facilities on the newly constructed Port Reitz-Airport Road.



Figure 15: Overall Satisfaction Source: Field Surveys, 2019

3.2.Cargo Volumes

During the survey period, data on cargo volumes moved from the Port of Mombasa was also collected from the port records.

| | Rail | | Road | | CFS | |
|-------------------|--------------|-----------------|--------------|---------------|-----------|-----------------|
| | Distance | Weight (ton) | Distance | Weight (ton) | Distance | Weight (ton) |
| Dangerous | 104,118.00 | 5,330.62 | 143,376.00 | 2,678,359.00 | 1,332.40 | 1,531.17 |
| General | 2,829,985.00 | 140,975.22 | 3,231,986.00 | 58,216,186.00 | 61,964.80 | 82,243.48 |
| Over Dimension | 469.00 | 6.38 | 31,735.00 | 560,560.00 | 267.84 | 267.84 |
| Reefer | 469.00 | 13.74 | 21,507.00 | 347,104.00 | 908.21 | 908.21 |
| Reefer & DG | - | - | 2,304.00 | 17,590.00 | - | - |
| Grand Total | 2,935,041.00 | 146,325.95 | 3,430,908.00 | 61,819,799.00 | 64,473.24 | 84,950.70 |

| Table 21: Summary | Table of Volum | e of Cargo moved |
|-------------------|----------------|------------------|
|-------------------|----------------|------------------|

Source: Field Survey, 2019

From the table above, 61 million tons of cargo was evacuated by road to various destinations in the EAC. CFSs within Mombasa handled a further 84,950.70 tons of cargo.

4. Socioeconomic Survey

4.1. Quantitative survey -Household survey

1. Sampling Frame

A sampling frame was constructed to include areas that are within a radius of 0.5km of the roads. All Enumeration Areas (EAs) as defined by Kenya National Bureau of Statistics (KNBS) that fall with the radius will provide base for sub subsequent sampling.

2. Sample Size

The sample size calculation will be based below formula:

$$n = Deff \times \frac{Z_{\alpha/2}^2(p^{-1} - 1)}{\varepsilon^2}$$

where *n* is the number of individuals; *p* is the estimated prevalence rate or proportion; $Z_{\alpha/2}$ is the $\alpha/2$ quintile of the standard normal distribution, with $Z_{\alpha/2} = 1.96$ when a 95% confidence interval is requested; ε is the relative margin of error expected; *Deff* is the design effect.

Using the values of $Z_{\alpha/2} = 1.96$, Deff = 2 (due to clustering), $\varepsilon = 0.09$ and p = 0.5 the calculation yields 484 and further adjusting for 10% expected non response the target sample was **532** individuals.

3. Sampling procedure

The two-stage cluster sampling methodology was undertaken as follows.

- 1. *First stage:* Using a uniform sample take of 30 households per cluster, the study will require **18 clusters** to be sampled. The clusters for the study will be Enumeration Areas (EAs) as defined and created by KNBS. All the EAs within each stratum will first be sorted by unique geographical ID. A probability proportional to size (PPS) with number of households from the census be the measure of size will then be used to select the 18 EAs. The maps showing the boundaries of the selected EAs will be requested from KNBS.
- 2. *Second Stage:* Once the EAs are selected, a random walk method will be adopted to select the 30 households for the study. Any responsible adult member of the household can be a respondent for the survey. Each household was **assigned a number** between 100 and 999. These numbers and the respondents contact numbers will assist in identifying the household panel for a repeat end-line survey in the year 2020.

Map showing enumerated households.



Figure 16: Map Showing Household Survey Locations Source: Field Survey, 2019

| Location | Sub Location | KNBS Enumeration Area Name | Latitude | Longitude |
|------------|--------------|---|----------|-----------|
| PORT REITZ | PORT REITZ | BOKOLE NURSERY ESTATE | -4.02147 | 39.60793 |
| PORT REITZ | PORT REITZ | WAYANI | -4.01801 | 39.61303 |
| PORT REITZ | PORT REITZ | NAROK | -4.02068 | 39.61734 |
| PORT REITZ | PORT REITZ | KWA HOLA | -4.02585 | 39.61517 |
| CHAANI | CHAANI | MBUYUNI UPPER | -4.03284 | 39.62487 |
| CHAANI | CHAANI | MIGADINI | -4.0333 | 39.62166 |
| CHAANI | CHAANI | KALAHARI/KIBARANI | -4.02881 | 39.62974 |
| PORT REITZ | PORT REITZ | KRA | -4.02896 | 39.61269 |
| PORT REITZ | PORT REITZ | AIRPORT | -4.03022 | 39.6098 |
| PORT REITZ | PORT REITZ | MWANGOZI 'B' | -4.02733 | 39.60851 |
| CHANGAMWE | CHANGAMWE | HAMISI | -4.0208 | 39.62826 |
| CHAANI | CHAANI | KWA HOLA | -4.02598 | 39.62023 |
| CHAANI | CHAANI | MSIKITI NOOR | -4.02426 | 39.62244 |
| CHAANI | CHAANI | CHAANI CENTRE | -4.02992 | 39.62779 |
| MIRITINI | MIRITINI | STATION | -4.00466 | 39.57431 |
| MIRITINI | MIRITINI | VIKOBANI 'B' | -4.01335 | 39.58927 |
| MIRITINI | MIRITINI | CHAMUNYU'B' | -4.01173 | 39.60089 |
| GANJONI | GANJONI | MARELINI (Replaced by HH in Mombasa West) | -4.06983 | 39.66394 |

Table 22: Sampled Clusters

This is a repeat survey conducted by a team of 8 enumerators for 6 days between 18th and 23rd August 2019. This was a repeat household survey targeting a larger sample size of 642 households after the May 2019 household survey had captured 227 households. Below are the results of the survey:

- The team interviewed 642 Household respondents out of which 300 were female and 342 males.
- Forty percent (40%) of the respondents attained secondary school education. while 21% attained primary school and 23% tertiary education.
- Sixty one percent (61%) of the respondents were household heads while others were related to the household head.
- Sixty four percent of the respondents moved into the settlement before the road construction began.
- Seventy four percent (74%) are rent paying tenants.
- Sixty nine percent (69%) work around Mombasa west.



Figure 17: Respondents by Gender and Education Level

Source: Field Surveys, 2019

Table 23: Frequently Used by the Respondents

| Section of road (Complete and Incomplete) | Female | Male | Grand Total |
|---|--------|------|-------------|
| Magongo Road (to A109 Jomvu) (Incomplete) | 168 | 146 | 314 |
| Miritini/Jomvu Mkupe Jetty (Incomplete) | 19 | 66 | 85 |
| Port Reitz/ Airport Road (Completed) | 113 | 130 | 243 |
| Grand Total | 300 | 342 | 642 |

Source: Field Surveys, 2019

Note: Completed road means the road expansion and construction works were concluded successfully and the road is open for use. The incomplete road section means the works are either partially complete (Magongo Road to A109) or the construction works are at the planning phase (Miritini/Jomvu to Mkupe Jetty)



Figure 18: What has been affected? Source: Field Surveys, 2019

Table 24: Summary table of the Effect of the Road

| Has the road affected | Increased/ Reduced/ Rem | Comment |
|-------------------------------|-------------------------|---|
| | Same | |
| Job Opportunities | 50% Increased | 66% of the respondents who frequently |
| | 42% Decreased | use the completed road indicated there |
| | 8% Remained the same | a decrease in Job opportunities contrary |
| | | to 64% from incomplete roads indicated |
| | | an increase. |
| Business opportunities | 43% Increased | 72% of the respondents who frequently |
| | 48% Decreased | use the completed road indicated there |
| | 9% Remained the same | a decrease in business opportunities |
| | | contrary to 60% from incomplete roads |
| | | who indicated an increase. |
| Earnings (how much they make) | 28% Increased | 57% of the respondents who frequently |
| | 24% Decreased | use the completed road indicated their |
| | 47% Remained the same | earning have remained the same |
| | | compared to 43% from incomplete roads |
| Land value (Price of land) | 48% Increased | 51% of the respondents who frequently |
| | 12% Decreased | use the completed road indicated there |
| | 40% Remained the same | an increase in the value of land |
| | | compared to 48% from incomplete roads |
| Rent value (rent) | 49% Increased | 50% of the respondents who frequently |
| | 12% Decreased | use the completed road indicated there |
| | 39% Remained the same | an increase in rental rates compared to |
| | | 48% from incomplete roads. |



Figure 19: Effect on use of road

Table 25: Summary table of impacts of the road

| Has the road affected | Increased/ Reduced/ Rem | Comment |
|-----------------------|------------------------------|---|
| | Same | |
| Price of goods | 41% Increased | 46% of the respondents who |
| | 13% Decreased | frequently use the completed road |
| | 46% Remained the same | indicated the price of goods |
| | | remained the same compared to |
| | | 49% from incomplete roads who |
| | | indicated that goods prices have |
| | | increased (46% indicated that |
| | | prices remained the same) |
| Price of Services | 32% Increased | 51% of the respondents who |
| | 15% Decreased | frequently use the completed road |
| | 53% Remained the same | indicated there an increase in price |
| | | of services compared to 53% from |
| | | incomplete roads. |
| Access to transport | 39% Increased | 50% of the respondents who |
| | 12% Decreased | frequently use the completed road |
| | 50% Remained the same | indicated that access to transport |
| | | has remained the same compared |
| | | to 49% from incomplete roads. |
| Traffic jams (Vehicle | 31% Increased | 82% of the respondents who |
| congestion) | 44% Decreased | frequently use the completed road |
| | 25% Remained the same | indicated there is a decrease in |
| | | traffic jams compared to 22% from |
| | | incomplete roads. |
| Pedestrian congestion | 20% Increased | 56% of the respondents who |
| | 43% Decreased | frequently use the completed road |
| | 37% Remained the same | indicated there an increase in |
| | | pedestrian congestion compared to |
| | | 26% from incomplete roads. |



Figure 20: Impacts of the roads to health, crime, accidents, noise and air pollution

| Has the road affected | Increased/ Reduced/ Rem | Comment |
|-----------------------|--|---|
| | Same | |
| Number of accidents | 38% Increased 32% Decreased 30% Remained the same | 56% of the respondents who frequently use the completed road indicated there an increase in number of accidents compared to 24% from incomplete roads. |
| Air pollution | 51% Increased 20% Decreased 29% Remained the same | 61% of the respondents who frequently use the completed road indicated there an increase in air pollution compared to 44% from incomplete roads. |
| Noise pollution | 61% Increased 18% Decreased 21% Remained the same | 67% of the respondents who frequently use the completed road indicated there an increase in noise pollution compared to 57% from incomplete roads. |
| Affected crime | 42% Increased 34% Decreased 24% Remained the same | 54% of the respondents who frequently use the completed road indicated that crime has decreased , contrary to 44% from incomplete roads who indicated that crime has increased . (20% from incomplete roads indicated crime has decreased) |
| Affected health | 54% Remained the same 25% worsened 21% Improved | 67% of the respondents who frequently use the completed road indicated their health has |

| Has the road affected | Increased/ Reduced/ Rem Same | Comment |
|-----------------------|---------------------------------|---|
| | | remained the same compared to 40% from incomplete roads. |



Figure 21: Impact to access to goods and services, education, housing, and quality of life Source: Field Surveys, 2019

| Table 27: Summary table on Impact to access to goods | and services, education, | housing, and | quality of life |
|--|--------------------------|--------------|-----------------|
|--|--------------------------|--------------|-----------------|

| Has the road affected | Increased/ Reduced/ Rem | Comment |
|---|--|---|
| | Same | |
| Access to health facilities | 66% Remained the same 29% Improved 6% Worsened | 64% of the respondents who frequently use the completed road indicated there an access to health facilities remained the same almost similar to 67% from incomplete roads. |
| Access to education facilities | 68% Remained the same 22% Improved 10% Worsened | 62% of the respondents who frequently use the completed road indicated there an access to education facilities remained the same similarly 62% from incomplete roads. |
| Access to goods and services facilities | 62% Remained the same 20% Improved 18% Worsened | 62% of the respondents who frequently use the completed road indicated there an access to goods and services remained the same , similarly62% from incomplete roads. |
| Housing demand | 51% Increased 14% Decreased 36% Remained the same | 57% of the respondents who frequently use the completed road indicated there an increase in |

| Has the road affected | Increased/ Reduced/ Rem | Comment |
|-----------------------|-------------------------|---|
| | Same | |
| | | housing demand to 46% from |
| | | incomplete roads. |
| Quality of life | 49% Remained the same | 54% of the respondents who |
| | 37% Improved | frequently use the completed road |
| | 14% Worsened | indicated the quality of life has |
| | | i mproved contrary to 60% from |
| | | incomplete roads who indicated |
| | | the quality of life has remained the |
| | | same. |

A similar survey will be repeated once Magongo Road and Miritini Road are completed. This study was conducted during a period of economic changes in Mombasa West. The economic changes are as a result of the increased container off take by the Standard Gauge Railway (SGR) cargo train. As of December 2018, the SGR was moving between 12,000 to 14,000 TEUs per month (Twenty Foot Equivalent). This has negatively impacted the trucking industry and Container Freight Stations (CFS) business, a major economic driver around Mombasa West.

The completion of Port Reitz/Airport road has improved vehicle congestion and improved security. Earnings, Access to transport, goods and services, health care facilities and education facilities remain unchanged. Business opportunities and job opportunities have reduced, while rent, demand for housing, house rent, and price of land has increased. While respondents reported an increase in the number of accidents, noise pollution and air pollution 54% of the respondents reported improvement in the general quality of life.

Respondents from the incomplete Magongo Road and Miritini-Mkupe road reported an increase in job and business opportunities however reported their earnings to have remained the same. The respondents also reported a reduction in the number of accidents while traffic jams, noise and air pollution has increased. Price of land, rental and housing demand has increased in the area owing to the proximity to town and the potential the area provides once the roads are completed. 60% of the respondents from this area reported that the general quality of life has remain unchanged.

4.2. Socio Economic - Business survey

Two hundred and Twelve (212) businesses were surveyed in May 2019. The businesses were all situated along the Port Reitz/Airport road and Magongo Road. Businesses in Miritini/Mkupe road did not consent to participate in the survey. This survey focussed on the completed Port Reitz road and the impact the road has had on their business.



Figure 22: Map Showing Location of Business Surveys Source: Field Survey, 2019

The following were the results of the survey. 69% of the businesses were there before the road construction. Businesses have been in operation for an average of 7 years.



Figure 23: Period when the business was situated in the study area Source: Field Surveys, 2019

Majority of the respondents were retailers (Kiosks 15% and Shops 15%). This is evident in the character of the businesses that front the project roads. Other businesses as indicated in the graph below were filling stations, internet cafes, construction work, handicraft vendors, mobile money kiosks etc.



Figure 24: Type of Business



- 65% of the respondents were male while 35% were female.
- 38% of the respondents were business owners, the rest were employees.
- Forty nine percent of the respondents were Secondary school graduates while 27% attained college/University education.
- 49% of the respondents had their businesses there before the construction of the Port Reitz/Airport Road.
- The businesses employed an average of 3 employees (temporary and permanent).



Figure 25: Nature of impact of the road construction on the businesses Source: One Thousand Alternatives

While majority of the respondents agreed that the completion of the Port Reitz/ Airport Road has affected security, accidents, traffic jams and profitability; 60% of the respondents indicated that this has not affected the number of people they hire. 40% of the respondents also indicated that the road has NOT affected the cost of labour.



Figure 26: Nature of Impact of the Road Construction on livelihoods Source: User Satisfaction Survey 2019

Respondents reported a decrease in the number of accidents and congestion. According to the respondents, there has been an increase in the cost of production; Competition, premise rent and cost of labour. Cost of transport is also on the rise. However, due to ease of accessibility by customers and suppliers, increase in the number of customers and improvement in delivery times, the businesses profitability has therefore increased. The completion of the Port Reitz/ Airport road has therefore positively impacted the businesses in the area.

5. GHG Emissions

5.1. Introduction

In the 21st century, anthropogenic global warming is considered to be a first-degree environmental challenge (United Nations, 1992). Uncertainties remain in relation to the scale and extent of GHG emissions from a particular sector of the local, national and global economy. Greenhouse Gas Emissions (GHGs) from transportation sector contribute about 7% of all emissions globally. International freight transport alone accounts for over 40% of the entire global transport emissions. From the foregoing, proactive measures and strategies should be employed to reduce GHGs in the transpiration sector. The Kenyan government launched a revision process of its National Climate Change Action Plan (NCCAP, Government of Kenya 2013) in November 2017. The first NCCAP identified a number of priority mitigation actions for the transport sector (e.g. Bus Rapid Transit (BRT) and Light Rail Transit system implementation in Nairobi, passenger vehicle stock efficiency, improving HGV stock efficiency, bioethanol, biodiesel and shift of freight from road to rail).

Recently, the environmental concerns from transport have gained a lot of traction globally to move local, regional and international economic factors of production to low-carbon growth paths and reduce the carbon footprint. Acknowledging this new approach and guided by the Northern Corridor Green Freight Programme, TMEA is developing a climate resilient low-carbon green northern corridor approach and plan for transport sector in collaboration with Northern Corridor Transit and Transport Coordination Authority (NCTTCA) and other stakeholders.

5.2. Methodology

GHGs measurement can be done in three main ways:

- 1. By Recording emissions at source,
- 2. By continuous emissions measuring and

3. By estimating emitted quantity using activity data (such as the volume of fuel consumed, distance covered) and applying derived conversion factors (such as calorific values, emission factors etc.)

For the purpose of undertaking this study, the Consultant adopted the activity data approach. The Consultant collected data on truck movements continuously for 14 days in and out of the port broken down into seven categories as illustrated in Table 4. This sample was assumed to be representative and was used to calculate the emission.

Emissions from local movements of the trucks mainly comprised of trips between the CFS Stations within the County and the Port were calculated on the basis of the actual distance using the preferred roads by the drivers from the various gates. For these trips, we there was an average of 30 minutes idling time. Emission factors appropriate to the vehicle types were used. It is noteworthy that the vehicle types used for local shunting were older, less fuel efficient and were either trucks or tractors.

For the calculation of the emissions captured the number of trucks, the Consultant adopted the GHG emission factors that were utilized for the Port of Mombasa – Emissions Inventory Baseline Report (June 2017), NCTTCA in Partnership with UNEP, KPA and KMA. The total GHG inventory for the 2017 Emissions inventory was 4,178,958.00 CO₂ kg and 14,903.68 NO_x kg emissions¹

¹ The Port of Mombasa – Emissions Inventory Baseline Study, June 2017

based on a sample of 580 HGV accessing the port of Mombasa. The consultant captured the number of trucks, tonnage transported, average distance travelled, this was be multiplied by the emission factor kilometre

| Emission type | Emission Factor (HGV) |
|----------------------|------------------------------|
| NO _x | 3.52g/km |
| CO_2 | 987g/km |

Table 28: Emission factors for Heavy Goods Vehicles (HGV)

Source: The Port of Mombasa - Emissions Inventory Baseline Survey 2017

The Consultant collected data with respect to the destination for the cargo trucks (either delivering cargo to CFS, destinations within the Kenya or Exports to the EAC Region) and the weight of what the trucks are carrying since this data is available when the truck is departing the port. It is however important to note that as expected, data availability and quality was less robust with respect to the real address of the final destination. The available data mainly indicated the address of the clearing agent, who in most cases was based in Mombasa. However, we were able to get the Country the goods were destined to. A number of assumptions were therefore made to enable the GHG inventory calculation. These include estimating distances travelled by freight, and selecting average emissions factors for each transport type.

The total GHG inventory for road transport destined to countries within the EAC the Survey period is $3,386,306,196.00 \text{ kg CO}_2$ emissions and $12,076,796.16 \text{ kg NO}_x$ emissions. The average daily emission is estimated at $1,252,332.17 \text{ kg CO}_2$ and $4,466.27 \text{ kg NO}_x$ emissions from a total of 2704 trucks captured during the survey period. The total distance over which freight cargo was transported was 3,430,908 km. This cargo was destined to various locations in Kenya, Uganda, Tanzania, South Sudan, Somalia, Sudan and Rwanda.

| Destination | Emission Level (kg) CO2 | Emission Level (kg) NO _x |
|------------------------------|----------------------------|---|
| Democratic Republic of Congo | 402,746,337.00 | 1,436,339.52 |
| Kenya | 9,870.00 | 35.20 |
| Rwanda | 71,310,750.00 | 254,320.00 |
| Sudan | 9,880,857.00 | 35,238.72 |
| Somalia | 17,450,160.00 | 62,233.60 |
| South Sudan | 450,966,222.00 | 1,608,309.12 |
| Tanzania | 50,739,696.00 | 180,956.16 |
| Uganda | 2,383,202,304.00 | 8,499,363.84 |
| Grand Total | 3,386,306,196.00 | 12,076,796.16 |

Table 29: Total GHG Emission by Destination within the EAC Region

Source: Field Surveys, 2019

The Consultant also collected data with respect to the total GHG inventory for road transport destined to the various CFS Stations located within Mombasa County, EPZ in Nairobi and Military supplies during the survey period. The average daily emission is estimated at 18,966.74 kg CO₂ emissions and 67.64 kg NO_x emissions. The total emissions to these destinations during the survey period 3582 truck that captured was 67,919,911.50 kg CO₂ emissions and 242,227.40 kg NO_x

emissions. The total distance covered by the trucks to these destinations during the survey period was 68,814.50km destined to the various destinations within Mombasa County, EPZs and the Armed Forces Ordinance.

| DESTINATION | CO ₂ | NOx | Distance (km) |
|-----------------------------------|-----------------|-----------|------------------|
| Armed Forces Ordinance | 00 551 00 | 116.16 | |
| Autoports Freight Terminals Ltd | 32,5/1.00 | 110.10 | 33.00 |
| Arrange | 1,135,148.70 | 4,048.35 | 1,150.10 |
| Awanad | 846,846.00 | 3,020.16 | 858.00 |
| Bahari | 60.009.60 | 214.02 | 60.80 |
| Bata | | | |
| Boss Freight | 4,113,816.00 | 14,671.36 | 4,168.00 |
| | 2,705,564.40 | 9,649.02 | 2,741.20 |
| Compact Freight Systems Ltd. | 4,952,667.30 | 17,663.01 | 5,017.90 |
| Consolbase | 328,177,50 | 1.170.40 | 332.50 |
| Damco | 7 121 205 00 | 25 206 80 | 7 915 00 |
| Focus Container Station | /,121,205.00 | 25,390.00 | /,215.00 |
| Coorino Agonaios Itd | 620,033.40 | 2,211.26 | 628.20 |
| | 53,298.00 | 190.08 | 54.00 |
| Great Lakes APM | 202,532.40 | 722.30 | 205.20 |
| Interpel | 618 849 00 | 2,207.04 | 627.00 |
| Kuehne | 80.009.00 | 2,207.04 | <u> </u> |
| Makupa Transit Shade Ltd. | 82,908.00 | 295.08 | 84.00 |
| MCT | 894,616.80 | 3,190.53 | 906.40 |
| | 319,195.80 | 1,138.37 | 323.40 |
| Midwave Freighters Ltd. | 5.922.00 | 21.12 | 6.00 |
| Mitchell Cotts | (,,) | | |
| Mombasa Island Cargo Terminal Ltd | 651,420.00 | 2,323.20 | 660.00 |
| | 644,313.60 | 2,297.86 | 652.80 |
| Multiple Hauliers | 302,022.00 | 1,077.12 | 306.00 |
| Neema Parcels Limited | 7,994.70 | 28.51 | 8.10 |
| New Wide Garments Kenya EPZ Ltd. | 17 065 374 00 | 64 071 04 | 18 202 00 |
| Portside | 1/,900,0/4.00 | 04,0/1.04 | 10,202.00 |
| Quick Movers Kenya Limited | 1,736,725.20 | 6,193.79 | 1,759.60 |
| | 7,106.40 | 25.34 | 7.20 |

Table 30: Total GHG Emission by Destination

| DESTINATION | CO ₂ | NOx | Distance |
|------------------------------------|-----------------|------------|-----------|
| | | | (km) |
| Rapid Kate | | | |
| - | 1,388,709.00 | 4,952.64 | 1,407.00 |
| Regal Freighters | | | |
| | 16,581.60 | 59.14 | 16.80 |
| Regional | | | |
| | 2,447,760.00 | 8,729.60 | 2,480.00 |
| Shipmarc Clearing & Forwarding Ltd | | | |
| | 5,823.30 | 20.77 | 5.90 |
| Siginon Freight | | | |
| | 3,777,446.40 | 13,471.74 | 3,827.20 |
| Speedex | | | |
| | 5,146,218.00 | 18,353.28 | 5,214.00 |
| Trans Freight | | | |
| _ | 10,067.40 | 35.90 | 10.20 |
| Ufanisi | | | |
| | 6,909.00 | 24.64 | 7.00 |
| United Aryan | | | |
| - | 9,712,080.00 | 34,636.80 | 9,840.00 |
| Grand Total | | | |
| | 67,919,911.50 | 242,227.04 | 68,814.50 |

From the foregoing, it was evident that there were more emissions accrued from the local freight within Mombasa. As earlier observed, the local shunting trucks were also older compared to the newer fleet used for ferrying freight cargo inland to Kenya or the EAC Region.

5.3. Combating GHG emissions

Over the years, there has been a projected exponential increase in GHG emissions between 2015 -2020^2 . The main reason for this increase is the increase of new registrations of motor vehicles, which is developing in parallel with the projected population growth, along with constant mileage being assumed constant. This leads to a strong increase in emissions of road transportation by 2050, and consequently, to rising annual mitigation potentials up to 2050. The relevance of freight transport in Kenya is very high. Thus, emissions from freight transport account for a large share of Kenya's road transport emissions. Therefore, measures not linked to the efficiency of the engine (like optimization of superstructures or tyres, reduced road roughness, eco-driving, etc.) can still have a major impact.

Several proposals exist, best on best practices from other nations, to aid in the reduction of GHG emissions and these can be summarized as;

- 1. Improvement of fuel efficiency
 - National legislation can be utilized in an attempt to improve vehicle fuel efficiency. Such an example is the Corporate Average Fuel Economy (CAFÉ) Standards Programme in the United States. This requires car manufacturers producing cars and light trucks in the United States to meet a fuel economy standard for new vehicles on a fleet average basis.
 - Voluntary Agreements amongst the various stakeholders can also go a long way in the reduction of emissions. Such agreements can be between the car

² Greenhouse gas emissions from the transport sector: Mitigation options for Kenya 2018, GIZ

manufacturers and Kenya or the EAC similar to the European Union's CO_2 from Cars Strategy that aimed to reduce average CO_2 emissions from new passenger cars to 140 g/km by 2005 or 2010 at the latest

- Fiscal policies can also be put in place to encourage consumers to purchase more fuel-efficient vehicles, to reduce reliance on motorized modes and also to drive in a more fuel-efficient manner. The United Kingdom introduced a graduated annual registration tax (Vehicle Excise Duty) for new cars from March 2001. Cars are categorised into one of four bands based on their rate of CO_2 emissions. Cars using cleaner fuels and alternative fuel technology (initially those run on road fuel gas, bi-fuel, dual fuel and hybrids) will receive an extra discount. Within each band, there is also a supplement for diesel cars to reflect their higher emissions of particulates and other pollutants that damage local air quality. Existing cars will be separated into two groups depending on engine size (as a rough proxy for CO_2 emissions). Those with an engine size of 1549 cc or less will pay a lower rate
- Canada has an EnerGuide Labelling Programme developed jointly by government and industry. Under this programme, automobile manufacturers voluntarily affix fuel consumption labels to new vehicles offered for sale. The label will show the estimated fuel consumption of the vehicle as well as the fuel cost for 20 000 km. Consumers will be able to compare the average city and highway fuel consumption ratings of all new cars, vans and light duty trucks and also to assess the potential economic and environmental savings that can be realised by choosing to purchase one vehicle over another. This initiative operates in conjunction with the Fuel Consumption Guide that provides vehicle buyers with fuel efficiency information for all new vehicles. Such can also be implemented locally in conjunction with can assembly and manufacturing industries both locally and internationally.

2. Traffic Demand Management

- Initiatives that go a long way in the improvement of road traffic flow, reduce transport demand and promote a switch in modes shall go a long way in the reduction of GHG emissions. Such initiatives include staggering work hours so as to alleviate congestion during the peak hours, electric toll collection and road pricing (congestion charging). The CO_2 benefits of such policies as the switch in transport modes depend on the fuel efficiency of trains relative to cars, trucks and buses.
- 3. Alternative fuels and technologies A number of alternative fuels and technologies are being developed that have the potential to significantly reduce CO₂ emissions and local air pollutants. Several countries have incentives in place to encourage the uptake of such vehicles. These include:
 - Fiscal incentives for the purchase of such vehicles.
 - Support for the research and technological development of alternatively powered vehicles.
 - Obligations to purchase alternatively powered-vehicles.
- 4. Combination of measures

Most countries have adopted a combination of the above policies and measures as part of a comprehensive strategy to reduce CO₂ emissions. The United Kingdom has adopted a combination of fiscal and labelling measures to back up the European Commission voluntary agreements, as well as providing support for alternative fuels and technologies.

• Voluntary agreements between the European Commission and European, Japanese and Korean car manufacturers.

- Graduated Vehicle Excise Duty (described in Chapter 3 above).
- Company Car Taxation
- Consumer information this will consist of a combination of the labelling directive and public advertising campaigns and civic education
- Powershift Programme this can be a government-funded programme to help encourage the development of a market for clean fuel vehicles in the County.
- Energy Efficiency Best Practice Programme (EEBPP) this programme can be aimed at promoting greater fuel efficiency within the road haulage and bus industries.

A wide range of policies and measures can be pursued to reduce CO₂ emissions from road transport in the county. There is varying emphasis on the different components of the transport system. However, many countries have similar approaches to the policies and measures expected to produce the largest reductions in CO_2 emissions:

- Fiscal measures (e.g., fuel taxes, vehicle taxes) and other incentives to encourage the purchase of more fuel-efficient vehicles.
- Voluntary agreements with vehicle manufacturers to reduce the fuel consumption of new vehicles.
- Usage charges to encourage reduction in CO₂ emissions through more efficient use of transport vehicles.

The approaches taken by many countries show that there is support for packages of policy measures which address issues on a national, state and local basis and provide consistent incentives to the transport industry and to transport users to pursue more sustainable transport activity. However, there are relatively few examples of national policies and measures taken by national governments to reinforce actions being taken by industry and individuals.

While there are ex post evaluations of local experiments, given the different policy frameworks and circumstances in different geographic regions, countries and cities, it is clear that what works for one country/city will not necessarily work for another.

It is also clear that the majority of the examples provided by different countries are aimed at reducing CO₂ emissions from passenger cars. Analysis of the relative contributions from passenger and freight transport and their respective growth projections indicates that freight is a very important sector that will require the implementation of specific measures to reduce the forecast contribution of freight to global emissions.



ANNEXURES Annex 1: Business Questionnaire

BUSINESS QUESTIONNAIRE FOR THE BASELINE AND END OF PROJECT SURVEYS FOR MOMBASA WEST ROADS IMPROVEMENT PROGRAMME AND MOMBASA COUNTY PORT ACCESS ROADS

APRIL 2019

Household Questionnaire

| Consent Form | L | | |
|----------------|---|----|---|
| Enumerator's | id number: | | |
| Supervisor's I | D: | | |
| Date (Day, Mo | nth, Year): Time: | | |
| | | | |
| Surv | ey Location coordinates: | | |
| Surve | ey Location 1. Chaani 2. Port Reitz | | 3. Magongo 3. Mbaraki |
| Nam | e of respondent: | | |
| Result codes | : | | |
| 1. (| Completed | 6. | Dwelling vacant or address not a dwelling |
| 2. l | No (competent) household member at home | 7. | Dwelling destroyed |
| 3. l | Entire household absent for extended period | 8. | Dwelling not found |
| 4. l | Postponed | 9. | Other (specify) |
| 5. I | Refused | | |

Introduction

Hello and thank you for talking to me. My name is _____. I am from this settlement and am conducting a survey aimed at identifying the impacts of the Mombasa West Road Improvement Project.

The interview will take about 20 minutes. If possible, I would prefer to talk to any authorized company executive who would be most knowledgeable about questions regarding the company. In order for us to be able to reach you for any potential follow-up, I will collect your name and contact information at the end of this survey.

The information you provide will be analysed by the Consultant and shared with the Trademark East Africa (TMEA), the County Government of Mombasa, Kenya Ports Authority (KPA) and Kenya National Highways Authority (KeNHA). Your participation is completely voluntary but it is to your benefit to answer the questions as completely and accurately as possible because the information will be used to make decisions on infrastructure investments.

You are free to not answer any question with which you are not comfortable, and you may stop the interview at any time.

May we begin? Yes/No

Select Location of survey

- 1. Magongo
- 2. Chaani
- 3. Port Reitz
- 4. Others, Specify

Gender of respondent?

- 1. Male
- 2. Female

What is your highest level of education?

- 1. Primary School
- 2. Secondary School
- 3. College/University
- 4. Informal education
- 5. Not educated

What is your role in the company

How long have you been working with this business (employment period)? _____ years _____ months

Type of Business

- 1. Retail- Shop
- 2. Retail- Kiosk
- 3. Wholesale
- 4. Manufacturing
- 5. Transport/logistics
- 6. Restaurant
- 7. Salon
- 8. Bakery
- 9. Others, specify

Total Number of Permanent employees Male: Female:

Total number of temporary employees Male: Female: How long has the business been in operation? _____ years?

Was your business situated here before or after the construction of the Airport/Port Reitz road?

- 1. Before
- 2. After
- 3. During construction

Has the completion of Airport/Port Reitz road affected cost of Production?

- 1. Yes
- 2. No

Have the costs of production increased or decreased?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent?

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected cost of transportation?

- 3. Yes
- 4. No

Have the costs of transportation increased or decreased?

- 4. Increased
- 5. Decreased
- 6. Remained the same

To what extent?

- 6. Very Great Extent
- 7. Great extent
- 8. Moderately
- 9. Little extent
- 10. Low extent

Has the completion of Airport/Port Reitz road affected cost of premises rent?

1. Yes

2. No

Have the costs of premises rent increased or decreased?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent?

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected cost of labour?

- 1. Yes
- 2. No

Have the costs of labour/manpower increased or decreased?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent?

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected the number of people you hire (temporary and permanent)?

- 1. Yes
- 2. No

Has the number of people you hire increased or decreased due to completion of the Airport/Port Reitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent

5. Low extent

Has the completion of Airport/Port Reitz road affected the value of land?

- 1. Yes
- 2. No

Has the value of land increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent has the road completion of the Airport/Port Reitz road resulted in higher land value?

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected the premises rent?

- 1. Yes
- 2. No

Has the premises rent increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent has the road completion of the Airport/Port Reitz road resulted in higher premises rents?

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected (business) competition?

- 1. Yes
- 2. No

Has competition increased or decreased due to completion of the Airport/PortReitz road?

1. Increased

- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected the number of customers?

- 1. Yes
- 2. No

Has the number of customers increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected delivery times for your customer (efficiency)?

- 1. Yes
- 2. No

Has the delivery times increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected your customer's satisfaction?

- 1. Yes
- 2. No

Has the customer's satisfaction increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected accessibility to your business by your customers?

- 1. Yes
- 2. No

Has accessibility by customers increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected accessibility to your business by your suppliers?

- 1. Yes
- 2. No

Has accessibility by suppliers increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected your profitability?

- 3. Yes
- 4. No

Has the business profitability increased or decreased due to completion of the Airport/PortReitz road?

- 4. Increased
- 5. Decreased
- 6. Remained the same

To what extent

- 6. Very Great Extent
- 7. Great extent
- 8. Moderately
- 9. Little extent
- 10. Low extent

Has the completion of Airport/Port Reitz road affected congestion/traffic jams?

- 1. Yes
- 2. No

Has the congestion/traffic jams increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent has the road completion of the Airport/Port Reitz road resulted in lower congestion (traffic jams)?

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Has the completion of Airport/Port Reitz road affected the number of accidents?

- 1. Yes
- 2. No

Has the number of accidents increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same
- To what extent
 - 1. Very Great Extent
 - 2. Great extent
 - 3. Moderately
 - 4. Little extent
 - 5. Low extent

Has the completion of Airport/Port Reitz road affected the security in the area?

- 1. Yes
- 2. No

Has crime/insecurity increased or decreased due to completion of the Airport/PortReitz road?

- 1. Increased
- 2. Decreased
- 3. Remained the same

To what extent

- 1. Very Great Extent
- 2. Great extent
- 3. Moderately
- 4. Little extent
- 5. Low extent

Annex 2: Household Questionnaire

HOUSEHOLD QUESTIONNAIRE FOR THE BASELINE AND END OF PROJECT SURVEYS FOR MOMBASA WEST ROADS IMPROVEMENT PROGRAMME AND MOMBASA COUNTY PORT ACCESS ROADS

FORM NUMBER:_____

Household Questionnaire

Hello and thank you for talking to me. My name is ______. I am from this settlement and am conducting a survey aimed at identifying the impacts of the Mombasa West Road Improvement Project

TradeMark East Africa (TMEA) is a not for profit organisation funded by governmental development agencies from Belgium, Canada, Denmark, European Union, Ireland, Finland, the Netherlands, Norway, the United Kingdom, and the United States. TMEA has supported the East African Community (EAC) and National governments in reducing barriers to trade and improving business environment in the region since 2010. We are conducting this targeted baseline survey with you for your views and perception on the on-going road TMEA funded road construction in Mombasa.

WHAT TO EXPECT: You have been selected to take part in this survey because you are a leading private institution operating in one of the countries where TMEA has operations in Eastern Africa. The survey should take no longer than 20-25 minutes to complete.

USE OF INFORMATION GATHERED: The information we gather will be analysed by the Consultant and shared with the Trademark East Africa (TMEA), the County Government of Mombasa, Kenya Ports Authority (KPA) and Kenya National Highways Authority (KeNHA). Your participation is completely voluntary but it is to your benefit to answer the questions as completely and accurately as possible because the information will be used to make decisions on infrastructure investments.

BENEFITS: There will be no direct benefit to you from this survey. However, aggregated information gathered from this survey will be used to inform policy makers on areas of focus to improve the road. The analysed information may be used in various communication products like short feature stories, publications, proposals, annual reports and appeals. Depending on the relevance, these products will be used in our annual reports, power points, meeting briefs, website and social media. Your information is valuable to us and we will treat it with respect and confidence.

YOUR RIGHTS: If the survey tool has question(s) that you don't want to answer, please feel free to indicate as such. If you decide not to provide some or any information, there will be no effect on your relationship with TMEA or any of its partners.

RISK: We do not anticipate that you will suffer ill effects from participating in this survey. But if you have any questions or concerns please write to <u>info@trademarkea.com</u>

CONSENT TO USE INFO: All answers you give will be treated with respect and confidence. The aggregated information we receive may be used to develop public information materials like short videos, feature stories, annual reports, and other publications and disseminated to TMEA's audiences. Should we choose to utilise information attributable directly to you, we will share with you the draft products related to your unique responses and seek approval.

Consent

Form number____

Please answer the questions below to give us your consent to participate in this survey. Thank you!

1. Date of consent *

Example: December 15, 2018 11:03 AM

2. Do you agree to participate in this survey? *

| • | To physical and the standards | Yes |
|---|--|-----|
| • | The picture scatterer affective scatterer affe | No |

3. Can TMEA use your responses anonymously in public information materials including short videos, annual reports, feature stories, power points, appeals; which will be disseminated through our website, Facebook, twitter, newsletters, meetings? *

| • | The place can be a first and the displace of the second se | Yes |
|---|--|-----|
| • | The plates car has a figure at | No |

Respondent Signature_____

| | FOR OFFICIAL U | SE | |
|-----------------------|---|--------------------------|--|
| Name of | cluster/zone (a: 250m b: 500m): | | |
| Enumerat | or's id number: | | |
| Superviso | r's ID: | | |
| Date (Day | , Month, Year): Time: | | |
| | | | |
| S | urvey Location coordinates: | | |
| S M | urvey Location (Tick one) 1. Port Reitz Airpon Iiritini Jomvu Mkupe | rt road | 2. Magongo Rd 3. |
| Ň | lame of respondent: | | |
| Result co | des: | | |
| 1 2 3 4 5 | Completed No (competent) household member at home Entire household absent for extended period Postponed Refused | 6. e 7. d 8. 9. | Dwelling vacant or address not a dwelling Dwelling destroyed Dwelling not found Other (specify) |

ENUMERATOR, PLEASE MAKE SURE YOU ARE TALKING TO HOUSEHOLD HEAD, SPOUSE OF THE HEAD OR SOME OTHER INFORMED ADULT MEMBER OF THE HOUSEHOLD.THE RESPONDENT SHOULD BE AT LEAST 13 YEARS OR OLDER.


5. Demographic Information

List names, indicating age, sex, relationship to head of the household, and other information FORM as related to this household (*Survey codes on next page*) NO.

| | Name | Age (YRS) | Gender | Marital Status | Religion | Relationship with Household head | Highest Education Level Completed | Employment status [For Older than 16yr] | Other Sources of Income | AVERAG E Income / Wages earned per month for 12 months | Disability if any | Suffers from Chronic illness |
|----|------|--------------|--------|----------------|----------|---|--|--|----------------------------|---|----------------------|---------------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | |

SURVEY CODES F

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
|-------------------|--|------------------|----------------|------------------|--------------------|-----------------|----------------------------|---|----------------------|---|------------------------|----------|
| Indicate the name | Indi cate age in | 1= Male | 1=Single | 1= None | 1=Head | 1= None | 1=Formal employme nt | 0=None | Incom e in KES | 0=None | 1=None | |
| | year s 2 F a | 2= Fem ale | 2=Marrie d | 2=Catholi c | 2= Spouse | 2= Primary | 2=Self employed | 1= Business | | 1= Hearing impairm ent | 2=HIV/AIDs | |
| | | | 3=Divorc ed | 3=Protest ant | 3=Son | 3=Secon dary | 3=Unempl oyed | 3=Others, specify | | 2= Speech Impairm ent | 3=Diabetes | |
| | 4=Widow ed 4=M 5=Separ ated 5=C | | 4=Widow ed | 4=Muslim | 4= Daughte r | 4=Tertiar y | | | | 3=Sight Impairm ent / Blind | 4=Hyperten sion | |
| | | | | 5=Separ ated | 5=Other | 5=Relati ves | 5= University | | | | 4=In Wheel chair | 5=Cancer |
| | | | 6=Other | 6=Other | | | | 5=Loss of function in one limb (leg / arm) | 6=Other | | | |
| | | | | | | | | | | 6=Othe r (Insert notes specifyi | | |

disabilit y) Asset Ownership

FORM NO.

Which of the following assets does the household own

| | | How |
|--|--------|-------|
| Asset | Yes/No | many? |
| Animal-drawn cart | Yes/No | |
| Beds | Yes/No | |
| Bicycle | Yes/No | |
| Boat/canoe | Yes/No | |
| Books (not school books) | Yes/No | |
| Carts | Yes/No | |
| Cell phone | Yes/No | |
| Chairs | Yes/No | |
| Coffee pulping machine | Yes/No | |
| Complete music system | Yes/No | |
| Computer | Yes/No | |
| Cooking pots, Cups, other kitchen utensils | Yes/No | |
| Cupboards, chest-of-drawers, boxes, wardrobes, bookcases | Yes/No | |
| Dish antenna/decoder | Yes/No | |
| Donkeys | Yes/No | |
| Electric/gas stove | Yes/No | |
| Fan/Air conditioner | Yes/No | |
| Fertilizer distributor | Yes/No | |
| Fields/Land | Yes/No | |
| Hand milling machine | Yes/No | |
| Harrow | Yes/No | |
| Harvesting and threshing machine | Yes/No | |
| Hoes | Yes/No | |
| House(s) | Yes/No | |

| Iron (Charcoal or electric) | Yes/No |
|---------------------------------------|--------|
| Lanterns | Yes/No |
| Livestock | Yes/No |
| Milking machine | Yes/No |
| Mosquito net | Yes/No |
| Motor Vehicles | Yes/No |
| Motorcycle | Yes/No |
| Outboard engine | Yes/No |
| Plough etc. | Yes/No |
| Poultry | Yes/No |
| Power tiller | Yes/No |
| Radio and Radio Cassette | Yes/No |
| Reapers | Yes/No |
| Record/cassette player, tape recorder | Yes/No |
| Refrigerator or freezer | Yes/No |
| Sewing Machine | Yes/No |
| Sofas | Yes/No |
| Spraying machine | Yes/No |
| Tables | Yes/No |
| Telephone(landline) | Yes/No |
| Telephone(mobile) | Yes/No |
| Television | Yes/No |
| Tractor | Yes/No |
| Trailer for tractors etc. | Yes/No |
| Video / DVD | Yes/No |
| Watches | Yes/No |
| Water pumping set | Yes/No |
| Water-heater | Yes/No |

Household Questionnaire

Baseline Survey

Wheel barrow

Yes/No

How much do you spend on the below on average per month (Over the last 12 months)

| Expense | Average spend per month |
|--|-------------------------|
| Food and Non-alcoholic beverages Inside | |
| (Food prepared in the house) | |
| Food and Non-alcoholic beverages Outside | |
| (Food bought from outside/ dining out) | |
| Utilities, Water, Kerosene, Lighting | |
| Furnishings and household expenses | |
| Health | |
| Transport | |
| Communication | |
| Recreation | |
| Education | |
| Other Consumption | |

Household Head Years of Education _____

FORM NO.

- 1. Select the road you use frequently
 - 1. Port Reitz/Airport Road
 - 2. Magongo Road (to A109 Jomvu)
 - 3. Miritini/Jomvu Mkupe Jetty
 - 4. Others, Please specify

Note to Enumerator: If respondent selects 2,3 or 4 note that all questions are asked based on how the road was before recent construction started.

2.What is [Household Head] 's most frequently mode of travel for economic activity (indicated on the table above)

- 01: Walk 02: Own Bicycle 03: Own vehicle 04: Microbus/Matatu 05: Shared Taxi 06: Taxi (vehicle) 07: Boda (Bicycle taxi) 08: Bus regular 09: Student 10: Retired/Pensioner 11: Earning income from investments or property 12: Sick/handicapped, unable to work 13: Other (specify below)
- 14: None

3a.How many minutes does it take on average in the past 12 months [for the Household Head] to get to work?

3b.How many minutes did it use to take on average before road construction [for the Household Head] to get to work? (only for respondents that selected Port Reitz/Airport Road in 1 above)

4.Which month and year did you move into this settlement? _____

5.Did you move to this settlement before or after the construction of the road?

- 4. Before
- 5. After
- 6. During construction

6.Do you own this land and structure, rent it, or is there a different arrangement?

- 1. Own both land and structure
- 2. Own the land but not the structure
- 3. Own the structure but not the land
- 4. Own neither the structure or the land; am just occupying this site
- 5. Rent paying tenant
- 6. Tenant not paying rent

7a. Has the road affected job opportunities?

- 1. Yes
- 2. No (If No skip below questions)

7b. How has the road affected job opportunities?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change) [Skip the questions below]

7c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | _ | 0 | - | 0 |

7d. Please explain why? _____

8a.Has the road affected business opportunities?

- 1. Yes
- 2. No (If No skip below questions)
- 3. I don't know(skip below questions)

How has the road affected business opportunities?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change) [Skip the questions below]

8c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| | | 0 | 0 0 , | |
|---|---|---|-------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

8d. Please explain why? _____

9a. Has the road affected your earnings?

- 1. Yes
- 2. No(If No skip below questions)

9b How has the road affected your earnings?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change)

9c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | | | | |

9d. Please explain why? _____

10a. Has the road affected the land value?

- 1. Yes
- 2. No(If No skip below questions)
- 3. I don't know(skip below questions)

10b. How has the road affected the land value?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change) [Skip the questions below]

9c. To what extent (On a scale of 1-5, 1 being the lowest, 5 being the highest)

| , | | 0 , | 0 0 , | |
|---|---|-----|-------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

11a.Has the road affected the rental rates?

- 1. Yes
- 2. No(If No skip below questions)

11b. How has the road affected the rental rates?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change) [Skip the questions below]

11c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

|--|

12a.Has the road affected housing demand in this area?

- 3. Yes
- 4. No(If No skip below questions)

12b.How has the road affected the housing demand?

- 4. Increased
- 5. Decreased
- 6. Remained same (No change) [Skip the questions below]

12c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 2 3 4 5 | |
|-----------|--|

13a.Has the road completion affected the prices for goods?

- 1. Yes
- 2. No(If No skip below questions)

13b.How has the road affected the prices for goods?

- 11. Increased
- 12. Decreased
- 13. Remained same (No change) [Skip the questions below]

13c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 | 2 | 3 | 4 | 5 | | | | |
|---|---|---|---|---|--|--|--|--|
| | | | | • | | | | |

14a.Has the road affected the prices for services?

- 1. Yes
- 2. No(If No skip below questions)

14b.How has the road affected the prices for services?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change) [Skip the questions below]

14c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| | . (| 0 | 0 0 | |
|---|-----|---|-----|---|
| 1 | 2 | 3 | 4 | 5 |
| | | • | | |

15a.Has the road affected access to transport?

- 1. Yes
- 2. No(If No skip below questions)

15b.How has the road affected access to transport?

- 1. Improved
- 2. worsened
- 3. Remained same (No change) [Skip the questions below]

15c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| | (, | 0 , | 0 0) | |
|---|-----|-----|-------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

15d.Please explain why? _____

16a.Has the road affected vehicle congestion (traffic jams)?

- 1. Yes
- 2. No(If No skip below questions)

16b. How has the road affected congestion (traffic jams)?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change)

16c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 2 3 4 5 | | (| 0 | 0 0 | |
|-----------|---|---|---|-----|---|
| | 1 | 2 | 3 | 4 | 5 |

17a.Has the road affected pedestrian congestion?

- 1. Yes
- 2. No(If No skip below questions)

17b.How has the road affected pedestrian congestion?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change)

17c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| | (************************************** | 0 | 0 | |
|-----|---|---|---|---|
| 1 | 2 | 2 | 4 | - |
| 1 Z | | 3 | 4 | 5 |
| | | | | |
| | | | | |

18a.Has the road affected road safety?

- 1. Yes
- 2. No(If No skip below questions)

18b.How has the road affected accidents?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change)

18c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| a, | | (*********************** | 0 | 0 | |
|----|---|--------------------------|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| | | | | | |

19a.Has the road affected air pollution?

- 1. Yes
- 2. No(If No skip below questions)

19b.How has the road affected air pollution?

- 1. Increased
- 2. Decreased
- 3. Remained same (No change)

| 19c. To what extent | (On a scale of 1- 5, 1 | being the lowest, 5 | being the highest) | |
|--|--|---------------------|--------------------|---|
| 1 | 2 | 3 | 4 | 5 |
| 20a.Has the road aff 1. Yes 2. No(If No ski 20b.How has the road 1. Increase 2. Decrease 3. Remained | fected noise pollutio p below questions) ad affected noise pol ed ed ed same (No change) | n? llution? | | |
| 20c. To what extent | (On a scale of 1- 5, 1 | being the lowest, 5 | being the highest) | · |
| 1 | 2 | 3 | 4 | 5 |
| Yes No(If No ski 21b.How has the roat 1. Increase 2. Decrease 3. Remaine 21c To what extent | p below questions) ad affected crime rat ed ed ed same (No change) (On a scale of 1-5-1 | tes? | heing the highest) | |
| 1 | 2 | 3 | 4 | 5 |
| 21d.Please explain v 22a.Has the road aff 1. Yes 2. No(If No ski 22b.How has the road 1. Improve 2. worsene 3. Remained | why? fected your health? p below questions) ad affected your hea ed ed same (No change) (On a scale of 1- 5, 1 | lth? | being the highest) | |
| 1 | 2 | 3 | 4 | 5 |
| 22d.Please explain v | why? | | | |

RESERVE CODES: NOT APPLICABLE (NA): 97; DON'T KNOW: 98; REFUSED: 99

23a.Has the road affected access to health facilities (Hospitals, Clinics)?

- 1. Yes
- 2. No(If No skip below questions)

23bHow has the road affected access to health facilities?

- 1. Improved
- 2. worsened
- 3. Remained same (No change)

23c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| | (| 0 , | 0 0) | |
|---|---|-----|-------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

23dPlease explain why? _____

24a.Has the road affected access to education facilities?

- 1. Yes
- 2. No(If No skip below questions)

24b.How has the road affected access to education facilities?

- 1. Improved
- 2. worsened
- 3. Remained same (No change)

| 24c. To what extent | On a scale of 1-5, 1 being the lowest, 5 being the highest) | |
|-----------------------|---|--|
| a ic. i o what cheche | on a scale of 1 b, 1 being the lowest, 5 being the inghest) | |

| 1 2 3 4 5 | | • | - | | |
|-----------|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |

24d.Please explain why? _____

25a.Has the road affected ACCESS to goods and services facilities?

- 1. Yes
- 2. No(If No skip below questions)

25b.How has the road affected access to goods and services facilities?

- 1. Improved
- 2. worsened
- 3. Remained same (No change)

25c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | | | | |

25d.Please explain why? _____

26a.Has the road affected the general quality of life?

- 1. Yes
- 2. No(If No skip below questions)

26bHow has the road affected the quality of life?

- 1. Improved
- 2. Worsened
- 3. Remained the same

26c. To what extent (On a scale of 1- 5, 1 being the lowest, 5 being the highest)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | 0 | | | |

Annex 3: User Satisfaction Survey Questionnaire – CFS Trucks

X NARE

USER SATISFACTION SURVEY



| Questions | | | | | Responses | 0 | | | | Q # | Record |
|---------------------------------|--------------------|------------------|----------------|-----------------|----------------|-----------------|------------------|--------------|-----------|----------|----------|
| GENERAL INFORMATION | 0 | | | | | | | | | _ | |
| Quarties 1: What is user | Male | Female | | | | | | | <u> </u> | | |
| addedon 1. What is your | | | | | | | | | | | |
| genderr | 4 | 2 | | | | | | | | | <u> </u> |
| Outstilles 9: Acre? | >24 | 22.24 | 25-44 | 45.54 | 55.64 | 65.4 | Decline | | — | <u> </u> | <u> </u> |
| Question 2. Ager | 221 | 22-34 | 30744 | 40*04 | 55*64 | 00% | Decine | | <u> </u> | | <u> </u> |
| | 1 | 4 | 3 | - | D and a second | 0 | 1 | | | | |
| Quection 3: Nationality? | Uganoan | Kenyan | Tanzanian | Rowangan | Burundian | Other | | | 4 | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | | | |
| Question 4: How many years | One - six | Six | One - two | Two - four | Over five | Other | | | | | |
| have you been driving CFS | months | months - | years | years | years | | | | | | |
| trucks? | | one year | | | | | | | | | |
| | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | | | |
| Question 5: How often do | Several | Daily | Weekly | Monthly | Infrequently | | | | | | |
| you come to the port? | Times per | | | | | | | | | | |
| | Day | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | | | | | | |
| Question 8: IF several times | | | | | | | | | | | |
| per day, how many times? | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Question 7: What gate do | Gate 18/20 | Gate 22 | Gate 12 | Gate 10 | | | | | | | |
| you use entering the port | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | - | | | | | <u> </u> | | — | | - |
| Constitue & the factor is | 1 | 2 | 3 | 4 | | | <u> </u> | | — | | |
| Quection 8: What gate do | Gate 18/20 | Gate 22 | Gate 12 | Gate 10 | | | | | | | |
| you use leaving the port | | - | | | | | | | — | | |
| | 1 | 2 | 3 | 4 | | | | | | | |
| Question 8: What routes do | PortReltz/ | A109 - | Other | | | | | | | | |
| you normally use to access | magongo | Mikindan | routes | | | | | | | | |
| and leave the port? | road | Iroad | spealty | | | | | | | | |
| | | | | | | | | | | | |
| | 1 | 2 | 3 | | | | | | | | |
| Question 10: Have you made | Yec | No | | | | | | | | | |
| any changes to the route you | | | | | | | | | | | |
| ucually take? | | | | | | | | | | | |
| | 4 | 2 | | | | | | | | | 1 |
| Huar what route war NO | PortPath/ | A109 | Other | т | | | | | | | 1 |
| in yes, what route was it? | FUTUREILZ | Mikindan | Outer | | | | | | | | |
| | magongo | Mikingan | FOUTES | | | | | | | | |
| | road | Troad | cpeony | | | | | | | | |
| | | | | 1 | | | | | | | |
| | 1 | 2 | 3 | - | | | | | | | |
| If yes, why are you now | Due to | As an | Other | | | | | | | | |
| using this route? | road | alternati | reasons, | | | | | | | | |
| | oonstructi | ve eacler | speality | | | | | | | | |
| | on | route | | | | | | | | | |
| | | | | | | | | | | | |
| | 1 | 2 | 3 | - | | | | | | | |
| TURN AROUND TIME | | - | - | | | | | | | 1 | |
| Question 11: What is the | | | | | | | | | | | |
| average firms (in hours) that | | | | | | | | | | | |
| wou speed from the axit axis | | | | | | | | | | | |
| to the CE2 and return? | | | | | | | | | | | |
| to the one and return? | | | | | | | | | | | |
| | | | | | | | | | | | |
| The following states | the support of the | de atile a sette | the of the | | | en aleger la di | and a set of the | | discourse | | |
| the following statements relate | wo your satis | stices are a | a follows: Sto | at the port. In | your respon | Disaster and | Strongly D | you agree or | orangiree | | |
| with each state | ment. The of | NUCHS and a | a ronowa. Ser | ongly Agree, A | gree, neutral | , chargree and | Saongry D | | | | |
| (place a cross | on the state | ment selec | (ed) | | | | | | | | |
| Question 12: The time It | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | | | |
| takes to drive to the CFS and | agree | | | | disagree | | | | | | |
| return to the port has | | | | | | | | | | | |
| decreased | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | | | |
| Question 13: Number of | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | | | |
| accidents have reduced | agree | | | | disagree | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | | | |
| Question 14: Number of | Strongly | Acces | Neutral | Disagree | Strongly | Not Sure | | | | | |
| delays due to traffic large | agree | | | and gree | disagree | Hat Oure | | | | | |
| bave reduced | | | | | | | | | | | |
| 11210100000 | 4 | | 2 | 4 | E | 6 | — | | — | | |
| 1 | 1 | - | 5 | 4 | • | 0 | | | | | |

| Question 15: There is Improved security in the area | Strongly | Agree | Neutral | Disagree | Strongly disagree | Not Sure | | | |
|--|----------|---------|---------|-------------|----------------------|----------|------|---|--|
| Airport roads | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| QUALITY OF ROADS | | | | | | | | | |
| Question 18: The completed | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | |
| port reitz and Airport roads | agree | | | | disagree | | | | |
| are very well done | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| Question 17: The size of the | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | + | |
| new road is adequate | agree | | | | disagree | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| Quection 18: The signage on | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | |
| the port reitz and airport | agree | | | | disagree | | | | |
| roads are adequate | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | + | |
| Guestion 19: The number of | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | + | |
| turning points and justions | agree | | | | disagree | | | | |
| are sufficient | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | + | |
| Question 20: The road space | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | |
| and parking spages are | agree | | | | disagree | | | | |
| sufficient | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| OVERALL IMPROVEMENTS | | | | | | | | | |
| | | | | | | | | | |
| Quection 21: There are | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | |
| sufficient facilities for the | agree | | | | disagree | | | | |
| physically impaired | | | | | | | | | |
| members of the public. | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| Question 22: There road has | Strongly | Agree | Neutral | Disagree | Strongly | Not Sure | | | |
| sufficient space for | agree | | | | disagree | | | | |
| pedectrianc and non | | | | | | | | | |
| motorised transport | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| Question 23: On the overall, | very | oausned | Neural | Ussatisfied | Very | Notsure | | | |
| now cationed are you with | sausried | | | | Chissaushed | | | | |
| the new developments of the | | | | | | | | | |
| Port Reizz and Airport roade? | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| Question 24: What are areas | | | | | | | | | |
| of improvement you would | | | | | | | | | |
| suggest at the port? | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Annex 4: User Satisfaction Questionnaire – Other Road Users

USER SATISFACTION SURVEY QUESTIONNAIRE

FOR

THE BASELINE AND END OF PROJECT SURVEYS FOR MOMBASA WEST ROADS IMPROVEMENT PROGRAMME AND MOMBASA COUNTY PORT ACCESS ROADS

[August 2019]

1b. We would like to ask you a few questions regarding this road, do you frequently use this road?

- 1. Yes
- 2. No (If no, do not continue with questionnaire)

1.b Select the road (Single Select)

- 1. Port Reitz/Airport Road
- 2. Magongo Road (to A109 Jomvu)
- 3. Miritini/Jomvu Mkupe Jetty
- 4. Kipevu Road
- 5. Others, Please specify

Note to Enumerator: If respondent selects 2,3 or 4 note that all questions are asked based on how the road was before recent construction started.

1b. Select road user

- 1. Pedestrian
- 2. Bicycle rider
- 3. Tuk tuk driver
- 4. Motorcycle taxi (boda boda)
- 5. Matatu Driver/Bus driver
- 6. Light truck/pickup driver

2a. Gender of the respondent? Male/ Female

2b. Citizenship _____

Household Questionnaire

2c. Do you have any disability? Yes/No

If yes, which disability? _____

2d. Highest level of Education

- 1. Primary School
- 2. Secondary School
- 3. College/University
- 4. Informal Education
- 5. Not educated

2e. State your total years of education_____

2f. Age of the respondent (Years) ______

2g.Marital Status

- 1. Single
- 2. Married
- 3. Divorced
- 4. Widowed

2h. What is your employment status?

- 1. Employed (full time)
- 2. Self Employed
- 3. Part time labourer
- 4. Not employed and not looking for work
- 5. Not employed and looking for work

If 5. Is selected, for how long? _____

If employed/Self-employed/Part time labourer, what is your occupation?

3a. Are you a resident of this area? Yes/No

If No, Where do you live?_____

If yes, how long have you lived in this area? (years)

3b. How long have you been using this road? (years)

- 4. Did you start using this road before or after the construction of the road?
 - 1. Before
 - 2. After
 - 3. During construction

4a. If you started using this road Before construction were you informed of the changes that are going to happen to this road? Yes/No?

5.Has the road affected the following?

| | Yes/No | How? | What Extent* |
|---------------------|--------|----------------------|--------------|
| | | Increased/Decreased/ | 1-5 |
| | | Remained same | |
| Travel time | | | |
| Cost of travel | | | |
| Number of Accidents | | | |
| Traffic jams | | | |
| Security | | | |

*To what extent (On a scale of 1-5, 1 being the lowest, 5 being the highest)

6.Any other benefits please specify? _____

7. The size of the road is adequate for vehicles and pedestrians?

- 1. Strongly Agree
- 2. Agree
- 3. Neutral

- 4. Disagree
- 5. Strongly Disagree

8.The road signage is adequate?

- 1. Strongly Agree
- 2. Agree
- 3. Neutral
- 4. Disagree
- 5. Strongly Disagree

9a.The parking space/ bus & matatu stops are sufficient

- 1. Strongly Agree
- 2. Agree
- 3. Neutral
- 4. Disagree
- 5. Strongly Disagree

9b.The junctions and turning points are sufficient

- 1. Strongly Agree
- 2. Agree
- 3. Neutral
- 4. Disagree
- 5. Strongly Disagree

10a. There are sufficient walkways for pedestrians

- 1. Strongly Agree
- 2. Agree
- 3. Neutral
- 4. Disagree
- 5. Strongly Disagree

10b.There are sufficient space for non-motorized traffic (bicycles)

- 1. Strongly Agree
- 2. Agree
- 3. Neutral
- 4. Disagree
- 5. Strongly Disagree

10b.There are sufficient designated road crossing areas?

- 1. Strongly Agree
- 2. Agree

- 3. Neutral
- 4. Disagree
- 5. Strongly Disagree

11. There are sufficient facilities for the physically impaired members of the public

- 1. Strongly Agree
- 2. Agree
- Neutral
 Disagree
- 5. Strongly Disagree

12.0verall how satisfied are you with the road

- 1. Very Satisfied
- 2. Satisfied
- 3. Neutral
- 4. Dissatisfied
- 5. Very dissatisfied

14b.What has been the most significant change the road has brought about? (Open answer)



Annex 5: Traffic Volume Survey Data Collection Tool

| CLIENT: Trademark East | LIENT: Trademark East Africa | | | | | | | | | | | | | |
|------------------------|------------------------------|----------------|------------------|---------|---------------|--------------|----------------------------|------------|---------|--|-------------------|-----------|--|-------------|
| Job No.: | Enumerator's Name: | | | | | | | | | | 1 | | | Date: |
| | | | | | | | | ŕ. | | | 1 | | | f |
| Site: | | | | | | | | Direction: | | | | | | Weather: |
| | | | | 1020000 | | | | <u> </u> | 201001 | | | | | (* |
| <u> </u> | Container Trimba | Bully Trailors | Madium Trusta | Trucks | Links Tauraha | Eucl Technol | Transfer (Emister Terralia | Buses | | | Personal Venicles | | | Matana |
| | Container Trucks | | Interior Process | | LIGHT TYDEKS | ruer rankers | | | conster | | Mini-vans | Pick-ups | | Matorcycles |
| Time Period | 000-0-0 | 00-00-0 | -00-0 | 00 00 0 | | | 0 0 | O | A.A.T | | | - Charles | | 000 |
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Annex 6: PCU Equivalent Chart

| Vehicle | PCU |
|----------------------|------|
| Passenger Car | 1.0 |
| Light Goods Vehicle | 1.0 |
| Medium Goods Vehicle | 2.5 |
| Heavy Goods Vehicle | 3.5 |
| Matatu | 1.0 |
| Bus | 3.0 |
| Motorcycle | 0.77 |
| Bicvcle | 0.33 |

Source: Road Design Manual II