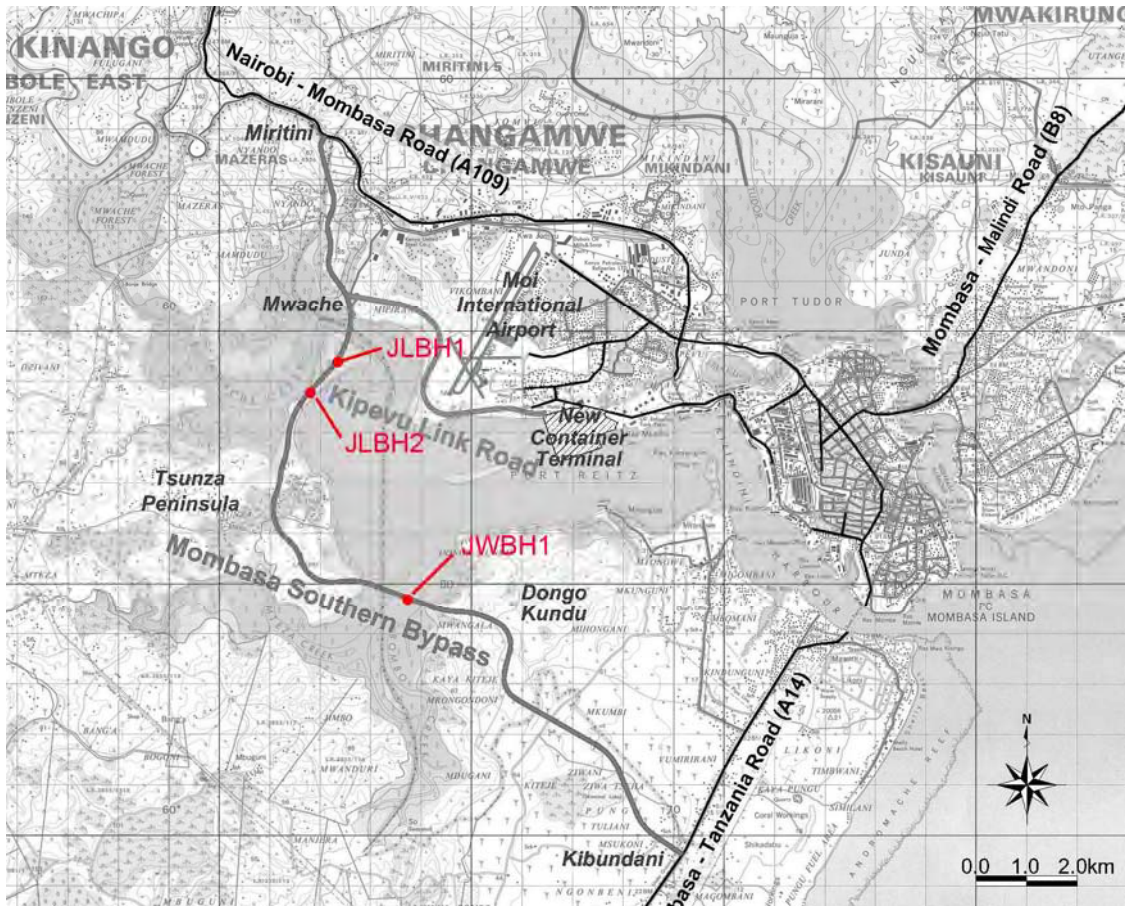


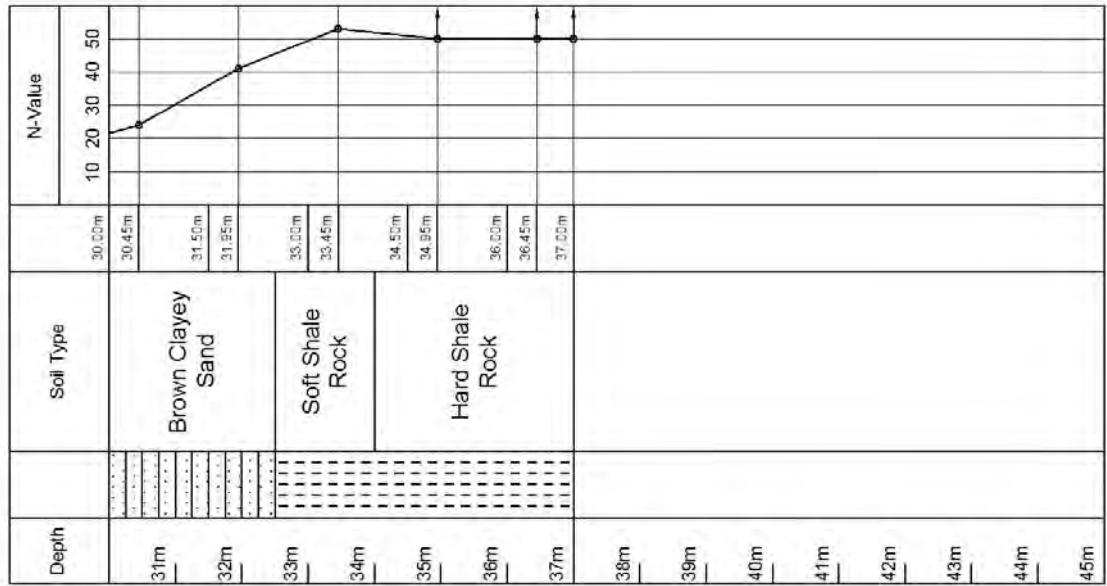
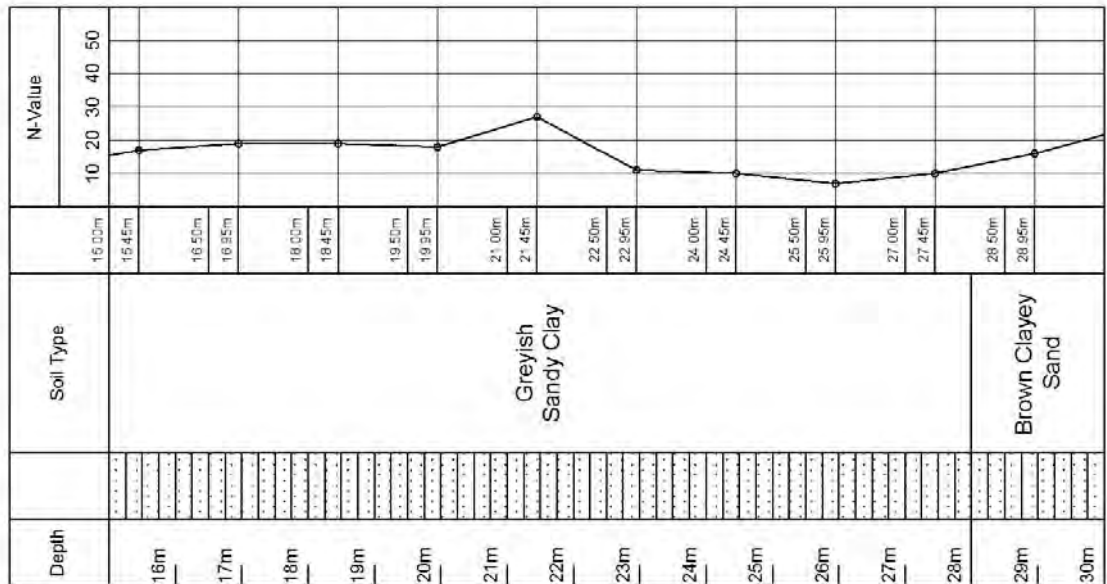
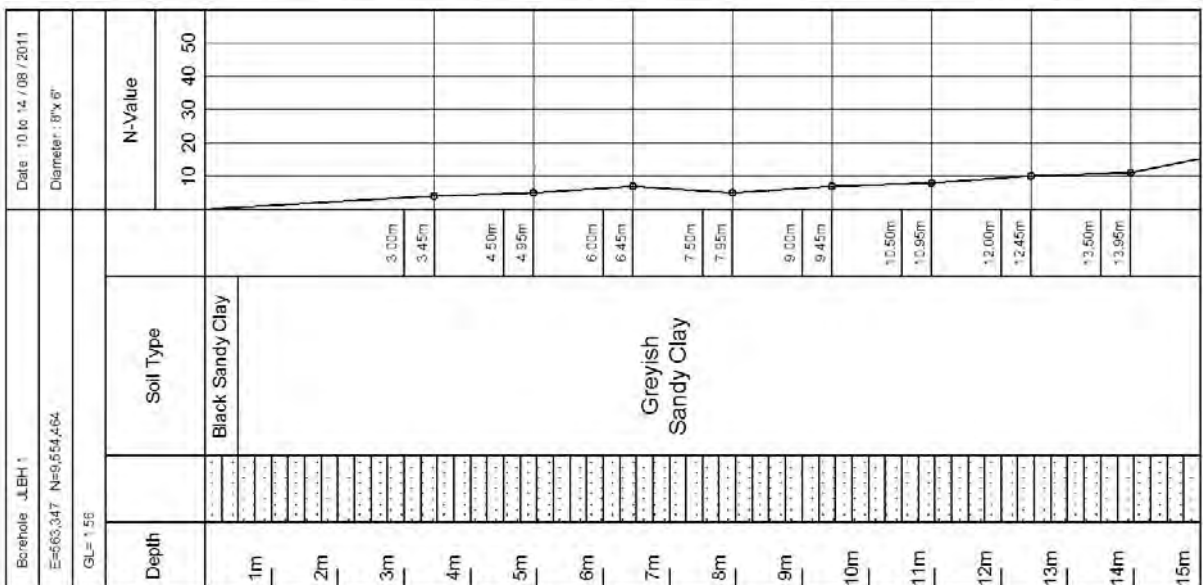
APPENDIX 4 Geological Survey Result

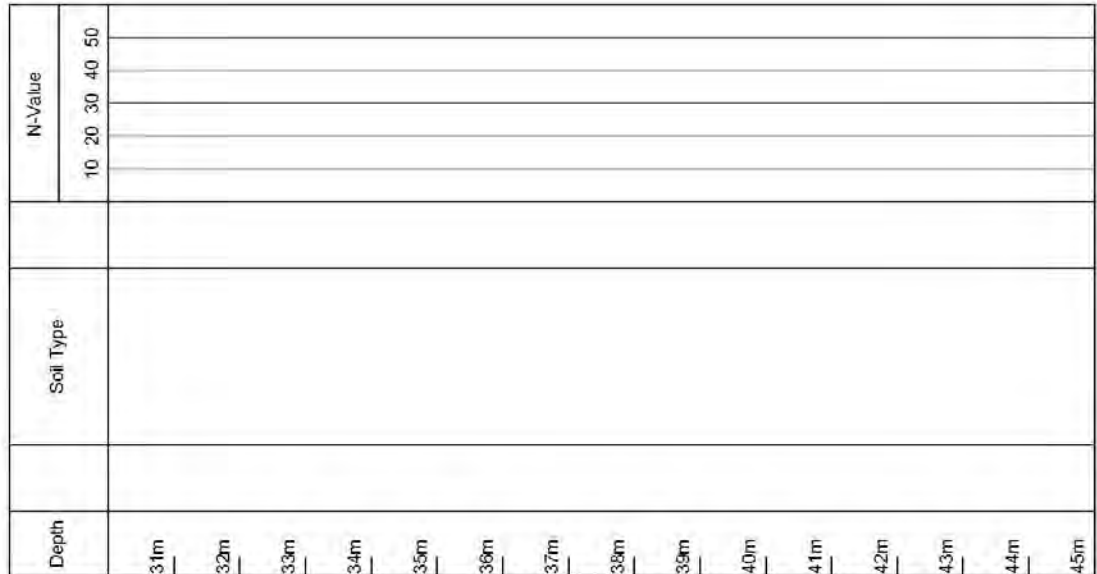
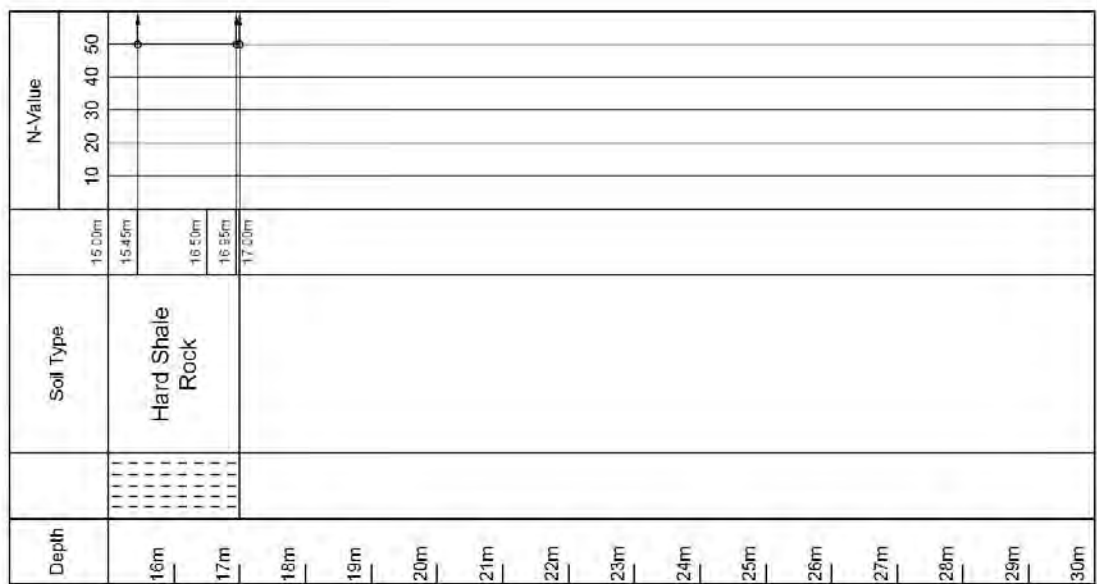
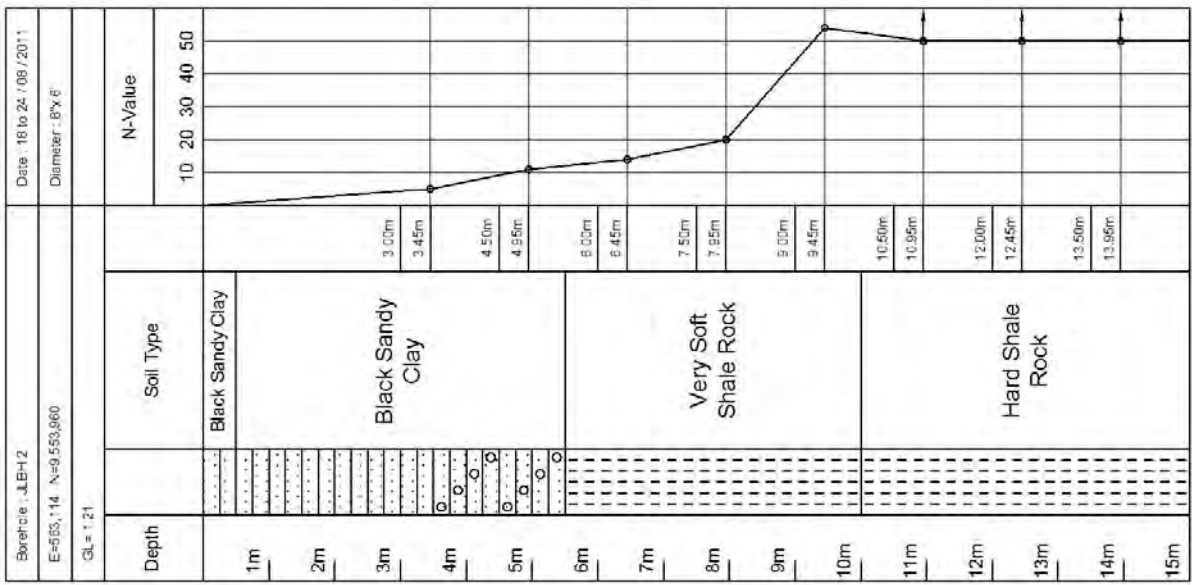


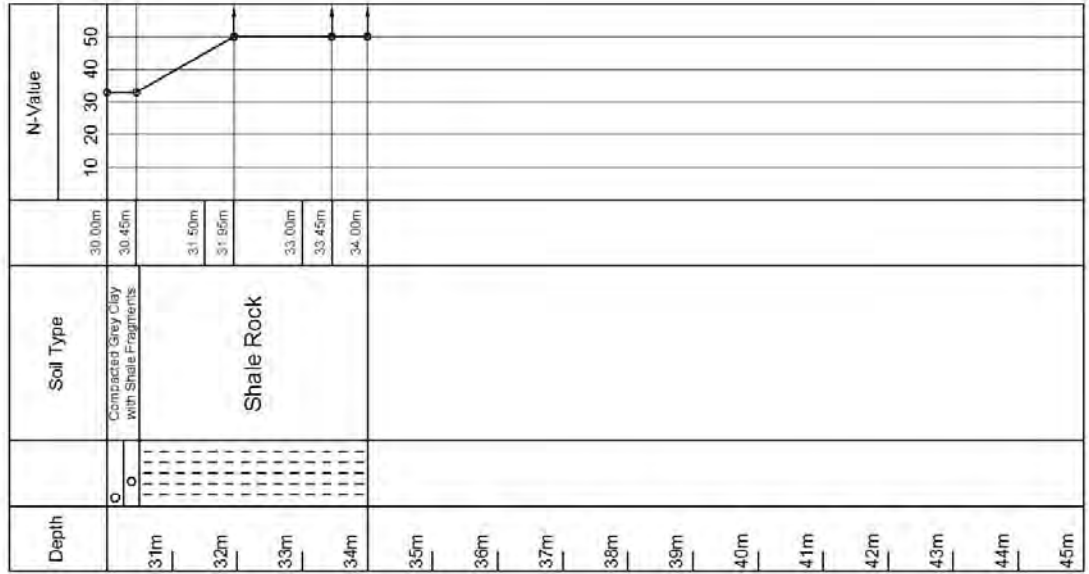
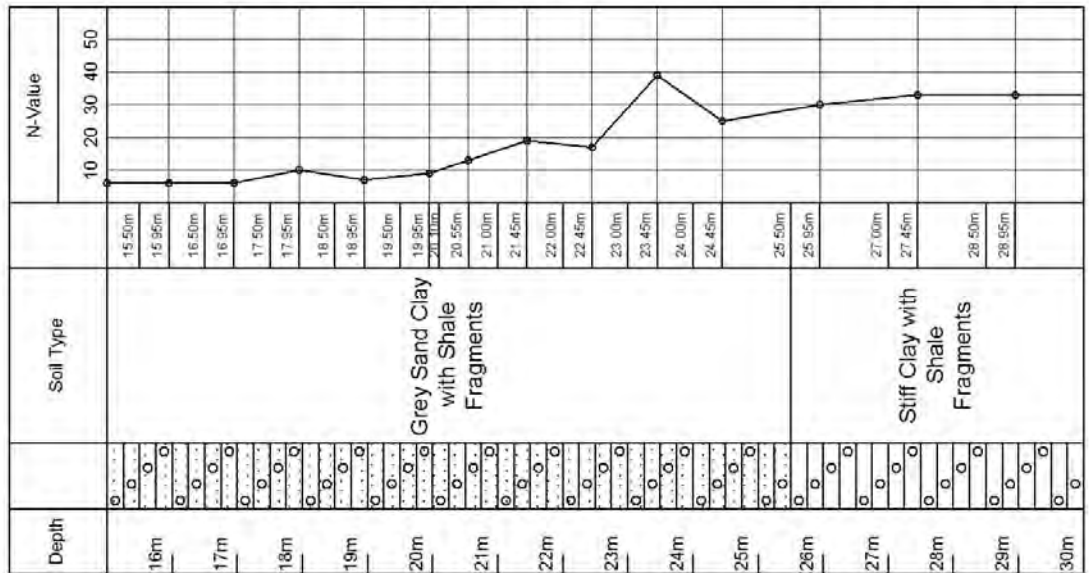
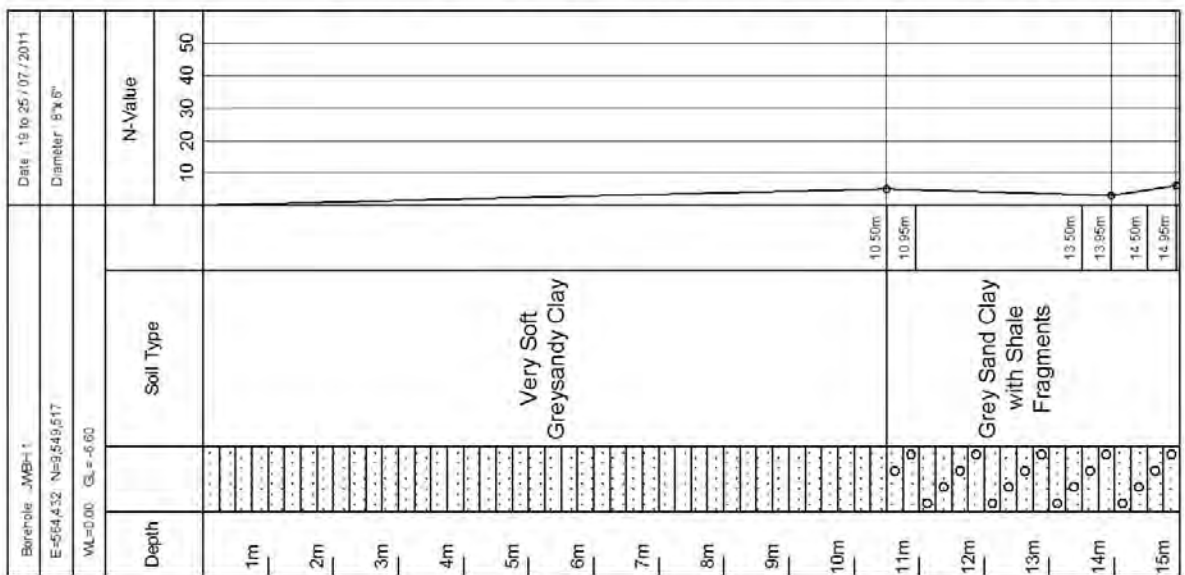
Location of Boring Spots

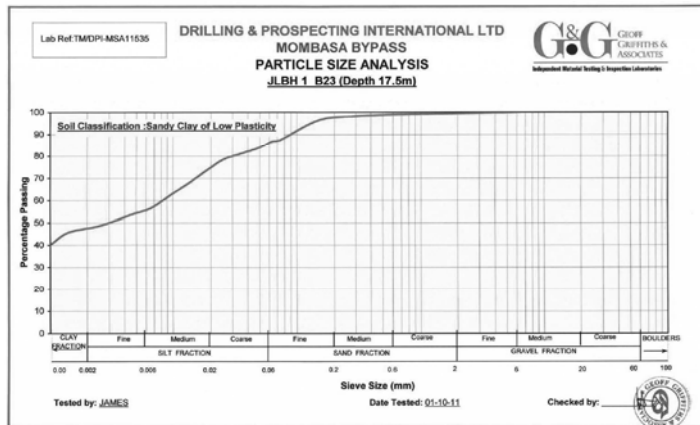
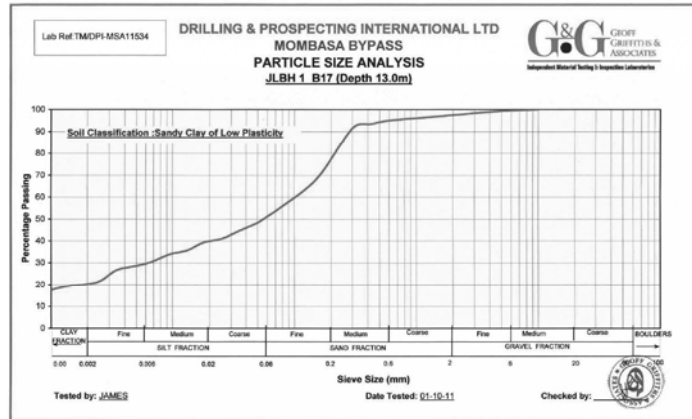
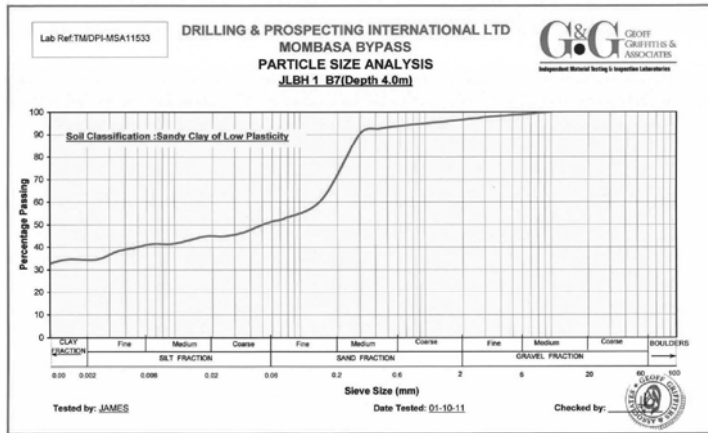
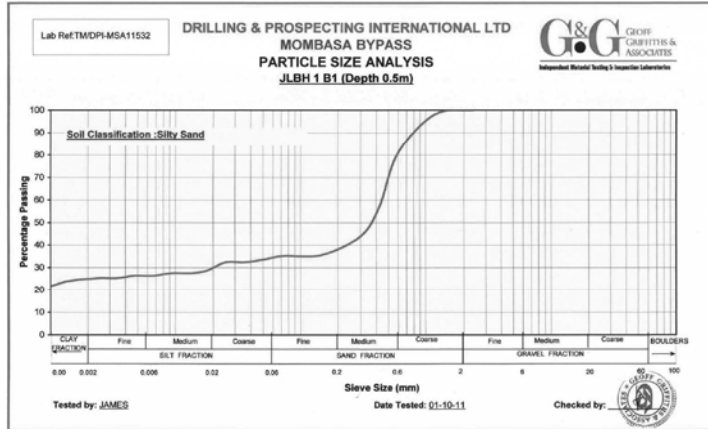
Coordinates of Boring Spots

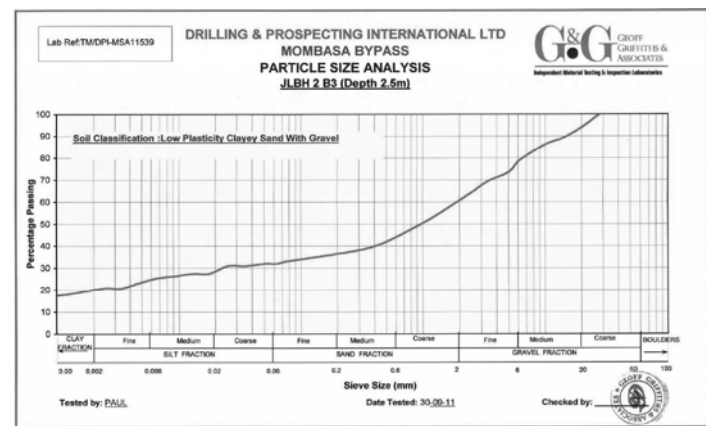
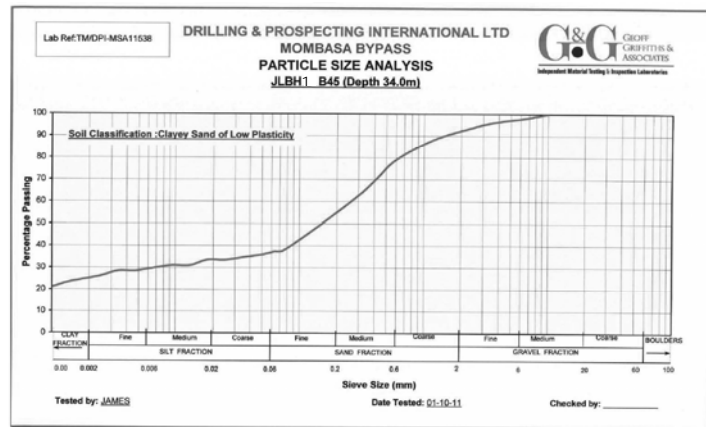
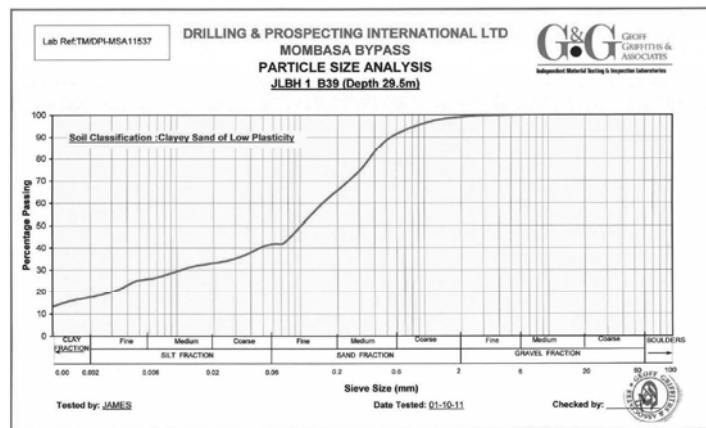
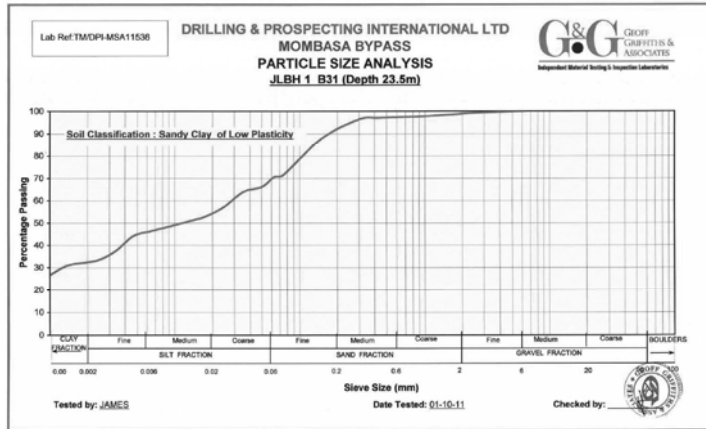
Boring	Easting	Northing
JLBH1	563,347	9,554,464
JLBH2	563,114	9,553,960
JWBH1	564,432	9,549,517

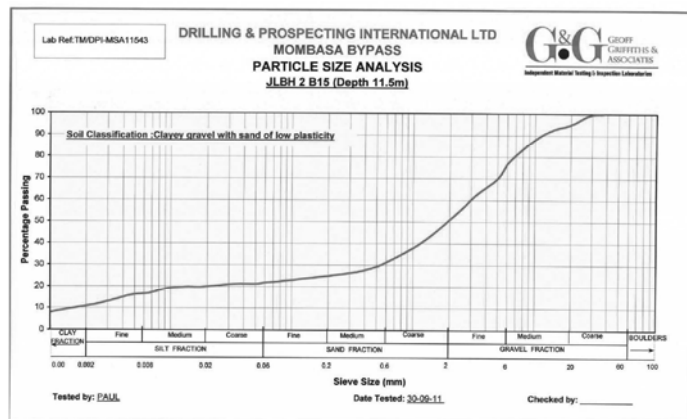
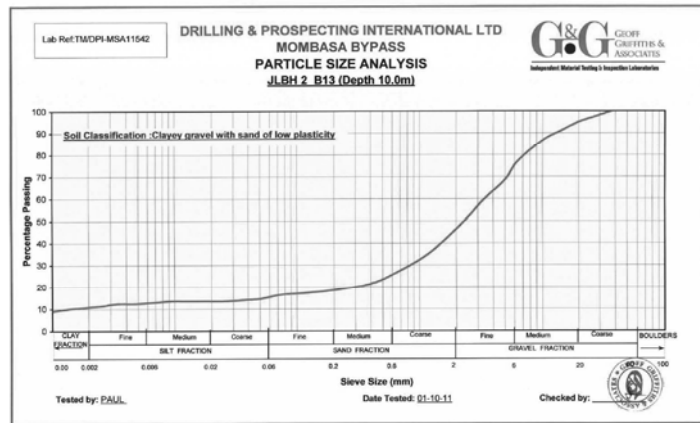
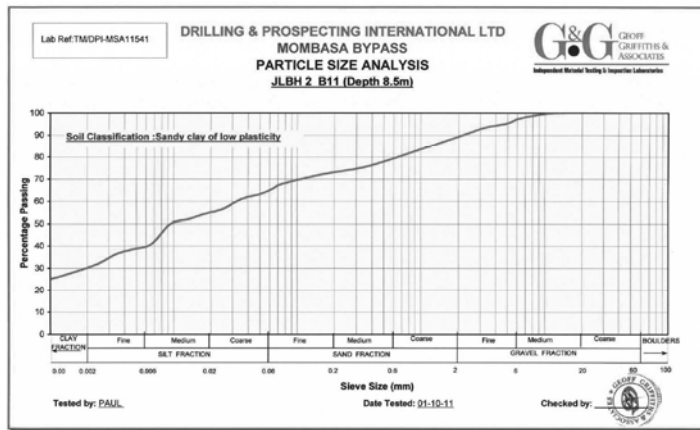
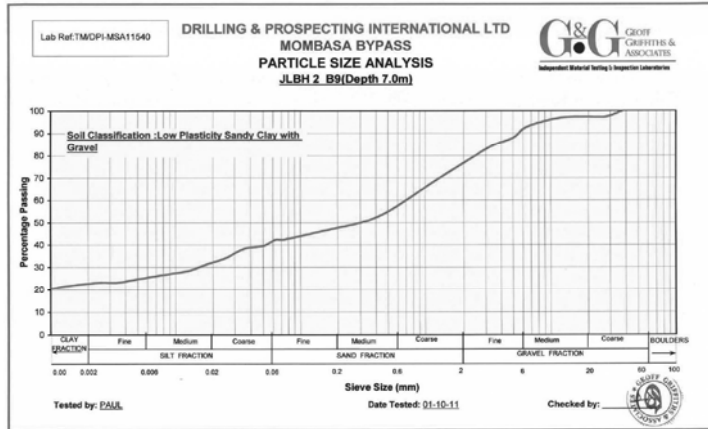


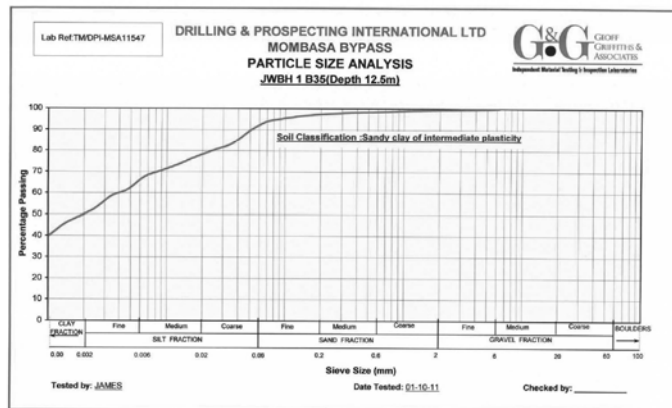
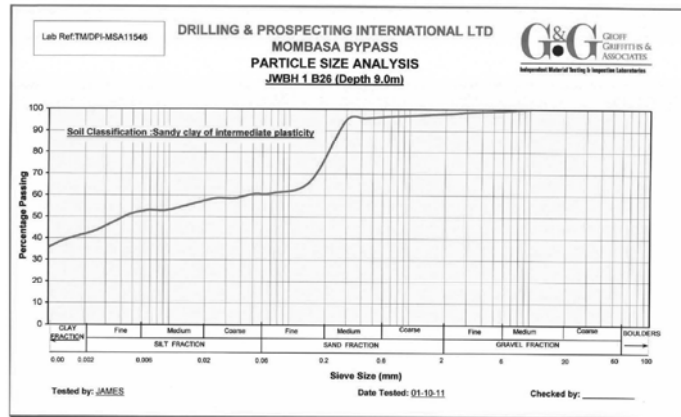
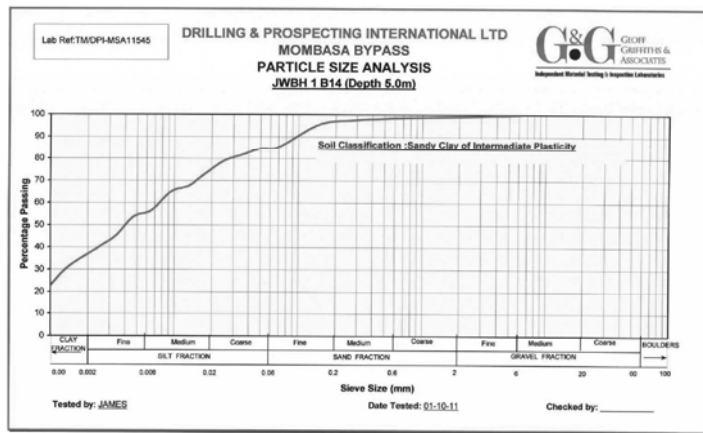
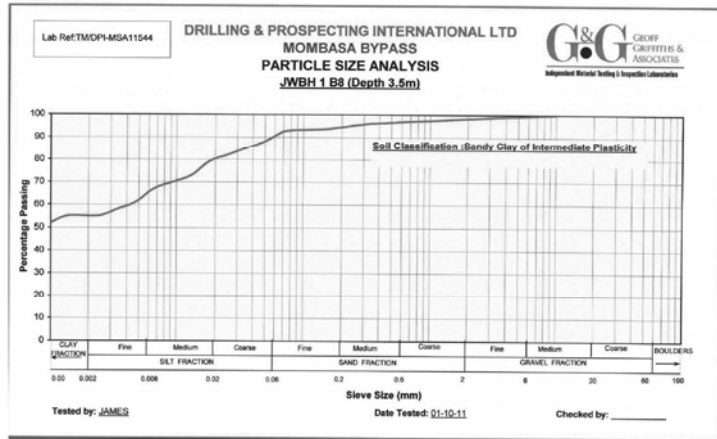


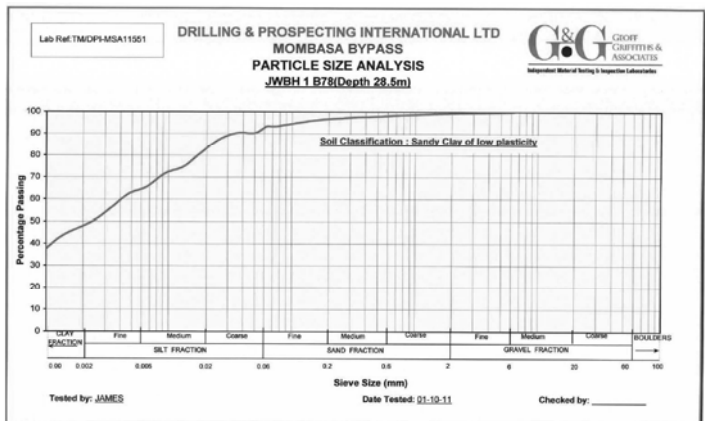
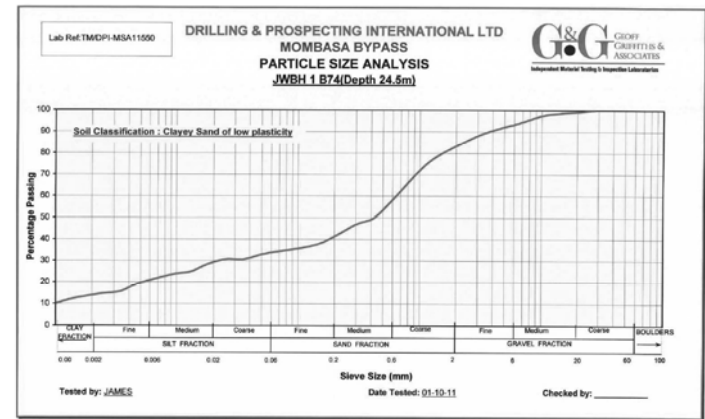
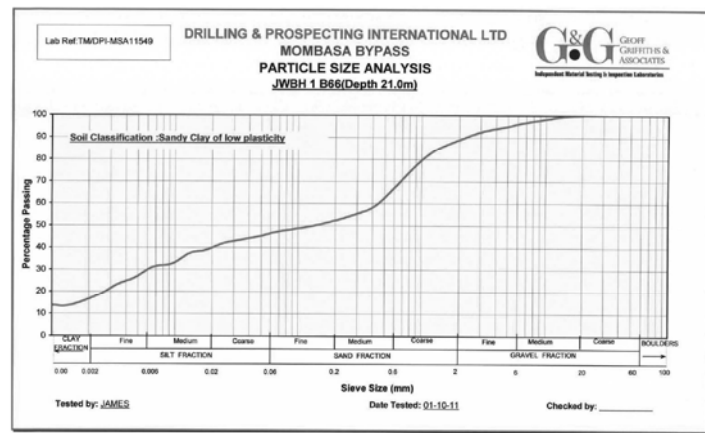
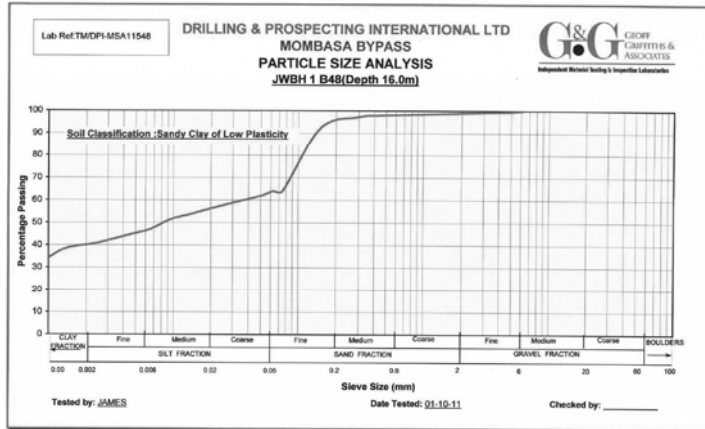












APPENDIX 5 Pavement Design Calculation

(1) Design Traffic Volume

Future traffic volume (pcu/day) by section is shown in Table A5-1 which is referred to Figure 4.2-6 in Chapter 4. The design traffic volume (pcu) for 15 years after opening is calculated as shown in the table.

Table A5-1 Future Traffic Volume by Section (pcu/day)

	Section 1	Section 2	Section 3	Section 4
2015	17,300	22,600	7,900	7,900
2020	22,000	28,300	9,500	9,500
2025	37,600	41,300	23,400	14,600
2035	75,400	64,500	50,700	23,800
2015-2030 (pcu)	176 x 10 ⁶	196 x 10 ⁶	101 x 10 ⁶	69 x 10 ⁶

The design traffic volume (veh.) by vehicle type for the design period was calculated with assumption of the traffic distribution by vehicle type is same as the observation at Traffic Count Station 2. The calculation of the design traffic volume by vehicle type is shown in Table A5-2.

Table A5-2 Design Traffic Volume

	Cars	Pick-ups	Matatus	Minibuses	Large buses	Light trucks	Medium trucks	Heavy trucks (3 axles)	Heavy Trucks (4 axles)	Total
12h Traffic Volume (1st day)	883	712	1,187	156	150	459	297	346	1,921	6,111
12h Traffic Volume (2nd day)	931	848	1,237	143	157	418	321	341	2,200	6,596
12h Traffic Volume (Average)	907	780	1,212	150	154	439	309	344	2,061	6,354
24/12 hr Ratio (1st day)	1.45	1.51	1.31	1.33	1.82	1.18	1.48	1.33	1.35	
24/12 hr Ratio (2nd day)	1.27	1.40	1.32	1.49	1.69	1.19	1.28	1.22	1.26	
24/12 hr Ratio (Average)	1.36	1.46	1.32	1.41	1.76	1.19	1.38	1.28	1.31	
24 hr Traffic Volume (Veh./day)	1,234	1,135	1,594	211	269	520	426	438	2,689	8,515
pcu Racio	1.0	1.0	1.0	2.0	2.0	2.5	2.5	3.5	3.5	
Traffic Volume (pcu/day)	1,234	1,135	1,594	422	539	1,299	1,066	1,533	9,411	18,232
Ration of Veh. / Total pcu	0.068	0.062	0.087	0.012	0.015	0.029	0.023	0.024	0.147	
Traffic Vol. of Section 1 for 15 yr.	11,908,000	10,956,000	15,385,000	2,035,000	2,601,000	5,016,000	4,116,000	4,228,000	25,957,000	
Traffic Vol. of Section 2 for 15 yr.	13,261,000	12,201,000	17,134,000	2,266,000	2,896,000	5,586,000	4,584,000	4,708,000	28,907,000	
Traffic Vol. of Section 3 for 15 yr.	6,833,000	6,287,000	8,829,000	1,168,000	1,492,000	2,879,000	2,362,000	2,426,000	14,896,000	
Traffic Vol. of Section 4 for 15 yr.	4,668,000	4,295,000	6,032,000	798,000	1,020,000	1,967,000	1,614,000	1,657,000	10,176,000	

(2) ESAL (18-kip Equivalent Single Axle Load) per Vehile

ESAL per vehicle by vehicle type was referred to the average vehicle equivalence factors mentioned in Road Design Manual, Road Department of Kenya 1987. The ESAL per vehicle by vehicle type is shown in Table A5-3.

Table A5-3 ESAL per Vehicle by Vehicle Type

	Large Bus	Medium Truck	Heavy Truck (3 axle)	Heavy Truck (4 axle)
ESAL	1.0	1.5	3.0	10.0

(3) Pavement Design Load

The pavement design load (Total ESAL) was obtained from the traffic volume during the design period by vehicle type multiplied by ESAL per vehicle by vehicle type as shown in Table A5-4. The pavement design load per design lane is assumed as 90% of direction ESAL as suggested in AASHTO.

Table A5-4 Calculation of Pavement Design Load

	Large buses	Medium trucks	Heavy trucks (3 axles)	Heavy Trucks (4 axles)	Total ESAL
ESAL per Vehicle	1.0	1.5	3.0	10.0	
Traffic Vol. of Section 1	2,601,000	4,116,000	4,228,000	25,957,000	126,000,000
Traffic Vol. of Section 2	2,896,000	4,584,000	4,708,000	28,907,000	141,000,000
Traffic Vol. of Section 3	1,492,000	2,362,000	2,426,000	14,896,000	73,000,000
Traffic Vol. of Section 4	1,020,000	1,614,000	1,657,000	10,176,000	50,000,000

(4) Calculation of Required Pavement Thickness

The equation and constants given in AASHTO are referred as follows:

$$\text{Log}_{10}(W_{18}) = Z_R \times S_0 + 9.36 \times \text{Log}_{10}(\text{SN} + 1) - 0.20 + \{ \text{Log}_{10}[\Delta \text{PSI} / (4.2 - 1.5)] / [0.40 + 1094 / (\text{SN} + 1)^{5.19}] \} + 2.32 \times \text{Log}_{10}(M_r) - 8.07$$

Where,

W18: Total ESAL

ZR: Standard Deviation (= -1.282 in case reliability = 90%)

S0: Combined standard error (= 0.45 in case flexible pavement)

SN: Structural number = a1 x D1 + a2 x m2 x D2 + a3 x m3 x D3 + a4 x m4 x D4

(a: Layer coefficient, m: Drainage coefficient, D: Layer thickness in inch)

ΔPSI : Po - Pt

P0: Initial serviceability index (= 4.2 in case flexible pavement)

Pt: Terminal serviceability index (= 2.5 in case arterial road)

MR: Resilient modulus (= 1500 x CBR)

Layer coefficient:

a1=0.44 (asphalt concrete surface course)

a2=0.35 (bituminous stabilized base course)

a3=0.14 (mechanically stabilized base course)

a4=0.11 (crusher run subbase course)

Drainage coefficient :

m3: drainage coefficient of base course (= 1.0 in case average condition)

m4: drainage coefficient of subbase course (=1.0 in case average condition)

Table A5-5 Calculation of Required Pavement Thickness

Calculation of Required SN

Design Section		1	2	3	4
18kip Equivalent Single Axle Load	W18	126,000,000	141,000,000	73,000,000	50,000,000
Reliability	R (%)	90	90	90	90
Standard deviation	ZR	-1.282	-1.282	-1.282	-1.282
Combine standard error	S0	0.45	0.45	0.45	0.45
Initial serviceability index	P0	4.2	4.2	4.2	4.2
Terminal serviceability index	P1	2.5	2.5	2.5	2.5
P0-P1	ΔPSI	1.7	1.7	1.7	1.7
Subgrade CBR	CBR	10	10	10	10
Resilient modulus	MR	15,000	15,000	15,000	15,000
Required SN	SN	5.640	5.727	5.232	4.960

where, $\text{Log}_{10}^{(W18)} = Z_R \times S_0 + 9.36 \times \text{Log}_{10}(\text{SN}+1) - 0.20 + \text{Log}_{10} \left[\frac{Z[\Delta\text{PSI}/(4.2-1.5)]}{[0.40+1094/(\text{SN}+1)^{5.19}]} \right] + 2.32 \times \text{Log}_{10}(\text{MR}) - 8.07$

Left value, $\text{Log}_{10}^{(W18)} =$	8.100	8.149	7.863	7.699
Right formula value=	8.100	8.149	7.863	7.699

Proposed Pavement Thickness (cm) and SN

Pavement Structure (new pavement)	Drainage coefficient	Layer coefficient	Proposed Pavement Thickness (cm)			
			1	2	3	4
Design Section						
Asphalt concrete surface	-	0.440	10.0	10.0	10.0	10.0
Bituminous Stabilized Base	-	0.350	10.0	10.0	10.0	10.0
Mechanically Stabilized Base	1.0	0.140	25.0	25.0	20.0	20.0
Crusher run Subbase	1.0	0.110	30.0	30.0	25.0	20.0
Pavement Thickness (cm)			75.0	75.0	65.0	60.0
Proposed pavement SN			5.79	5.79	5.30	5.08

where, $\text{SN} = a_1 \times D_1 + a_2 \times D_2 + a_3 \times m_3 \times D_3 + a_4 \times m_4 \times D_4$

APPENDIX 6 Proposed Consultant Assignment

APPENDIX 7 Draft TOR of Consulting Services

TERMS OF REFERENCE
CONSULTING SERVICES FOR
MOMBASA CITY ROAD DEVELOPMENT PROJECT

(Draft)

1. Introduction

The Government of the Republic of Kenya, through its Ministry of Road has applied for a loan from the Japan International Cooperation Agency (JICA) to finance Mombasa City Road Development Project (the Project). The implementation agency of the Project is Kenya Highway Authority (KeNHA) under the Ministry of Road.

KeNHA intends to engage a consulting company (hereinafter referred as “the Consultant”) for successful implementation of the Project, and the Terms of Reference (TOR) sets out the scope of services to be provided by the Consultant.

2. Background

Feasibility study with environmental and social impact assessment and preliminary and detailed engineering design of Mombasa Bypass including the new container terminal link road has started in 2008 with assistance of the World Bank.

In 2011, Japan International Cooperation Agency (JICA) conducted the Preparatory Survey on Mombasa City Road Development Project to facilitate formation of the project to be implemented with a Japanese ODA loan. The Survey reviewed the F/S reports and updated basic design of the Project facilities and implementation procedure and schedule.

3. Outline of the Project

- Road Length : 25.5 km
- Number of Lanes :4-lane (Section 1 and 2 = 9.5 km)
2-lane (Section 3 and 4 = 16.0 km)
- Design Speed :80km/hr (Main roads), 50km/hr (Slip roads)
- Number of Intersections :3 (Grade separated intersections)
1 (At grade intersection)
5 (U-turn bay)
- Number of Bridge/Length :3 bridges (Total length 3,650m)

4. Project Component

The Project consists of the following components:

- Mombasa Southern Bypass (the Bypass): From Miritini Jct. at A104 through Mwache Jct. and Tsunza to Kibundani Jct. at A14. The length is 20.0km. The section from Miritini Jct. to Mwache Jct. is 4-lane and from Mwache to Kibundani Jct. is 2-lane.
- Kipevu Link Road (the Link Road): From Mwache Jct. to New Container Terminal is 5.7km with 4-lane.
- Long bridges, namely Mwache Bridge (900m), Mteza Bridge (1450m) and a pile-slab type viaduct (1300m) are proposed along the Bypass.
- Grade separated junctions at Miritini, Mwache and Kibundani along the road.
- Grade separated U-turn bay at 5 points along the road.
- Other necessary road facilities such as drainage, slope protection and road safety as proposed in the Preparatory Survey Report.

5. Project Packaging

The Project is split into the following three packages:

- Package-1: From Miritini Jct. to Mwache Jct. and Kipevu Link Road (9.5km)
- Package-2: From Mwache Jct. to Mteza (including Mteza Bridge) (8.4km)
- Package-3: From Mteza (excluding Mteza Bridge) to Kibundani Jct. (7.8km)

6. Objectives of Consultancy Services

To implement the Project, the Consultant shall carry out the engineering services for detailed design, tendering assistance and construction supervision. The selection of the Consultant shall be in accordance with the Guidelines for the Employment of Consultant under Japanese ODA Loans and the regulations of the Government of Kenya.

The objectives of the Consultancy services are:

- To ensure efficient and proper preparation of detailed design;
- To ensure that project implementation is executed with the efficient and timely manner to construct planned structure in accordance with the planned implementation schedule; and
- To render proper technical supervision and execution of the construction works and ensure that the resulting project structures meet the international quality standards.

7. Scope of Consultancy Services

In order to achieve the aforementioned objectives, the Consultant shall render, among others, the following services:

- (1) Detailed Design Stage
 - Reviewing of previous studies

- Detailed Engineering Design, Cost Estimation and Preparation of Tender Documents
- Assistance in RAP implementation and monitoring

(2) Tendering Assistance Stage

- Assistance in Pre-qualification, Tendering and Contract Negotiation
- Assistance in RAP implementation and monitoring

(3) Construction Supervision Stage

- Construction Supervision
- Environmental Monitoring
- Assistance in RAP implementation and monitoring
- Maintenance Plan and Training
- Technical Training

8. Detailed Scope of the Consultancy Services

The Consultant shall perform all works necessary to achieve the objectives set out in the Terms of Reference, under the direct supervision of the Project Director to be nominated by KeNHA.

In carrying out the work, the Consultant shall cooperate fully with the concerned agencies of the Government of Kenya and JICA.

The Consultant shall perform the tasks listed below:

8.1 Detailed Design Stage

(1) Review of Previous Studies

The Consultant shall study the previous approved documents related to the Project, and carefully review the technical designs and recommendations in the previous studies.

Review of the previous studies shall cover, among others, the following subjects:

- Site survey and test results such as topographic survey, geotechnical survey and traffic survey to utilize in the detailed design
- Design criteria and basic design of Project facilities
- EIA and monitoring plan
- RAP and monitoring plan
- Relocation plan of public utilities, buildings, obstacles, etc.
- Construction plan and unit prices required for the construction cost estimates

(2) Topographic Survey

Detailed topographic surveys shall be carried out either by ground survey or aerial photo survey to prepare a basic topographic data required for the detailed design of the road and structures.

- a. Vertical control monument shall be set at the location where it shall not be disturbed during construction.
- b. Horizontal and vertical monuments, with reference shall be shown in the plans
- c. A detailed topographic survey shall be conducted to locate man-made features such as roads, buildings, etc.. and natural features such as creeks, canals, slopes, etc..
- d. The levelling shall be tied to the existing government benchmarks in the area.
- e. Cross sections shall be taken at 20 meter intervals, unless local conditions require cross section at closer intervals.

(3) Material Source Survey

Borrow pits and quarry sites surveys shall be carried out taking into account of the quality necessary for the road and bridge construction of the Project.

The Consultant shall identify the sources of borrow which are acceptable to be used for the construction of the Project road and bridges.

At proposed material sources, test pits shall be made and sufficient sample should be taken for laboratory testing.

Quality survey of reinforcement bar, steel material, cement and PC-tendon shall be carried out.

(4) Geotechnical Survey and Soil Investigation

The Consultant is required to study geological data in F/S and Preparatory Survey to determine boring locations in the detailed design stage avoiding overlapping.

The locations of the boring required to execute in the detailed design are shown in the **Attachment-1**. Except 5 of above sea borings as shown in Attachment-1, borings at the planned bridge piers in the sea are not included in the Consultancy services but are proposed to be executed by the Contractor during the construction stage. (Three spots of offshore boring along the road were conducted in the previous studies. The bridges over the sea shall be designed using these geological data. Then the final pile length shall be determined in the shop drawing to be submitted by the Contractor based on his boring survey.)

At the bridge foundation, the boring shall be conducted 3-5m deeper than the bottom of foundation. Soil sampling and SPT shall be carried out every 2m depth. The following laboratory tests shall be carried out on the samples which represent each soil layer.

- Grain size distribution and classification
- Moisture content
- Atterberg limits
- Consolidation test (only where embankment on soft ground)

The Consultant shall investigate, test and analyse about the subsoil conditions for the design of the Project based on the results of the survey and tests mentioned above.

(5) Review of Environmental Impact Assessment (EIA)

The Consultant shall review the Environmental Impact Assessment (EIA) for the Project site and submit recommendation for mitigation of the environmental impacts, if any. The requirements of the Environmental Monitoring Plan shall be incorporated in preparation of the specifications of the tender documents.

(6) Alignment Study

The Consultant shall review the route alignment recommended in the previous studies and define the horizontal and vertical alignment of the Project based on the results of the topographic survey and updated site conditions.

(7) Detailed Design of the Project Facilities

- a. Establishment of the design criteria, including review of the basic design in the previous studies and the existing design based on the results of topographic survey, material survey and geotechnical survey and soil investigation and other available data.
- b. Make comparative study and selection of the most appropriate types of bridge/structures including road types taking into account the site conditions, construction method as well as economic conditions.
- c. Preparation of detailed design of road, bridge, drainage and other structures, including structural analysis, design calculation, drawings, etc., taking into account the most appropriate construction method.
- d. Preparation of engineering drawings which shall include; plan, profile and cross sections of roads and general view, structural drawing of bridges with accessories, reinforcement bending schedule and arrangement, PC tendon arrangement, structural detail drawing of

other structures necessary for the Project.

(8) Construction Planning

The Consultant shall study and propose optimum construction method and schedule for every work including material and equipment procurement plan and plant (crushing, asphalt, concrete, precast girder, etc.) procurement plan.

The Consultant shall study construction method to mitigate impacts on environment and to comply with the EIA requirements. The construction method for the environment consideration shall be reflected as the requirement in the Tender Documents.

(9) Cost Estimate

The Consultant shall prepare the detailed cost estimate for the construction of the Project, including:

- Bill of Quantities for the construction works
- Engineer's Estimate including detail unit price analysis.
- Annual financing schedules according to the construction schedule with breakdown of foreign and local currency portion.

(10) Preparation of Pre-qualification Documents and Tender Documents

The Consultant shall prepare the following documents to engage the Contractor who shall be selected through international competitive bidding in accordance with the conditions of the Guidelines for Procurement under Japanese ODA Loans.

- Pre-qualification Documents, including evaluation criteria
- Instruction to Bidders
- Bid Form
- General Conditions of Contract
- Special Conditions
- General Specifications
- Technical Specifications
- Bill of Quantities
- Drawings
- Contract Form
- Bid Security Form
- Performance Security Form

(11) Preparation of Implementation Program

The Consultant shall prepare the Implementation Program in accordance with the final scope of works

8.2 Tendering Assistance Stage

The Consultant shall assist KeNHA in the tendering procedure and in successfully organizing the tender in accordance with the Guidelines of JICA and regulations of Kenya.

During the tendering stage, the Consultant's services shall include, but not necessarily limited to, the following tasks:

(1) Pre-qualification

Assist KeNHA in the evaluation of pre-qualification documents and selection of pre-qualified tenderers.

(2) Pre-Bid Conferences

Assist KeNHA to conduct pre-bid conference and pre-bid site inspection for the qualified prospective contractors and to furnish any other information or assistance, which they may need.

Prepare for approval by KeNHA of any necessary revision or addenda to the tender documents during the tender period.

(3) Bid Evaluation

Assist KeNHA in the opening of tenders, evaluation of the received tenders, prepare recommendation for the contract award and report to the responsible authorities of Kenya and JICA for their approval.

(4) Contract Negotiation

Assist KeNHA in the contract negotiation with the contractors, if necessary.

(5) Reporting Form

Prepare standard forms and reporting format to be used during construction supervision. Prepare and compile all documents for the complete construction contract to be submitted to KeNHA for approval.

8.3 Construction Supervision

During the Construction Supervision Stage, the Consultant services shall include, but not limited

to, the following general tasks:

- (1) The Consultant shall function on behalf of KeNHA as “the Engineer” of the Project. The Consultant shall perform his duties in accordance with acceptable criteria and standards applicable to the road/bridge construction works and shall exercise the powers vested as the Engineer under the KeNHA's contract with the Contractors to be awarded.
- (2) The term “the Engineer’s Representative” shall mean the Consultant's Project Manager appointed by the Consultant to perform the duties and whose authority shall be notified in writing to the Contractors by the KeNHA's Project Director for the Project. In general, the duties of the Engineer are to inspect, to test and examine any materials to be used or workmanship employed in connection with the works to ensure that the construction is carried out in accordance with the plans and specifications.
- (3) The Consultant shall setup an office and ensure proper staffing including its staffing that shall meet KeNHA's requirements for the proper execution of the services.

More specifically, the Consultant shall provide the following services:

- (1) Represent the interest of KeNHA against the Contractor in any matters related to the construction contract and the proper execution thereof. Establish the contract management system to administer the contract and to maintain records of all contractual correspondences, measurements quality control test.
- (2) Review and approve the Contractor's work method including plan for traffic management and safety control during construction.
- (3) Review and approve the Contractor's working drawings, shop drawings, the "As Built" drawings, erection drawings, and drawings for temporary works. Issue further drawings, and to give instruction to the Contractor for any works which may not be sufficiently detailed in the contract documents.
- (4) Review and recommend for approval of the Contractor's work schedule or revisions of plans or programs that the Contractor is obliged to furnish for the Consultant's approval. Prepare and submit a disbursement schedule to KeNHA.
- (5) Assess the adequacy of all inputs such as materials, labour and equipment provided by the Contractor and his methods of work in relation to the required rate of progress and when required, take appropriate action in order to expedite progress. Keep and regularly update

a list of the Contractor's equipment (and its conditions) to ensure compliance with the list of equipment which the Contractor provided in his bid.

- (6) Inspect and evaluate all Contractor's installations, site office, yards, warehouses and other temporary works at the site to ensure compliance with the terms and conditions of the contract documents.
- (7) To provide effective and regular supervision of the works and supervise the quality control tests to assure that the works are executed in accordance with the established standard, criteria, specifications and procedure. Maintain at least one of the Engineer Representative staff at the site at all times when the Contractor is working to supervise the work and issue instructions as required.
- (8) Assess the adequacy of the testing laboratory provided by the Contractor, order necessary tests on materials and the completed works and instruct removal and substitution of improper works, structures and/or material as required.
- (9) Control and appraise the progress of the works, order suspension of the works as required, and evaluate time extension of the period for completion of the works with authorization by KeNHA's approval.
- (10) Verify the Contractor's stake-out survey for the centerline of alignment, structure locations and vertical control benchmarks.
- (11) Examine and make recommendation to KeNHA on all claims from the Contractor for extension of time, extra compensation, work or expenses or other relevant matters, including preparing the technical justification for any change of works due to any matters on site.
- (12) Measure and compute quantities of approved and accepted work and materials, and check, certify and make recommendations to Engineer on the Contractor's monthly and final payment certificates.
- (13) Propose and present to KeNHA for approval any changes in plans deemed necessary for the completion of the works, including information or any effect changes may have on the contract amount and the time of completion of the Project. The Consultant shall prepare all necessary change orders including altering plans and specifications and other details, and inform KeNHA of any problems or potential problems which may arise in connection

with the construction contract and make recommendation to KeNHA for possible solutions.

- (14) Assure the receipts of and maintain all warrants for materials and equipment accepted and incorporated in the Project as required under the terms of the contract documents.
- (15) Prepare and submit to KeNHA the periodical reports as required on the progress of works, the performance of the Consultant and the Contractor, the work quality and financial forecast of the Project.
- (16) Inspect the safety and environmental aspects of the construction works, methods and procedure to ensure that every reasonable measure has been taken to protect life and property.
- (17) Before the issuance of the Certificate of Completion, the Consultant shall carry out necessary inspection, specify and supervise any remedial works to be carried out and when completed, recommend KeNHA to carry out final inspection and acceptance of the project.
- (18) Perform any other items of works not specifically mentioned above but which are necessary and essential for successful supervision and control of the construction activities in accordance with the plans, specifications and terms of contract. The Consultant's responsibility for the assignment shall remain valid until the issuance of the Certificate of Completion by KeNHA.

8.4 Environmental Monitoring

Based on the following documents, the Consultant shall supervise monitoring and reporting on the environmental condition including its impact during construction. The consultant shall inspect adverse environmental pollution caused by contractor's activities.

- Environmental and Social Impact Assessment for Mombasa Bypass Road Study: Volume I Main Report (KeNHA, March 2010) and its Environmental and Social Management & Monitoring Plan
- Supplementary Environmental Impact Assessment Report (JICA, November 2011) and its Environmental Management Plan

Monitoring of the environmental conditions shall include among others, the following items:

- Water pollution

- Air pollution
- Noise and vibration
- Solid waste
- Tree and mangrove cutting and replanting
- Birds and fish catch

The Consultant shall monitor the status of compliance of the environmental standards defined in the above documents throughout the duration of construction, and make necessary recommendations on mitigation measures to KeNHA and the Contractor of the Project.

8.5 RAP Assistance and Monitoring

Based on the Resettlement Monitoring Plan in the Supplementary Resettlement Action Plan on Mombasa City Road Development Project (KeNHA, November 2011), the Consultant shall assist KeNHA to implement RAP and monitor the activities including the following:

- To provide project road alignment and road reserve limit coordinates to cadastral surveyors of KeNHA for installation of beacons in the land acquisition.
- To assist in the implementation of resettlement for minimizing adverse social impacts from land acquisition.
- To assist in the preparation of quarterly progress report on resettlement.
- To assist in the preparation of a resettlement completion report to properly document the actual resettlement impacts, resettlement implementation and evaluation of the resettlement plan.

8.6 Technical Training

Through the implementation of the consulting services, the Consultant shall provide transfer of knowledge and introduce advanced technology on construction, management systems and operation and maintenance to the Kenyan engineers.

Train Kenyan engineers on the job by assigning them to get involved in the implementation process of the consulting services. Provide transfer of knowledge to the KeNHA staff at the project site about the construction management, quality control and international contract administration.

8.7 Maintenance and Operation Plan

The Consultant shall review the present road and bridge maintenance system and propose the appropriate maintenance system for the Project. The Consultant shall assist and make recommendations to KeNHA for setting up an actual maintenance and operation scheme for the

Project after the completion.

9. Reports

9.1 Consultant's Report to KeNHA

The Consultant shall submit the following reports and documents in English to KeNHA.

- (1) Within one month after commencement of the services of the project, the Consultant shall submit 10 hard copies and two softcopies of Inception Report for guiding all the consulting services to be undertaken by the Consultant.
- (2) By the 10th day of each month, the Consultant shall submit 10 hard copies and two softcopies of a Monthly Progress Report in the accepted form briefly and concisely describing all activities and progress in the previous month. Problems encountered or problems anticipated shall be clearly stated, together with steps taken or recommendations for their correction. It will also indicate the works to be performed during the coming month.
- (3) Within one month after completion of the Detailed Design, 10 hard copies and two softcopies of Detailed Design Report including Draft Tender Documents shall be submitted for review and approval of KeNHA. After the review and approval, 30 copies of the Tender Documents for each contract package shall be submitted.
- (4) Within one month after completion of construction, the Consultant shall provide KeNHA with one set of original as-built plans with two softcopies showing final details of the Project completed together with all data, records, field books, etc., and a properly indexed catalogue.
- (5) After completion of all services stipulated in the contract, the Consultant shall submit the Service Completion Report, giving summary of whole period of services.

9.2 KeNHA's Report to JICA

- (1) The Consultant shall assist KeNHA in preparing the progress reports for the Project on a quarterly basis until the Project is completed in such form and in such detail as JICA requests in accordance with the Loan Agreement.
- (2) The Consultant shall assist KeNHA in preparing the project completion report after completion of the Project in such detail as JICA requests in accordance with the Loan Agreement.

10. Schedule of the Project

The overall Project Implementation Schedule as follows:

Overall Project Implementation Schedule (Tentative)

	2012	2013	2014	2015	2016	2017	2018	2019
Loan Agreement								
Selection of Consultant		(10M)						
Land Acquisition				(26M)				
Utility Relocation			(18M)					
Detailed Design								
Package-1: Miritini - Mwache - Kipevu		(9 M)						
Package-2: Mwache -Tunza - Mteza		(12 M)						
Package-3: Mteza - Kibundani		(9 M)						
Tendering								
Package-1: Miritini - Mwache - Kipevu		(15M)						
Package-2: Mwache -Tunza - Mteza		(15M)						
Package-3: Mteza - Kibundani		(15M)						
Construction								
Package-1: Miritini - Mwache - Kipevu					(24 M)			
Package-2: Mwache -Tunza - Mteza						(41 M)		
Package-3: Mteza - Kibundani					(24 M)			

11. Estimated Staffing and Input Schedule

Based on the Project implementation schedule, the total project duration is 67 months, which includes 15 months for the detailed design stage, 21 months for the tender assistance stage and 47 months for the construction supervision.

The estimated staffing and input schedule for the consultancy service is summarized as follows:

	Professional A (International)		Professional B (National)	
	No. of staff	Man-month	No. of staff	Man-month
Detailed Design Stage (15 months)				
Project Manager	1	15	-	-
Deputy Project Manager	-	-	1	15
Highway Engineer	1	11	2	20
Pavement Engineer	1	4	-	-
Drainage Engineer	1	6	1	6
Structural Engineer	2	20	2	20
Const. Planner/Cost Estimator	1	11	1	10
Specification Specialist	1	7	1	7
Document Specialist	1	5	1	8
Geotechnical Engineer	-	-	1	4
Geodetic Engineer	-	-	1	3
Quantity Engineer	-	-	1	7
Resettlement Specialist	-	-	1	15
Subtotal	9	79	13	115
Tendering Assistance Stage (21 months)				
Project Manager	1	5	-	-

	Professional A (International)		Professional B (National)	
Deputy Project Manager	-	-	1	5
Document Specialist	0	0	0	0
Const. Planner/Cost Estimator	1	1	1	1
Resettlement Specialist	-	-	1	5
Subtotal	2	6	3	11
Construction Supervision Stage (47 months)				
Project Manager	1	48		
Deputy Project Manager	-	-	1	48
Highway Engineer	1	47	1	47
Structural Engineer	1	43	2	76
PC Girder Specialist	1	30	-	-
Drainage Engineer	1	33	1	39
Quantity Engineer	-	-	1	47
Quality Engineer	1	47	1	46
Resident Engineer	-	-	3	89
Environmental Specialist	-	-	1	47
Resettlement Specialist	-	-	1	47
Maintenance Specialist (Road)	1	1	-	-
Maintenance Specialist(Bridge)	1	1	-	-
Subtotal	6	250		486
Total		335		612

The general experience requirement of the professional staff is as follows:

	General and Academic Qualification	Project Related Experience	Overseas and Country Experience
Professional A (International)			
Project Manager	Should have more than 20 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Project Manager	More than 10 projects assigned in the developing countries
Highway Engineer	Should have more than 15 years of experience with a bachelor's degree.	More than 5 highway projects as Highway Engineer	More than 5 projects assigned in the developing countries
Pavement Engineer	Should have more than 15 years of experience with a bachelor's degree.	More than 5 highway projects as Pavement Engineer	More than 5 projects assigned in the developing countries
Drainage Engineer	Should have more than 15 years of experience with a bachelor's degree.	More than 5 highway projects as Drainage Engineer	More than 5 projects assigned in the developing countries
Structural Engineer	Should have more than 15 years of experience with a bachelor's degree.	More than 5 bridge projects as Structural Engineer	More than 5 projects assigned in the developing countries
Const. Planner/Cost Estimator	Should have more than 15 years of experience with a bachelor's degree.	More than 5 highway and bridge projects as Const. Planner/ Cost Estimator	More than 5 projects assigned in the developing countries
Specification Specialist	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Specification Specialist	More than 3 projects assigned in the developing countries
Document Specialist	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Document Specialist	More than 3 projects assigned in the developing countries
PC Girder Specialist	Should have more than 12 years of experience with a bachelor's degree.	More than 3 bridge projects as PC Girder Specialist	More than 3 projects assigned in the developing countries
Quality Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Quality Engineer	More than 3 projects assigned in the developing countries
Maintenance Specialist (Road)	Should have more than 15 years of experience with a bachelor's degree.	More than 3 highway projects as Maintenance Specialist (Road)	More than 3 projects assigned in the developing countries
Maintenance Specialist (Bridge)	Should have more than 15 years of experience with a bachelor's degree.	More than 3 bridge projects as Maintenance Specialist (Bridge)	More than 3 projects assigned in the developing countries
Professional B (National)			
Deputy Project Manager	Should have more than 15 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Project	More than 3 projects assigned in international lending

	General and Academic Qualification	Project Related Experience	Overseas and Country Experience
		Manager or Deputy Project Manager	organization funded projects
Highway Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 5 highway projects as Highway Engineer	More than 3 projects assigned in international lending organization funded projects
Drainage Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 5 highway projects as Drainage Engineer	More than 3 projects assigned in international lending organization funded projects
Structural Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 5 bridge projects as Structural Engineer	More than 3 projects assigned in international lending organization funded projects
Const. Planner/Cost Estimator	Should have more than 12 years of experience with a bachelor's degree.	More than 5 highway and bridge projects as Const. Planner/ Cost Estimator	More than 3 projects assigned in international lending organization funded projects
Specification Specialist	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Specification Specialist	More than 3 projects assigned in international lending organization funded projects
Document Specialist	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as	More than 3 projects assigned in international lending organization funded projects
Geotechnical Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 3 bridge projects as geotechnical Engineer	More than 3 projects assigned in international lending organization funded projects
Geodetic Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway projects as Geodetic Engineer	More than 3 projects assigned in international lending organization funded projects
Quantity Engineer	Should have more than 10 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Quantity Engineer	More than 3 projects assigned in international lending organization funded projects
Resettlement Specialist	Should have more than 10 years of experience with a bachelor's degree.	More than 3 projects as Resettlement Specialist	More than 3 projects assigned in international lending organization funded projects
Quality Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Quality	More than 3 projects assigned in international lending

	General and Academic Qualification	Project Related Experience	Overseas and Country Experience
		Engineer	organization funded projects
Resident Engineer	Should have more than 12 years of experience with a bachelor's degree.	More than 3 highway and bridge projects as Resident Engineer	More than 3 projects assigned in international lending organization funded projects
Environmental Specialist	Should have more than 10 years of experience with a bachelor's degree.	More than 3 projects as Environmental Specialist	More than 3 projects assigned in international lending organization funded projects

12. Responsibility of the Government of Kenya

In connection with work by the Consultant that requires the cooperation of other Government agencies, the Government will provide liaison and will ensure that the Consultant has access to all information as may be allowed by law for the performance of the Services.

13. Services and Facilities Provided by KeNHA

KeNHA shall provide the Consultant with the following facilities and support staff to assist in performing the services for the effective implementation of the Project:

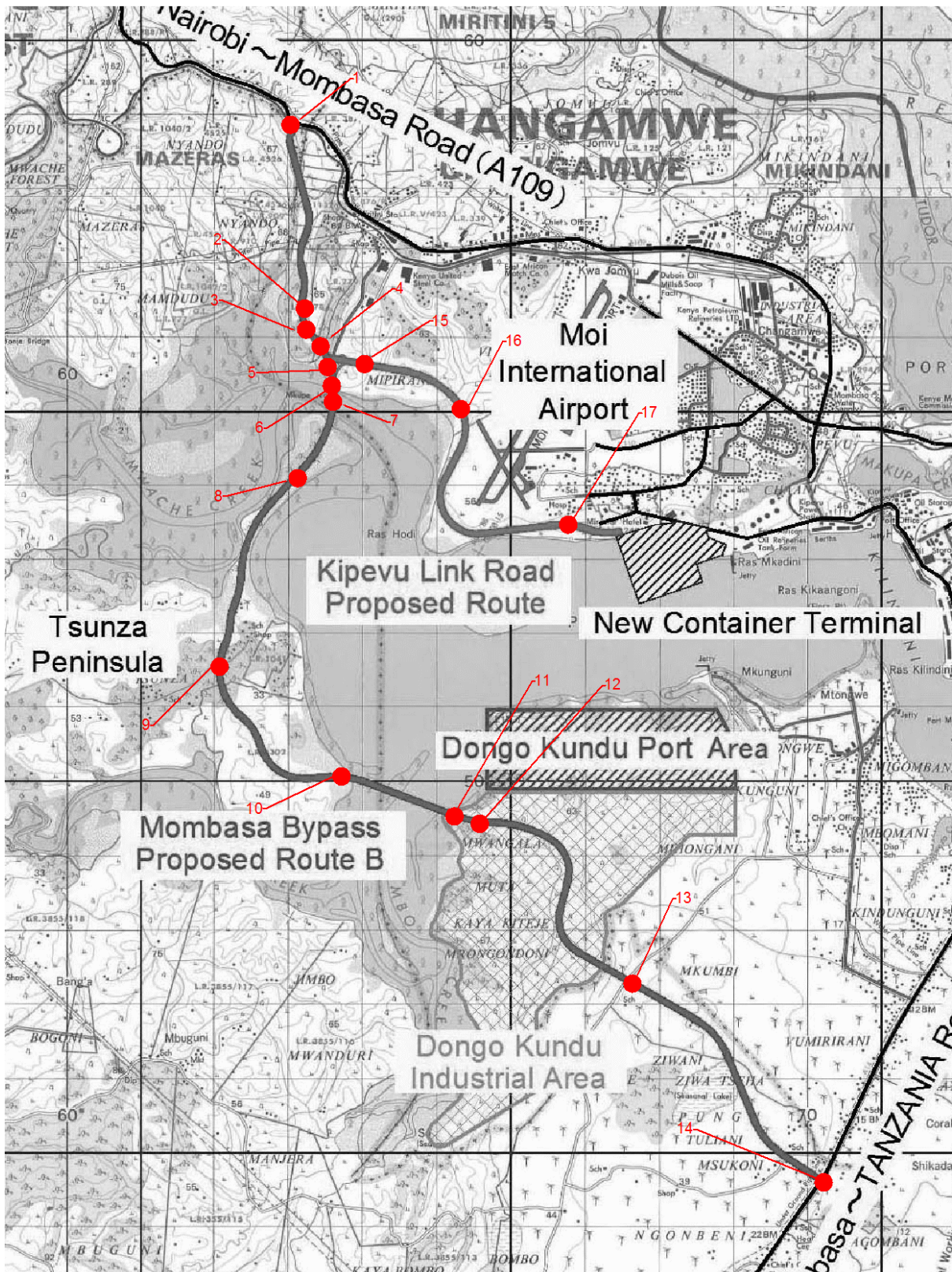
- Counterpart staff consisting of technical and administrative staff.
- Provision of all available documents and other information and data related to the Project.
- Assistance in securing all necessary permits and authorizations from the Government agencies for clearance through customs, and obtaining visas, residential permits, etc. as required for carrying out the Services.

Attachment 1 Boring Locations Required to Execute in the Detailed Design Stage

No.	Location	No. of Boring	Remarks
1	Sta. 0+000	3	For design of bridge/culvert foundation
2	Sta. 2+600	1	For classify deep excavation soil (depth about 25m)
3	Sta. 3+100	1	For classify deep excavation soil (depth about 30m)
4	Sta. 3+400	1	For stability check of embankment
5	Sta. 3+600	5	For design of ramp viaduct foundation
6	Sta. 3+900	2	For design Mwache Bridge A1 & P1 foundation
7	Sta. 2+400	2 (above sea)	For design Mwache Bridge P2 & P3 foundation
8	Sta. 4+700 – 5+700	3	For design pile-slab viaduct foundation
9	Sta. 8+100	3	For design over-bridge foundation
10	Sta. 10+750	1	For design Mteza Bridge A1 foundation
11	Sta. 12+000	3 (above sea)	For design Mteza Bridge P30, P31, P32 foundation
12	Sta. 12+200	1	For design Mteza Bridge A2 foundation
13	Sta. 13+530	3	For design over-bridge foundation
14	Sta. 20+000	5	For design of ramp viaduct foundation
15	Sta. 0+400 (Kipevu Link Rd)	1	For classify deep excavation soil (depth about 25m)
16	Sta. 1+350 (Kipevu Link Rd)	1	For stability check of embankment
17	Sta. 1+800 (Kipevu Link Rd)	1	For classify deep excavation soil (depth about 15m)

Note: The above are approximate locations. The Consultant shall be responsible to determine the actual boring location.

Attachment 2 Location of Boring Spots to be executed in D/D



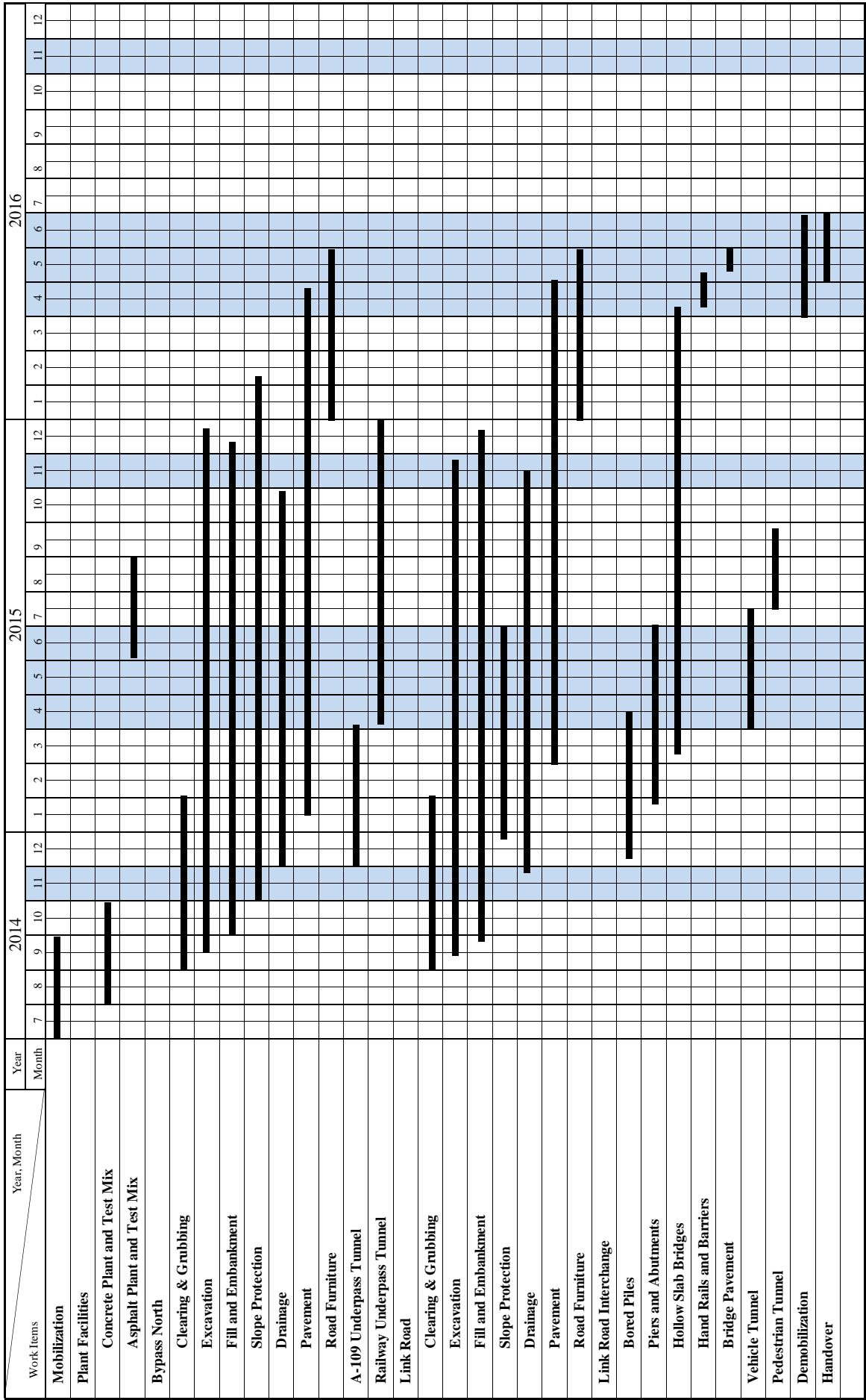
Note: Content of borings of each spots is explained in Attachment 1.

APPENDIX 8 Cost Estimate Data

Construction Schedule

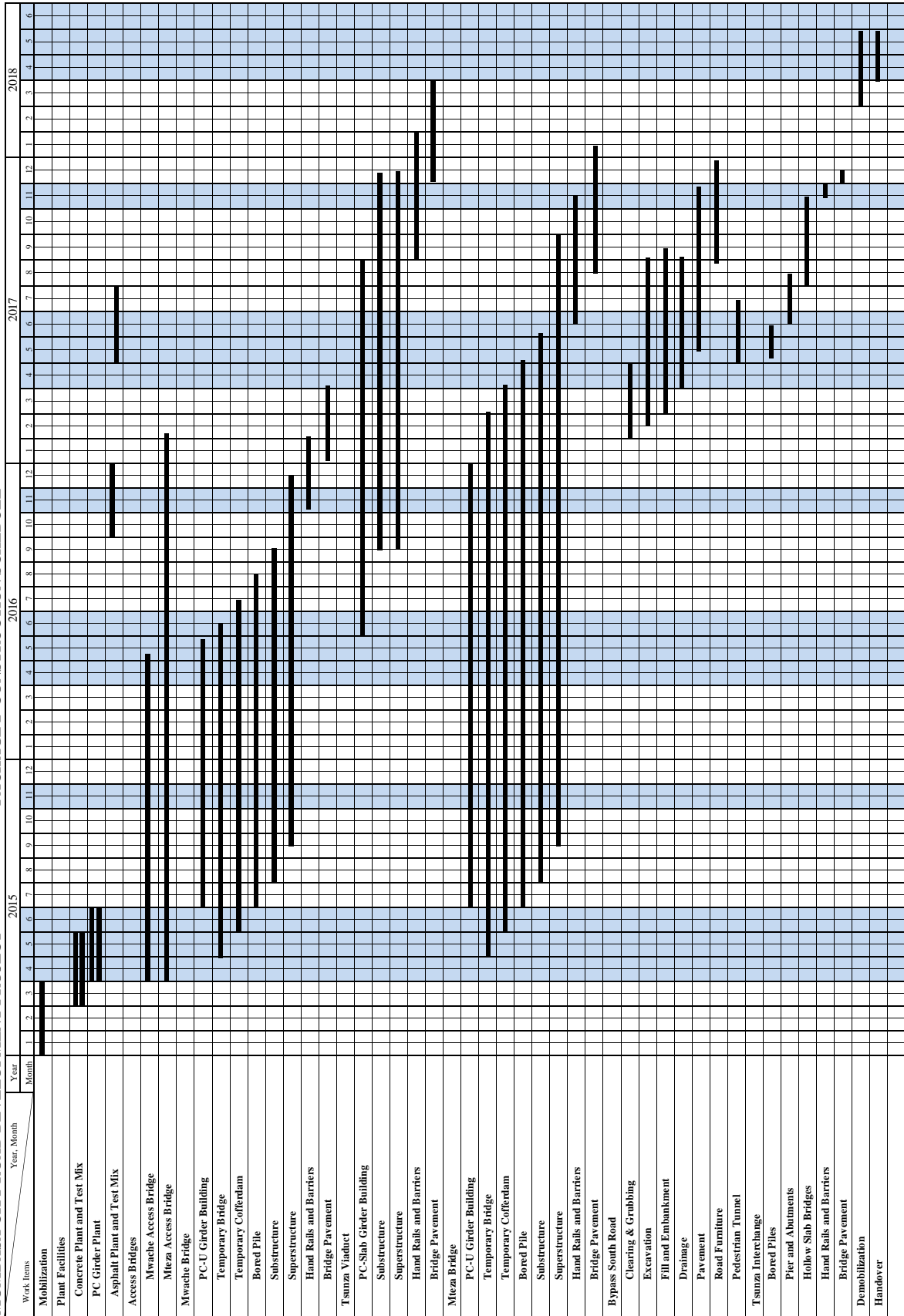
MOMBASA CITY ROAD DEVELOPMENT PROJECT PACKAGE 1 CONSTRUCTION SCHEDULE

MOMBASA CITY ROAD DEVELOPMENT PROJECT PACKAGE 1 CONSTRUCTION SCHEDULE



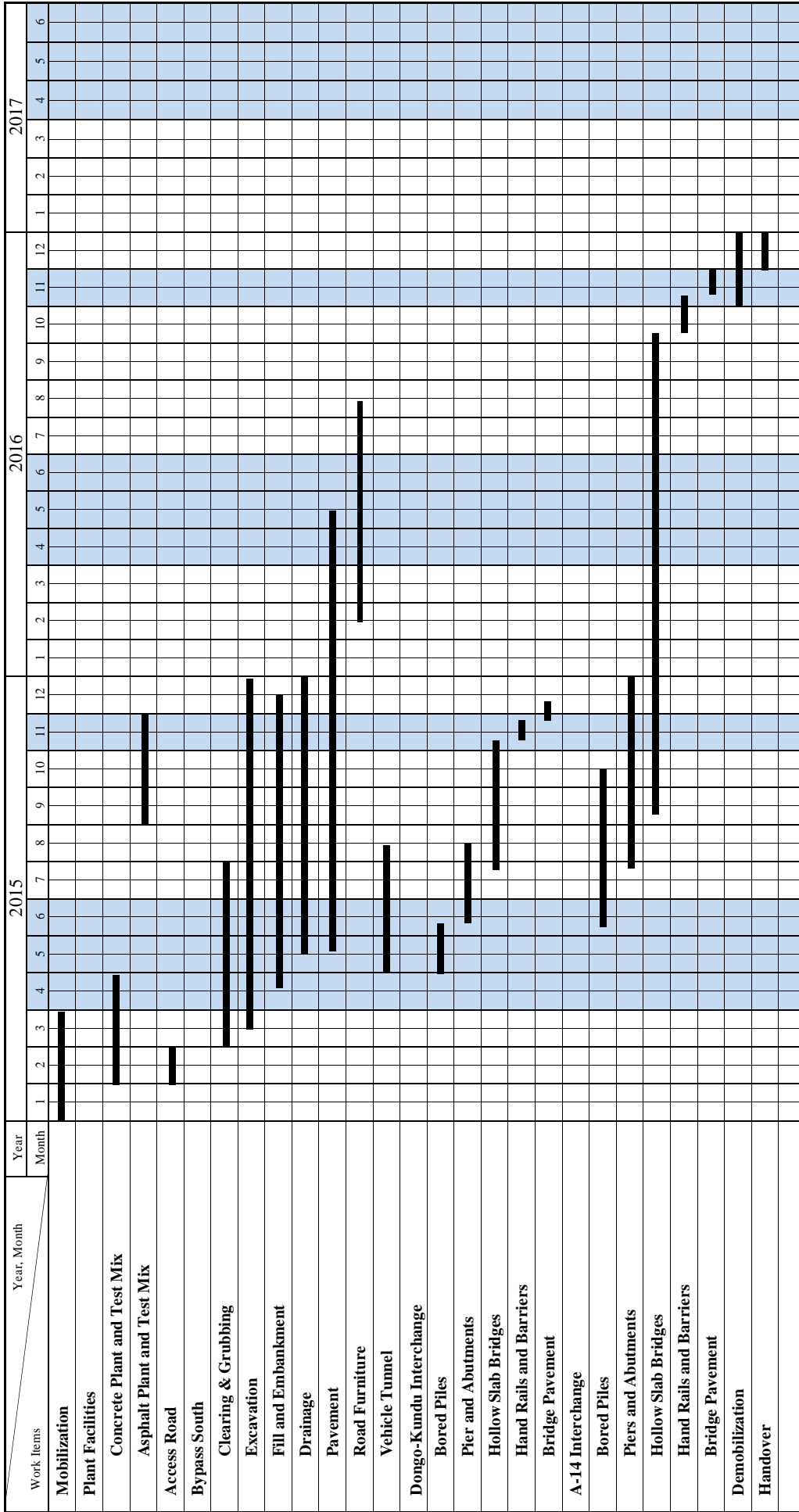
☐ : Rainy Season

MOMBASA CITY ROAD DEVELOPMENT PROJECT PACKAGE 2 CONSTRUCTION SCHEDULE



Legend: Rainy Season

MOMBASA CITY ROAD DEVELOPMENT PROJECT PACKAGE 3 CONSTRUCTION SCHEDULE



Legend: : Rainy Season

Construction Rate

Package 1 (The Northern Section of Mombasa Bypass Route B and The Link Road)										
No.	Items	Description	Quantity	Unit	Rate		Amount			Remarks
					Ksh	Yen	Ksh	Yen	Total (Yen)	
Provisional & General										
900	Supervising Vehicle	Bypass B North	1	Sum	68,422,800		68,422,800		54,738,240	
903	Supervising Vehicle	Link Road	1	Sum	63,375,000		63,375,000		50,700,000	
904	Office & Accomodation	Route B North	1	Sum	81,741,040		81,741,040		65,392,832	
907	Office & Accomodation	Link Road	1	Sum	69,028,480		69,028,480		55,222,784	
214	Quality Control Equipment	Laboratory Test Equipment	1	Sum	11,500,000		11,500,000		9,200,000	Assessed
215	Survey Equipment	Survey Equipment	2	Sum	4,025,000		8,050,000		6,440,000	Assessed
908	Security	Route B North	1	Sum	32,124,480		32,124,480		25,699,584	
911	Security	Link Road	1	Sum	23,206,440		23,206,440		18,565,152	
216	Safty Equipment	Safty net, barrier etc	2	Sum	2,300,000		4,600,000		3,680,000	Assessed
912	Borrow Estate	Route B North	1	Sum	13,800,000		13,800,000		11,040,000	
915	Borrow Estate	Link Road	1	Sum	8,280,000		8,280,000		6,624,000	
916	Prepare Office, Plant & Yard	Route B North	1	Sum	5,498,546		5,498,546		4,398,837	
919	Prepare Office, Plant & Yard	Link Road	1	Sum	3,299,128		3,299,128		2,639,302	
218	Business Trip	Nairobi-Mombasa	96	round	28,750		2,760,000		2,208,000	Assessed
217	Publicity Sign Board		4	No.	287,500		1,150,000		920,000	Assessed
921	Equipment Mobilization	Route B North	1	Sum	8,625,000		8,625,000		6,900,000	
924	Equipment Mobilization	Link Road	1	Sum	5,462,500		5,462,500		4,370,000	
929	Concrete Mixing Plant	Install & demolish	1	Set	7,194,016		7,194,016		5,755,213	
931	Asphalt Mixing Plant	Install & demolish	1	Set	6,616,731		6,616,731		5,293,385	
933	Overseas Transportation	Route B North	1	Sum		49,450,000		49,450,000	49,450,000	
	Insurance	0.5% of estimate items					39,728,086	1,596,646	33,379,115	
Access Road										
920	Access Road	6m width, Crusher-run 200mm	6	km	7,890,874		47,345,244		37,876,195	
Clearance & Topsoil Strip										
1052	Site Clearance		49.78	Ha	437,092		21,758,440		17,406,752	Mouchel Parkman
1053	Topsoil Strip	To Stockpile or Spoil, Haul 1.5km	99,551	m3	746		74,265,046		59,412,037	Mouchel Parkman
Earth Work										
1000	Cut in Soft Material & Haul	Cut, stockpile, load, haul 1.5km	734,180	m3	827		607,166,860		485,733,488	
1001	Cut in Hard Material & Haul	Cut, stockpile and haul 1.5km	550,635	m3	950		523,103,250		418,482,600	
1002	Cut in Soft Rock & Haul	Cut, stockpile and haul 1.5km	367,090	m3	1,251		459,229,590		367,383,672	
1003	Cut in Hard Rock & Haul	Cut, stockpile and haul 1.5km	183,545	m3	3,733		685,173,485		548,138,788	
1004	Road Bed Fill	Spread, trim, compact material	114,615	m3	402		46,075,230		36,860,184	
1006	Embankment Fill	Spread, water, compact material	1,011,815	m3	277		280,272,755		224,218,204	
1008	Level Bank	Spread, water, compact material	36,430	m3	210		7,650,300		6,120,240	
1010	Riprap Embankment	Riprap with excavated rock	25,485	m3	1,097		27,957,045		22,365,636	
1017	Preparation of Spoil Area		312,125	m3	153		47,755,125		38,204,100	Mouchel Parkman
1012	Haul & Spoil Soft Material	Overhaul & Spoil area preparation	133,992	m3	482		64,584,144		51,667,315	Mouchel Parkman
1013	Haul & Spoil Hard M. & Rock	Overhaul & Spoil area preparation	200,988	m3	499		100,293,012		80,234,410	Mouchel Parkman
Slope Protection										
1054	Build Cut Slope Surface		93,960	m2	453		42,563,880		34,051,104	
1055	Build Embankment Slope Surfa		135,735	m2	435		59,044,725		47,235,780	
1056	Topsoiling 50mm	Deliver and Hand Spreading	229,695	m2	189		43,412,355		34,729,884	Mouchel Parkman
1057	Grassing	Deliver and Plant Grass Springs	229,695	m2	173		39,737,235		31,789,788	Mouchel Parkman
1060	Masonry Wall, t=300	Wet masonry & Backfilling	22,000	m2	9,494		208,868,000		167,094,400	
1061	Stone Pitching t=150	Wet masonry & Backfilling	14,000	m2	3,327		46,578,000		37,262,400	
1064	Masonry Wall Base Concrete	366*234	1,000	m	2,883		2,883,000		2,306,400	
1065	Masonry Wall Cap Concrete	100*594	1,000	m	1,489		1,489,000		1,191,200	
1066	Stone Pitching Base Concrete	215*196	2,500	m	1,810		4,525,000		3,620,000	
Drainage										
1076	In-situ Concrete Ditch	500*500, Class 20/20 concrete	37,622	m	7,997		300,863,134		240,690,507	
1078	Single Drain Pipe 0.6m	Supply pipes & Place	780	m	25,980		20,264,400		16,211,520	
1080	Single Drain Pipe 1.2m	Supply pipes & Place	476	m	55,626		26,477,976		21,182,381	
1084	Single Drain 0.6m Inlet/Outlet	25N/mm2	34	No.	49,631	266	1,687,454	9,044	1,359,007	
1086	Single Drain 1.2m Inlet/Outlet	25N/mm2	22	No.	136,531	879	3,003,682	19,338	2,422,284	
1090	Build Oil Separator	10m3 (2.8*3.1*3.4)	12	No.	1,643,001	7,852	19,716,012	94,224	15,867,034	
Road Pavement										
1106	Surface Course AC, t=50	Supply and Lay AC	12,282	m3	36,933		453,611,106		362,888,885	
1103	Binding Course AC, t=50	Supply and Lay AC	14,381	m3	32,608		468,935,648		375,148,518	
1101	Asphaltic Base Course, t=100	Supply and Lay Asphaltic Base Cour	28,973	m3	28,566		827,642,718		662,114,174	

Package 2 (The Middle Section of Mombasa Bypass Route B)										
No.	Items	Description	Quantity	Unit	Rate		Amount			Remarks
					Ksh	Yen	Ksh	Yen	Total (Yen)	
Provisional & General										
901	Supervising Vehicle	Bypass B Middle	1	Sum	158,374,650		158,374,650		126,699,720	
905	Office & Accomodation	Route B Middle	1	Sum	180,622,380		180,622,380		144,497,904	
214	Quality Control Equipment	Laboratory Test Equipment	2	Sum	11,500,000		23,000,000		18,400,000	Assessed
215	Survey Equipment	Survey Equipment	2	Sum	4,025,000		8,050,000		6,440,000	Assessed
909	Security	Route B Middle	1	Sum	96,627,860		96,627,860		77,302,288	
216	Safy Equipment	Safy net, barrier etc	4	Sum	2,300,000		9,200,000		7,360,000	Assessed
913	Borrow Estate	Route B Middle	1	Sum	67,620,000		67,620,000		54,096,000	
917	Prepare Office, Plant & Yard	Route B Middle	1	Sum	15,395,929		15,395,929		12,316,743	
218	Business Trip	Nairobi-Mombasa	84	round	28,750		2,415,000		1,932,000	Assessed
394	Flight fare	Tokyo-Nirobi-Mombasa	44	round		1,153,450		50,751,800	50,751,800	
395	Overseas Incentives	Foreign Engineer	210	month		322,092		67,639,320	67,639,320	JICA
217	Publicity Sign Board		4	No.	287,500		1,150,000		920,000	Assessed
922	Equipment Mobilization	Route B Middle	1	Sum	13,225,000		13,225,000		10,580,000	
929	Concrete Mixing Plant	Install & demolish	2	Set	7,194,016		14,388,032		11,510,426	
931	Asphalt Mixing Plant	Install & demolish	1	Set	6,616,731		6,616,731		5,293,385	
934	Overseas Transportation	Route B Middle	1	Sum		811,900,000		811,900,000	811,900,000	
	Insurance	0.5% of estimate items					28,257,461	41,196,437	63,802,406	
Access Road										
920	Access Road	6m width, Crusher-run 200mm	4.0	km	7,890,874		31,563,496		25,250,797	
1297	Mwache Access Bridge	Acces Bridge, B=8m, L=900m	1	Sum	105,033,600	485,654,782	105,033,600	485,654,782	569,681,662	Mwache Access Bridge
1299	Mteza Access Bridge	Access Bridge, B=8m, L=1500m	1	Sum	164,966,400	768,432,682	164,966,400	768,432,682	900,405,802	Mteza Access Bridge
Clearance & Topsoil Strip										
1052	Site Clearance		15.99	Ha	437,092		6,989,101		5,591,281	Mouchel Parkman
1053	Topsoil Strip	To Stockpile or Spoil, Haul 1.5km	31,988	m3	746		23,863,048		19,090,438	Mouchel Parkman
Earth Work										
1000	Cut in Soft Material & Haul	Cut, stockpile, load, haul 1.5km	69,376	m3	827		57,373,952		45,899,162	
1001	Cut in Hard Material & Haul	Cut, stockpile and haul 1.5km	52,032	m3	950		49,430,400		39,544,320	
1002	Cut in Soft Rock & Haul	Cut, stockpile and haul 1.5km	34,688	m3	1,251		43,394,688		34,715,750	
1003	Cut in Hard Rock & Haul	Cut, stockpile and haul 1.5km	17,344	m3	3,733		64,745,152		51,796,122	
1004	Road Bed Fill	Spread, trim, compact material	41,510	m3	402		16,687,020		13,349,616	
1006	Embankment Fill	Spread, water, compact material	104,255	m3	277		28,878,635		23,102,908	
1008	Level Bank	Spread, water, compact material	1,840	m3	210		386,400		309,120	
1007	Borrow M. Embankment Fill	Spread, water, compact borrow M.	112,435	m3	875		98,380,625		78,704,500	
1010	Riprap Embankment	Riprap with excavated rock	25,835	m3	1,097		28,340,995		22,672,796	
Slope Protection										
1054	Build Cut Slope Surface		11,500	m2	453		5,209,500		4,167,600	
1055	Build Embankment Slope Surfa		26,600	m2	435		11,571,000		9,256,800	
1056	Topsoiling 50mm	Deliver and Hand Spreading	38,100	m2	189		7,200,900		5,760,720	Mouchel Parkman
1057	Grassing	Deliver and Plant Grass Springs	38,100	m2	173		6,591,300		5,273,040	Mouchel Parkman
Drainage										
1076	In-situ Concrete Ditch	500*500, Class 20/20 concrete	9,320	m	7,997		74,532,040		59,625,632	
1078	Single Drain Pipe 0.6m	Supply pipes & Place	240	m	25,980		6,235,200		4,988,160	
1084	Single Drain 0.6m Inlet/Outlet	25N/mm2	12	No.	49,631	266	595,572	3,192	479,650	
1090	Build Oil Separator	10m3 (2.8*3.1*3.4)	6	No.	1,643,001	7,852	9,858,006	47,112	7,933,517	
Road Pavement										
1106	Surface Course AC, t=50	Supply and Lay AC	2,643	m3	36,933		97,613,919		78,091,135	
1103	Binding Course AC, t=50	Supply and Lay AC	3,585	m3	32,608		116,899,680		93,519,744	
1101	Asphaltic Base Course, t=100	Supply and Lay Asphaltic Base Course	7,216	m3	28,566		206,132,256		164,905,805	
1099	Base Course, t=150	Supply, lay & compact	14,621	m3	5,814		85,006,494		68,005,195	
1098	Sub-base Course, t=200	Supply, lay & compact	18,570	m3	4,766		88,504,620		70,803,696	
1097	Grade Road Bed Surface	Supply, lay & compact	76,165	m2	134		10,206,110		8,164,888	
1095	Prime Coating	Provide, Heat and Spray MC30	95,968	litre	124		11,900,032		9,520,026	Mouchel Parkman
1096	Tack Coating	Spray K160	32,751	litre	115		3,766,365		3,013,092	Mouchel Parkman
Box Tunnel										
1161	Pedestrian Tunnel	Inner dimension 3.0m*3.0m	28	m	277,976	150,950	7,783,328	4,226,600	10,453,262	
Bridge										
1180	Mwache bridge	PCU Girder, L=900m, B=12.2m	1	Sum	944,024,865	1,702,405,808	944,024,865	1,702,405,808	2,457,625,700	PCU
1181	Tsunza Viaduct	PC Slab Girder, L=1300m, B=12.2m	1	Sum	1,139,663,473	1,714,394,553	1,139,663,473	1,714,394,553	2,626,125,331	PC Slab Girder
1182	Mteza bridge	PCU Girder L=1450m, B=12.2m	1	Sum	1,368,856,690	2,604,525,531	1,368,856,690	2,604,525,531	3,699,610,883	PCU

Package 3 (The Southern Section of Mombasa Bypass Route B)										
No.	Items	Description	Quantity	Unit	Rate		Amount			Remarks
					Ksh	Yen	Ksh	Yen	Total (Yen)	
Provisional & General										
902	Supervising Vehicle	Bypass B South	1	Sum	68,422,800		68,422,800		54,738,240	
906	Office & Accomodation	Route B South	1	Sum	129,351,040		129,351,040		103,480,832	
214	Quality Control Equipment	Laboratory Test Equipment	1	Sum	11,500,000		11,500,000		9,200,000	Assessed
215	Survey Equipment	Survey Equipment	1	Sum	4,025,000		4,025,000		3,220,000	Assessed
910	Security	Route B South	1	Sum	32,124,480		32,124,480		25,699,584	
216	Safy Equipment	Safy net, barrier etc	2	Sum	2,300,000		4,600,000		3,680,000	Assessed
914	Borrow Estate	Route B South	1	Sum	13,800,000		13,800,000		11,040,000	
918	Prepare Office, Plant & Yard	Route B South	1	Sum	5,498,546		5,498,546		4,398,837	
218	Business Trip	Nairobi-Mombasa	48	round	28,750		1,380,000		1,104,000	Assessed
217	Publicity Sign Board		2	No.	287,500		575,000		460,000	Assessed
923	Equipment Mobilization	Route B South	1	Sum	14,087,500		14,087,500		11,270,000	
929	Concrete Mixing Plant	Install & demolish	1	Set	7,194,016		7,194,016		5,755,213	
931	Asphalt Mixing Plant	Install & demolish	1	Set	6,616,731		6,616,731		5,293,385	
935	Overseas Transportation	Route B South	1	Sum		49,450,000		49,450,000	49,450,000	
	Insurance	0.5% of estimate items					10,594,387	1,516,160	9,991,670	
Access Road										
920	Access Road	6m width, Crusher-run 200mm	8	km	7,890,874		63,126,992		50,501,594	
Clearance & Topsoil Strip										
1052	Site Clearance		11.50	Ha	437,092		5,026,558		4,021,246	Mouchel Parkman
1053	Topsoil Strip	To Stockpile or Spoil, Haul 1.5km	22,993	m3	746		17,152,778		13,722,222	Mouchel Parkman
Earth Work										
1000	Cut in Soft Material & Haul	Cut, stockpile, load, haul 1.5km	81,228	m3	827		67,175,556		53,740,445	
1001	Cut in Hard Material & Haul	Cut, stockpile and haul 1.5km	60,921	m3	950		57,874,950		46,299,960	
1002	Cut in Soft Rock & Haul	Cut, stockpile and haul 1.5km	40,614	m3	1,251		50,808,114		40,646,491	
1003	Cut in Hard Rock & Haul	Cut, stockpile and haul 1.5km	20,307	m3	3,733		75,806,031		60,644,825	
1004	Road Bed Fill	Spread, trim, compact material	29,535	m3	402		11,873,070		9,498,456	
1006	Embankment Fill	Spread, water, compact material	159,365	m3	277		44,144,105		35,315,284	
1008	Level Bank	Spread, water, compact material	9,750	m3	210		2,047,500		1,638,000	
1007	Borrow M. Embankment Fill	Spread, water, compact borrow M.	980	m3	875		857,500		686,000	
1010	Riprap Embankment	Riprap with excavated rock	5,400	m3	1,097		5,923,800		4,739,040	
Slope Protection										
1056	Topsoiling 50mm	Deliver and Hand Spreading	30,510	m2	189		5,766,390		4,613,112	Mouchel Parkman
1057	Grassing	Deliver and Plant Grass Springs	30,510	m2	173		5,278,230		4,222,584	Mouchel Parkman
1070	Build Terrearnee wall	Concrete skin & strips	1,200	m2	665	46,419	798,000	55,702,800	56,341,200	
1069	Spread & Compact Fill	Backfill of Terrearnee	6,000	m3	2,937		17,622,000		14,097,600	
Drainage										
1076	In-situ Concrete Ditch	500*500, Class 20/20 concrete	13,560	m	7,997		108,439,320		86,751,456	
1078	Single Drain Pipe 0.6m	Supply pipes & Place	347	m	25,980		9,002,070		7,201,656	
1084	Single Drain 0.6m Inlet/Outlet	25N/mm2	26	No.	49,631	266	1,290,406	6,916	1,039,241	
Road Pavement										
1106	Surface Course AC, t=50	Supply and Lay AC	5,799	m3	36,933		214,174,467		171,339,574	
1103	Binding Course AC, t=50	Supply and Lay AC	7,155	m3	32,608		233,310,240		186,648,192	
1101	Asphaltic Base Course, t=100	Supply and Lay Asphaltic Base Cour	1,727	m3	28,566		49,333,482		39,466,786	
1099	Base Course, t=150	Supply, lay & compact	28,914	m3	5,814		168,105,996		134,484,797	
1098	Sub-base Course, t=200	Supply, lay & compact	43,068	m3	4,766		205,262,088		164,209,670	
1097	Grade Road Bed Surface	Supply, lay & compact	149,523	m2	134		20,036,082		16,028,866	
1095	Prime Coating	Provide, Heat and Spray MC30	188,399	litre	124		23,361,476		18,689,181	Mouchel Parkman
1096	Tack Coating	Spray K160	64,295	litre	115		7,393,925		5,915,140	Mouchel Parkman
Box Tunnel										
1160	Vehicle Tunnel	Inner dimension 11.5m*6.0m	24	m	1,270,522	834,587	30,492,528	20,030,088	44,424,110	
Bridge										
1184	Dongo-Kundu Overbridge	Hollow Slab, B=10.5m, L=30m	1	Sum	36,243,665	27,658,283	36,243,665	27,658,283	56,653,215	Hollow Slab
1178	A14 Interchange Overbridge	Hollow Slab, B=10.5m, L=230m	1	Sum	157,503,525	150,379,613	157,503,525	150,379,613	276,382,433	Hollow Slab
Road Furniture										
1140	Single Guardrailling	Provide Posts & Rails, Erect	1,670	m	7,584		12,665,280		10,132,224	Mouchel Parkman rev
1143	Precast Kerbs	1000*250*125	10,220	m	2,206		22,545,320		18,036,256	Mouchel Parkman
1145	Paint Road Line Marking	b=100	40,584	m	236		9,577,824		7,662,259	
1146	Set Road Sign	dia. 600 -750	45	No.	47,362		2,131,290		1,705,032	

1147	Set Cat Eyes	Provide & Set, Both sides	2,260	No.	2,681		6,059,060		4,847,248	
	Miscellaneous									
1338	Soundproofing Tree Zone	H=3.0 - 3.5m @1.5m, staggered	2,000	m	25,514		51,028,000		40,822,400	Soundproofing
1339	Animal Pass Tunnel	dia. 900, L=30m	5	No.	1,403,354	862	7,016,770	4,310	5,617,726	Soundproofing
1302	Temporary Maintenance Shaft	Inner Dimension 1.5m*2.0m		m	129,434	10,996				Water Supply Line
		Subtotal					2,129,471,778	304,748,170	2,008,325,592	
	Price Contingency	Local portion								
		Foreign portion								
		Subtotal								
	Physical Contingencies									
	VAT									
	Import Tax									
	Grand Total						2,129,471,778	304,748,170	2,008,325,592	

Water Supply Line Relocation										
No.	Items	Description	Quantity	Unit	Rate		Amount			Remarks
					Ksh	Yen	Ksh	Yen	Total (Yen)	
A109 Nairobi Road										
1301	Install 700 dia. Water pipe	ductile pipe	1,100	m	122,611		134,872,100		107,897,680	Water Supply Line
1309	Build Water Manhole	1.5m*4.0m*2.0m	3	No.	638,323		1,914,969		1,531,975	Water Supply Line
1310	Demolish Water Manhole	1.5m*4.0m*2.0m	4	No.	54,111		216,444		173,155	Water Supply Line
1316	Install Water Valve	Cast iron 700mm dia.	6	No.	815,539		4,893,234		3,914,587	Water Supply Line
1317	Demolish Water Valve	Cast iron 700mm dia.	8	No.	49,593		396,744		317,395	Water Supply Line
Bypass North										
1303	Install 350 dia. Water pipe	steel pipe	200	m	52,102		10,420,400		8,336,320	Water Supply Line
1304	Demolish 350 dia. Water pipe	steel pipe	200	m	5,956		1,191,200		952,960	Water Supply Line
1311	Build Water Manhole	1.5m*1.5m*1.5m	2	No.	281,154		562,308		449,846	Water Supply Line
1318	Install Water Valve	Cast iron 350mm dia.	2	No.	285,435		570,870		456,696	Water Supply Line
A14 Tanzania Road										
1305	Install 200 dia. Water pipe	steel pipe	500	m	32,339		16,169,500		12,935,600	Water Supply Line
1306	Demolish 200 dia. Water pipe	steel pipe	500	m	4,709		2,354,500		1,883,600	Water Supply Line
1312	Build Water Manhole	1.2m*1.2m*1.2m	2	No.	154,272		308,544		246,835	Water Supply Line
1313	Demolish Water Manhole	1.2m*1.2m*1.2m	1	No.	45,114		45,114		36,091	Water Supply Line
1319	Install Water Valve	Cast iron 200mm dia.	2	No.	95,749		191,498		153,198	Water Supply Line
1320	Demolish Water Valve	Cast iron 200mm dia.	1	No.	2,461		2,461		1,969	Water Supply Line
Bypass South Kaya										
1307	Install 150 dia. Water pipe	PVC pipe	200	m	3,788		757,600		606,080	Water Supply Line
1308	Demolish 150 dia. Water pipe	PVC pipe	200	m	1,866		373,200		298,560	Water Supply Line
1314	Build Water Manhole	1.0m*1.0m*1.0m	2	No.	99,185		198,370		158,696	Water Supply Line
1315	Demolish Water Manhole	1.0m*1.0m*1.0m	1	No.	24,469		24,469		19,575	Water Supply Line
1321	Install Water Valve	Cast iron 150mm dia.	2	No.	46,863		93,726		74,981	Water Supply Line
1322	Demolish Water Valve	Cast iron 150mm dia.	1	No.	2,046		2,046		1,637	Water Supply Line
Preliminary & General Items										
	Mobilization, etc	10% of above works	1	sum			17,555,930		14,044,744	
		Subtotal					193,115,227		154,492,182	
	Price Contingency	Local portion								
		Foreign portion								
		Subtotal								
	Physical Contingency									
	Utility Owner Supervising Cost		20%				38,623,045		30,898,436	
	VAT									
	Import Tax		4.0%							
	Grand Total						231,738,272		185,390,618	

Electric Power Line Relocation										
No.	Items	Description	Quantity	Unit	Rate		Amount			Remarks
					Ksh	Yen	Ksh	Yen	Total (Yen)	
A109 Nairobi Road										
1325	Install Double Powe Pole	Pole height 14m	24	No.	329,808		7,915,392		6,332,314	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	12	No.	10,488		125,856		100,685	Electric Power Line
1326	Demolish Double Powe Pole	Pole height 14m	12	No.	20,973		251,676		201,341	Electric Power Line
1327	Install Electric Cable	High Voltage CV 3c-38mm2	1,200	m	8,038		9,645,600		7,716,480	Electric Power Line
1328	Demolish Electric Cable	High Voltage CV 3c-38mm2	1,400	m	753		1,054,200		843,360	Electric Power Line
A14 Tanzania Road										
1323	Install Single Powe Pole	Pole height 14m	12	No.	161,612		1,939,344		1,551,475	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	12	No.	10,488		125,856		100,685	Electric Power Line
1329	Install Electric Cable	High Voltage CV 3c-22mm2	600	m	6,129		3,677,400		2,941,920	Electric Power Line
1330	Demolish Electric Cable	High Voltage CV 3c-22mm2	600	m	654		392,400		313,920	Electric Power Line
Bypass South near school										
1323	Install Single Powe Pole	Pole height 14m	2	No.	161,612		323,224		258,579	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	2	No.	10,488		20,976		16,781	Electric Power Line
1331	Install Electric Cable	Low Voltage CV 3c-14mm2	150	m	2,269		340,350		272,280	Electric Power Line
1332	Demolish Electric Cable	Low Voltage CV 3c-14mm2	150	m	312		46,800		37,440	Electric Power Line
Bypass South at valley top										
1323	Install Single Powe Pole	Pole height 14m	2	No.	161,612		323,224		258,579	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	2	No.	10,488		20,976		16,781	Electric Power Line
1331	Install Electric Cable	Low Voltage CV 3c-14mm2	150	m	2,269		340,350		272,280	Electric Power Line
1332	Demolish Electric Cable	Low Voltage CV 3c-14mm2	150	m	312		46,800		37,440	Electric Power Line
Bypass South around Kaya										
1323	Install Single Powe Pole	Pole height 14m	2	No.	161,612		323,224		258,579	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	2	No.	10,488		20,976		16,781	Electric Power Line
1331	Install Electric Cable	Low Voltage CV 3c-14mm2	150	m	2,269		340,350		272,280	Electric Power Line
1332	Demolish Electric Cable	Low Voltage CV 3c-14mm2	150	m	312		46,800		37,440	Electric Power Line
Bypass South around Dongo Kundu										
1323	Install Single Powe Pole	Pole height 14m	2	No.	161,612		323,224		258,579	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	2	No.	10,488		20,976		16,781	Electric Power Line
1331	Install Electric Cable	Low Voltage CV 3c-14mm2	150	m	2,269		340,350		272,280	Electric Power Line
1332	Demolish Electric Cable	Low Voltage CV 3c-14mm2	150	m	312		46,800		37,440	Electric Power Line
Preliminary & General Items										
	Mobilization, etc	10% of above works	1	sum			2,805,312		2,244,250	
Total							30,858,436		24,686,749	
Price Contingency		Local portion								
		Foreign portion								
		Subtotal								
Physical Contingency										
Utility Owner Supervising Cost			20%				6,171,688		4,937,350	
VAT										
Import Tax			4.0%							
Grand Total							37,030,124		29,624,099	

Telkom Communication Line Relocation										
No.	Items	Description	Quantity	Unit	Rate		Amount			Remarks
					Ksh	Yen	Ksh	Yen	Total (Yen)	
	A109 Nairobi Road									
1333	Install Communication Cable	Optic cable 1.2mm-200P	750	m	10,726		8,044,500		6,435,600	Communication Line
1335	Install Protection Pipe	PVC pipe 100mm dia.	750	m	4,967		3,725,250		2,980,200	Communication Line
1336	Install Hand Hole	Inner dimension 600*600*800	15	No.	53,355		800,325		640,260	Communication Line
	Preliminary & General Items									
	Mobilization, etc	10% of above works	1	sum			1,257,008		1,005,606	
		Subtotal					13,827,083		11,061,666	
	Price Contingency	Local portion								
		Foreign portion								
		Subtotal								
	Physical Contingency									
	Utility Owner Supervising Cost		20%				2,765,416		2,212,333	
	VAT									
	Import Tax		4.0%							
	Grand Total						16,592,499		13,273,999	

Table of Unit Rates

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
	Labour						
1	Foreman	Kenyan	day	5,750		4,600	S.S. Mehta*0.8
2	Artisan	Kenyan	day	1,786		1,429	Dhanjal
3	Skilled Labourer	Kenyan	day	1,786		1,429	Dhanjal
4	Labourer	Kenyan	day	1,323		1,058	S.S. Mehta
5	Leveller	Kenyan	day	1,786		1,429	Same with Artisan
6	Re-bar fabricator	Kenyan	day	1,786		1,429	Same with Artisan
7	Carpenter	Kenyan	day	1,786		1,429	Same with Artisan
8	Mason	Kenyan	day	1,786		1,429	Same with Artisan
9	Scaffolder	Kenyan	day	1,786		1,429	Same with Artisan
10	Welder	Kenyan	day	1,786		1,429	Same with Artisan
11	Electrician	Kenyan	day	1,786		1,429	Same with Artisan
12	Waterproofer	Kenyan	day	1,786		1,429	Same with Artisan
13	Painter	Kenyan	day	1,786		1,429	Same with Artisan
14	Plumber	Kenyan	day	1,786		1,429	Same with Artisan
15	Gurdman	Kenyan	day	1,323		1,058	same with Unskilled
16	Operator	Kenyan	hr	235		188	Cementers
17	Turnboy	Kenyan	hr	196		157	same with labourer
	Local Staff						
20	Civil Engineer	Experience 20 years	month	330,625		264,500	Kounoike
21	Civil Engineer	Experience 10 years	month	264,500		211,600	Kounoike
22	Surveyor		month	132,250		105,800	Kounoike
23	Assistant Surveyor		month	92,575		74,060	Kounoike
24	CAD Operator		month	121,670		97,336	Mortorways
25	Accountant		month	79,350		63,480	Kounoike
26	Clerk		month	66,125		52,900	Kounoike
27	Office Driver		month	33,063		26,450	Kounoike
28	Office boy		month	19,838		15,870	Kounoike
	Foreign Labour						
30	Bridge Foreman	Japanese	day		47,171	47,171	Japan cost book
31	Bridge Artisan	Japanese	day		40,868	40,868	Japan cost book
32	Foreman	Japanese	day		39,240	39,240	Japan cost book
33	Welder	Japanese	day		39,444	39,444	Japan cost book
	Local Material						
100	Diesel		litre	118		94	Gas Station
101	Gasoline		litre	130		104	Gas Station
102	Heavy oil	Type C	litre	99		79	Assessed
103	Bitumen	80/100	ton	116,412		93,130	Kounoike
104	Tack Coat	K160	litre	104.0		83	Dhanjal
105	Prime Coat	MC30	litre	98.2		79	Dhanjal
106	Bagged Cement	Portland	ton	13,613		10,890	Bamburi
107	Bulk Cement	Portland	ton	13,432		10,746	Bamburi
108	Aggregate		ton	1,150		920	Kavee quarry
109	Blasted Rock, Boudar		ton	863		690	Kavee quarry
110	Subbase course material	Crusher-run	ton	863		690	Kavee quarry
111	Base course material	Mechanically stabilized crushed stone	ton	1,150		920	Kavee quarry= Aggregate
112	Sand		ton	1,150		920	Assessed, =Aggregate
113	Screenings		ton	230		184	Kavee quarry
114	Stone Powder		ton	230		184	Kavee quarry
115	Royalties on Borrow		m3	57.5		46	Mouchelparkman
118	F3 Timber	Cypress	m2	665		532	Mouchelparkman
119	F1 Timber	Cypress	m2	500		400	Mouchelparkman
120	Timber	Cypress	m3	37,950		30,360	Cementers
121	Plywood	900*1800, t=12	m2	922		738	S.S. Mehta

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
122	Form Oil		litre	174.8		140	Assessed Japan cost book
123	Guardrails	without Post	m	3,305		2,644	Brollo Kenya
124	Deformed Rebar	Y Grade, High Yield	ton	118,450		94,760	Corrugated Sheets
125	Round Bar	BS 4449(460)	ton	118,450		94,760	Corrugated Sheets
126	Steel Angle	L-100*100 & Smaller sizes	ton	137,172		109,738	Corrugated Sheets
127	Steel H beam	H-250*250 % Smaller sizes	ton	137,172		109,738	Assessed
128	Flat Bar		ton	123,913		99,130	Corrugated Sheets
129	Square Pipe	100*100	ton	142,106		113,685	Corrugated Sheets
130	Steel Pipe	dia. 25	ton	132,593		106,074	Corrugated Sheets
131	Barbed wire		kg	253.0		202	Assessed
132	Neil		kg	184		147	Assessed
133	Concrete Pipes	dia. 600	m	7,274		5,819	Mortorways
134	Concrete Pipes	dia. 900	m	16,531		13,225	Mortorways
135	Concrete Pipes	dia. 1200	m	21,821		17,457	Mortorways
136	PVC Pipe	dia. 50	m	288		230	Cementers
137	PVC Pipe	dia. 100	m	1,346		1,077	Cementers
138	PVC Pipe	dia. 150	m	1,668		1,334	Kounoike
139	Precast Concrete Kerbs	1000*250*125	m	460		368	SCONCO
140	Precast Edge Beams	1000*100*120	m	213		170	SCONCO
141	Concrete Paving Blocks	80mm Bamburi	m2	1,035		828	Bamburi hearing
142	Concrete Paving Blocks	60mm Bamburi	m2	748		598	Bamburi hearing
143	Concrete Paving Blocks	50mm Bamburi	m2	633		506	Assessed
144	Interlocking Blocks	80mm, ex. Works	m2	1,380		1,104	Tracon
145	Interlocking Blocks	60mm, ex. Works	m2	805		644	Tracon
146	Precast panel	600*600*50	m2	958		766	SCONCO
147	Grass Springs		m2	92.0		74	Kounoike
148	Rustproof Paint		kg	219		175	Assessed Japan cost book
149	Elastight	Bitumenous board, t=20	m2	2,400		1,920	Assessed Japan cost book
150	Waterstop	t=5, B=200, Center bulb, Flat	m	1,325		1,060	Assessed Japan cost book
151	Cylinder Form dia. 850	Paper Cylinder	m	978		782	Assessed Japan cost book
152	Road Marking Paint		kg	403		322	Assessed Japan cost book
153	Glass Beads		kg	173		138	Assessed Japan cost book
154	Circular Sign Board	dia. 600-750 with Post	No.	40,250		32,200	Cementers
155	Overhang Sign Noard	2.0m*4.0m	No.	115,000		92,000	Assessed
156	Cat Eye	Both sides	No.	2,415		1,932	Assessed Japan cost book
157	Geotextile	for stone masonry	m2	575		460	Assessed
158	Steel casing pipe dia.54mm	for electric cable	m	1,257		1,006	Corrugated Sheets
159	Electric cable	22mm2-3c	m	910		728	Assessed Japan cost book
160	Signal cable		m	910		728	Assessed
161	Steel Taper Pole	H=8m, for one light	No.	69,000		55,200	Kounoike
162	Lighting Socket	KSC-4	No.	31,625		25,300	Cementers
163	Sodium Lamp	360W	No.	20,125		16,100	Cementers
164	Light Stabilizer	360W	No.	13,800		11,040	Cementers
165	Stainless Pull Box	400*400*200	No.	17,940		14,352	Assessed Japan cost book
166	Traffic Signal Post	H=8m	No.	69,000		55,200	same with Illumination Post
167	Signal Controller Post	H=5m	No.	46,000		36,800	Assessed
168	Signal	2 Aspects	No.	149,500		119,600	Assessed
169	Signal	3 Aspects	No.	230,000		184,000	Assessed
170	Signal Controller		No.	80,500		64,400	Assessed
171	Gate valve	Cast iron 150mm dia.	No.	43,930		35,144	Assessed
172	Electric power pole	Concrete pole 14m	No.	143,750		115,000	Assessed
173	Electric power cable	High Voltage CV 3c-38mm2	m	2,210		1,768	Assessed
174	Electric power cable	High Voltage CV 3c-22mm2	m	1,641		1,313	Assessed
175	Electric power cable	Low Voltage CV 3c-14mm2	m	529		423	Assessed
176	Tree	H=3.0 - 3.5m	No.	34,500		27,600	Assessed

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
177	Optic Cable	1.2mm-200P	m	9,874		7,899	Assessed
178	water pipe	ductile, 700mm dia.	m	105,771		84,617	Assessed
179	water pipe fitting	ductile, 700mm dia.	No.	42,384		33,907	Assessed
180	Strainer valve	Cast iron 700mm dia.	No.	744,361		595,489	Assessed
181	water pipe	steel pipe dia. 350, t=6	m	44,287		35,430	Assessed
182	Strainer valve	Cast iron 350mm dia.	No.	266,027		212,822	Assessed
183	water pipe	steel pipe dia. 200, t=5.5	m	26,589		21,271	Assessed
184	Gate valve	Cast iron 200mm dia.	No.	92,260		73,808	Assessed
Other Local Purchase & Expenditure							
200	Build & Demolish Office		m2	26,450		21,160	Mortorways
201	Hotel Accomodation	Foreigner, long stay	month	132,250		105,800	Assessed
202	Hotel Accomodation	Local, long stay	month	34,500		27,600	Assessed
203	Barrack & Other Housing	Local worker	m2	23,000		18,400	Cementers
204	Laptop		No.	92,000		73,600	100000*0.8
205	Office Consumables	Papers, water, electricity etc	month	230,000		184,000	Assessed
206	Telephone & Internet		month	115,000		92,000	Assessed
207	Office Desk & Chairs		No.	18,400		14,720	20000*0.8
208	Office Soffer Set		No.	46,000		36,800	50000*0.8
209	Air Conditionor		No.	92,000		73,600	100000*0.8
210	Refrigerator		No.	138,000		110,400	150000*0.8
211	TV Set		No.	92,000		73,600	100000*0.8
212	Video Set		No.	46,000		36,800	50000*0.8
213	Bed	for workers in barrack	No.	18,400		14,720	20000*0.8
214	Quality Control Equipment	Laboratory Test Equipment	Sum	11,500,000		9,200,000	Assessed
215	Survey Equipment	Survey Equipment	Sum	4,025,000		3,220,000	Assessed
216	Safty Equipment	Safty net, barrier etc	Sum	2,300,000		1,840,000	Assessed
217	Publicity Sign Board		No.	287,500		230,000	Assessed
218	Business Trip	Nairobi-Mombasa	round	28,750		23,000	Assessed
219	Borrow Estate		m./m2	115.0		92.0	Assessed
220	Equipment Mobilization	Nairobi-Mombasa	No.	287,500		230,000	Kounoike
221	Equipment Mobilization	Mombasa	No.	143,750		115,000	Kounoike*0.5
222	Plant Mangrove		m2	201		161	Assessed
223	Mangrove Maintenance	Monitoring & Maintenance	year	1,495,000		1,196,000	Assessed
Japanese Material							
300	AE retarder	Pozolis No.8	kg		327	327	Japan made
301	Expansion Additive	Gypcal	kg		129	129	Japan made
302	PC strand 190kN	1S 12.7	kg		335	335	Japan made
303	PC strand 390kN	1S 17.8	kg		362	362	Japan made
304	PC strand 450kN	1S 19.3	kg		370	370	Japan made
305	PC strand 570kN	1S 21.8	kg		376	376	Japan made
306	PC strand 850kN	1S 28.6	kg		394	394	Japan made
307	PC strand 1300kN	7S 12.7B	kg		335	335	Japan made
308	PC strand 2200kN	12S 12.7B	kg		335	335	Japan made
309	PC strand 3100kN	12S 15.2B	kg		351	351	Japan made
310	PC strand 4900kN	19S 15.2B	kg		351	351	Japan made
311	PC bar dia.26	SBPR930/1080	kg		443	443	Japan made
312	PC bar dia.32	SBPR930/1080	kg		443	443	Japan made
313	Sheath dia. 35	for 1S21.8	m		208	208	Japan made
314	Sheath dia. 45	for 1S28.6	m		285	285	Japan made
315	Sheath dia. 70	for 12S12.7B	m		561	561	Japan made
316	Sheath dia. 80	for 12S15.2B	m		812	812	Japan made
317	Sheath dia. 130	for 19S15.2B	m		1,932	1,932	Japan made
318	Anchorage 190kN	Tension end	No.		2,412	2,412	Japan made
319	Anchorage 190kN	Fixing end	No.		3,131	3,131	Japan made
320	Anchorage 850kN	Tension end	No.		14,300	14,300	Japan made

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
321	Anchorage 850kN	Fixing end	No.		13,383	13,383	Japan made
322	Anchorage 570kN	Tension end	No.		5,628	5,628	Japan made
323	Anchorage 570kN	Fixing end	No.		6,384	6,384	Japan made
324	Anchorage 2200kN	Tension end	No.		36,478	36,478	Japan made
325	Anchorage 2200kN	Fixing end	No.		37,872	37,872	Japan made
326	Anchorage 3100kN	Tension end	No.		67,154	67,154	Japan made
327	Anchorage 3100kN	Fixing end	No.		69,710	69,710	Japan made
328	Anchorage 4900kN	Tension end	No.		72,163	72,163	Japan made
329	Anchorage 4900kN	Fixing end	No.		72,163	72,163	Japan made
330	Rubber Shoe Belt	1000*300*23	m		34,871	34,871	Japan made
331	Rubber Shoe H-12	360*310*50	No.		29,993	29,993	Japan made
332	Rubber Shoe H-36	610*460*80	No.		114,543	114,543	Japan made
333	Rubber Shoe H-43	610*460*98	No.		137,909	137,909	Japan made
334	Rubber Shoe H-52	560*560*135	No.		208,109	208,109	Japan made
335	Closed Rubber Shoe 616F	Bearing capacity 500t	No.		2,385,077	2,385,077	Japan made
336	Anchor Bar dia.60*1220	S35CN	No.		14,602	14,602	Japan made
337	Anchor Bar dia.70*1420	S35CN	No.		23,051	23,051	Japan made
338	Anchor Bar dia.100*2000	S35CN	No.		34,045	34,045	Japan made
339	Non-shrinkage Mortar	Steel powder type	kg		176	176	Japan made
340	Bridge Expansion Joint	50mm, for Carriage way	m		87,661	87,661	Japan made
341	Bridge Expansion Joint	35mm, for Walk way	m		63,734	63,734	Japan made
342	Bridge Surface Drain	dia.150*370mm	No.		33,764	33,764	Japan made
343	PVC Pipe dia.150	dia.150, t=9.6	m		2,911	2,911	Japan made
346	Steel Pipe dia.1000, t=12	SKK400, 292kg/m	ton		253,614	253,614	Japan made
347	Steel Pipe dia.1000, t=14	SKK400, 340kg/m	ton		238,916	238,916	Japan made
348	Steel Pipe dia.1100, t=14	SKK400, 375kg/m	ton		246,772	246,772	Japan made
349	Steel Pipe dia.1200, t=14	SKK400, 409kg/m	ton		258,427	258,427	Japan made
350	Deformed Rebar	SD345	ton		114,644	114,644	Japan made
351	Anti-corrosion Rebar	SD345, epoxy coated	ton		186,657	186,657	Japan made
352	Rebar Coupler	FD Grip D32 A type	No.		3,419	3,419	Japan made
353	Steel Sheet Pile	SSP-III	ton		182,011	182,011	Japan made
354	Steel Sheet Pile	SSP-IV	ton		182,011	182,011	Japan made
355	Steel H-Beam	H-300*300*10*15	ton		129,743	129,743	Japan made
356	Steel H-Beam	H-350*350*12*19	ton		132,066	132,066	Japan made
357	Steel H-Beam	H-400*400*13*21	ton		135,551	135,551	Japan made
358	Steel H-Girder	H-588*300*12*20	ton		135,551	135,551	Japan made
359	Steel Plate	t=3-12mm	ton		113,482	113,482	Japan made
360	Lip Channel	[150*50 & Smaller sizes	ton		151,046	151,046	Japan made
361	Steel Channel	[200*90 & Smaller sizes	ton		135,551	135,551	Japan made
362	Steel Channel	[250*90 & Larger sizes	ton		135,551	135,551	Japan made
363	Steel Angle	L-130*130 & Larger sizes	ton		148,327	148,327	Japan made
364	Steel Deck	2000*1000*200	m2		64,476	64,476	Japan made
365	Steel Pipe	dia. 48.6, t=2.4	m		485	485	Japan made
366	Pipe Frame	1219*1930	No.		9,032	9,032	Japan made
367	Pipe Frame	1700*914	No.		6,860	6,860	Japan made
368	Pipe Frame Bracing	1219*1219	No.		1,005	1,005	Japan made
369	Pipe Frame Bracing	1829*1219	No.		1,042	1,042	Japan made
370	Adjust-Jack	Ajusting 460mm	No.		2,000	2,000	Japan made
371	Adjust-Jack Base	Ajusting 260mm	No.		1,251	1,251	Japan made
372	Pipe Clamp		No.		1,048	1,048	Japan made
373	Waterproofing Sheet	for Bridge Surface	m2		1,584	1,584	Japan made
374	Geotextile NK-2000S	for road embankment	m2		4,731	4,731	Japan made
375	Metal Form	300mm*1500mm	m2		13,089	13,089	Japan made
376	SSP Junction waterstop	Adeka Ultra Sheal	kg		4,091	4,091	Japan made
377	Terreamee	1500*1500*180	No.		72,418	72,418	Japan made

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
378	Terrearmee Strip	4*60	m		1,640	1,640	Japan made
Other Japan Purchase & Ependiture							
390	Overseas Transportation	Foundation Equipment	Set		14,950,000	14,950,000	
391	Overseas Transportation	Bridge Equipment	Set		69,000,000	69,000,000	
392	Overseas Transportation	Shoring & Scaffolding	Set		34,500,000	34,500,000	
393	Overseas Transportation	Temporary bridge	Set		287,500,000	287,500,000	
394	Flight fare	Tokyo-Nirobi-Mombasa	round		1,153,450	1,153,450	
395	Overseas Incentives	Foreign Engineer	month		322,092	322,092	JICA
Japanese Machinery & Equipment							
400	Reverse Circulation Drill	S-300, max dia. 3000	hr		9,338	9,338	Japan made
401	Rock Bits	dia.800-1200mm	day		8,056	8,056	Japan made
402	Drill Pipes	inner dia. 200, L=39m	day		16,015	16,015	Japan made
403	Suction & Delivery Hose	dia. 200, L=60m	day		11,357	11,357	Japan made
404	Hydraulic Pile Driver	Ram 6.5-8T	hr	3,257	19,481	22,087	Japan made
405	Hydraulic Pile Driver	Ram 10-12.5T	hr	3,528	22,982	25,804	Japan made
406	Pile Driver Base Machine	Leader 21-33m, Weight 100-110T	hr	1,853	30,319	31,801	Japan made
407	Pile Driver Base Machine	Leader 21-33m, Weight 120-125T	hr	2,395	39,259	41,175	Japan made
408	Vibro Hammer	60kW	hr		6,215	6,215	Japan made
409	Telescopic Clamshell	0.4m3, Hydraulic	hr	2,938	9,111	11,461	Japan made
Local Equipment							
500	Bulldozer	21 ton	hr	14,715		11,772	Mortorways
501	Bulldozer	32 ton	hr	17,805		14,244	Bulldozer 21ton * 1.18
502	Bulldozer with Ripper	32 ton	hr	18,601		14,881	Bulldozer 32ton * 1.02
503	Excavator	0.45 m3	hr	5,788		4,630	S.S. Mehta
504	Excavator	0.8 m3	hr	7,025		5,620	Dhanjal
505	Excavator	1.4 m3	hr	10,991		8,793	Assess Japan cost book
506	Rock Hammer	1300 kg	hr	1,797		1,438	Motorways
507	Wheel Loader	1.5-1.7 m3	hr	6,039		4,831	Assess Japan cost book
508	Wheel Loader	2.3 m3	hr	7,616		6,093	Dhanjal
509	Wheel Loader	3.1 m3	hr	10,715		8,572	S.S. Mehta
510	Motorgrader	3.1 m	hr	7,039		5,631	Mortor Grader 3.7m/1.3
511	Motorgrader	3.7 m	hr	9,086		7,269	S.S. Mehta
512	Motorgrader	4.0 m	hr	11,223		8,978	Assess Japan cost book
513	Macadam Roller	10-12T	hr	5,397		4,318	Cementers
514	Vibrating Roller	0.5-0.6 ton, Hand Guide	hr	800		640	S.S. Mehta
515	Vibrating Roller	1.2-1.5 ton	hr	1,553		1,242	S.S. Mehta
516	Vibrating Roller	3-4 ton	hr	3,580		2,864	Mortorways *0.8
517	Vibrating Roller	15-18 ton	hr	15,351		12,281	Assess Japan cost book
518	Pneumatic tyre roller	8-20 ton	hr	5,834		4,667	Dhanjal
519	Sheepsfoot Roller	15T	hr	3,450		2,760	Mouchel Parkman
520	Pulvimixer Cat RM 250	Soil Stabilizer	hr	11,632		9,306	Mouchel Parkman
521	Asphalt Finisher	2.4-6.0 m	hr	16,363		13,090	S.S. Mehta
522	Bitumen Distributor	3000 littres	hr	3,800		3,040	S.S. Mehta *0.8
523	Bitumen Distributor	5000-6000 littres	hr	5,270		4,216	Assess Japan cost book
524	Chip Spreader	Tale Gate, 0.25 m3	hr	1,058		846	Mortorways
525	Tractor & Broom		hr	2,471		1,977	Mouchel Parkman
526	Tractor & Post Driver		hr	2,471		1,977	Mouchel Parkman
527	Concrete mixer	0.5 m3 drum	hr	2,156		1,725	Cementers
528	Compressor	5 m3/min	hr	2,154		1,723	S.S Mehta
529	Flatbed Truck	4-4.5 ton	hr	2,931		2,345	Assess Japan cost book
530	Flatbed Truck	10-11 ton	hr	4,909		3,927	Mortorways
531	Water Bowser	6000-10,000L	hr	4,299		3,439	S.S. Mehta
532	Cement Tank Truck	10 ton	hr	4,732		3,786	Assessed
533	Bitumen Tank Truck	10,000L	hr	5,767		4,614	Assessed
534	Tipping Truck	10 ton, Bogie Drive	hr	4,774		3,819	Dhanjal

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
535	Tipping Truck	25 ton, Bogie Drive	hr	12,299		9,839	Assess Japan cost book
536	Agitator Truck	4.4m ³	hr	5,628		4,502	S.S. Mehta
537	Trailer	20-25 ton	hr	8,463		6,770	S.S. Mehta
538	Concrete Pumping Car	90-110m ³ /hr, Boom	hr	22,113		17,690	Cementers
539	Concrete dumper	2000 kg	hr	1,787		1,430	Mouchel Parkman
540	Mobile Crane	20-25 ton	hr	9,895		7,916	Cementers
541	Crawler Crane	50 ton lift	hr	19,374		15,499	Kounoike
542	Crawler Crane	100 ton lift	hr	37,438		29,950	Kounoike
543	Generator	20-25kVA, 8 hours operation	day	7,657		6,126	Motorways
544	Generator	60kVA, 8 hours operation	day	17,485		13,988	Motorways
545	Generator	60kVA, 24 hours operation	day	38,654		30,923	Motorways
546	Generator	100kVA, 8 hours operation	day	28,870		23,096	Motorways
547	Engine Welder	300A, Diesel Engine	hr	891		713	Assess Japan cost book
548	Concrete Vibrator		hr	230		184	Mouchel Parkman
549	Timber Planer		hr	230		184	Mouchel Parkman
550	Rebar Bender		hr	1,104		883	Mouchel Parkman
551	Band Saw		hr	598		478	Mouchel Parkman
552	Tamper	60 kg	day	4,030		3,224	S.S. Mehta *0.25
553	Vibrating Compacter	40-60 kg	day	4,030		3,224	same with Tamper
554	Concrete Hand Breaker	20 kg	day	1,725		1,380	S.S. Mehta
555	Sand Pump	dia.150, 7.5kW	day	851		681	Assess Japan cost book
556	Sand Pump	dia.250, 11kW	day	1,185		948	Assess Japan cost book
557	Slash Tank	30m ³ + 20m ³	day	5,758		4,606	Assess Japan cost book
558	Asphalt Mixing Plant		hr	28,750		23,000	Dhanjal
559	Concrete Mixing Plant		hr	10,350		8,280	Assess Japan cost book
560	Cement Silo	100 ton	day	5,865		4,692	Assess Japan cost book
561	Belt Conveyor	t=600, L=10m	hr	978		782	Assess Japan cost book
562	Sedan		day	8,413		6,730	Assess Ketty Tour
563	4 wheel drive		day	11,075		8,860	Assess Ketty Tour
564	Pickup		day	12,265		9,812	Assess Ketty Tour
	Japanese Equipment						
700	Erection Girder	Two beam, Span 40m, Lifting 127t	day		128,110	128,110	
701	Lifting Unit	Lifting 140t	day		47,495	47,495	
702	Erection Gears		day		10,891	10,891	
703	Traverser	Capacity 70t	day		29,325	29,325	
704	Traveller	Capacity 140t	day		29,325	29,325	
705	30kg/m Rail	Rails and sleepers	m-day		24	24	
706	Center Hole Jack	196-5900kN	day		4,025	4,025	
707	Center Hole Jack	2940kN, 200 stroke	day		7,820	7,820	
708	Push Jack	1960kN, 200 stroke	day		7,372	7,372	
709	Hydraulic Unit fo PC Jack	with Controle Unit	day		7,901	7,901	
710	Jacking Chair	981kN, 200 stroke	day		1,311	1,311	
711	Lever Brock	49kN, 1.5m	day		243	243	
712	Chill Hole	29kN	day		380	380	
713	Gantry Crane with Hoist	H=8m, B=10m, 3T Hoist	day		12,650	12,650	
714	Reform Work Stage		set		4,057,200	4,057,200	
715	Box Girder Equipment	All-in	Sum		80,500,000	80,500,000	
716	Bottom Scaffolding		m ² /mon		426	426	
717	Side Scaffolding		m ² /mon		673	673	
718	Ladder		m ² /mon		3,383	3,383	
719	Nose-slab Scafoding	derived from the estimation standard	m ² /mon		587	587	
720	Bridge-side Scafoding	derived from the estimation standard	m ² /mon		305	305	
721	Rent Steel Decking	Rental within 12 months	m ² /mon		667	667	
722	Rent Steel Decking	Rental within 24 months	m ² /mon		575	575	
723	Rent Steel Decking	Rental within 36 months	m ² /mon		518	518	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
724	Steel Decking Cleaning	Cleaning & Maintenance	m2		1,035	1,035	
725	Rent Steel Sheet Pile III	Rental within 12 months	ton/day		81	81	
726	Rent Steel Sheet Pile III	Rental within 24 months	ton/day		69	69	
727	Rent Steel Sheet Pile III	Rental within 36 months	ton/day		63	63	
728	Steel Sheet Pile IV Cleaning	Cleaning & Maintenance	ton		3,450	3,450	
729	Rent Steel Sheet Pile IV	Rental within 12 months	ton/day		81	81	
730	Rent Steel Sheet Pile IV	Rental within 24 months	ton/day		69	69	
731	Rent Steel Sheet Pile IV	Rental within 36 months	ton/day		63	63	
732	Steel Sheet Pile IV Cleaning	Cleaning & Maintenance	ton		3,450	3,450	
733	Rent H beam H-200 to H-400	Rental within 12 months	ton/day		81	81	
734	Rent H beam H-200 to H-400	Rental within 24 months	ton/day		69	69	
735	Rent H beam H-200 to H-400	Rental within 36 months	ton/day		63	63	
736	H beam Cleaning	Cleaning & Maintenance	ton		3,450	3,450	
737	Rent H beam H-594*302	Rental within 12 months	ton/day		104	104	
738	Rent H beam H-594*302	Rental within 24 months	ton/day		92	92	
739	Rent H beam H-594*302	Rental within 36 months	ton/day		86	86	
740	H-594*302 Cleaning	Cleaning & Maintenance	ton		3,450	3,450	
741	Rent Shoring H-300 to H-400	Rental within 12 months	ton/day		104	104	
742	Rent Shoring H-300 to H-400	Rental within 24 months	ton/day		98	98	
743	Rent Shoring H-300 to H-400	Rental within 36 months	ton/day		92	92	
744	Steel Shoring Cleaning	Cleaning & Maintenance	ton		4,600	4,600	
745	Rent Shoring Parts	Rental within 12 months	ton/day		207	207	
746	Rent Shoring Parts	Rental within 24 months	ton/day		196	196	
747	Rent Shoring Parts	Rental within 36 months	ton/day		184	184	
748	Shoring Parts Cleaning	Cleaning & Maintenance	ton		9,200	9,200	
749	Pipe Frame	1219*1930	No./day		3.45	3.45	
750	Pipe Frame	1700*914	No./day		2.65	2.65	
751	Pipe Frame Bracing	1219*1219	No./day		0.92	0.92	
752	Pipe Frame Bracing	1829*1219	No./day		0.92	0.92	
753	Ajust-Jack	Ajusting 460mm	No./day		1.27	1.27	
754	Ajust-Jack Base	Ajusting 260mm	No./day		1.27	1.27	
755	Pipe Clamp		No./day		0.46	0.46	
756	Rent Steel Pipe	dia. 48.6, t=2.4	m/day		0.32	0.32	
	Transportation						
800	Transportation	Bitumen	ton	1,247		998	
801	Transportation	Prime coat & Tack coat	litter	1,247		0.998	
802	Transportation	Bagged cement	ton	5,671		4,537	
803	Transportation	Bulk cement	ton	1,052		842	
804	Transportation	boulder, aggregate, crushed, sand etc.	ton	637		510	
805	Transportation	Steel, Re-bars, Steel products	ton	1,429		1,143	
806	Transportation	Paving blocks t=50mm	m2	601		481	
807	Transportation	Paving blocks t=60mm	m2	703		562	
808	Transportation	Paving blocks t=80mm	m2	942		754	
809	Transportation	Kerb stone (250*125)	m	367		294	
810	Transportation	Edge beams (120*100)	m	141		113	
811	Transportation	Timber	m3	4,664		3,731	
	Preliminary & General items						
900	Supervising Vehicle	Bypass B North	Sum	68,422,800		54,738,240	
901	Supervising Vehicle	Bypass B Middle	Sum	158,374,650		126,699,720	
902	Supervising Vehicle	Bypass B South	Sum	68,422,800		54,738,240	
903	Supervising Vehicle	Link Road	Sum	63,375,000		50,700,000	
904	Office & Accomodation	Route B North	Sum	81,741,040		65,392,832	
905	Office & Accomodation	Route B Middle	Sum	180,622,380		144,497,904	
906	Office & Accomodation	Route B South	Sum	129,351,040		103,480,832	
907	Office & Accomodation	Link Road	Sum	69,028,480		55,222,784	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
908	Security	Route B North	Sum	32,124,480		25,699,584	
909	Security	Route B Middle	Sum	96,627,860		77,302,288	
910	Security	Route B South	Sum	32,124,480		25,699,584	
911	Security	Link Road	Sum	23,206,440		18,565,152	
912	Borrow Estate	Route B North	Sum	13,800,000		11,040,000	
913	Borrow Estate	Route B Middle	Sum	67,620,000		54,096,000	
914	Borrow Estate	Route B South	Sum	13,800,000		11,040,000	
915	Borrow Estate	Link Road	Sum	8,280,000		6,624,000	
916	Prepare Office, Plant & Yard	Route B North	Sum	5,498,546		4,398,837	
917	Prepare Office, Plant & Yard	Route B Middle	Sum	15,395,929		12,316,743	
918	Prepare Office, Plant & Yard	Route B South	Sum	5,498,546		4,398,837	
919	Prepare Office, Plant & Yard	Link Road	Sum	3,299,128		2,639,302	
920	Access Road	6m width, Crusher-run 200mm	km	7,890,874		6,312,699	
921	Equipment Mobilization	Route B North	Sum	8,625,000		6,900,000	
922	Equipment Mobilization	Route B Middle	Sum	13,225,000		10,580,000	
923	Equipment Mobilization	Route B South	Sum	14,087,500		11,270,000	
924	Equipment Mobilization	Link Road	Sum	5,462,500		4,370,000	
925	Concrete Batching Plant	Install & demolish	Set	1,366,016		1,092,813	
926	Aggregate Storage	Install & demolish	Set	4,239,894		3,391,915	
927	Water Storage 2.3m3	Install & demolish	Tank	49,163		39,330	
928	Cement Silo 100ton	Install & demolish	Set	408,416		326,733	
929	Concrete Mixing Plant	Install & demolish	Set	7,194,016		5,755,213	
930	Asphalt Mixer	Install & demolish	Set	1,590,451		1,272,361	
931	Asphalt Mixing Plant	Install & demolish	Set	6,616,731		5,293,385	
932	Barbed Wire Fence	Install & demolish	m	1,021		817	
933	Overseas Transportation	Route B North	Sum		49,450,000	49,450,000	
934	Overseas Transportation	Route B Middle	Sum		811,900,000	811,900,000	
935	Overseas Transportation	Route B South	Sum		49,450,000	49,450,000	
	Excavation & Hauling						
1000	Cut in Soft Material & Haul	Cut, stockpile, load, haul 1.5km	m3	827		662	
1001	Cut in Hard Material & Haul	Cut, stockpile and haul 1.5km	m3	950		760	
1002	Cut in Soft Rock & Haul	Cut, stockpile and haul 1.5km	m3	1,251		1,001	
1003	Cut in Hard Rock & Haul	Cut, stockpile and haul 1.5km	m3	3,733		2,986	
1004	Road Bed Fill	Spread, trim, compact material	m3	402		322	
1005	Road Bed Fill with crusher-run	Spread, trim, compact material	m3	3,402		2,722	
1006	Embankment Fill	Spread, water, compact material	m3	277		222	
1007	Borrow M. Embankment Fill	Spread, water, compact borrow M.	m3	875		700	
1008	Level Bank	Spread, water, compact material	m3	210		168	
1009	Set Geotextile	Set Geotextile, Spread & Compact	m2	893	4,731	5,445	
1010	Riprap Embankment	Riprap with excavated rock	m3	1,097		878	
1011	Riprap Embankment	Riprap with purchased rock	m3	4,097		3,278	
1012	Haul & Spoil Soft Material	Overhaul & Spoil area preparation	m3	482		386	Mouchel Parkman
1013	Haul & Spoil Hard M. & Rock	Overhaul & Spoil area preparation	m3	499		399	Mouchel Parkman
1014	Borrow Material Overhaul	Haul over 1.5km	m3km	85		68	Mouchel Parkman
1015	Soft Material Overhaul	Cut material, Haul over 1.5km	m3km	85.3		68.2	Mouchel Parkman
1016	Hard M. & Rock Overhaul	Cut material, Haul over 1.5km	m3km	90		72	
1017	Preparation of Spoil Area		m3	153		122	Mouchel Parkman
1018	Preparation of Borrow Pit	Including Royalties	m3	173		138	Mouchel Parkman
1019	Machine Excavate in Soft M.	Backhoe 0.8m3,Excavate & stockpile	m3	365		292	
1020	Hand Excavate in Soft M.	Excavate & stockpile	m3	1,032		826	
1021	Hand Excavate in Hard M.	Excavate, Load & Haul 1.5km	m3	3,019		2,415	
1022	Machine Backfill with cut m.	Backfill in soft material	m3	558		446	
1023	Hand Backfill with cut materia	Backfill in soft material	m3	822		658	
1024	Hand Backfill with sand	Backfill & Compact	m3	4,396		3,517	
1025	Tamper Compaction	Backfill & Compact	m3	213		170	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
1026	Tunnel Excavation	Excavate, Load & Haul 1.5km	m3	3,264		2,611	
1027	Telescopic Excavation	Clamshell 0.4m3 & Hand excavation	m3	504	868	1,271	
	Demolition						
1028	Demolish Concrete	Hand Breaker	m3	11,254		9,003	
1029	Demolish Plain Concrete	Rock hammer	m3	2,286		1,829	
1030	Demolish Reinforced Concrete	Rock hammer	m3	4,404		3,523	
1031	Load demolished concrete	Backhoe 0.8m, Load & haul 1.5km	m3	736		589	
1032	Spoil demolished concrete	Haul 18.5(=20-1.5) km	m3	562		450	
	Concrete and Mortar Producing						
1033	Class 15/20 Concreting	In Situ Mixing	m3	16,293		13,034	Mouchel Parkman
1034	Class 20/20 Concreting	In Situ Mixing	m3	17,390		13,912	Mouchel Parkman
1035	Mortar 1:3	In Situ Mixing	m3	22,108		17,686	
1036	Concrete Mixing	Mixing in Concrete Plant	m3	2,601		2,081	
1037	Concrete Hauling	Agitator Truck 4.4m3	m3	1,738		1,390	
1038	Concrete 15/20	Plant Mixing, including hauling	m3	11,875		9,500	
1039	Concrete 20/20	Plant Mixing, including hauling	m3	12,437		9,950	
1040	Concrete 25/20	Plant Mixing, including hauling	m3	12,729	275	10,458	
1041	Concrete 30/20	Plant Mixing, including hauling	m3	13,481	326	11,111	
1042	Concrete 36/20	Plant Mixing, including hauling	m3	14,369	378	11,873	
1043	Concrete 40/20	Plant Mixing, including hauling	m3	14,626	858	12,559	
1044	Concrete 50/20	Plant Mixing, including hauling	m3	14,489	1,607	13,198	
1045	Concrete 60/20	Plant Mixing, including hauling	m3	14,778	1,717	13,539	
1046	Expandable Concrete	Concrete Plant Mixing	m3	14,626	4,922	16,623	
	Asphalt Producing						
1047	Hot-mix Asphalt Mixing	Asphalt Plant	ton	3,375		2,700	
1048	Asphalt Hauling	Tipping Truck 10 ton	ton	650		520	
1049	Binder Course Asphalt	Hot-mixing, including hauling	ton	11,783		9,426	
1050	Surface Course Asphalt	Hot-mixing, including hauling	ton	13,503		10,802	
1051	Asphaltic Base Course	Hot-mixing, including hauling	ton	10,768		8,614	
	Clearance & Topsoil Strip						
1052	Site Clearance		Ha	437,092		349,674	Mouchel Parkman
1053	Topsoil Strip	To Stockpile or Spoil, Haul 1.5km	m3	746		597	Mouchel Parkman
	Slope Protection						
1054	Build Cut Slope Surface		m2	453		362	
1055	Build Embankment Slope Surf		m2	435		348	
1056	Topsoiling 50mm	Deliver and Hand Spreading	m2	189		151	Mouchel Parkman
1057	Grassing	Deliver and Plant Grass Springs	m2	173		138	Mouchel Parkman
1058	Wet masonry	Provide stones & lay with concrete	m3	16,095		12,876	
1059	Crusher-run backfilling	Provide crusher-run & backfill	m3	5,364		4,291	
1060	Masonry Wall, t=300	Wet masonry & Backfilling	m2	9,494		7,595	
1061	Stone Pitching t=150	Wet masonry & Backfilling	m2	3,327		2,662	
1062	Base Concreting	Concreting & Formwork	m3	30,954		24,763	
1063	Cap Concreting	Concreting & Formwork	m3	26,590		21,272	
1064	Masonry Wall Base Concrete	366*234	m	2,883		2,306	
1065	Masonry Wall Cap Concrete	100*594	m	1,489		1,191	
1066	Stone Pitching Base Concrete	215*196	m	1,810		1,448	
1067	Set Terreamee	1500*1500*140	m2	544	34,757	35,192	
1068	Set Terreamee strips	4*60	m	17	1,640	1,654	
1069	Spread & Compact Fill	Backfill of Terreamee	m3	2,937		2,350	
1070	Build Terreamee wall	Concrete skin & strips	m2	665	46,419	46,951	
	Drainage						
1075	Precast Panel Ditch	600*600	m	12,329		9,863	
1076	In-situ Concrete Ditch	500*500, Class 20/20 concrete	m	7,997		6,398	
1077	In-situ Concrete Cat-walk Ditch	500*300, Class 20/20 concrete	m	10,512		8,410	
1078	Single Drain Pipe 0.6m	Supply pipes & Place	m	25,980		20,784	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
1079	Single Drain Pipe 0.9m	Supply pipes & Place	m	41,688		33,350	
1080	Single Drain Pipe 1.2m	Supply pipes & Place	m	55,626		44,501	
1081	Double Drain Pipe 0.6m	Supply pipes & Place	m	50,076		40,061	
1082	Double Drain Pipe 0.9m	Supply pipes & Place	m	75,330		60,264	
1083	Double Drain Pipe 1.2m	Supply pipes & Place	m	101,810		81,448	
1084	Single Drain 0.6m Inlet/Outlet	25N/mm2	No.	49,631	266	39,971	
1085	Single Drain 0.9m Inlet/Outlet	25N/mm2	No.	76,357	431	61,517	
1086	Single Drain 1.2m Inlet/Outlet	25N/mm2	No.	136,531	879	110,104	
1087	Double Drain 0.6m Inlet/Outlet	25N/mm2	No.	84,438	477	68,027	
1088	Double Drain 0.9m Inlet/Outlet	25N/mm2	No.	135,707	798	109,364	
1089	Double Drain 1.2m Inlet/Outlet	25N/mm2	No.	193,507	1,170	155,976	
1090	Build Oil Separator	10m ³ (2.8*3.1*3.4)	No.	1,643,001	7,852	1,322,253	
	Road Pavement						
1091	Borrow Gravel Subbase	Provide, Haul 1.5km, Spread, Compact	m ³	2,129		1,703	Mouchel Parkman
1092	Carriageway Borrow Gravel Base	Provide, Haul 1.5km, Spread, Compact	m ³	2,129		1,703	Mouchel Parkman
1093	Graded Crushed Stone	Provide, Spread, Water, Compact	m ³	4,534		3,627	Mouchel Parkman
1094	Cement Stabilizing	Provide Cement, Mixing In-situ	m ³	1,240		992	Mouchel Parkman
1095	Prime Coating	Provide, Heat and Spray MC30	litre	124		99	Mouchel Parkman
1096	Tack Coating	Spray K160	litre	115		92	Mouchel Parkman
1097	Grade Road Bed Surface	Supply, lay & compact	m ²	134.0		107.2	
1098	Sub-base Course, t=200	Supply, lay & compact	m ³	4,766		3,813	
1099	Base Course, t=150	Supply, lay & compact	m ³	5,814		4,651	
1100	Cement stabilized Base Course	Supply, lay & compact	m ³	7,054		5,643	
1101	Asphaltic Base Course, t=100	Supply and Lay Asphaltic Base Course	m ³	28,566		22,853	
1102	Binding Course AC, t=40	Supply and Lay AC	m ³	33,352		26,682	
1103	Binding Course AC, t=50	Supply and Lay AC	m ³	32,608		26,086	
1104	Intermediate Course AC, t=50	Supply and Lay AC	m ³	36,933		29,546	
1105	Surface Course AC, t=40	Supply and Lay AC	m ³	37,677		30,142	
1106	Surface Course AC, t=50	Supply and Lay AC	m ³	36,933		29,546	
	Concreting Works						
1112	Concrete Pouring	Hand pour & cure, without concrete	m ³	2,094		1,675	
1113	Small Concrete Pouring	Hand pour & cure, without concrete	m ³	3,310		2,648	
1114	Concrete Pouring	Pump pour & cure, without concrete	m ³	3,204		2,563	
1115	15/20 Blinding Concreting	Provide, Hand pour & Cure	m ³	14,563		11,650	
1116	15/20 Blinding Concreting	Provide, Pump pour & Cure	m ³	15,673		12,538	
1117	15/20 Small Member Concreting	Provide 15/20, Hand pour & Cure	m ³	15,779		12,623	
1118	20/20 Small Member Concreting	Provide 20/20, Hand pour & Cure	m ³	16,369		13,095	
1119	Pour Small Structure Concrete	Concrete 25/20, Hand pouring	m ³	16,130	289	13,193	
1120	30/20 Small Member Concreting	Provide, Hand pour & Cure	m ³	16,249	342	13,341	
1121	Class 20/20 Concreting	Provide 20/20, Hand pour & Cure	m ³	15,153		12,122	
1122	Class 25/20 Concreting	Provide 25/20, Hand pour & Cure	m ³	15,460	289	12,657	
1123	Class 25/20 Concreting	Provide, Pump pour & Cure	m ³	16,570	289	13,545	
1124	Class 30/20 Concreting	Provide, Pump pour & Cure	m ³	17,359	342	14,229	
1125	Circular Formwork	Set & Remove timber & plywood	m ²	4,195		3,356	
1126	Timber Formwork	Set & Remove timber & plywood	m ²	3,338		2,670	
1127	Small Member Formwork	Set & Remove timber & plywood	m ²	3,166		2,533	
1128	Blinding Concrete Formwork	Set & Remove timber & plywood	m ²	1,988		1,590	
1129	Precast Formwork	Set & Remove precast steel form	m ²	1,625		1,300	
1130	Precast Steel Form	Manufacture steel form	m ²	12,595		10,076	
1131	Re-bar Fabrication	Provide Y Grade, Hand Fabricate	ton	157,275		125,820	Mouchel Parkman
1132	Small Structure R-ebar	Provide SD345, Hand Fabricate	ton	41,602	121,523	154,805	
1133	Re-bar Fabrication	Provide SD345, Crane Fabricate	ton	41,212	120,376	153,346	
1134	Re-bar Fabrication	Provide Epoxy R-ebar, Crane Fabricate	ton	41,212	195,990	228,960	
1135	Shoring	Pipe frame Shoring	m ³	662	1,452	1,982	
1136	Scaffolding	Pipe frame Scaffolding	m ²	1,800	676	2,116	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
1137	Set Elastight	Furnish & Set Elastight	m2	2,822		2,258	
1138	Set Waterstop	Furnish & Set Waterstop	m	1,647		1,318	
1139	Crushed Stone Base	Furnish material & Compact	m3	8,088		6,470	
	Road Furniture						
1140	Single Guardrailing	Provide Posts & Rails, Erect	m	7,584		6,067	Mouchel Parkman rev
1141	Precast Guardrail Post	In situ manufacturing	post	6,285		5,028	
1142	Build Median Barrier	In situ manufacturing	m	33,392		26,714	
1143	Precast Kerbs	1000*250*125	m	2,206		1,765	Mouchel Parkman
1144	Precast Edge Beams	1000*100*120	m	1,298		1,038	Mouchel Parkman
1145	Paint Road Line Marking	b=100	m	236		189	
1146	Set Road Sign	dia. 600 -750	No.	47,362		37,890	
1147	Set Cat Eyes	Provide & Set, Both sides	No.	2,681		2,145	
1148	Build Overhang Traffic Sign	Interchange Destination Sign	No.	468,228	822,571	1,197,153	
1149	Install Overhang Frame	H-300*300	ton	19,703	129,743	145,505	Overhang Sign Board
1150	Build Illumination	H=8m, 360W	Set	516,320		413,056	
1151	Illumination Post & Light	H=8m, 360W Sodium	No.	178,573		142,858	
1152	Install Casing Pipe	dia.100mm, for road ilumination	m	4,912		3,930	
1153	Install Electric Cable	22mm-3c, for road ilumination	m	1,396		1,117	
1154	Install Pull Box	Stainless, 400*400*250	No.	22,347		17,878	
1155	Traffic Signal Post	H=8m	No.	113,023		90,418	
1156	Signal Controller Post	H=5m	No.	90,023		72,018	
1157	Install Signal Cable		m	1,396		1,117	
1158	Build Post Foundation	H=8m	No.	26,914		21,531	
1159	Build Traffic Signal	2 Aspects *8 & 3 aspects *8	No.	585,263		468,210	
	Box Tunnel						
1160	Vehicle Tunnel	Inner dimension 11.5m*6.0m	m	1,270,522	834,587	1,851,005	
1161	Pedestrian Tunnel	Inner dimension 3.0m*3.0m	m	277,976	150,950	373,331	
1162	Bypass under A109	Box Underpass 11.5m*6m*2 boxes	Sum	57,304,749	38,608,704	84,452,503	
	Railway Underpass Tunnel						
1163	Bypass under railway	Box Underpass 11.5m*6m*2 boxes	Sum	71,097,559	52,074,529	108,952,576	
1164	Underpass Tunnel	Class 25/20 concrete	m	2,179,202	1,608,696	3,352,058	
1165	Pavement in Tunnel	Carriageway Pavement AC 50+50	Sum	1,929,236		1,543,389	
1166	Temporary works for Underpas	Underpinning railways	Sum	9,995,988	19,265,001	27,261,791	
1167	Tunnel Earth Works	Excavation and Backfilling	Sum	14,634,712		11,707,770	
1168	Sleeper Supports	Excavation and Backfilling	No.	6,645		5,316	
1169	Drive Underpinning pile	H-350*350 L=20.0m, Vibro hammer	pile	135,596	398,876	507,353	
1170	Drive Soldier Beams	H-350*350 L=15.0m, Vibro hammer	pile	67,253	155,196	208,998	
1171	Timber Lagging	Timber t=75	m2	4,362		3,490	
1172	Extract Soldier Beams	H-350*350 L=15.0m, Vibro hammer	pile	22,418	7,050	24,984	
1173	Drive Strut Support Piles	H-350*350 L=13.5m, Vibro hammer	pile	53,802	257,279	300,321	
1174	Tunnel Strutting & Waling	Install & Remove H-350*350	ton	54,101	66,033	109,314	Underpass
1175	Install & Remove H-Girder	H-588*300	ton	33,187	170,198	196,748	Underpass
1176	Cut H-Piles	H-350*350	No.	5,696		4,557	
1177	Install Steel Slippers	H-250*250	No.	96,478		77,182	
	Bridges						
1178	A14 Interchange Overbridge	Hollow Slab, B=10.5m, L=230m	Sum	157,503,525	150,379,613	276,382,433	Hollow Slab
1179	Link Road Overbridge	Hollow Slab, B=10.5m, L=200m	Sum	125,823,441	118,820,367	219,479,120	Hollow Slab
1180	Mwache bridge	PCU Girder, L=900m, B=12.2m	Sum	944,024,865	1,702,405,808	2,457,625,700	PCU
1181	Tsunza Viaduct	PC Slab Girder, L=1300m, B=12.2m	Sum	1,139,663,473	1,714,394,553	2,626,125,331	PC Slab Girder
1182	Mteza bridge	PCU Girder L=1450m, B=12.2m	Sum	1,368,856,690	2,604,525,531	3,699,610,883	PCU
1183	Tsunza Overbridge	Hollow Slab, B=10.5m, L=30m	Sum	36,243,665	27,658,283	56,653,215	Hollow Slab
1184	Dongo-Kundu Overbridge	Hollow Slab, B=10.5m, L=30m	Sum	36,243,665	27,658,283	56,653,215	Hollow Slab
	PCU Superstructure						
1185	PCU Superstructure	PCU Girder H=2.0m	m2	35,673	112,172	140,710	
1186	Fabricate Bridge Slab Rebar	Supply eepoxy-cated rebar & Fabrica	ton	49,185	195,990	235,338	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
1187	Fabricate Tie-beam Re-bar	Supply eepoxy-cated rebar & Fabrica	ton	53,073	197,856	240,314	
1188	Fabricate Steel Formwork	For PCU Girder	m2	729	1,743	2,326	
1189	Bridge Slab Formwork	Non-emoval, Plywood t=12mm	m2	5,936		4,749	
1190	Bridge Slab Formwork	Reuse, Plywood t=12mm	m2	4,134		3,307	
1191	Small Structure Formwork	Plywood t=12mm	m2	2,974		2,379	
1192	Pour Bridge Slab Concrete	Concrete 30/20, Concrete Pumping	m3	17,991	342	14,735	
1193	Pour Tie-beam Concrete	Concrete 30/20, Concrete Pumping	m3	33,668	17,663	44,597	
1194	Pour Expandable Concrete	Pumping	m3	34,870	22,489	50,385	
1195	Install PC Cables 1S21.8	Fabricate & Install Cables & Sheath	m	98	3,073	3,151	
1196	Install PC Cables 12S15.2B	Fabricate & Install Cables	m	310	8,868	9,116	
1197	Pull PC Cable 1S21.8	Jacking and Grouting	cable	289	19,232	19,463	
1198	Girder Building Equipment	Various Jacks, Gantry Crane	m3	2,252	18,642	20,444	
1199	Set & Remove Railway	One railway (2 rails)	m	417	4,622	4,956	
1200	Set & Remove Gantry Crane	Lifting 3tons	gantry	31,163	155,298	180,228	
1201	Set & Remove Building Stage	For building PCU Girders	m	15,442	7,490	19,844	PCU
1202	Girder Fabricate Facilities	For building PCU Girders	factory	2,990,188	19,276,238	21,668,388	PCU
1203	Ajust Building Stage	For building PCU Girders	girder	7,031		5,625	PCU
1204	Build PCU Girder	B=1.5m, H=2.0m, L=39.8m	girder	2,203,008	7,283,975	9,046,381	
1205	Temporay Stock of Girder	Relocation of Girder	girder	8,798	150,277	157,315	
1206	Erect PCU Girder	Erection Girder	ton	247	11,129	11,327	
1207	Set & Remove Erection Girder	two girder	time	1,687,742	32,775,773	34,125,967	
1208	Travel & Set Erection Girder	two girder	time	46,305	1,997,960	2,035,004	
1209	Set & Remove Scafoding	Scaffolding with pipes	m2		7,292	7,292	
1210	Set & Remove Ladder	At Pier	No.		176,868	176,868	
1211	Set Rubber Shoes H-36	610*460*80	No.	3,454	217,327	220,090	
1212	Non-shrinkage Mortar	Supply & Mix Mortar	m3	15,876	396,000	408,701	
1213	Carriageway Expansion Joint	Supply & Install Expansion Joint	m	11,494	87,661	96,856	
1214	Walkway Expansion Joint	Supply & Install Expansion Joint	m	11,494	63,734	72,929	
	PC Slab Girder Superstructure						
1215	PC Slab Girder Superstructure		m2	48,036	89,310	127,739	
1216	Build PC Slab Girder		No.	268,532	574,277	789,103	
1217	Set Rubberbelt shoe		m	963	48,277	49,047	
1218	Erect PC Slab Girder	Crawler Crane 100ton	No.	23,225	6,906	25,486	
1219	Install PC Cables 1S21.8	Fabricate & Install Cables	m	98	2,852	2,930	
1220	Pull PC Cable 1S21.8	Jacking and Grouting	cable	289	12,763	12,994	
1221	Transport PC Slab Girder		No.	33,210		26,568	
1222	Drive Pier H piles	Provide and drive H piles	No.	55,665	331,495	376,027	
1223	H-pile Corrosion Protection	Provide & Pour Concrete	No.	263,107	13,637	224,123	
1224	Drive Abutment H piles	Provide and drive H piles	No.	44,532	258,064	293,690	
1225	Build Viaduct Pier	Concrete + H steel	Pier	2,667,786	2,667,954	4,802,183	
1226	Build Viaduct Abutment	Concrete + H steel	Pier	2,219,170	4,531,253	6,306,589	
1227	Fabricate Steel Form	For Box Girder	m2	7,233	17,426	23,212	
1228	Steel Rib	For Precast members & girders	ton	146,278	114,127	231,149	
	Hollow Slab Superstructure						
1229	Buid Hollow Slab	B=10.5m, Span 18.0m	m2	43,229	57,086	91,669	
1230	Set Cylinder Form	Crane set	m	3,412		2,730	
1231	Build Hollow Slab Pier	In-situ Concrete Pile, 6 piles	pier	7,238,475	2,226,621	8,017,401	
1232	Build Hollow Slab Pier	In-situ Concrete Pile, 2 piles	pier	2,588,778	695,128	2,766,150	
1233	Build Hollow Slab Abutment	In-situ Concrete Pile Foundation	abut.	9,114,437	3,645,154	10,936,704	
	Bridge Surface Pavement						
1234	Sheet Waterproofing	Bridge Surface	m2	239	1,853	2,044	
1235	Bridge Carriageway Pavement	AC t=80mm(40+40)	m2	3,130	1,853	4,357	
1236	Bridge Walkway Pavement	AC t=40mm	m2	1,796	1,853	3,290	
1237	Bridge Surface Drain	dia.150	No.	1,766	41,274	42,687	
1238	Build Barrier	H=1300	m	17,805	5,984	20,228	

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
1239	Build RC Hand Rail	H=1300	m	9,354	4,156	11,639	
	Bridges Pier & Abutment						
1240	Abutment/Pier Concreting	Class 24/20, Pumping	m3	14,953	289	12,251	
1241	Install Rebar Couplers	Furnish and install couplers	No.	201	3,419	3,580	
1242	Fabricate Substructure Rebar	Supply & Fabricate epoxy coated reb	ton	29,884	195,990	219,897	
1243	Mwache Pier	In-situ Concrete Pile	pier	14,167,949	6,003,311	17,337,670	Pile length 31m
1244	Mteza Pier Mid Span	In-situ Concrete Pile	pier	12,940,079	5,691,845	16,043,908	Pile length 28.5m
1245	Mteza Pier East	In-situ Concrete Pile	pier	10,484,447	5,235,143	13,622,701	Pile length 20m
1246	Mwache Abutment	In-situ Concrete Pile	Abut.	19,764,377	8,406,376	24,217,878	Pile length 31m
1247	Mteza West Abutment	In-situ Concrete Pile	Abut.	18,077,063	7,991,088	22,452,738	Pile length 28.5m
1248	Mteza East Abutment	RC Footing, no foundation pile	Abut.	6,186,477	5,166,328	10,115,510	No foundation pile
1249	Road Slab	RC 400*6000*8000	No.	433,005	236,671	583,075	
	Foundation Pile						
1250	Stand Pipe for RCD Piles	dia. 1200, t=14	ton		2,584	2,584	
1251	Boared Concrete Pile	RCD pile dia. 1.0m, L=28.5m	pile	1,499,163	353,095	1,552,425	Mteza Pier Midspan
1252	Boared Concrete Pile	RCD pile dia. 1.0m, L=31m	pile	1,703,808	405,006	1,768,052	Mwache Pier & Abutment
1253	Boared Concrete Pile	RCD pile dia. 1.0m, L=20m	pile	1,089,891	276,978	1,148,891	Mteza Pier East
1254	Boared Concrete Pile	RCD pile dia. 1.0m, L=10m	pile	660,243	190,949	719,143	Hollow Slab Bridge
1255	Steel Pipe Piling	Pile hammer, dia. 0.8m, L=34.5m	pile	106,675	2,022,614	2,107,954	Mwache Abutment
1256	Steel Pipe Piling	Pile hammer, dia. 0.8m, L=28.5m	pile	77,509	1,646,621	1,708,628	Mwache Pier Plan A
1257	Steel Pipe Piling	Pile hammer, dia. 0.8m, L=31m	pile	77,509	1,783,354	1,845,361	Mwache Pier Plan B
1258	Steel Pipe Piling	Pile hammer, dia. 0.8m, L=37m	pile	77,509	2,321,991	2,383,998	Mwache Pier Plan C
1259	Steel Pipe Piling	Pile hammer, dia. 0.8m, L=20m	pile	77,509	1,181,213	1,243,220	Mteza Abutment
1260	Steel Pipe Piling	Pile hammer, dia. 0.8m, L=28.5m	pile	77,509	1,646,621	1,708,628	Mteza Pier
1261	Pile Top Welding	Welding stopper	m	1,704		1,363	
1262	Install Casing Pile	dia.1000, L=12m	No.	17,296	888,706	902,543	
	Temporary Facilities						
1263	Drive Sheet Piles SSP-IV	L=18m, Vibro Hammer	pile	12,492	53,806	63,800	Mteza Pier
1264	Extract Sheet Piles SSP-IV	L=18m, Vibro Hammer	pile	6,400	2,013	7,133	Mteza Pier
1265	Drive Sheet Piles SSP-III	L=16m, Vibro Hammer	pile	9,608	37,603	45,289	Mteza Pier
1266	Extract Sheet Piles SSP-III	L=16m, Vibro Hammer	pile	5,467	1,719	6,093	Mteza Pier
1267	Drive H-350*350 Piles	L=35m, Vibro Hammer	pile	53,802	16,919	59,961	Mwache Mid Span
1268	Drive H-350*350 Piles	L=30m, Vibro Hammer	pile	53,802	16,919	59,961	Mteza Mid Span
1269	Drive H-350*350 Piles	L=18m, Vibro Hammer	pile	33,627	10,574	37,476	Mteza East End
1270	Drive H-300*300 Piles	L=18m, Vibro Hammer	pile	22,418	50,405	68,339	Strut Support Pile
1271	Extract H-350*350 Piles	L=30-35m, Vibro Hammer	pile	16,400	5,157	18,277	Mteza Pier
1272	Extract H-350*350 Piles	L=18m, Vibro Hammer	pile	16,400	5,157	18,277	Mteza East End
1273	Extract H-300*300 Piles	L=18m, Vibro Hammer	pile	16,400	5,157	18,277	Strut Support Pile
1274	Strutting & Waling	Install & Remove H-400*400	ton	54,101	27,110	70,391	Temporary support
1275	Strutting & Waling	Install & Remove H-350*350	ton	54,101	26,413	69,694	Temporary support
1276	Strutting & Waling	Install & Remove H-300*300	ton	54,101	25,949	69,230	Temporary support
1277	Install & Remove H-Girder	H-588*300	ton	33,187	34,647	61,197	Temporary Bridge
1278	Install & Remove Deck Stoppe	L-150*150	ton	33,187	34,647	61,197	Temporary Bridge
1279	Install & Remove Substructure	L-250*90 & Larger sizes	ton	21,466	190,121	207,294	Temporary Bridge
1280	Install & Remove Bracing	L-130*130	ton	21,466	202,897	220,070	Temporary Bridge
1281	Install & Remove Decking	Steel Deck 2000*1000	m2	1,828		1,462	Temporary Bridge
1282	Install & Remove Gurd Pipes	dia. 48.6, t=2.4	m	262	121	331	Temporary Bridge
1283	Tempo. Bridge Superstructure	B=8m, L=6m	m2	7,275	21,736	27,556	Temporary Bridge
1284	Mwache Temporary Bridge	Mwache Midspan, B=8.0m	m2	14,588	24,036	35,706	
1285	Mwache Temp. Bridge Steel	Steel procurement	Sum		118,429,612	118,429,612	
1286	Mteza Temporary Bridge	Mteza Mid Span, B=8.0m	m2	14,588	24,036	35,706	Mteza Mid Span
1287	Mteza Temporary Bridge	Mteza East End, B=8.0m	m2	12,486	23,375	33,364	Mteza East End
1288	Mteza Temp. Bridge Steel	Steel procurement	Sum		109,449,124	109,449,124	Mteza Temo. Bridge
1289	Backfill Cofferdam	Supply sand & Backfill	m3	3,694		2,955	For Cofferdam
1290	Dewatering	24 hours operation	day	40,289		32,231	For Cofferdam

No.	Items	Specification/Capacity	Unit	Construction Rate			Source
				Ksh	Yen	Convert. Yen	
1291	Dewatering	8 hours operation	day	8,878		7,102	For Cofferdam
1292	Set & Remove Pump	Dewatering Pump	time	58,803		47,042	For Cofferdam
1293	Mwache Pier Cofferdam	Cofferdam for 1 pier, Plan B	No.	5,028,276	6,141,950	10,164,571	Plan B
1294	Mteza Pier Cofferdam	Cofferdam for 1 pier, Plan B	No.	4,096,796	6,395,406	9,672,843	Plan B
1295	Mwache Abutment Sheathing	Sheathing for 1 abutment	No.	3,703,295	5,874,247	8,836,883	
1296	Mteza Abutment Sheathing	Sheathing for 1 abutment	No.	3,703,295	5,874,247	8,836,883	Mteza Abutment
1297	Mwache Access Bridge	Access Bridge, B=8m, L=900m	Sum	105,033,600	485,654,782	569,681,662	Mwache Access Bridge
1298	Mwache Access Bridge Steel	Steel procurement	Sum		312,595,582	312,595,582	Mteza Access Bridge
1299	Mteza Access Bridge	Access Bridge, B=8m, L=1500m	Sum	164,966,400	768,432,682	900,405,802	Mteza Access Bridge
1300	Mteza Access Bridge Steel	Steel procurement	Sum		483,173,482	483,173,482	Mteza Access Bridge
	Utility Relocations						
1301	Install 700 dia. Water pipe	ductile pipe	m	122,611		98,089	Water Supply Line
1302	Temporary Maintenance Shaft	Inner Dimension 1.5m*2.0m	m	129,434	10,996	114,543	Water Supply Line
1303	Install 350 dia. Water pipe	steel pipe	m	52,102		41,682	Water Supply Line
1304	Demolish 350 dia. Water pipe	steel pipe	m	5,956		4,765	Water Supply Line
1305	Install 200 dia. Water pipe	steel pipe	m	32,339		25,871	Water Supply Line
1306	Demolish 200 dia. Water pipe	steel pipe	m	4,709		3,767	Water Supply Line
1307	Install 150 dia. Water pipe	PVC pipe	m	3,788		3,030	Water Supply Line
1308	Demolish 150 dia. Water pipe	PVC pipe	m	1,866		1,493	Water Supply Line
1309	Build Water Manhole	1.5m*4.0m*2.0m	No.	638,323		510,658	Water Supply Line
1310	Demolish Water Manhole	1.5m*4.0m*2.0m	No.	54,111		43,289	Water Supply Line
1311	Build Water Manhole	1.5m*1.5m*1.5m	No.	281,154		224,923	Water Supply Line
1312	Build Water Manhole	1.2m*1.2m*1.2m	No.	154,272		123,418	Water Supply Line
1313	Demolish Water Manhole	1.2m*1.2m*1.2m	No.	45,114		36,091	Water Supply Line
1314	Build Water Manhole	1.0m*1.0m*1.0m	No.	99,185		79,348	Water Supply Line
1315	Demolish Water Manhole	1.0m*1.0m*1.0m	No.	24,469		19,575	Water Supply Line
1316	Install Water Valve	Cast iron 700mm dia.	No.	815,539		652,431	Water Supply Line
1317	Demolish Water Valve	Cast iron 700mm dia.	No.	49,593		39,674	Water Supply Line
1318	Install Water Valve	Cast iron 350mm dia.	No.	285,435		228,348	Water Supply Line
1319	Install Water Valve	Cast iron 200mm dia.	No.	95,749		76,599	Water Supply Line
1320	Demolish Water Valve	Cast iron 200mm dia.	No.	2,461		1,969	Water Supply Line
1321	Install Water Valve	Cast iron 150mm dia.	No.	46,863		37,490	Water Supply Line
1322	Demolish Water Valve	Cast iron 150mm dia.	No.	2,046		1,637	Water Supply Line
1323	Install Single Powe Pole	Pole height 14m	No.	161,612		129,290	Electric Power Line
1324	Demolish Single Powe Pole	Pole height 14m	No.	10,488		8,390	Electric Power Line
1325	Install Double Powe Pole	Pole height 14m	No.	329,808		263,846	Electric Power Line
1326	Demolish Double Powe Pole	Pole height 14m	No.	20,973		16,778	Electric Power Line
1327	Install Electric Cable	High Voltage CV 3c-38mm2	m	8,038		6,430	Electric Power Line
1328	Demolish Electric Cable	High Voltage CV 3c-38mm2	m	753		602	Electric Power Line
1329	Install Electric Cable	High Voltage CV 3c-22mm2	m	6,129		4,903	Electric Power Line
1330	Demolish Electric Cable	High Voltage CV 3c-22mm2	m	654		523	Electric Power Line
1331	Install Electric Cable	Low Voltage CV 3c-14mm2	m	2,269		1,815	Electric Power Line
1332	Demolish Electric Cable	Low Voltage CV 3c-14mm2	m	312		250	Electric Power Line
1333	Install Communication Cable	Optic cable 1.2mm-200P	m	10,726		8,581	Communication Line
1334	Demolish Communication Cab	Optic cable 1.2mm-200P	m	251		201	Communication Line
1335	Install Protection Pipe	PVC pipe 100mm dia.	m	4,967		3,974	Communication Line
1336	Install Hand Hole	Inner dimension 600*600*800	No.	53,355		42,684	Communication Line
	Miscellaneous						
1337	Planting Trees	H=3.0 - 3.5m	No.	38,269		30,615	Soundproofing
1338	Soundproofing Tree Zone	H=3.0 - 3.5m @ 1.5m, staggered	m	25,514		20,411	Soundproofing
1339	Animal Pass Tunnel	dia. 900, L=30m	No.	1,403,354	862	1,123,545	Soundproofing

Construction Unite Rate Derivation of Labour and Staff

Project Name : Mombasa City Road Development Project

Local Labour & Staff (to be procured in Kenya)

Construction Unite Rate Derivation

No.	Items	Description	Unit	Base Rate			Income Tax		Cost in Kenya	Overheads & Profit		Cost + Overheads & Profits Ksh	Const'n Rate Ksh	Source
				without inflation	inflation rate	with inflation Ksh	ratio	Tax Amount Ksh		ratio	Overheads & Profit Ksh			
0														
1	Foreman	Kenyan	day	4,000	0	4,000	25%	1000	5,000	15%	750	5,750	5,750	S.S. Mehta*0.8
2	Artisan	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Dhanjal
3	Skilled Labourer	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Dhanjal
4	Labourer	Kenyan	day	1,000	0	1,000	15%	150	1,150	15%	173	1,323	1,323	S.S. Mehta
5	Leveller	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
6	Re-bar fabricator	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
7	Carpenter	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
8	Mason	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
9	Scaffolder	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
10	Welder	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
11	Electrician	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
12	Waterproofofer	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
13	Painter	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
14	Plumber	Kenyan	day	1,350	0	1,350	15%	203	1,553	15%	233	1,786	1,786	Same with Artisan
15	Gurdman	Kenyan	day	1,000	0	1,000	15%	150	1,150	15%	173	1,323	1,323	same with Unskilled
16	Operator	Kenyan	hr	188	0	188	25%	47	235	0%	0	235	235	Cementers
17	Turnboy	Kenyan	hr	170	0	170	15%	26	196	0%	0	196	196	same with labourer
20	Civil Engineer	Experience 20 years	month	250,000	0	250,000	15%	37500	287,500	15%	43,125	330,625	330,625	Kounoike
21	Civil Engineer	Experience 10 years	month	200,000	0	200,000	15%	30000	230,000	15%	34,500	264,500	264,500	Kounoike
22	Surveyor		month	100,000	0	100,000	15%	15000	115,000	15%	17,250	132,250	132,250	Kounoike
23	Assistant Surveyor		month	70,000	0	70,000	15%	10500	80,500	15%	12,075	92,575	92,575	Kounoike
24	CAD Operator		month	92,000	0	92,000	15%	13800	105,800	15%	15,870	121,670	121,670	Mortorways
25	Accountant		month	60,000	0	60,000	15%	9000	69,000	15%	10,350	79,350	79,350	Kounoike
26	Clerk		month	50,000	0	50,000	15%	7500	57,500	15%	8,625	66,125	66,125	Kounoike
27	Office Driver		month	25,000	0	25,000	15%	3750	28,750	15%	4,313	33,063	33,063	Kounoike
28	Office boy		month	15,000	0	15,000	15%	2250	17,250	15%	2,588	19,838	19,838	Kounoike
29														

Foreign Labour (to be procured from Japan)

Construction Rate Derivation (Including overseas incentive(+36%))

No.	Items	Description	Unit	Base Rate			Income Tax		Cost in Kenya Yen	Overheads & Profit		Cost + Overheads & Profits Yen	Const'n Rate Yen	Source
				without inflation Yen	inflation rate	with inflation Yen	ratio	Tax Amount Yen		ratio	Overheads & Profit Yen			
0														
30	Bridge Foreman	Japanese	day	31,552	0	31,552	30%	9466	41,018	15%	6,153	47,171	47,171	Japan cost book
31	Bridge Artisan	Japanese	day	27,336	0	27,336	30%	8201	35,537	15%	5,331	40,868	40,868	Japan cost book
32	Foreman	Japanese	day	26,248	0	26,248	30%	7874	34,122	15%	5,118	39,240	39,240	Japan cost book
33	Welder	Japanese	day	26,384	0	26,384	30%	7915	34,299	15%	5,145	39,444	39,444	Japan cost book

Construction Unite Rate Derivation of Local Material and Miscellaneous

Project Name : Mombasa City Road Development Project

Local Material & Miscellaneous (to be procured in Kenya)

No.	Items	Description	Unit	Base Rate			Import Duty		Excise Duty & Levies & Ksh	Import Declaration Form Ksh	Cost in Kenya Ksh	Overheads & Profit		Const'n Rate Ksh	Source
				without inflation Ksh	inflation rate	with inflation Ksh	ratio	Duty Amount Ksh				ratio	Overheads & Profit Ksh		
	Material														
100	Diesel		litre	83	0	83		17,644	2	103	118	15	118	118	Gas Station
101	Gasoline		litre	82	0	82		28,905	2	113	130	17	130	130	Gas Station
102	Heavy oil	Type C	litre	80	0	80		4.1	2	86	99	13	99	99	Assessed
103	Bitumen	80/100	ton	90,000	0	90,000	10%	0.4	2,228	101,228	116,412	15,184	116,412	116,412	Kounoike
104	Tack Coat	K160	litre	80	0	80.0	10%	0.4	2	90.4	104.0	13.6	104.0	104.0	Dhanjal
105	Prime Coat	MC30	litre	75	0	75.0	10%	0.4	2	85.4	98.2	12.8	98.2	98.2	Dhanjal
106	Bagged Cement	Portland	ton	11,837	0	11,837				11,837	13,613	1,776	13,613	13,613	Bamburi
107	Bulk Cement	Portland	ton	11,680	0	11,680				11,680	13,432	1,752	13,432	13,432	Bamburi
108	Aggregate		ton	1,000	0	1,000				1,000	1,150	150	1,150	1,150	Kavee quarry
109	Blasted Rock, Boulder		ton	750	0	750				750	863	113	863	863	Kavee quarry
110	Subbase course material	Crusher-run	ton	750	0	750				750	863	113	863	863	Kavee quarry
111	Base course material	Mechanically stabilized crushed stone	ton	1,000	0	1,000				1,000	1,150	150	1,150	1,150	Kavee quarry= Aggregate
112	Sand		ton	1,000	0	1,000				1,000	1,150	150	1,150	1,150	Assessed, =Aggregate
113	Screenings		ton	200	0	200				200	230	30	230	230	Kavee quarry
114	Stone Powder		ton	200	0	200				200	230	30	230	230	Kavee quarry
115	Royalties on Borrow		m3	50	0	50.0				50.0	58	7.5	58	57.5	Mouchelparkman
116	Gabion Box		m3	3,500	0	3,500				3,500	4,025	525	4,025	4,025	Kounoike
117	Gabion Mattress	0.5m x 1m x 2m	m2	3,200	0	3,200				3,200	3,680	480	3,680	3,680	Cementers
118	F3 Timber	Cypress	m2	578	0	578				578	665	87	665	665	Mouchelparkman
119	F1 Timber	Cypress	m2	435	0	435				435	500	65	500	500	Mouchelparkman
120	Timber	Cypress	m3	33,000	0	33,000				33,000	37,950	4,950	37,950	37,950	Cementers
121	Plywood	900*1800, t=12	m2	802	0	802				802	922	120	922	922	S.S. Mehta
122	Form Oil		litre	152	0	152.0				152.0	174.8	22.8	174.8	174.8	Assessed Japan cost book
123	Guardrails	without Post	m	2,874	0	2,874				2,874	3,305	431	3,305	3,305	Brollo Kenya
124	Deformed Rebar	Y Grade, High Yield	ton	103,000	0	103,000				103,000	118,450	15,450	118,450	118,450	Corrugated Sheets
125	Round Bar	BS 4449(460)	ton	103,000	0	103,000				103,000	118,450	15,450	118,450	118,450	Corrugated Sheets

No.	Items	Description	Unit	Base Rate			Import Duty		Excise Duty & Levies	Import Declaration Form	Cost in Kenya	Overheads & Profit		Const'n Rate	Source
				without inflation Ksh	inflation rate	with inflation Ksh	ratio	Duty Amount Ksh				ratio	Overheads & Profit Ksh		
126	Steel Angle	L-100*100 & Smaller sizes	ton	119,280	0	119,280				119,280	17,892	137,172	137,172	Corrugated Sheets	
127	Steel H beam	H-250*250 % Smaller sizes	ton	119,280	0	119,280				119,280	17,892	137,172	137,172	Assessed	
128	Flat Bar		ton	107,750	0	107,750				107,750	16,163	123,913	123,913	Corrugated Sheets	
129	Square Pipe	100*100	ton	123,570	0	123,570				123,570	18,536	142,106	142,106	Corrugated Sheets	
130	Steel Pipe	dia. 25	ton	115,298	0	115,298				115,298	17,295	132,593	132,593	Corrugated Sheets	
131	Barbed wire		kg	220	0	220.0				220.0	33.0	253.0	253.0	Assessed	
132	Neil		kg	160	0	160				160	24	184	184	Assessed	
133	Concrete Pipes	dia. 600	m	6,325	0	6,325				6,325	949	7,274	7,274	Mortorways	
134	Concrete Pipes	dia. 900	m	14,375	0	14,375				14,375	2,156	16,531	16,531	Mortorways	
135	Concrete Pipes	dia. 1200	m	18,975	0	18,975				18,975	2,846	21,821	21,821	Mortorways	
136	PVC Pipe	dia. 50	m	250	0	250				250	38	288	288	Cementers	
137	PVC Pipe	dia. 100	m	1,170	0	1,170				1,170	176	1,346	1,346	Cementers	
138	PVC Pipe	dia. 150	m	1,450	0	1,450				1,450	218	1,668	1,668	Kounoike	
139	Precast Concrete Kerbs	1000*250*125	m	400	0	400				400	60	460	460	SCONCO	
140	Precast Edge Beams	1000*100*120	m	185	0	185				185	28	213	213	SCONCO	
141	Concrete Paving Blocks	80mm Bamburi	m2	900	0	900				900	135	1,035	1,035	Bamburi hearing	
142	Concrete Paving Blocks	60mm Bamburi	m2	650	0	650				650	98	748	748	Bamburi hearing	
143	Concrete Paving Blocks	50mm Bamburi	m2	550	0	550				550	83	633	633	Assessed	
144	Interlocking Blocks	80mm. ex. Works	m2	1200	0	1200				1,200	180	1,380	1,380	Tracon	
145	Interlocking Blocks	60mm. ex. Works	m2	700	0	700				700	105	805	805	Tracon	
146	Precast panel	600*600*50	m2	833	0	833				833	125	958	958	SCONCO	
147	Grass Springs		m2	80	0	80				80.0	12.0	92.0	92.0	Kounoike	
148	Rustproof Paint		kg	190	0	190				190	29	219	219	Assessed Japan cost book	
149	Elastight	Bitumenous board, t=20	m2	2,087	0	2,087				2,087	313	2,400	2,400	Assessed Japan cost book	
150	Waterstop	t=5, B=200, Center bulb, Flat	m	1,152	0	1,152				1,152	173	1,325	1,325	Assessed Japan cost book	
151	Cylinder Form dia. 850	Paper Cylinder	m	850	0	850				850	128	978	978	Assessed Japan cost book	
152	Road Marking Paint		kg	350	0	350				350	53	403	403	Assessed Japan cost book	
153	Glass Beads		kg	150	0	150				150	23	173	173	Assessed Japan cost book	
154	Circular Sign Board	dia. 600-750 with Post	No.	35,000	0	35,000				35,000	5,250	40,250	40,250	Cementers	

No.	Items	Description	Unit	Base Rate		Import Duty		Excise Duty & Levies	Import Declaration Form	Cost in Kenya	Overheads & Profit		Const'n Rate	Source
				without inflation Ksh	with inflation rate Ksh	ratio	Duty Amount Ksh				ratio	Overheads & Profit Ksh		
155	Overhang Sign Noard	2.0m*4.0m	No.	100,000	0	100,000				100,000	15%	15,000	115,000	Assessed
156	Cat Eye	Both sides	No.	2,100	0	2,100				2,100	15%	315	2,415	Assessed Japan cost book
157	Geotextile	for stone masonry	m2	500	0	500				500	15%	75	575	Assessed
158	Steel casing pipe dia.54mm	for electric cable	m	1,093	0	1,093				1,093	15%	164	1,257	Corrugated Sheets
159	Electric cable	22mm2-3c	m	791	0	791				791	15%	119	910	Assessed Japan cost book
160	Signal cable		m	791	0	791				791	15%	119	910	Assessed
161	Steel Taper Pole	H=8m, for one light	No.	60,000	0	60,000				60,000	15%	9,000	69,000	Kounoike
162	Lighting Socket	KSC-4	No.	27,500	0	27,500				27,500	15%	4,125	31,625	Cementers
163	Sodium Lamp	360W	No.	17,500	0	17,500				17,500	15%	2,625	20,125	Cementers
164	Light Stabilizer	360W	No.	12,000	0	12,000				12,000	15%	1,800	13,800	Cementers
165	Stainless Pull Box	400*400*200	No.	15,600	0	15,600				15,600	15%	2,340	17,940	Assessed Japan cost book
166	Traffic Signal Post	H=8m	No.	60,000	0	60,000				60,000	15%	9,000	69,000	same with Illumination Post
167	Signal Controller Post	H=5m	No.	40,000	0	40,000				40,000	15%	6,000	46,000	Assessed
168	Signal	2 Aspects	No.	130,000	0	130,000				130,000	15%	19,500	149,500	Assessed
169	Signal	3 Aspects	No.	200,000	0	200,000				200,000	15%	30,000	230,000	Assessed
170	Signal Controller		No.	70,000	0	70,000				70,000	15%	10,500	80,500	Assessed
171	Gate valve	Cast iron 150mm dia.	No.	38,200	0	38,200				38,200	15%	5,730	43,930	Assessed
172	Electric power pole	Concrete pole 14m	No.	125,000	0	125,000				125,000	15%	18,750	143,750	Assessed
173	Electric power cable	High Voltage CV 3c-38mm2	m	1,922	0	1,922				1,922	15%	288	2,210	Assessed
174	Electric power cable	High Voltage CV 3c-22mm2	m	1,427	0	1,427				1,427	15%	214	1,641	Assessed
175	Electric power cable	Low Voltage CV 3c-14mm2	m	460	0	460				460	15%	69	529	Assessed
176	Tree	H=3.0 - 3.5m	No.	30,000	0	30,000				30,000	15%	4,500	34,500	Assessed
177	Optic Cable	1.2mm-200P	m	8,586	0	8,586				8,586	15%	1,288	9,874	Assessed
178	water pipe	ductile, 700mm dia.	m	91,975	0	91,975				91,975	15%	13,796	105,771	Assessed
179	water pipe fitting	ductile, 700mm dia.	No.	36,856	0	36,856				36,856	15%	5,528	42,384	Assessed
180	Strainer valve	Cast iron 700mm dia.	No.	647,270	0	647,270				647,270	15%	97,091	744,361	Assessed
181	water pipe	steel pipe dia. 350, t=6	m	38,510	0	38,510				38,510	15%	5,777	44,287	Assessed
182	Strainer valve	Cast iron 350mm dia.	No.	231,328	0	231,328				231,328	15%	34,699	266,027	Assessed
183	water pipe	steel pipe dia. 200, t=5.5	m	23,121	0	23,121				23,121	15%	3,468	26,589	Assessed

No.	Items	Description	Unit	Base Rate		Import Duty		Excise Duty & Levies	Import Declaration Form	Cost in Kenya Ksh	Overheads & Profit		Cost + Overheads & Profits Ksh	Const'n Rate Ksh	Source
				without inflation Ksh	with inflation rate Ksh	ratio	Duty Amount Ksh				ratio	Overheads & Profit Ksh			
184	Gate valve	Casi iron 200mm dia.	No.	80,226	0	80,226				80,226	15%	12,034	92,260	92,260	Assessed
	Miscellaneous														
200	Build & Demolish Office		m2	23,000	0	23,000				23,000	15%	3,450	26,450	26,450	Mortorways
201	Hotel Accomodation	Foraigner, long stay	month	115,000	0	115,000				115,000	15%	17,250	132,250	132,250	Assessed
202	Hotel Accomodation	Local, long stay	month	30,000	0	30,000				30,000	15%	4,500	34,500	34,500	Assessed
203	Barrack & Other Housing	Local worker	m2	20,000	0	20,000				20,000	15%	3,000	23,000	23,000	Cementers
204	Laptop		No.	80,000	0	80,000				80,000	15%	12,000	92,000	92,000	100000*0.8
205	Office Consumables	Papers, water, electricity etc	month	200,000	0	200,000				200,000	15%	30,000	230,000	230,000	Assessed
206	Telephone & Internet		month	100,000	0	100,000				100,000	15%	15,000	115,000	115,000	Assessed
207	Office Desk & Chairs		No.	16,000	0	16,000				16,000	15%	2,400	18,400	18,400	20000*0.8
208	Office Soffer Set		No.	40,000	0	40,000				40,000	15%	6,000	46,000	46,000	50000*0.8
209	Air Conditionor		No.	80,000	0	80,000				80,000	15%	12,000	92,000	92,000	100000*0.8
210	Refrigerator		No.	120,000	0	120,000				120,000	15%	18,000	138,000	138,000	150000*0.8
211	TV Set		No.	80,000	0	80,000				80,000	15%	12,000	92,000	92,000	100000*0.8
212	Video Set		No.	40,000	0	40,000				40,000	15%	6,000	46,000	46,000	50000*0.8
213	Bed	for workers in barrack	No.	16,000	0	16,000				16,000	15%	2,400	18,400	18,400	20000*0.8
214	Quality Control Equipment	Laboratory Test Equipment	Sum	10,000,000	0	10,000,000				10,000,000	15%	1,500,000	11,500,000	11,500,000	Assessed
215	Survey Equipment	Survey Equipment	Sum	3,500,000	0	3,500,000				3,500,000	15%	525,000	4,025,000	4,025,000	Assessed
216	Safy Equipment	Safy net, barrier etc	Sum	2,000,000	0	2,000,000				2,000,000	15%	300,000	2,300,000	2,300,000	Assessed
217	Publicity Sign Board		No.	250,000	0	250,000				250,000	15%	37,500	287,500	287,500	Assessed
218	Business Trip	Nairobi-Mombasa	round	25,000	0	25,000				25,000	15%	3,750	28,750	28,750	Assessed
219	Borrow Estate		m/m2	100	0	100				100	15%	15.0	115.0	115.0	Assessed
220	Equipment Mobilization	Nairobi-Mombasa	No.	250,000	0	250,000				250,000	15%	37,500	287,500	287,500	Kounoike
221	Equipment Mobilization	Mombasa	No.	125,000	0	125,000				125,000	15%	18,750	143,750	143,750	Kounoike*0.5
222	Plant Mangrove		m2	175	0	175				175	15%	26	201	201	Assessed
223	Mangrove Maintenance	Monitoring & Maintenance	year	1,300,000	0	1,300,000				1,300,000	15%	195,000	1,495,000	1,495,000	Assessed

Construction Unite Rate Derivation of Foreign Material and Miscellaneous

Project Name : Mombasa City Road Development Project

Foreign Material & Miscellaneous (to be procured from Japan)

Construction Unit-Rate Derivation

No.	Items	Description	Unit	Base Rate			Overseas Transportation	Kenya Arrival Price		Import tax		Cost in Kenya Yen	Overheads & Profit		Cost + Overheads & Profits Yen	Const'n Rate		Source
				without inflation Yen	inflation rate	with inflation Yen		Yen	Yen	ratio	Yen		Yen	ratio		Yen	Yen	
	Material																	
300	AE retarder	Pozolis No.8	kg	260		260	24	284				284	15%	43	327	327		Japan made
301	Expansion Additive	Gypcal	kg	90		90	22	112				112	15%	17	129	129		Japan made
302	PC strand 190kN	IS 12.7	kg	267		267	24	291				291	15%	44	335	335		Japan made
303	PC strand 390kN	IS 17.8	kg	291		291	24	315				315	15%	47	362	362		Japan made
304	PC strand 450kN	IS 19.3	kg	298		298	24	322				322	15%	48	370	370		Japan made
305	PC strand 570kN	IS 21.8	kg	303		303	24	327				327	15%	49	376	376		Japan made
306	PC strand 850kN	IS 28.6	kg	318		318	25	343				343	15%	51	394	394		Japan made
307	PC strand 1300kN	7S 12.7B	kg	267		267	24	291				291	15%	44	335	335		Japan made
308	PC strand 2200kN	12S 12.7B	kg	267		267	24	291				291	15%	44	335	335		Japan made
309	PC strand 3100kN	12S 15.2B	kg	281		281	24	305				305	15%	46	351	351		Japan made
310	PC strand 4900kN	19S 15.2B	kg	281		281	24	305				305	15%	46	351	351		Japan made
311	PC bar dia.26	SBPR930/1080	kg	360		360	25	385				385	15%	58	443	443		Japan made
312	PC bar dia.32	SBPR930/1080	kg	360		360	25	385				385	15%	58	443	443		Japan made
313	Sheath dia. 35	for IS21.8	m	154		154	27	181				181	15%	27	208	208		Japan made
314	Sheath dia. 45	for IS28.6	m	214		214	34	248				248	15%	37	285	285		Japan made
315	Sheath dia. 70	for 12S12.7B	m	391		391	97	488				488	15%	73	561	561		Japan made
316	Sheath dia. 80	for 12S15.2B	m	584		584	122	706				706	15%	106	812	812		Japan made
317	Sheath dia. 130	for 19S15.2B	m	1,390		1,390	290	1,680				1,680	15%	252	1,932	1,932		Japan made
318	Anchorage 190kN	Tension end	No.	1,970		1,970	127	2,097				2,097	15%	315	2,412	2,412		Japan made
319	Anchorage 190kN	Fixing end	No.	2,590		2,590	133	2,723				2,723	15%	408	3,131	3,131		Japan made
320	Anchorage 850kN	Tension end	No.	12,100		12,100	335	12,435				12,435	15%	1,865	14,300	14,300		Japan made
321	Anchorage 850kN	Fixing end	No.	11,310		11,310	327	11,637				11,637	15%	1,746	13,383	13,383		Japan made
322	Anchorage 570kN	Tension end	No.	4,740		4,740	154	4,894				4,894	15%	734	5,628	5,628		Japan made
323	Anchorage 570kN	Fixing end	No.	5,390		5,390	161	5,551				5,551	15%	833	6,384	6,384		Japan made
324	Anchorage 2200kN	Tension end	No.	31,300		31,300	420	31,720				31,720	15%	4,758	36,478	36,478		Japan made
325	Anchorage 2200kN	Fixing end	No.	32,500		32,500	432	32,932				32,932	15%	4,940	37,872	37,872		Japan made

No.	Items	Description	Unit	Base Rate			Overseas Transportation	Kenya Arrival Price Yen	Import tax		Cost in Kenya Yen	Overheads & Profit		Cost + Overheads & Profits Yen	Const'n Rate Yen	Source
				without inflation Yen	inflation rate	with inflation Yen			ratio	Tax Amount Yen		ratio	Yen			
326	Anchorage 3100kN	Tension end	No.	57,500		57,500	895	58,395		58,395	15%	8,759	67,154	67,154	Japan made	
327	Anchorage 3100kN	Fixing end	No.	59,700		59,700	917	60,617		60,617	15%	9,093	69,710	69,710	Japan made	
328	Anchorage 4900kN	Tension end	No.	61,600		61,600	1,150	62,750		62,750	15%	9,413	72,163	72,163	Japan made	
329	Anchorage 4900kN	Fixing end	No.	61,600		61,600	1,150	62,750		62,750	15%	9,413	72,163	72,163	Japan made	
330	Rubber Shoe Belt	1000*300*23	m	29,600		29,600	723	30,323		30,323	15%	4,548	34,871	34,871	Japan made	
331	Rubber Shoe H-12	360*310*50	No.	25,400		25,400	681	26,081		26,081	15%	3,912	29,993	29,993	Japan made	
332	Rubber Shoe H-36	610*460*80	No.	97,200		97,200	2,403	99,603		99,603	15%	14,940	114,543	114,543	Japan made	
333	Rubber Shoe H-43	610*460*98	No.	117,000		117,000	2,921	119,921		119,921	15%	17,988	137,909	137,909	Japan made	
334	Rubber Shoe H-52	560*560*135	No.	176,000		176,000	4,964	180,964		180,964	15%	27,145	208,109	208,109	Japan made	
335	Closed Rubber Shoe 616F	Bearing capacity 500t	No.	1,990,000		1,990,000	83,980	2,073,980		2,073,980	15%	311,097	2,385,077	2,385,077	Japan made	
336	Anchor Bar dia.60*1220	S35CN	No.	12,000		12,000	697	12,697		12,697	15%	1,905	14,602	14,602	Japan made	
337	Anchor Bar dia.70*1420	S35CN	No.	19,000		19,000	1,044	20,044		20,044	15%	3,007	23,051	23,051	Japan made	
338	Anchor Bar dia.100*2000	S35CN	No.	28,000		28,000	1,604	29,604		29,604	15%	4,441	34,045	34,045	Japan made	
339	Non-shrinkage Mortar	Steel powder type	kg	130		130	23	153		153	15%	23	176	176	Japan made	
340	Bridge Expansion Joint	50mm, for Carriage way	m	72,300		72,300	3,927	76,227		76,227	15%	11,434	87,661	87,661	Japan made	
341	Bridge Expansion Joint	35mm, for Walk way	m	51,700		51,700	3,721	55,421		55,421	15%	8,313	63,734	63,734	Japan made	
342	Bridge Surface Drain	dia.150*370mm	No.	28,900		28,900	460	29,360		29,360	15%	4,404	33,764	33,764	Japan made	
343	PVC Pipe dia.150	dia.150, t=9.6	m	2,020		2,020	511	2,531		2,531	15%	380	2,911	2,911	Japan made	
344	Steel Pipe dia.800, t=12	SKK400, 233kg/m	ton	130,000		130,000	74,292	204,292		204,292	15%	30,644	234,936	234,936	Japan made	
345	Steel Pipe dia.800, t=14	SKK400, 271kg/m	ton	130,000		130,000	63,875	193,875		193,875	15%	29,081	222,956	222,956	Japan made	
346	Steel Pipe dia.1000, t=12	SKK400, 292kg/m	ton	130,000		130,000	90,534	220,534		220,534	15%	33,080	253,614	253,614	Japan made	
347	Steel Pipe dia.1000, t=14	SKK400, 340kg/m	ton	130,000		130,000	77,753	207,753		207,753	15%	31,163	238,916	238,916	Japan made	
348	Steel Pipe dia.1100, t=14	SKK400, 375kg/m	ton	130,000		130,000	84,584	214,584		214,584	15%	32,188	246,772	246,772	Japan made	
349	Steel Pipe dia.1200, t=14	SKK400, 409kg/m	ton	133,000		133,000	91,719	224,719		224,719	15%	33,708	258,427	258,427	Japan made	
350	Deformed Rebar	SD345	ton	67,000		67,000	32,690	99,690		99,690	15%	14,954	114,644	114,644	Japan made	
351	Anti-corrosion Rebar	SD345, epoxy coated	ton	129,000		129,000	33,310	162,310		162,310	15%	24,347	186,657	186,657	Japan made	
352	Rebar Coupler	FD Grip D32 A type	No.	2,880		2,880	93	2,973		2,973	15%	446	3,419	3,419	Japan made	
353	Steel Sheet Pile	SSP-III	ton	125,000		125,000	33,270	158,270		158,270	15%	23,741	182,011	182,011	Japan made	
354	Steel Sheet Pile	SSP-IV	ton	125,000		125,000	33,270	158,270		158,270	15%	23,741	182,011	182,011	Japan made	

No.	Items	Description	Unit	Base Rate			Overseas Transportation	Kenya Arrival Price	Import tax		Cost in Kenya	Overheads & Profit		Cost + Overheads & Profits	Const'n Rate	Source
				without inflation	inflation rate	with inflation			ratio	Tax Amount		ratio	Yen			
355	Steel H-Beam	H-300*300*10*15	ton	80,000		80,000	32,820	112,820		112,820	16,923	129,743	129,743		Japan made	
356	Steel H-Beam	H-350*350*12*19	ton	82,000		82,000	32,840	114,840		114,840	17,226	132,066	132,066		Japan made	
357	Steel H-Beam	H-400*400*13*21	ton	85,000		85,000	32,870	117,870		117,870	17,681	135,551	135,551		Japan made	
358	Steel H-Girder	H-588*300*12*20	ton	85,000		85,000	32,870	117,870		117,870	17,681	135,551	135,551		Japan made	
359	Steel Plate	t=3-12mm	ton	66,000		66,000	32,680	98,680		98,680	14,802	113,482	113,482		Japan made	
360	Lip Channel	[150*50 & Smaller sizes	ton	92,000		92,000	39,344	131,344		131,344	19,702	151,046	151,046		Japan made	
361	Steel Channel	[200*90 & Smaller sizes	ton	85,000		85,000	32,870	117,870		117,870	17,681	135,551	135,551		Japan made	
362	Steel Channel	[250*90 & Larger sizes	ton	85,000		85,000	32,870	117,870		117,870	17,681	135,551	135,551		Japan made	
363	Steel Angle	L-130*130 & Larger sizes	ton	96,000		96,000	32,980	128,980		128,980	19,347	148,327	148,327		Japan made	
364	Steel Deck	2000*1000*200	m2	46,000		46,000	10,066	56,066		56,066	8,410	64,476	64,476		Japan made	
365	Steel Pipe	dia. 48.6, t=2.4	m	360		360	62	422		422	63	485	485		Japan made	
366	Pipe Frame	1219*1930	No.	5,280		5,280	2,574	7,854		7,854	1,178	9,032	9,032		Japan made	
367	Pipe Frame	1700*914	No.	3,410		3,410	2,555	5,965		5,965	895	6,860	6,860		Japan made	
368	Pipe Frame Bracing	1219*1219	No.	770		770	104	874		874	131	1,005	1,005		Japan made	
369	Pipe Frame Bracing	1829*1219	No.	780		780	126	906		906	136	1,042	1,042		Japan made	
370	Adjust-Jack	Ajusting 460mm	No.	1,510		1,510	229	1,739		1,739	261	2,000	2,000		Japan made	
371	Adjust-Jack Base	Ajusting 260mm	No.	950		950	138	1,088		1,088	163	1,251	1,251		Japan made	
372	Pipe Clamp		No.	880		880	31	911		911	137	1,048	1,048		Japan made	
373	Waterproofing Sheet	for Bridge Surface	m2	1,300		1,300	77	1,377		1,377	207	1,584	1,584		Japan made	
374	Geotextile NK-2000S	for road embankment	m2	3,820		3,820	294	4,114		4,114	617	4,731	4,731		Japan made	
375	Metal Form	300mm*1500mm	m2	10,000		10,000	1,382	11,382		11,382	1,707	13,089	13,089		Japan made	
376	SSP Junction waterstop	Adeka Ultra Sheal	kg	3,500		3,500	57	3,557		3,557	534	4,091	4,091		Japan made	
377	Terarnee	1500*1500*180	No.	41,200		41,200	21,772	62,972		62,972	9,446	72,418	72,418		Japan made	
378	Terarnee Strip	4*60	m	1,370		1,370	56	1,426		1,426	214	1,640	1,640		Japan made	

No.	Items	Description	Unit	Base Rate			Kenya Arrival Price Yen	Import tax		Cost in Kenya Yen	Overheads & Profit		Cost + Overheads & Profits Yen	Const'n Rate Yen	Source
				without inflation Yen	inflation rate	with inflation Yen		ratio	Tax Amount Yen		ratio	Yen			
	Miscellaneous														
390	Overseas Transportation	Foundation Equipment	Set	13,000,000		13,000,000	13,000,000			13,000,000	15%	1,950,000	14,950,000	14,950,000	
391	Overseas Transportation	Bridge Equipment	Set	60,000,000		60,000,000	60,000,000			60,000,000	15%	9,000,000	69,000,000	69,000,000	
392	Overseas Transportation	Shoring & Scaffolding	Set	30,000,000		30,000,000	30,000,000			30,000,000	15%	4,500,000	34,500,000	34,500,000	
393	Overseas Transportation	Temporary bridge	Set	250,000,000		250,000,000	250,000,000			250,000,000	15%	37,500,000	287,500,000	287,500,000	
394	Flight fare	Tokyo-Nairobi-Mombasa	round	1,003,000		1,003,000	1,003,000			1,003,000	15%	150,450	1,153,450	1,153,450	
395	Overseas Incentives	Foreign Engineer	month	280,080		280,080	280,080			280,080	15%	42,012	322,092	322,092	JICA

Construction Unite Rate Derivation of Local Equipment

Project Name : Mombasa City Road Development Project

Local Equipment (to be procured in Kenya)

Item	Description	Unit of Rate	Construction Unite Rate Derivation										Remarks		
			Base Rate			Fuel usage L/hr	Fuel Price Ksh	Fuel cost per hr Ksh	Operator cost per hr Ksh	Turn boy cost per hr Ksh	Machine + Fuel + Operator Ksh	Overheads & profit 15% Ksh		Machine + Fuel + Operator + OH Ksh	Constn Rate Ksh
			without inflation Ksh	inflation rate	with inflation Ksh										
Bulldozer	15 ton	hr	7,500	0.00	7,500	18	118	2,124	235		9,859	1,479	11,338	11,338	Dhanjal
Bulldozer	21 ton	hr	9,375	0.00	9,375	27	118	3,186	235		12,796	1,919	14,715	14,715	Mortorways
Bulldozer	32 ton	hr	11,000	0.00	11,000	36	118	4,248	235		15,483	2,322	17,805	17,805	Bulldozer 21ton * 1.18
Bulldozer with Ripper	32 ton	hr	11,220	0.00	11,220	40	118	4,720	235		16,175	2,426	18,601	18,601	Bulldozer 32ton * 1.02
Excavator	0.45 m3	hr	3,500	0.00	3,500	11	118	1,298	235		5,033	755	5,788	5,788	S.S. Mehta
Excavator	0.8 m3	hr	3,750	0.00	3,750	18	118	2,124	235		6,109	916	7,025	7,025	Dhanjal
Excavator	1.4 m3	hr	5,900	0.00	5,900	29	118	3,422	235		9,557	1,434	10,991	10,991	Assess Japan cost book
Rock Hammer	1300 kg	hr	1,563	0.00	1,563						1,563	234	1,797	1,797	Motorways
Wheel Loader	1.5-1.7 m3	hr	3,600	0.00	3,600	12	118	1,416	235		5,251	788	6,039	6,039	Assess Japan cost book
Wheel Loader	2.3 m3	hr	4,500	0.00	4,500	16	118	1,888	235		6,623	993	7,616	7,616	Dhanjal
Wheel Loader	3.1 m3	hr	6,250	0.00	6,250	24	118	2,832	235		9,317	1,398	10,715	10,715	S.S. Mehta
Motorgrader	3.1 m	hr	4,800	0.00	4,800	9.2	118	1,086	235		6,121	918	7,039	7,039	Mortor Grader 3.7m/1.3
Motorgrader	3.7 m	hr	6,250	0.00	6,250	12.0	118	1,416	235		7,901	1,185	9,086	9,086	S.S. Mehta
Motorgrader	4.0 m	hr	7,400	0.00	7,400	18.0	118	2,124	235		9,759	1,464	11,223	11,223	Assess Japan cost book
Macadam Roller	10-12T	hr	3,750	0.00	3,750	6.0	118	708	235		4,693	704	5,397	5,397	Cementers
Vibrating Roller	0.5-0.6 ton, Hand Guide	hr	625	0.00	625	0.6	118	71			696	104	800	800	S.S. Mehta
Vibrating Roller	1.2-1.5 ton	hr	938	0.00	938	1.5	118	177	235		1,350	203	1,553	1,553	S.S. Mehta
Vibrating Roller	3-4 ton	hr	2,500	0.00	2,500	3.2	118	378	235		3,113	467	3,580	3,580	Mortorways *0.8
Vibrating Roller	15-18 ton	hr	10,400	0.00	10,400	23	118	2,714	235		13,349	2,002	15,351	15,351	Assess Japan cost book
Pneumatic tyre roller	8-20 ton	hr	4,000	0.00	4,000	7	118	838	235		5,073	761	5,834	5,834	Dhanjal
Sheepsfoot Roller	15T	hr	1,349	0.00	1,349	12	118	1,416	235		3,000	450	3,450	3,450	Mouchel Parkman

Item	Description	Unit of Rate	Base Rate			Fuel usage L/hr	Fuel Price Ksh	Fuel cost per hr Ksh	Operator cost per hr Ksh	Turn boy cost per hr Ksh	Machine + Fuel + Operator Ksh	Overheads & profit 15% Ksh	Machine + Fuel + Operator + OH Ksh	Const'n Rate Ksh	Remarks
			without inflation Ksh	inflation rate	with inflation Ksh										
Pulvimmixer Cat RM 250	Soil Stabilizer	hr	3,980	0.00	3,980	50	118	5,900	235	10,115	1,517	11,632	11,632	Mouchel Parkman	
Asphalt Finisher	2.4-6.0 m	hr	12,500	0.00	12,500	11	118	1,298	235	14,229	2,134	16,363	16,363	S.S. Mehta	
Bitumen Distributor	3000 litres	hr	2,000	0.00	2,000	7.4	118	873	235	3,304	496	3,800	3,800	S.S. Mehta *0.8	
Bitumen Distributor	5000-6000 litres	hr	2,500	0.00	2,500	14	118	1,652	235	4,583	687	5,270	5,270	Assess Japan cost book	
Chip Spreader	Tale Gate, 0.25 m3	hr	625	0.00	625	0.51	118	60	235	920	138	1,058	1,058	Motorways	
Tractor & Broom		hr	1,600	0.00	1,600	1.00	118	118	235	2,149	322	2,471	2,471	Mouchel Parkman	
Tractor & Post Driver		hr	1,600	0.00	1,600	1.00	118	118	235	2,149	322	2,471	2,471	Mouchel Parkman	
Concrete mixer	0.5 m3 drum	hr	1,875	0.00	1,875					1,875	281	2,156	2,156	Cementers	
Compressor	5 m3/min	hr	1,000	0.00	1,000	7.4	118	873		1,873	281	2,154	2,154	S.S. Mehta	
Flatbed Truck	4-4.5 ton	hr	1,500	0.00	1,500	6.9	118	814	235	2,549	382	2,931	2,931	Assess Japan cost book	
Flatbed Truck	10-11 ton	hr	2,500	0.00	2,500	13	118	1,534	235	4,269	640	4,909	4,909	Motorways	
Water Bowser	6000-10,000L	hr	2,500	0.00	2,500	8.5	118	1,003	235	3,738	561	4,299	4,299	S.S. Mehta	
Cement Tank Truck	10 ton	hr	2,700	0.00	2,700	10	118	1,180	235	4,115	617	4,732	4,732	Assessed	
Bitumen Tank Truck	10,000L	hr	3,600	0.00	3,600	10	118	1,180	235	5,015	752	5,767	5,767	Assessed	
Tipping Truck	10 ton, Bogie Drive	hr	2,500	0.00	2,500	12	118	1,416	235	4,151	623	4,774	4,774	Dhanjal	
Tipping Truck	25 ton, Bogie Drive	hr	8,100	0.00	8,100	20	118	2,360	235	10,695	1,604	12,299	12,299	Assess Japan cost book	
Agitator Truck	4.4m3	hr	3,125	0.00	3,125	13	118	1,534	235	4,894	734	5,628	5,628	S.S. Mehta	
Trailer	20-25 ton	hr	5,000	0.00	5,000	18	118	2,124	235	7,359	1,104	8,463	8,463	S.S. Mehta	
Concrete Pumping Car	90-110m3/hr, Boom	hr	17,500	0.00	17,500	11	118	1,298	235	19,229	2,884	22,113	22,113	Cementers	
Concrete dumper	2000 kg	hr	800	0.00	800	4.4	118	519	235	1,554	233	1,787	1,787	Mouchel Parkman	
Mobile Crane	20-25 ton	hr	7,500	0.00	7,500	5.7	118	673	235	8,604	1,291	9,895	9,895	Cementers	
Crawler Crane	50 ton lift	hr	15,000	0.00	15,000	12	118	1,416	235	16,847	2,527	19,374	19,374	Kounoike	
Crawler Crane	100 ton lift	hr	30,000	0.00	30,000	18	118	2,124	235	32,555	4,883	37,438	37,438	Kounoike	
Generator	20-25k VA, 8 hours operation	day	3,000	0.00	3,000	31	118	3,658		6,658	999	7,657	7,657	Motorways	

Item	Description	Unit of Rate	Base Rate			Fuel usage L/hr	Fuel Price Ksh	Fuel cost per hr Ksh	Operator cost per hr Ksh	Turn boy cost per hr Ksh	Machine + Fuel + Operator Ksh	Overheads & profit 15% Ksh	Machine + Fuel + Operator + OH Ksh	Constn Rate Ksh	Remarks
			without inflation Ksh	inflation rate	with inflation Ksh										
Generator	60kVA, 8 hours operation	day	6,000	0.00	6,000	78	118	9,204			15,204	2,281	17,485	17,485	Motorways
Generator	60kVA, 24 hours operation	day	6,000	0.00	6,000	234	118	27,612			33,612	5,042	38,654	38,654	Motorways
Generator	100kVA, 8 hours operation	day	10,000	0.00	10,000	128	118	15,104			25,104	3,766	28,870	28,870	Motorways
Engine Welder	300A, Diesel Engine	hr	350	0.00	350	3.6	118	425			775	116	891	891	Assess Japan cost book
Concrete Vibrator		hr	200	0.00	200						200	30	230	230	Mouchel Parkman
Timber Planer		hr	200	0.00	200						200	30	230	230	Mouchel Parkman
Rebar Bender		hr	960	0.00	960						960	144	1,104	1,104	Mouchel Parkman
Band Saw		hr	520	0.00	520						520	78	598	598	Mouchel Parkman
Tamper	60 kg	day	1,000	0.00	1,000	7.2	130	936		1,568	3,504	526	4,030	4,030	S.S. Mehta *0.25
Vibrating Compacter	40-60 kg	day	1,000	0.00	1,000	7.2	130	936		1,568	3,504	526	4,030	4,030	same with Tamper
Concrete Hand Breaker	20 kg	day	1,500	0.00	1,500						1,500	225	1,725	1,725	S.S. Mehta
Sand Pump	dia.150, 7.5kW	day	740	0.00	740						740	111	851	851	Assess Japan cost book
Sand Pump	dia.250, 11kW	day	1,030	0.00	1,030						1,030	155	1,185	1,185	Assess Japan cost book
Slash Tank	30m3 + 20m3	day	5,007	0.00	5,007						5,007	751	5,758	5,758	Assess Japan cost book
Asphalt Mixing Plant		hr	25,000	0.00	25,000						25,000	3,750	28,750	28,750	Dhanjal
Concrete Mixing Plant		hr	9,000	0.00	9,000						9,000	1,350	10,350	10,350	Assess Japan cost book
Cement Silo	100 ton	day	5,100	0.00	5,100						5,100	765	5,865	5,865	Assess Japan cost book
Belt Conveyor	l=600, L=10m	hr	850	0.00	850						850	128	978	978	Assess Japan cost book
Sedan		day	4,500	0.00	4,500	9.6	130	1,248		1,568	7,316	1,097	8,413	8,413	Assess Ketty Tour
4 wheel drive		day	7,000	0.00	7,000	9	118	1,062		1,568	9,630	1,445	11,075	11,075	Assess Ketty Tour
Pickup		day	8,000	0.00	8,000	9	118	1,097		1,568	10,665	1,600	12,265	12,265	Assess Ketty Tour

Construction Unite Rate Derivation of Foreign Equipment

Project Name : Mombasa City Road Development Project

Foreign Equipment (to be procured from Japan)

Construction Unit Rate Derivation

Item	Description	Refer. Page	Weight ton	Unit of Rate	New Price in Japan without inflation Yen	inflation rate	New Price in Japan with inflation Yen	Kenya arrival Price with inflation Yen	New Cost in Kenya with import tax Yen	Basic Hour rate Yen	Fuel usage L/hr	Fuel Price Ksh	Fuel cost per hr Ksh	Operator cost per hr Ksh	Turn boy cost per hr Ksh	Machine + Fuel + Operator		Overheads & profit 15%		Construction Rate	
																Yen	Ksh	Yen	Ksh	Yen	Ksh
Reverse Circulation Drill	S-300, max dia. 3000	P05-23	12	hr	23,200,000		23,200,000	23,200,000	23,200,000	8,120							8,120	1,218	9,338		
Rock Bits	dia.800-1200mm	P05-23	0.3	day	1,000,000		1,000,000	1,000,000	1,000,000	7,005							7,005	1,051	8,056		
Drill Pipes	inner dia. 200, L=39m	P05-23	1.3	day	3,107,000		3,107,000	3,107,000	3,107,000	13,926							13,926	2,089	16,015		
Suction & Delivery Hose	dia. 200, L=60m	P05-23	3	day	3,000,000		3,000,000	3,000,000	3,000,000	9,876							9,876	1,481	11,357		
Hydraulic Pile Driver	Ram 6.5-8T	P05-1	18.3	hr	34,500,000		34,500,000	34,500,000	34,500,000	16,940	24	118	2,832				16,940	2,832	19,481	425	3,257
Hydraulic Pile Driver	Ram 10-12.5T	P05-1	25.8	hr	40,700,000		40,700,000	40,700,000	40,700,000	19,984	26	118	3,068				19,984	3,068	22,982	460	3,528
Pile Driver Base Machine	Leader 21-33m, Weight 100-110T	P05-9	72.5	hr	78,000,000		78,000,000	78,000,000	78,000,000	26,364	10	118	1,180	235		196	26,364	1,611	30,319	242	1,853
Pile Driver Base Machine	Leader 21-33m, Weight 120-125T	P05-9	96.6	hr	101,000,000		101,000,000	101,000,000	101,000,000	34,138	14	118	1,652	235		196	34,138	2,083	39,259	312	2,395
Vibro Hammer	60KW	P05-1	4.8	hr	10,700,000		10,700,000	10,700,000	10,700,000	5,404							5,404	811	6,215		
Telescopic Clamshell	0.4m3, Hydraulic	P02-19	21.4	hr	22,900,000		22,900,000	22,900,000	22,900,000	7,923	18	118	2,124	235		196	7,923	2,555	9,111	383	2,938

Construction Unite Rate Derivation of Overseas Transportation

Overseas Transportation (to be transported from Japan)

Construction Unite Rate Derivation

item	Description	Refer. Page	Unit	Quantity	Price/each in Japan without inflation Yen	New Price in Japan without inflation Yen	Volume m ³ /each	Weight Metric ton/each	Total Volume m ³	Total Metric ton	Freight	Overseas Transport. Rate US\$	Cargo	Overseas transport. Yen	Loading Unloading Yen	Packing Yen	Insurance Yen	Total Cost Yen	
																			Yen
Bored Pile Equipment																			
Reverse Circulation Drill	S-300, max dia. 3000	P05-23		2	23,200,000	46,400,000	40	12	80	24.0	80	260	Bulk	3,194,880	1,280,000	432,000	928,000	5,834,880	
Rock Bits	dia.800-1200mm	P05-23		2	1,000,000	2,000,000	3	0.3	6	0.6	6	260	Bulk	239,616	96,000	32,400	40,000	408,016	
Drill Pipes	inner dia. 200, L=39m	P05-23		2	3,107,000	6,214,000	3	1.3	6	2.6	6	260	Bulk	239,616	96,000	32,400	124,280	492,296	
Suction & Delivery Hose	dia. 200, L=60m	P05-23		2	3,000,000	6,000,000	15	3	30	6.0	30	260	Bulk	1,198,080	480,000	162,000	120,000	1,960,080	
Vibro Hammer	60KW	P05-1		2	10,700,000	21,400,000	20	4.8	40	9.6	40	260	Bulk	1,597,440	640,000	216,000	428,000	2,881,440	
Telescopic Clamshell	0.4m3, Hydraulic	P02-19		2	22,900,000	45,800,000	90	21.4	180	42.8	180	260	Bulk	7,188,480	2,880,000	972,000	916,000	11,956,480	
																	total	23,533,192	
Bridge Equipment																			
Erection Girder	Two beam, Span 40m, Lifting 127t		No.	2			160	100	320	200.0	320	260	Bulk	12,779,520	5,120,000	1,728,000		19,627,520	
Lifting Unit	Lifting 140t		No.	2			50	17	100	34.0	100	260	Bulk	3,993,600	1,600,000	540,000		6,133,600	
Erection Gears			No.	2			20	10	40	20.0	40	260	Bulk	1,597,440	640,000	216,000		2,453,440	
Traverser	Capacity 70t		No.	4	1,120,000	4,480,000	50	7.5	200	30.0	200	260	Bulk	7,987,200	3,200,000	1,080,000	89,600	12,356,800	
Traveller	Capacity 140t		No.	2			100	30	200	60.0	200	260	Bulk	7,987,200	3,200,000	1,080,000		12,267,200	
30kg/m Rail	Rails and sleepers		m	4,000	13,800	55,200,000	0.1	0.13	400	520.0	520	260	Bulk	20,766,720	8,320,000	2,808,000	1,104,000	32,998,720	
Center Hole Jack	196-5900KN		No.	10			0.5	0.5	5	5.0	5	130	20 MT	99,840	80,000	27,000		206,840	
Center Hole Jack	2940KN, 200 stroke		No.	10			0.5	0.5	5	5.0	5	130	20 MT	99,840	80,000	27,000		206,840	
Push Jack	1960KN, 200 stroke		No.	10			0.5	0.5	5	5.0	5	130	20 MT	99,840	80,000	27,000		206,840	
Hydraulic Unit fo PC Jack	with Control Unit		No.	10			0.5	0.5	5	5.0	5	130	20 MT	99,840	80,000	27,000		206,840	
Jacking Chair	981KN, 200 stroke		No.	10			0.5	0.5	5	5.0	5	130	20 MT	99,840	80,000	27,000		206,840	
Lever Brook	49KN, 1.5m		No.	10	60,000	600,000	0.1	0.1	1	1.0	1	130	20 MT	19,968	16,000	5,400	12,000	53,368	
Chill Hole	29KN		No.	10	63,000	630,000	0.1	0.1	1	1.0	1	130	20 MT	19,968	16,000	5,400	12,600	53,968	
Gantry Crane with Hoist	H=8m, B=10m, 3T Hoist		No.	4			100	50	400	200.0	400	260	Bulk	15,974,400	6,400,000	2,160,000	total	24,534,400	
Steel Sections																	total	111,513,216	
Rent Steel Decking			m2	18,800	46,000	864,800,000		0.20		3760.0	3760	130	20 MT	75,079,680	60,160,000	20,304,000	17,296,000	172,839,680	
Rent H beam H=200 to H=400			ton	5,489	82,000	450,098,000		1		5489.0	5489	210	40 MT	177,053,184	87,824,000	29,640,600	9,001,960	303,519,744	
Rent H beam H=594*302			ton	1,728	85,000	146,880,000		1		1728.0	1728	130	20 MT	34,504,704	27,648,000	9,331,200	2,937,600	74,421,504	
																	total	550,790,928	

item	Description	Refer. Page	Unit	Quantity	Price/each in Japan without inflation Yen	New Price in Japan without inflation Yen	Volume m ³ /each	Weight Metric ton/each	Total Volume m ³	Total Metric ton	Freight	Overseas Transport. Rate US\$	Cargo	Overseas transport. Yen	Loading Unloading		Packing	Insurance		Total Cost	
															Yen	Yen		Yen	Yen	Yen	Yen
Miscellaneous Temporary Materials																					
Pipe Frame	1219*1930		No.	5000	5280	26,400,000	0.12	0.021	600	105.0	600	110	40' V	10,137,600	9,600,000	3,240,000	528,000				
Pipe Frame	1700*914		No.	5000	3410	17,050,000	0.08	0.017	400	85.0	400	110	40' V	6,758,400	6,400,000	2,160,000	341,000				
Pipe Frame Bracing	1219*1219		No.	5000	730	3,650,000	0.003	0.0033	15	16.5	16.5	110	40' V	2,787,784	2,640,000	89,100	73,000				704,884
Pipe Frame Bracing	1829*1219		No.	5000	780	3,900,000	0.004	0.0042	20	21.0	21	110	40' V	3,548,816	3,360,000	113,400	78,000				882,216
Ajust-Jack	Ajusting 460mm		No.	5000	1510	7,550,000	0.045	0.005	225	25.0	225	110	40' V	3,801,600	3,600,000	1,215,000	151,000				8,767,600
Ajust-Jack Base	Ajusting 260mm		No.	5000	950	4,750,000	0.027	0.004	135	20.0	135	110	40' V	2,280,960	2,160,000	729,000	95,000				5,264,960
Pipe Clamp			No.	10000	880	8,800,000	0.001		10		10	110	40' V	1,689,600	1,600,000	54,000	176,000				558,960
Rent Steel Pipe	dia. 48.6, l=2.4		m	10000	360	3,600,000	0.0025	0.0027	25	27.0	27	110	40' V	456,192	432,000	145,800	72,000				1,105,992
																		total			56,449,612
																					1,484,553,896

APPENDIX 9
Environmental Management Plan Monitoring Form
for Submitting to JICA

- Appendix 9-1 Environmental Management Plan Monitoring Form for Submitting to JICA
 - Construction Phase
- Appendix 9-2 Environmental Management Plan Monitoring Form for Submitting to JICA
 - Operation Phase

Appendix 9-1 Environmental Management Plan Monitoring Form for Submitting to JICA -Construction Phase

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/ Max/ Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Implementing Institution	Responsible Institution	Reporting
Construction of bridges and roads	Loss of mangrove trees	Mangrove replanting should be implemented Regular monitoring of replanted mangroves	Extent of cleared area and progress of replanting	Mwache and Mteza	(Refer to the Mangrove Reforesting Plan)				Contractor / Consultant	KeNHA/ Kenya Forest Service	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Aquatic habitat loss/ fragmentation; migration/feeding corridor restrictions. Loss and disturbance of benthic fauna	Oil separator (grit chamber) with drainage facilities When the abutments of the bridges are installed, turbidity in the creeks should be monitored.	Benthos species composition and density	2 sites	2 times/year		Compare with the baseline conditions		Contractor / Consultant	KeNHA/ Ministry of Fisheries department	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.
			Seawater quality Turbidity (or SS)	2 bridges and ripraps along the coasts	Every work days		Increment of SS < 10 mg/L		Contractor / Consultant		<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of roads	Terrestrial flora: loss of vegetation cover	Planting of trees and grass in road rights of way and adjacent areas (seedlings and saplings of indigenous trees and other important plant species before clearing of vegetation)	Extent of cleared area and progress of revegetation	All construction sites	Visual inspection				Contractor / Consultant	KeNHA/ National Museums of Kenya/ Kenya Wildlife Service	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Terrestrial and avian fauna: Habitat loss / damage Loss of migratory / feeding corridors	Underpass culvert to secure migration path for small animals	Bird Species and count	4 sites	2 times/year				Contractor / Consultant	KeNHA/ Kenya Wildlife Service/ Ministry of Fisheries Development	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.
			Fish/Prawn: species, size, count	4 sites	2 times/year				Contractor / Consultant		
Construction of roads	Soil erosion/ land slides	Design of drainage facilities to avoid soil erosion and slope stabilization measures	Changes in vegetation, scouring and siltation.	All construction sites	Visual inspection				Contractor / Consultant	KeNHA	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of roads	Groundwater contamination	Protection measures: construction of culverts and retaining walls, soil erosion control, oil spillage prevention and monitoring.	pH, Suspended solids, Nitrate, Ammonia, Nitrite, TDS, E.coli, Fluoride, Phenols, Arsenic, Cadmium, Lead, Selenium, Copper, Zinc ABS Permanganate value	2 sites	Methods specified by the Environmental Management and Coordination, (Water Quality) Regulations 2006 2 times/year		Environmental Management and Coordination, (Water Quality) Regulations 2006 First Schedule : Quality Standards for Sources of Domestic Water		Contractor / Consultant	KeNHA/ NEMA/ Ministry of Public Health and Sanitation	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Air pollution	Dust control measures: sprinkling of water; covers of the trucked material during transportation	Ambient air quality PM ₁₀ ,	5 sites	Methods specified by (Draft) The Environmental Management and		(Draft) The Environmental Management and Coordination (Air		Contractor / Consultant	KeNHA/ NEMA	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/ Max/ Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Implementing Institution	Responsible Institution	Reporting
		Pollutant emission control measures: low emission construction vehicles, maintenance and inspection.	NO ₂ /NO _x , SO ₂ /SO _x , CO		Coordination (Air Quality) Regulations, 2008 2times per year		Quality) Regulations, 2008 WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005				
Construction of bridges and roads	Seawater pollution	Oil separator (grit chamber) with drainage facilities Establish an oil spill monitoring system and a rapid response unit in the contractor's team.	pH, Temperature, Salinity BOD COD T- Nitrogen T- Phosphorus Oil & Grease, Cyanides, Phenols, Sulphide, TSS E.coli, Arsenic Lead, Cadmium, Nickel, Chromium, Mercury, ABS Total pesticide residues	4 sites	Methods specified by the Environmental Management and Coordination, (Water Quality) Regulations 2006 2times per year		Environmental Management and Coordination, (Water Quality) Regulations 2006 Third Schedule : Standards for Effluent Discharge into the Environment		Contractor / Consultant	KeNHA/ NEMA	• Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Noise and vibrations	Proper service of equipment; installation of sound barriers for pile driving activity; construction activities to be restricted during day time hours only. Plant trees in environmental facility zones.	Noise level: L _{Aeq} (day and night) Vibrations: velocity or acceleration	5 sites	Methods specified by The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.		The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007.		Contractor / Consultant	KeNHA/ NEMA	• Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Waste generation	Project Waste Management Plan (PWMP) To promote segregation and recycling (3R: Reduce, Re-use and Recycle)	Site conditions and cleanliness	All construction sites and labor camp	(Refer to the Project Waste Management Plan)				Contractor / Consultant	KeNHA/ NEMA/ Mombasa Municipal Council	• Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Community Health and Safety	Public Meetings	Opinions, grievance	2 locations per year	For a construction period of each package				Contractor / Consultant	KeNHA/ District Offices	• Quarterly Monitoring Report submitted to KeNHA and JICA.

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/ Max/ Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Implementing Institution	Responsible Institution	Reporting
Labor Camp	Occupational Health and Safety	Supply the works: -clean water and safe food -toilets/sewage treatment facilities -domestic solid waste management	Camp conditions	All camps	Weekly inspection		the Occupational Safety and Health Act, 2007		Contractor / Consultant	keNHA/ Directorate of Occupational Health and Safety	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.

Appendix 9-2 Environmental Management Plan Monitoring Form for Submitting to JICA - Operation Phase

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
Construction of bridges and roads Road traffic	Loss of mangrove trees	Monitor the growth of replanting mangroves	Mangroves: density, height and diameter	Mwache and Mteza	(Refer to the Mangrove Reforesting Plan)				KeNHA/ Kenya Forest Service	<ul style="list-style-type: none"> • Annual Monitoring Report submitted to JICA.
	Aquatic habitat loss/ fragmentation; migration/feeding corridor restrictions. Loss and disturbance of benthic fauna	Oil separator (grit chamber) with drainage facilities Regularly monitoring of fish catch and benthos	Benthos species composition and density	2 sites	2 times/year		Compare with the baseline conditions		KeNHA/ Ministry of Fisheries department	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.
Road traffic	Terrestrial and avian fauna: Habitat loss / damage Loss of migratory / feeding corridors	Conduct regular maintenance of the grit chambers and underpass culvert	Bird Species and count Fish/Prawn: species, size, count	4 sites 4 sites	2 times/year 2 times/year				KeNHA/ Kenya Wildlife Service/ Ministry of Fisheries Development	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.
Construction of roads	Soil erosion/ land slides	Soil erosion and slope stabilization measures	Changes in vegetation, scouring and siltation.	All construction sites	Visual inspection				KeNHA	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.
Road traffic	Air pollution	Pollutant emission control measures.	Ambient air quality PM ₁₀ , NO ₂ /NO _x , SO ₂ /SO _x , CO	5 sites	Methods specified by (Draft) The Environmental Management and Coordination Regulations, 2008 2times per year		(Draft) The Environmental Management and Coordination (Air Quality) Regulations, 2008 WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005		KeNHA/ NEMA	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
Road traffic	Seawater pollution	Regular maintenance of oil separator (grit chamber) with drainage facilities	pH, Temperature, Salinity BOD COD T- Nitrogen T- Phosphorus Oil & Grease, Cyanides, Phenols, Sulphide, TSS E.coli, Arsenic Lead, Cadmium, Nickel, Chromium, Mercury, ABS Total pesticide residues	4 sites	Methods specified by the Environmental Management and Coordination, (Water Quality) Regulations 2006 2times per year		Environmental Management and Coordination, (Water Quality) Regulations 2006 Third Schedule : Standards for Effluent Discharge into the Environment		KeNHA/ NEMA	• Biannual Monitoring Report submitted to JICA.
Road traffic	Noise and vibrations	Based on the monitoring results of noise levels, installation of noise barriers should be considered where necessary. Conduct regular monitoring of noise levels along the roadside. Install warning signs on road for horn ban, speed control and lane restriction. Regular maintenance on road to keep road surface good condition. Develop a mechanism to record and respond to monitoring results and complaints.	Noise level: L _{Aeq} (day and night) Vibrations: velocity or acceleration	5 sites	Methods specified by The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.		The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007.		KeNHA/ NEMA	• Biannual Monitoring Report submitted to KeNHA and JICA.
Road traffic	Community Health and Safety	Public Meetings	Opinions, grievance	2 locations per year	2 times a year				KeNHA/ District Offices	• Biannual Monitoring Report submitted to JICA.

APPENDIX 10 Results of Supplemental EIA Survey

1. PREDICTION OF IMPACTS ON AMBIENT AIR QUALITY

1.1 Prediction Method

The prediction method established in the “Technical Handbook for Environmental Impact Assessment of Roads”¹ is used to predict the pollutant levels in ambient air based on the projected traffic volume. The basic principles and procedure are as follows:

- 1) To obtain the emission of pollutants from vehicles based on the projected traffic volume;
- 2) To compute the concentration increment of pollutants by the atmospheric dispersion models such as a Plume Model; and,
- 3) To estimate the pollution levels adding the computed increment to the background conditions.

1.1.1 Emission of Pollutants in Exhaust Gas from Vehicles

The average emission of gaseous pollutants is calculated by the following equation.

$$Q_t = V_W \times \frac{1}{3600} \times \frac{1}{1000} \times \sum_{i=1}^2 (N_{it} \times E_i) \quad (\text{eqn. 1.1})$$

where

Q_t : the average emission of a gaseous pollutant at hour t [g/km·day]

E_i : the emission factor of the i -th type of vehicle [g/km· vehicle]

N_{it} : the hourly traffic volume of the i -th type of vehicles [vehicle/hr]

V_W : the conversion coefficient [mL/g or mg/g]

The emission factor of the i -th type of vehicle, E_i is calculated by the following equation.

$$E_i = a/V + bV + cV^2 + d \quad (\text{eqn. 1.2})$$

where V is the average running speed of the i -th type of vehicle and a , b , c , and d are regression coefficients given in Table A8.1-1 (Technical Handbook for Environmental Impact Assessment of Roads¹ provide the coefficients of NO_x, PM₁₀, CO and SO₂). Table A10.1-1 shows the calculated emission factors for the light and heavy vehicles at the velocities of 60, 70 and 80 [km/hr].

¹ Japan Highway Environment Research Institute (HERI), “Technical Handbook for Environmental Impact Assessment of Roads, 2007 edition”.

Table A10.1-1 Pollutant Emission Factors for Vehicle Types

Pollutants	Vehicle Size	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	Average Speed of Vehicle [km/hr]		
						60	70	80
NO _x	Light	-0.902	-0.00578	4.39E-05	0.261	0.0572	0.0586	0.0683
	Heavy	-7.12	-0.0895	0.000735	3.93	1.0873	1.1648	1.3850
PM ₁₀	Light	-0.069	-0.00039	2.87E-06	0.017	0.0031	0.0031	0.0037
	Heavy	0.0318	-0.0031	2.27E-05	0.158	0.0543	0.0527	0.0557
CO	Light	-12.5	-0.0559	0.000448	2.2	0.2505	0.3036	0.4390
	Heavy	10.9	-0.0168	0.000115	1.19	0.7777	0.7332	0.7183
SO ₂	Light	0.0783	-0.00016	1.31E-06	0.0112	0.0075	0.0074	0.0076
	Heavy	0.0411	-0.0007	5.51E-05	0.0424	0.1995	0.2640	0.3396

Source: The Survey Team

1.2.1 Pollutant Dispersion Model: Plume Model

Pollutant concentrations in ambient air were computed using the Plume Model, which expressed the dispersion of pollutants emitted from the moving vehicles when the wind is over one meter per second (> 1[m/s]). According to “Technical Handbook for Environmental Impact Assessment of Roads (2007)”, the pollutant concentration at point (x, y, z) is given by:

$$C(x, y, z) = \frac{Q}{2\pi \cdot u \cdot \sigma_y \cdot \sigma_z} \exp\left(-\frac{y^2}{2\sigma_y^2}\right) \left[\exp\left\{-\frac{(z+H)^2}{2\sigma_z^2}\right\} + \exp\left\{-\frac{(z-H)^2}{2\sigma_z^2}\right\} \right] \quad (eqn. 1.3)$$

where

$C(x, y, z)$: pollutant concentration at any prediction point (x, y, z) [ppm or mg/m³]

Q : air pollutant emission rate [mL/s or mg/s]

u : average wind speed [m/s]

H : height of emission source [m]

x : distance from an emission source to the prediction point along the wind direction [m]

y : horizontal distance from the prediction point perpendicular to the x -axis [m]

z : vertical distance from the prediction point perpendicular to the x -axis [m]

σ_y, σ_z : dispersion width of toward y dimension and z dimension [m]

in which

$$\sigma_y = W/2 + 0.46L^{0.81} \quad (\text{in case of } x < W/2: \sigma_y = W/2)$$

$$\sigma_y = \sigma_{z0} + 0.31L^{0.83} \quad (\text{in case of } x < W/2: \sigma_z = \sigma_{z0})$$

σ_{z0} : initial vertical dispersion width [m]

- without noise barrier $\sigma_0 = 1.5$

- with noise barrier (height > 3 m) $\sigma_0 = 4.0$

L : distance from the road edge to the prediction point [m]

W : road width [m]

1.2 Input Data and Calculation Conditions

1.2.1 Input Data

The future ambient air quality was calculated based on the projected traffic volume of Case 2 following the recommendations in Chapter 22. According to this scenario, during the Phase-1 until 2025, Sections 1 and 2 of the Kipevu Link Road is 4-lane, and Sections 3 and 4 of the Mombasa Southern Bypass Road is 2-lane.

Tables A10.1-2 to A10.1-5 show the projected traffic volume by vehicle types at four sections. In this calculation, cars, matatus and LGVs were categorized as the light vehicles, and MGVs, HGVs and buses were categorized as the heavy vehicles.

Table A10.1-2 Average Daily Traffic Volume at Section 1 [vehicles/day]

Year		2015	2020	2025	2035* ¹
1	Cars	393	660	1449	3752
2	Matatus	192	860	1199	2959
3	LGVs	371	643	1004	2144
4	MGVs	218	284	512	1178
5	HGVs	4238	5403	9235	17382
6	Buses	0	122	159	356
Total		5412	7972	13558	27771
Light vehicle: $\Sigma(1+2+3)$		956	2163	3652	8855
Heavy vehicle $\Sigma(4+5+6)$		4456	5809	9906	18916
Average velocity [m/s]		80	80	80	78
Number of lanes		4	4	4	4

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

Table A10.1-3 Average Daily Traffic Volume at Section 2 [vehicles/day]

Year		2015	2020	2025	2035* ¹
1	Cars	393	4406	5706	6798
2	Matatus	192	609	1813	3684
3	LGVs	371	1933	2830	3115
4	MGVs	218	816	1333	2294
5	HGVs	4238	5382	7517	11892
6	Buses	0	187	267	432
Total		5412	13333	19466	28215
Light vehicle: $\Sigma(1+2+3)$		956	6948	10349	13597
Heavy vehicle $\Sigma(4+5+6)$		4456	6385	9117	14618
Average velocity [m/s]		80	80	80	78
Number of lanes		4	4	4	4

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

Table A10.1-4 Average Hourly Traffic Volume at Section 3 [vehicles/day]

Year		2015	2020	2025	2035 ^{*1}
1	Cars	0	4070	5619	6490
2	Matatus	0	989	2366	4333
3	LGVs	0	1622	3016	3449
4	MGVs	0	547	1043	1950
5	HGVs	0	211	2335	6828
6	Buses	0	309	425	632
Total		0	7748	14804	23682
Light vehicle: $\Sigma(1+2+3)$		0	6681	11001	14272
Heavy vehicle $\Sigma(4+5+6)$		0	1067	3803	9410
Average velocity [m/s]		-	65	43	26
Number of lanes		-	2	2	2

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

Table A10.1-5 Average Daily Traffic Volume at Section 4 [vehicles/day]

Year		2015	2020	2025	2035 ^{*1}
1	Cars	0	4070	4457	6608
2	Matatus	0	989	1718	2851
3	LGVs	0	1622	2370	3515
4	MGVs	0	547	1173	2057
5	HGVs	0	211	443	871
6	Buses	0	309	421	622
Total		0	7748	10582	16524
Light vehicle: $\Sigma(1+2+3)$		0	6681	8545	12974
Heavy vehicle $\Sigma(4+5+6)$		0	1067	2037	3550
Average velocity [m/s]		-	65	57	43
Number of lanes		-	2	2	2

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

1.2.2 Calculation conditions

According to Appendix 1 Meteorological Data of the F/S Report, almost 90% of the wind speed at Moi International Airport exceeded 3.6 [m/s] (7 knots), and about 80% of wind is in the south or the south-southwest.

In this prediction, the wind speed of 2 [m/s] from the south was adopted to obtain more conservative estimates, i.e., higher pollutant concentrations. According to the *eqn.1.2*, the pollutant concentration $C(x, y, z)$ increases inversely with the wind speed.

The prediction point was set at the edge of ROW. The horizontal distance from the centre of the road to the prediction point is 55 meters since ROW is 110 meters wide.

1.3 Predicted Ambient Air Quality

1.3.1 Emission of Pollutants: NO_x, PM₁₀, CO and SO₂

The pollutant emissions calculated by *eqn.1.1* based on the projected traffic volume are summarized in Tables A10.1-6 to A10.1-9.

Table A10.1-6 Average Emission of Pollutants at Section 1 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	6,237	8,193	13,969	25,235
PM ₁₀	252	331	565	1,058
CO	3,620	5,122	8,718	17,065
SO ₂	1,521	1,989	3,392	6,040

Source: The Survey Team

Table A10.1-7 Average Emission of Pollutants at Section 2 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	6,237	9,318	13,334	20,327
PM ₁₀	252	381	546	848
CO	3,620	7,636	11,091	16,020
SO ₂	1,521	2,221	3,175	4,833

Source: The Survey Team

Table A10.1-8 Average Emission of Pollutants at Section 3 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	0	1,559	5,648	18,691
PM ₁₀	0	77	302	974
CO	0	2,574	7,225	19,880
SO ₂	0	293	531	749

Source: The Survey Team

Table A10.1-9 Average Emission of Pollutants at Section 4 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	0	1,559	2,719	5,439
PM ₁₀	0	77	140	292
CO	0	2,574	3,753	7,593
SO ₂	0	293	440	523

Source: The Survey Team

1.3.2 Predicted Pollutant Concentrations

The increments of pollutant concentration at the edge of ROW computed by *eqn. 1.3* were summarized in Tables A10.1-10 to A10.1-13.

Table A10.1-10 Average Emission of Pollutants at Section 1 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	3.5	4.6	7.9	14.3
PM ₁₀	0.1	0.2	0.3	0.6
CO	2.0	2.9	4.9	9.7
SO ₂	0.9	1.1	1.9	3.4

Source: The Survey Team

Table A10.1-11 Average Emission of Pollutants at Section 2 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	3.5	5.3	7.5	11.5
PM ₁₀	0.1	0.2	0.3	0.5
CO	2.0	4.3	6.3	9.1
SO ₂	0.9	1.3	1.8	2.7

Source: The Survey Team

Table A10.1-12 Average Emission of Pollutants at Section 3 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	0.0	0.9	3.2	10.6
PM ₁₀	0.0	0.0	0.2	0.6
CO	0.0	1.5	4.1	11.2
SO ₂	0.0	0.2	0.3	0.4

Source: The Survey Team

Table A10.1-13 Average Emission of Pollutants at Section 4 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	0.0	1.8	3.1	6.2
PM ₁₀	0.0	0.1	0.2	0.3
CO	0.0	2.9	4.3	8.7
SO ₂	0.0	0.3	0.5	0.6

Source: The Survey Team

1.3.3 Impact on Ambient Air Quality

The pollution levels of ambient air were estimated by adding the computed increments to the background pollutant concentrations shown in Table 19.3-2. Table A10.1-14 shows the predicted pollutant levels in 2025 (at the end of Phase 1).

Table A10.1-14 Predicted Pollutant levels in 2025 [$\mu\text{g}/\text{m}^3$]

Pollutants	Section 1	Section 2	Section 3	Section 4	Kenya Regulations ^{*1} (Residential Area)
NO _x	8	34	18	12	80 (24 hours) 60 (1year)
PM ₁₀	12	12	17	15	100 (24 hours) 50 (1year)
CO	384	510	427	408	4,000 (1 hour) 2,000 (8 hours)
SO ₂	20	18	1	1	80 (24 hours) 60 (1year)

Source: The Survey Team

Note 1: (Draft) The Environmental Management and Coordination (Air Quality) Regulations, 2008

2. PREDICTION OF ROAD TRAFFIC NOISE

2.1 Prediction Method

The mathematical model “ASJ RTN-Model 2008” developed by the Acoustical Society of Japan² is used to predict the noise levels based on the projected traffic volume.

The principles and basic formulas used in the prediction model are as follows.

First, obtain the time variation of the A-weighted sound level L_A (unit pattern) observed at a prediction point for a single vehicle which is passing along the road under consideration. Then, calculate its time integrated value over the duration of its passage, i.e., L_{AE} (the single-event level sound exposure level).

$$L_{AE} = 10 \log_{10} \left(\frac{1}{T_0} \sum_{i=1} 10^{L_{A,i}/10} \cdot \Delta t_i \right) \quad (\text{eqn. 2.1})$$

where

$L_{A,i}$: the A-weighted sound pressure level at the prediction point emitted from the i -th section of the road [dB]

Δt_i : $\Delta D_i/V$

ΔD_i : the length of the i -th section of the road [m]

V : the average running speed of the vehicle in the i -th section [m/s]

The A-weighted sound pressure level $L_{A,i}$ for noise propagation from the i -th source to the prediction point is calculated by considering the sound propagation in a hemi-free field from an omni-directional point source as:

$$L_{A,i} = L_{WA,i} - 8 - 20 \log_{10} r + \Delta L_{cor,i} \quad (\text{eqn. 2.2})$$

where

$L_{WA,i}$: the A-weighted sound pressure level at a single running vehicle at the i -th source [dB]

r_i : the direct distance from the the i -th source to the prediction point [m]

The correction term $\Delta L_{cor,i}$ [dB] is related to the various attenuation factors such as the correction for diffraction ($\Delta L_{dif,i}$), correction for ground effect ($\Delta L_{grd,i}$) and correction for atmospheric absorption ($\Delta L_{air,i}$). Therefore,

$$\Delta L_{cor,i} = \Delta L_{dif,i} + \Delta L_{grd,i} + \Delta L_{air,i} \quad (\text{eqn. 2.3})$$

The A-weighted sound power level of a road vehicle $L_{WA,i}$ [dB] is given by

² K. Yamamoto, “Road traffic noise prediction model “ASJ RTN-Model 2008”: Report of the Research Committee on Road Traffic Noise,” Acoust. Sci. & Tech. 31, 1 (2010)

$$L_{AW,i} = a + b \log_{10} V + C \quad (\text{eqn. 2.4})$$

where V is the vehicle speed [km/h], a and b are regression coefficients, and C is the correction term such as correction for pavement condition, road gradient and so on.

Finally, the time averaged value of the noise at a prediction point, L_{Aeq} (the equivalent continuous A-weighted sound pressure level is obtained by taking account of the traffic conditions such as traffic volume (N: number of vehicles per hour) and vehicle types (light and heavy vehicles).

$$L_{Aeq} = 10 \log_{10} \left(10^{L_{AE}/10} \cdot \frac{N}{3600} \right) \quad (\text{eqn. 2.5})$$

2.2 Input Data and Calculation Conditions

2.2.1 Input Data

The future noise levels were calculated based on the projected traffic volume of Case 2 following the recommendation of Chapter 22. In this scenario, Sections 1 and 2 of the Kipevu Link Road is 4-lane, and Sections 3 and 4 of the Mombasa Southern Bypass Road is 2-lane.

Tables A2.9-1 to A2.9-4 show the projected traffic volume by vehicle types at four sections. In this calculation, cars, matatus and LGVs were categorized as the light vehicles, and MGVs, HGVs and buses were categorized as the heavy vehicles.

Table A10.2-1 Average Hourly Traffic Volume at Section 1

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle [unit/hr]	58	14	424	104	631	155	829	204
Heavy Vehicle [unit/hr]	267	71	383	102	547	146	877	234
Average Velocity [m/s]	80	80	80	80	80	80	78	78
Number of Lanes	4	4	4	4	4	4	4	4

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

Table A10.2-2 Average Hourly Traffic Volume at Section 2

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle [unit/hr]	58	14	132	32	223	55	540	133
Heavy Vehicle [unit/hr]	267	71	349	93	594	158	1135	303
Average Velocity [m/s]	80	80	80	80	80	80	77	77
Number of Lanes	4	4	4	4	4	4	4	4

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

Table A10.2-3 Average Hourly Traffic Volume at Section 3

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle [unit/hr]	0	0	408	100	671	165	871	214
Heavy Vehicle [unit/hr]	0	0	64	17	228	61	565	151
Average Velocity [m/s]	-	-	65	65	43	43	26	26
Number of Lanes	-	-	2	2	2	2	2	2

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

Table A10.2-4 Average Hourly Traffic Volume at Section 4

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle	0	0	408	100	521	128	791	195
Heavy Vehicle	0	0	64	17	122	33	213	57
Average Velocity [m/s]	-	-	65	65	57	57	43	43
Number of Lanes	-	-	2	2	2	2	2	2

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

2.2.2 Calculation Conditions

In this prediction, the correction term C is omitted for simplification in *eqn. 2.4*, then the A-weighted sound pressure levels at a single running vehicle $L_{WA,i}$ along the steady traffic flow are given as

$$\text{Light vehicle} \quad : \quad L_{AW,i} = 46.7 + 30 \log_{10} V \quad (\text{eqn. 2.5})$$

$$\text{Heavy vehicle} \quad : \quad L_{AW,i} = 53.2 + 30 \log_{10} V \quad (\text{eqn. 2.6})$$

Furthermore, the correction terms for attenuation $\Delta L_{cor,i}$ in *eqn. 2.3* were neglected. This simplification provided the conservative estimates, i.e., slightly higher noise levels.

The prediction point was set at the edge of ROW. The horizontal distance from the centre of the road to the prediction point is 55 meters since ROW is 110 meters wide. The height of the prediction point was set at 1.2 meters above the ground.

2.3 Predicted Noise Levels

The predicted noise levels at the edge of ROW based on the projected traffic volume are shown in Table A10.2-5 for four sections.

Table A2.9-5 Predicted Noise Levels: L_{Aeq} [dB]

Year		2015		2020		2025		2035	
Road Section		Day	Night	Day	Night	Day	Night	Day	Night
Section 1		65	59	68	62	69	63	71	65
Section 2		65	59	67	61	69	63	71	66
Section 3		-	-	61	55	61	55	60	54
Section 4		-	-	61	55	62	56	61	55
Kenyan ^{*1} Regulations	Residence	50	35	50	35	50	35	50	35
	Commercial	60	35	60	35	60	35	60	35
IFC Guidelines ^{*2}	Residence	55	45	55	45	55	45	55	45
	Industrial	70	70	70	70	70	70	70	70

Source: The Survey Team

Note: 1) The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Note: 2) General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007. Time Frame: Day: 7.00 a.m. – 10.00 p.m.; Night: 10.00 p.m. – 7.00 a.m.

2.4 Noise Data for the Kipevu Link Road and the Mombasa Southern Bypass Road

The measurement results of noise survey are presented in Tables A10.2-6 to A10.2-10.

Table A10.2-6 Noise Levels at Point 1 (17-7-2011)

At the Open Football Field next to the Railway Track off the Nairobi-Mombasa Highway at Miritini

Time	Range in the Noise Levels dB(A)	Most Frequent/ Median Values dB(A)
6:00-7:00	49.4-70.8	54.2-62.5
7:00-8:00	49.7-71.2	54.5-64.6
8:00-9:00	48.9-70.3	54.9-65.2
9:00-10:00	49.2-71.0	54.4-65.1
10:00-11:00	48.8-70.7	55.5-64.2
11:00-12:00	49.4-75.1	54.8-65.4
12:00-13:00	49.6-74.9	55.6-64.1
13:00-14:00	48.8-74.8	54.3-63.5
14:00-15:00	48.7-72.3	54.5-64.2
15:00-16:00	49.2-72.7	54.6-64.3
16:00-17:00	49.4-73.0	55.2-64.6
17:00-18:00	49.0-72.6	54.8-64.5
18:00-19:00	49.4-70.8	54.2-62.5
19:00-20:00	49.7-71.2	54.5-64.6
20:00-21:00	48.9-70.3	54.9-65.2
21:00-22:00	49.2-71.0	54.4-65.1
22:00-23:00	48.8-70.7	55.5-64.2
23:00-00:00	49.4-75.1	54.8-65.4
0:00-1:00	49.6-74.9	55.6-64.1
1:00-2:00	48.8-74.8	54.3-63.5
2:00-3:00	48.7-72.3	54.5-64.2
3:00-4:00	49.2-72.7	54.6-64.3
4:00-5:00	49.4-73.0	55.2-64.6
5:00-6:00	49.0-72.6	54.8-64.5

Source: The Survey Team

Table A10.2-7 Noise Levels at Point 2 (16-7-2011)

At the Residential Houses behind the Port Reitz District Hospital

Time	Range in the Noise Levels dB(A)	Most Frequent/ Median Values dB(A)
6:00-7:00	45.8-52.7	47.2-49.4
7:00-8:00	46.4-52.6	47.4-49.2
8:00-9:00	46.7-53.5	47.6-49.5
9:00-10:00	46.8-54.8	47.1-49.0
10:00-11:00	46.9-54.0	47.2-48.8
11:00-12:00	46.4-55.2	47.6-48.5
12:00-13:00	48.2-58.6	48.5-51.6
13:00-14:00	48.4-58.9	48.7-49.5
14:00-15:00	48.1-54.6	48.4-49.7
15:00-16:00	45.5-53.8	47.7-49.2
16:00-17:00	45.8-60.4	47.6-49.3
17:00-18:00	48.5-54.4	49.2-51.6
18:00-19:00	45.7-59.4	46.1-47.2
19:00-20:00	45.6-49.3	46.4-47.2
20:00-21:00	45.4-49.2	46.2-47.4
21:00-22:00	45.2-52.4	46.1-47.3
22:00-23:00	45.8-59.6	46.4-48.5
23:00-00:00	45.0-51.8	46.2-47.8
0:00-1:00	44.9-49.0	46.0-48.2
1:00-2:00	44.8-48.9	45.6-46.5
2:00-3:00	45.1-48.5	45.8-47.0
3:00-4:00	45.2-48.7	46.2-47.4
4:00-5:00	44.8-48.8	45.4-47.1
5:00-6:00	45.7-52.4	46.1-48.8

Source: The Survey Team

Table A10.2-8 Noise Levels at Point 3 (15-7-2011)

At the Open Football Field at Tsunza Primary School

Time	Range in the Noise Levels dB(A)	Most Frequent/ Median Values dB(A)
6:00-7:00	42.8-48.2	44.0-46.9
7:00-8:00	44.3-48.4	44.5-47.0
8:00-9:00	44.0-48.8	44.2-46.6
9:00-10:00	43.6-49.4	44.3-46.4
10:00-11:00	43.7-49.2	44.3-47.0
11:00-12:00	43.3-48.2	44.2-46.8
12:00-13:00	43.6-51.9	44.3-46.7
13:00-14:00	42.8-50.4	44.2-46.3
14:00-15:00	43.3-50.2	44.1-46.8
15:00-16:00	43.7-58.0	44.2-46.3
16:00-17:00	43.4-52.8	44.4-46.8
17:00-18:00	42.8-46.6	43.8-46.5
18:00-19:00	42.8-47.2	43.2-44.2
19:00-20:00	42.9-47.4	43.6-44.8
20:00-21:00	39.8-51.0	40.7-43.6
21:00-22:00	39.7-50.5	40.8-43.4
22:00-23:00	40.3-47.4	41.4-42.6
23:00-00:00	40.4-47.2	41.4-43.5
0:00-1:00	40.1-46.8	41.5-43.9
1:00-2:00	40.6-46.4	42.1-43.8
2:00-3:00	40.3-45.8	42.2-43.4
3:00-4:00	40.9-45.6	42.0-43.8
4:00-5:00	40.4-46.2	42.4-44.3
5:00-6:00	41.4-47.3	42.3-44.0

Source: The Survey Team

Table A10.2-9 Noise Levels at Point 4 (14-7-2011)
 At the Open Football Field at Mwangala Primary School

Time	Range in the Noise Levels dB(A)	Most Frequent/ Median Values dB(A)
6:00-7:00	48.6-62.2	52.2-60.0
7:00-8:00	48.9-64.0	52.4-59.8
8:00-9:00	49.2-61.6	52.6-58.9
9:00-10:00	49.5-60.3	52.0-59.4
10:00-11:00	48.8-63.2	52.7-58.2
11:00-12:00	49.0-60.8	52.6-58.5
12:00-13:00	48.9-62.6	52.4-59.7
13:00-14:00	49.4-63.8	52.3-59.6
14:00-15:00	48.8-60.0	53.2-59.4
15:00-16:00	49.4-61.8	52.5-58.8
16:00-17:00	49.2-61.5	52.7-60.1
17:00-18:00	49.3-60.8	53.4-59.4
18:00-19:00	48.6-50.4	48.8-50.0
19:00-20:00	48.7-50.1	49.3-49.8
20:00-21:00	41.6-50.2	44.4-48.3
21:00-22:00	41.8-50.8	44.5-48.0
22:00-23:00	42.2-46.4	43.0-44.8
23:00-00:00	42.1-46.3	43.1-44.8
0:00-1:00	42.6-46.4	42.8-45.3
1:00-2:00	42.4-45.7	43.0-44.6
2:00-3:00	41.8-45.4	43.2-44.9
3:00-4:00	42.6-45.5	42.8-44.6
4:00-5:00	42.2-46.0	42.8-44.8
5:00-6:00	42.4-49.2	43.6-46.4

Source: The Survey Team

Table A10.2-10 Noise Levels at Point 5 (18-7-2011)
 At the Open Football Field next to Pungu Primary School

Time	Range in the Noise Levels dB(A)	Most Frequent/ Median Values dB(A)
6:00-7:00	48.9-60.6	50.2-58.0
7:00-8:00	50.4-62.2	51.0-59.2
8:00-9:00	49.4-62.3	50.6-60.0
9:00-10:00	49.8-62.5	52.3-58.6
10:00-11:00	49.1-63.8	50.4-60.0
11:00-12:00	49.6-74.1	52.9-58.6
12:00-13:00	49.0-75.2	51.0-59.5
13:00-14:00	50.7-64.4	51.1-57.6
14:00-15:00	49.3-72.3	51.4-58.2
15:00-16:00	48.8-70.4	50.2-59.8
16:00-17:00	49.4-62.1	52.2-58.1
17:00-18:00	49.2-60.3	50.6-58.3
18:00-19:00	48.8-51.2	49.0-50.2
19:00-20:00	48.9-52.6	49.1-50.4
20:00-21:00	44.4-53.5	45.0-48.2
21:00-22:00	44.8-46.1	45.4-46.0
22:00-23:00	44.6-47.0	45.2-46.2
23:00-00:00	45.0-46.7	45.0-45.8
0:00-1:00	44.4-46.3	45.1-46.2
1:00-2:00	44.5-46.8	45.2-46.4
2:00-3:00	44.7-46.5	44.9-46.2
3:00-4:00	44.8-46.9	45.2-46.4
4:00-5:00	44.6-46.8	45.4-46.1
5:00-6:00	45.2-51.4	45.5-48.0

Source: The Survey Team