KENYA RAILWAYS CORPORATION

CONSULTANCY SERVICES FOR THE FEASIBILITY STUDY, PRELIMINARY DESIGN (FEED/BASIC ENGINEERING) AND PREPARATION OF BIDDING DOCUMENTS FOR UPGRADING OF THE NAIROBI COMMUTER RAIL NETWORK

February 2025

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1 ABBREVIATIONS

Term	Meaning
AFCS	Automated Fare Collection System
BEMU	Battery Electric Multiple Unit
BRT	Bus Rapid Transit
COS	Chip Operating System
CSI	Customer Satisfaction Index
DCP	Dynamic Cone Penetrometer
DSQ	Determinants of Service Quality
FCS	Fare Collection System
FEL	Front-End Loading:
FEL-1	FEL Level 1: Scoping Study / Conceptual Design. *Part of project initiation and planning.* *Conceptual Design deliverables: i) Project description; ii) Process design basis; iii) Block Flow Diagrams; iv) Order-of magnitude cost estimate.*
FEL-2	FEL Level 2: Feasibility Study / Preliminary Engineering. *Part of project initiation and planning, FEL-2 is the most critical in the FEL process because it is the stage where business requirements should be translated into technical requirements.* *A Feasibility Study is a preliminary study that will produce the information required for Preliminary Engineering.* *Design deliverables will typically include: i) Preliminary Work Breakdown Structure; ii) Design basis with main process parameters defined; iii) Process Flow Diagrams / One Line Diagrams; iv) Equipment List; v) Plot plant showing plant areas, buildings to define overall space requirements; and vi) Preliminary Cost Estimate.*
FEL-3	FEL Level 3: Project Definition / FEED. *Part of project initiation and planning.* *In FEL-3, the scope should be finalised, the contracting strategy frozen and the bid package delivered. The cost estimate of the project is also known to a degree of accuracy of +/- 10%*. *Project Definition is the development of a well defined design package to in order to prove the feasibility and the cost estimate developed from Conceptual Design.* *Furthermore this is the start up package for Detailed Design. In many cases this package may also be used as a tender package for a Design/Construction Contract.* *Typical deliverables will include: i) Detailed Work Breakdown Structure; ii) Process Flow Diagrams / Simplified One Line Diagrams; iii) P&ID's /*

	One Line diagrams; iv) Process / Electrical simulations/ calculations as required to complete the above.; v) Equipment Lists; vi) Line Lists / Cable Schedules; vii) Instrument lists / Smart I/O devices; viii) Site Plans & Plot Plan's; ix) Building Layouts (Control Rooms, Substations, Utility Buildings); x) Preliminary Equipment specifications (datasheets); xi) Other overall layouts which may impact process design (e.g. Hazardous area classification drawings, Fire zone layouts which may dictate shut down valve requirements etc.); xii) Budget Cost Estimate; and xiii) Preliminary Plan and Schedule.
FEED	Front-End Engineering Design also known as Basic Engineering
FIDIC	International Federation of Consulting Engineers (Fédération Internationale Des Ingénieurs-Conseils)
FMVS	Fare Media Validation System
GoK	Government of Kenya
GPR	Ground Penetrating Radar
ILUT	Interdisciplinary Land-Use and Transport
IUMP	Integrated Urban Mobility Plan
JKIA	Jomo Kenyatta International Airport
KPCU	Kenya Planters' Cooperative Union
KR	Kenya Railways
KUMIP	Kenya Urban Mobility Improvement Project
MCA	Multi-Criteria Analysis
MRTS	Mass Rapid Transit System
MU	Multiple Unit
NaMATA	Nairobi Metropolitan Area Transport Authority
NIFCS	National Integrated Fare Collection System
NCR	Nairobi Commuter Rail
NMA	Nairobi Metropolitan Area
NMT	Non-Motorised Transport
PIT	Project Implementation Team
PMBOK	Project Management Book of Knowledge
PMI	Project Management Institute
PPA	Project Preparatory Advance
PPP	Public Private Partnerships
SIL	Safety Integrity Leve
TAZ	Traffic Analysis Zones

TCD	Transit Card
TOD	Transit Oriented Development
USD	Dollars of the United States of America

2 BACKGROUND.

The Government of Kenya (GoK) in partnership with the World Bank intend to finance the implementation of the Kenya Urban Mobility Improvement Project (KUMIP). KUMIP, as proposed will contribute to improving urban mobility and land use planning. The project will support urban policy formulation, institutional strengthening, and improvement of commuter rail services, station access roads and transit-oriented development (TOD) around railway stations.

Kenya Railways (KR) is a State Corporation established in 1978 pursuant to the Kenya Railways Act, Cap 397 Laws of Kenya, to provide a coordinated and integrated system of rail and inland waterways transport services and inland port services. KR has the mandate to develop Commuter Railway Networks and operate services thereon in Kenya.

The Nairobi Commuter Rail (NCR)[1] Network despite having a network coverage of 165km, faces aging facilities and infrastructure inadequacies which limit its utilization for transportation of commuters. NCR is envisaged as the future backbone for Mass Rapid Transit system within the functional urban area of the Nairobi Metropolitan Area (NMA). NMA comprises of five counties of Muranga, Kiambu, Nairobi, Kajiado and Machakos. The proposed upgrade of the NCR is therefore, targeted to among others:

- Rehabilitate, upgrade and enhance capacity of the railway track;
- Upgrade the signaling and communication systems;
- Automate the fare collection system;
- Acquire high-capacity commuter trains;
- Improve inter-modal connectivity and station area development within the NCR network;
- Initiate TOD along the Commuter Rail Corridors; and
- Optimize utilization of NCR network for commuter and freight services.

[1] Nairobi Commuter Rail Master Plan

These interventions are expected to improve the safety, accessibility and reliability of the NCR services resulting in reduced travel time, increased user comfort, operating cost savings, and reduction of pollution, congestion and road accidents.

The NCR network currently handles both passengers and freight services. Improvements to the existing network should be designed in a way that minimizes disruption to on-going operations.

In preparation of KUMIP, the Government of Kenya requested the World Bank for a Project Preparatory Advance (PPA). To firm up the proposed intervention under the KUMIP, Kenya Railways (KR) intends to use part of the PPA to procure the services of a consultant to:

i) prepare a feasibility study (FEL-2 stage), followed by
ii) preliminary designs (FEL-3 FEED/Basic Engineering), and
iii) preparation of bidding documents (FIDIC Yellow Book design-build compliant)

for the upgrade of the Nairobi Commuter Rail System.

The works are targeted to cover the entire Nairobi Commuter Rail Network, as seen in Figure 1 below. The corridors to be covered are:-

a) Line 1: Nairobi- Limuru
b) Line 2: Nairobi- Thika
c) Line 3: Nairobi- Konza
d) Line 4: Nairobi- Jomo Kenyatta International Airport (JKIA)
e) Line 5: Nairobi- Embakasi Village Line
f) Line 8(a): Ngong- Kiserian
g) Line 8(b): Kiserian- Ongata Rongai to Nyayo Stadium Link;

Analysis and preparation of bidding documents for construction stage will focus first on the Nairobi - Ruiru - Thika line, which has been prioritized for upgrade and equipment improvement under KUMIP.

The Consultant will carry out the scope of work in such a way as to transfer knowledge to the staff of KR and the relevant Ministries and County Governments, including on issues of railway engineering and operational design, land use planning, and TOD.

Finally, the Consultant will conduct an economic feasibility and financial analysis to establish the project's economic viability and future financial sustainability.

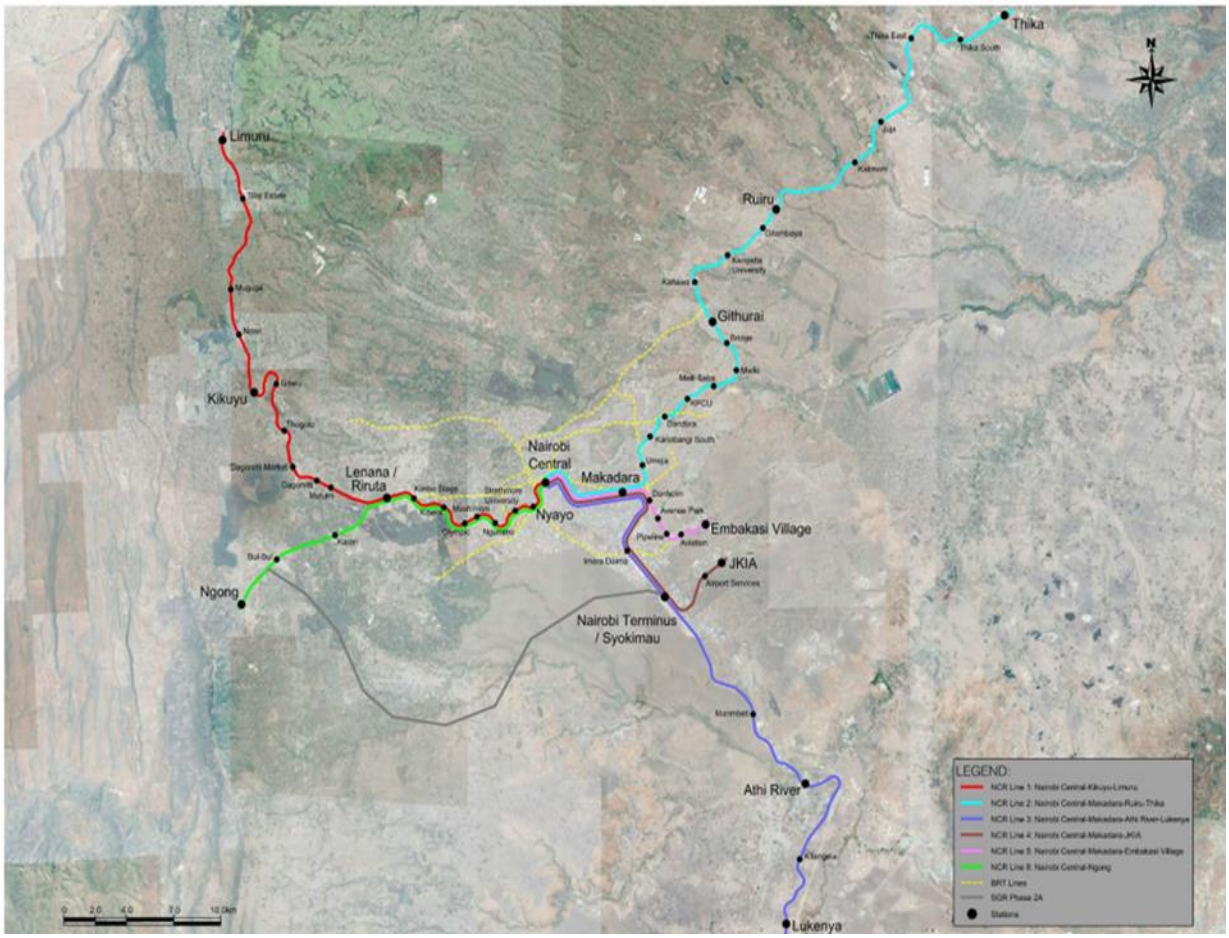

Figure 1: The Nairobi Commuter Rail Core Scenario (NCR Master Plan, 2018)

3 OBJECTIVES

The objectives of this assignment are to:

1. Undertake a FEL-2 Feasibility Study, including Preliminary, Engineering to assess technical, social, environmental, financial and economic viability for the upgrading and/or rehabilitation of the NCR network as well as the development of TOD facilities and access roads to commuter stations;

2. Complete the FEL-3 Project Definition / FEED (Basic Engineering) to 85% [2] cost accuracy for:
   a) the entire commuter NCR network including access facilities to commuter stations, and
   b) TOD-related infrastructure facilities for selected stations along Thika line;
3. Prepare the Engineering Requirement for Design & Build bidding documents for contracting under the FIDIC Yellow Book form of contract for:
   a) the entire commuter NCR network,
   b) access facilities to commuter stations, and
   c) TOD-related infrastructure facilities for selected stations along Thika line.

4 Scope of Services.

The Consultant shall undertake the following tasks as elaborated in the TOR:

Task 1: Preparation of inception report;

Task 2: Undertake traffic forecasts;

Task 3: Preparation of assessment report;

Task 4: Transit Oriented Development (TOD) Potentials;

Task 5: Development of the operating concept;

Task 6: Generation of the Preferred Option and Preliminary Design (FEED/Basic Engineering);

Task 7: Financial and economic analysis of the preferred options;

Task 8: Undertake environment, job creation assessment,social and gender impact study based on various options;

Task 9: Prepare detailed engineering design (FEL-3 Project Definition / FEED (Basic Engineering) to 85% cost accuracy) for the optimal option;

Task 10: Prepare the client's Engineering Requirement and draft the Bidding Documents;

Task 11: Prepare a draft business model and investment programme;

[2] The FEL-3 cost estimate of a project, also known as a degree of accuracy, is typically +/- 10%. KR's minimum internal requirement for feasibility assessment is 85%.

Task 12: Prepare operations, security and safety plan; and

Task 13: Undertake capacity building of counterpart staff.

4.1 Task 1: Preparation of inception report.

The Consultant will focus on the development of a contextual understanding and exchange of information to ensure efficient and effective study progress. It is expected that the consultant shall undertake an early site reconnaissance within the inception phase.

A key part of the inception stage is the collection and review of all available data, identify gaps, quality issues and alternatives/gap filling strategy (which may include additional data capture or survey), carry out initial site visits and hold individual data and information gathering meetings with all relevant knowledge holders. An institutional analysis will be developed that identifies and maps the main Stakeholders for urban moblity, including Transit – Oriented Development commuter rail operation, transport planning, transport service delivery, and others. The analysis will identify their roles and responsibilities and key points and stages of engagement within the work program.

An inception report shall be prepared within one (1) month from contract signing, providing a detailed methodology, work plan and background review towards undertaking the tasks as provided in the TOR.

4.2 Task 2: Undertake traffic forecasts.

The Consultant shall prepare robust traffic and revenue forecasts of the future traffic on the NCR for a 30-year appraisal period (up to 2053 and cognizant of the AU Agenda 2063 outcomes). This traffic and revenue forecast shall enable the traffic and revenue for individual lines to be disaggregated so it can feed to the economic and financial analyses of individual lines.

4.2.1 Review of Commuter Rail Master Plan

Since the feasibility study should be based on the Commuter Rail Master Plan (2018), the Consultant must review and familiarize itself with the methodology and data used in this master plan.

4.2.2 Traffic surveys.

The Consultant shall conduct appropriate traffic surveys to enable a reasonably accurate forecast of traffic and revenue in the future. The focus of this section (4.2.2) is on the demand potential for 30 years, up to 2053 for trips originating and terminating within the aggregated Traffic Analysis Zones (TAZ), Origin Destination Surveys forecasting land use, traffic modal shift, Induced Traffic after investment; which together with the study area that will be identified in this study by the Consultant, through discussion and agreement with KR and other Stakeholders.

This will be done to update and refine the results obtained by the Nairobi Commuter Rail Master Plan (2018), taking into consideration updated land use plans and actual land use development.

4.2.3 Analysis of population trends and socio-economic variables.

The Consultant shall gather and analyze data on population trends in the NMA and statistics on socio-economic factors for the catchment areas around the NCR that would affect travel behavior, inter alia, taking note of income levels, gender, and presence of vulnerable groups. The consultant shall consider destinations to major employment centers, the final destinations after transfer to other transport modes from commuter rail and other socio-economic institutions that could potentially be served by the commuter rail (commuter rail network as per Figure 1). The consultant must consider existing and potential future land use plans.

4.2.4 Customer surveys.

The Consultant shall carry out a survey of (existing and potential) passengers on the Nairobi Commuter Rail, including different user groups (socio-economic groups such as vulnerable groups, including women, elderly, and people with disability). The Consultant shall develop the survey methodology and questionnaire, and obtain the clearance from KR before the commencement. The survey shall collect the following information among others:

- Trip characteristics;
- Demographic characteristics;

- Views on quality and pricing of rail service vis-à-vis other modes of transport;
- Mode choice and willingness to change modes if rail service is improved;
- The Customers' Determinants of Service Quality (DSQs)[3].;
- Willingness to pay more for commuter rail if service were improved;
- Access to commuter rail stations;
- Facilities and services that make passengers feel comfortable to travel with commuter rail;
- 'Share-of-wallet' cost of commuting; and
- Challenges faced when using public transit.

4.2.5 Analysis of competition.

The Consultant shall gather and analyze information on the provision of alternative transport modes that compete with / complement the NCR including characteristics of volume of service, transit time, reliability, security, route convenience, frequency of service, comfort, and price. Based on this analysis and aligned with the developing Integrated Urban Mobility Plan (IUMP) progress, the Consultant shall forecast the potential rail modal share in each corridor over the 30-year forecast period and perform a sensitivy analysis using Monte Carlo simulation.

4.2.6 Travel demand forecast.

The Consultant shall forecast travel demand for the NCR catchment areas for a 30-year design period broken down by key origin/destination routes. As the Nairobi Metropolitan Area Transport Authority (NaMATA) is concurrently developing the IUMP for the NMA, the Consultant shall coordinate with the IUMP study for travel demand forecasting.

4.2.7 Demand and revenue modeling and scenario analysis.

The Consultant shall prepare a forecasting model(s) for the anticipated NCR traffic demand and revenue. The model shall cover a 30-year forecast period. A sensitivity analysis shall be carried out based on the key factors identified by the market analysis as

[3] The 10 DSQs perceived by the service provider and the consumer, are: reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding/ knowing the customer, and tangibility to formulate a service quality framework.

the most important for driving demand and willingness to pay. The Consultant shall prepare three traffic scenarios: most likely, low, medium, and high scenarios that show the impact of varying the key demand drivers. The model shall allow analysis of individual commuter lines as listed in the Nairobi Commuter Master Plan (2018).

4.2.8 Travel Demand Forecast Consultation Validation workshop

The Consultant shall consult with Project Implementation Team (PIT)[4] members on survey results and travel demand forecast, and incorporate PIT members' comments on the output. The Consultant shall support PIT (KR/GoK) in organizing a consultation workshop to present the integrated survey results and travel demand forecast. Consultant shall organize for a validation workshop for the demand forecast analysis.

4.2.9 Task 2 Outputs.

The Consultant shall report on the findings of Tasks 4.2.1- 4.2.8 in the Traffic Forecast Report. This task should cover the NCR network as a whole. This comprises of both existing commuter lines and those listed in Nairobi Commuter Rail Master Plan (2018). i.e Line 1 to Line 8.

The Consultant shall provide to KRC the following:

- Traffic and revenue forecasting model. The model should use software that is readily available to KRC or be made available.
- Training three (3) KR counterpart staff in the logic and use of the model, for future use and update of the model by KRC.
- One-day seminar for up to thirty (30) Counterpart staff on Demand Modeling for general capacity building.
- Baseline NCR Customer Satisfaction Index (CSI). This is to be conducted using classical DSQs highlighted under Task 4.2.4: Customer surveys.

[4] Project Implementation team comprises of KRC-KUMIP team, and representatives of key stakeholders.

4.3 Task 3: Preparation of assessment report.

The Consultant will focus on the development of a contextual understanding and exchange of information to ensure efficient and effective study progress. It is expected that the consultant shall undertake an early site investigation within the inception phase.

4.3.1 Review of Reports and Policy Papers.

In undertaking the assignment, the consultant is expected to review existing relevant studies and policy documents related to the NCR among them to inform the feasibility study report decisions. The non-exhaustive list of studies to be considered before traffic demand forecast (Task 2) is undertaken, includes:

- Prefeasibility Study of Kenya Urban Mobility Improvement Project 2024 April - Government of Kenya;
- Updated Integrated National Transport Policy (2023) - Draft;
- Development of a Spatial Planning Concept for Nairobi Metropolitan Region (2011);
- Report on the Feasibility Study and Technical Assistance for Mass Rapid Transit System For The Nairobi Metropolitan Region (2011);
- Modernization of Makadara – Embakasi - Village railway line (2013);
- Mass Rapid Transit System Harmonization Study, Nairobi Metropolitan Region – MRTS (2014);
- NIUPLAN: Integrated Urban Development Master Plan for the City of Nairobi;
- Development Vision, Structure Plan and Land Use Plan (2014);
- Urban Transport Development Plan (2014);
- Nairobi Commuter Rail Project Proposal (2015);
- Interdisciplinary Land-Use and Transport Metropolitan Analysis within the Nairobi Metropolitan Region (ILUT);
- Kenya Railways Legal and Regulatory Framework (2017);
- The Nairobi Commuter Rail Master Plan (2018);
- Smart Mobility Solutions to Improve Urban Mobility in Nairobi Metropolitan (2023) Area Ruiru Strategic Integrated Plan;
- Ruiru Sustainable Urban Mobility Plan –UNHABITAT;

- Nairobi BRT service plan and corridor concept design –UNHABITAT;
- Design Manual and Street Design- State Department of Roads;
- CIDPs- Nairobi and Kiambu County Governments (2023-2027);
- Nairobi City County Public Road Transport and Traffic Management Bill, 2017;
- Nairobi City County Transport Act (2020);
- World Bank safeguards documents;
- Eastland Urban Renewal Plan;
- Kenya Railways Master Plan for Commuter rail and SGR;
- Nairobi Thika Superhighway ISUDP Corridor Plan;
- Ruiru and Juja ISUDP;
- NIUPLAN and the Spatial Plan for the Nairobi Metropolitan Region;
- Integrated Land Use and Transportation Study and
- Harmonised MRTS Study.

In addition, the consultant may make reference to the ongoing studies by the World Bank:

- Flood Risk Assessment and Developing Management Plan Recommendations for the Commuter Rail System;
- Viability assessment for the electric battery option for commuter rail trains;
- Study on Land Value Capture Opportunities for Kenya Railways System; and
- Any other relevant studies the World Bank may provide to the Consultant.

4.3.2 Operational Assessment.

The Consultant shall, based on the demand forecast, anticipated population growth and urban development within NCR catchment area, identify the number and location of stations to enhance the accessibility of the railway stations and coverage of commuter rail service and analyze, including by simulation where appropriate, the train services needed to serve the traffic demand forecast in Task 2. This analysis should indicate the size, frequency and speed of the trains and provide an indicative schedule for each line. The proposed train services should be rolled out over time (year 1, year 2, etc.) to enable the matching of the rolling stock to the traffic requirements.

4.3.3 Railway Safety Assessment

The Consultant shall perform a Railway Safety Assessment both in Hard Assets and Policies, Procedures, Standards and Guidelines for the following key safety focus areas: Derailments, Collisions, Level crossings, Platform-Train Interchange occurrences and People Struck by Trains.

For each focus area, typical issues for concern are listed below:

1. Derailments:
    a. Broken Rail, typically due to inadequate Asset Monitoring (Longitudinal stresses on the rail, Position of defects – kick outs, slacks, rail crow defects, etc., Frequency of ultrasonic testing, Location of defects vs. maintenance facilities, Poor joining craftmanship and maintenance (bolted or welded rail quality / testing / training, Flat wheels);
    b. Structure Instability (Adverse weather conditions);
    c. Human Error (Points not set correctly, Unlocked points, Half-cocked points manually operated, Inadequate lubrication of points, Inappropriate Train Handling e.g. SPADS, non-adherence to speed limits, etc., Errors in maintenance of railway assets – work force incompetence, workload, lack of supervision, etc.);
    a. Theft and Vandalism (Socio-economic dynamics, Porous/unsecured rail reserve boundaries, Law enforcement: prosecution rate and conviction); and
    a. Supply Chain Management challenges due to lack of continuity in leadership.
2. Collisions:
    a. Operating in degraded mode / abnormal working (Accountability for repeat offenders, Communication between Train Control Officers and Train Drivers, Non-compliance with policies, procedures and execution);
    b. Categorisation of collision severity (Criteria for data to give meaning to the numbers)
3. Level crossings:
    a. Motorists behaviour (Motorists do not stop at level crossings);

b. Motorists driver licensing (Do current motorist driver licensing criteria does in-clude level crossings education);
c. Outdated Level Crossings and Increased Urbanisation (Level crossings did not evolve as the traffic volumes increased).
d. Informal Level Crossings (Proliferation or ad hoc and high-risk level crossings by the local community at their convenience)
e. Level Crossing elimination (Ineffective controls for pedestrians and road vehicle users at high-risk level crossings, No comprehensive risk assessment conducted, Inadequate funding, Approach taken to eliminate did not achieve the intended results);
f. Lack of Maintenance due to Inadequate Asset Monitoring (Level crossing assets e.g. booms, flashing lights, etc. not constantly monitored, Level crossing surrounding – signage, foliage, illegal structures, etc. not regularly monitored);
g. Assets not protected against theft and vandalism; and
h. Trains are not visible on level crossings at night time.

4. Platform-train interchange occurrences:
    a. Impact of Standards and Regulations not being tracked (Open loop regulation – Forward feed without any feedback on achieved success).
    b. Lack of track maintenance at stations and on the mainline (Dependency on outside interest for solutions, Lack of proper asset register and no specification);
    c. State of the infrastructure and station buildings (Heritage legislation, Outdated / Inadequate standards e.g. track maintenance standard/manual);
    d. Equipment Failure (Train movement control Signalling / Train schedule delays / Outdated systems / Late delivery of new projects / Vandalism and theft / Interoperability);
    e. Passenger Communication;
    f. Telecommunication (wayside cable theft, links to the cab);
    g. Rolling Stock (overcrowding, train fires, train delays);

h. Perway (In-station geometry, Mainline geometry, Ineffective drainage, Sink hole challenges, Universal access);
i. Fare Evasion ()No current commuter movement intelligence); and
j. Supply Chain Management challenges.

5. People struck by trains:
    a. Poor planning: Municipality, industry and law enforcement (Town Planning and new cities development);
    b. Lack of alignment between the different tiers of government;
    c. Justice system support for the rail system;
    d. Open system (human flow);
    e. Possible suicides/murder;
    f. Lack of security; and
    g. Culture of non-compliance.

4.3.4 Infrastructure Assessment.

The Consultant shall assess the existing condition of the NCR infrastructure and determine the investments required to bring the infrastructure into good working order for operation of commuter trains. As part of the assessment, the consultant shall propose and agree on design standards (cf. FEL-2 Design Basis) with KR that will be applied consistently to all the NCR lines. Consultant shall separately estimate the upgrading/rehabilitation costs for each line.

Consultant shall organize their services such that the assessment of the Nairobi - Ruiru - Thika line and the development of appropriate design standards are prioritized in time.

The specific functions to be assessed shall include and will not be limited to:

4.3.4.1 Geotechnical Survey;

The Consultant shall carry out a geotechnical assessment of the NCR network, examining the geotechnical parameters of the existing sub-ballast subgrade and surrounding areas. Furthermore, the Consultant shall review available engineering geological and geotechnical information of the site and a reconnaissance survey to appreciate the geotechnical aspects of the NCR. Finally, the Consultant shall prepare a detailed site

investigation program, including dynamic cone penetrometer (DCP), boring, ground penetrating radar (GPR), field and laboratory tests and analyses of the data gathered to evaluate the feasibility of the project as well as the geotechnical parameters, required for the foundation design, reuse of sub-ballast, and improvement for the project structures.

A risk assessment study for commuter rail, including the geotechnical and foundation testing is under preparation with the support of the World Bank. The Consultant shall coordinate with the risk assessment study (executed by the World Bank) to obtain the necessary information to determine the area to carry out in depth assessment, building on the results of and recommendations from the geotechnical and foundation testing.

4.3.4.2 Hydrological conditions and Drainage Structures;

The Consultant shall conduct a review and assessment of NCR drainage structures including bridges and culverts by carrying out a detailed site reconnaissance to identify the prevailing hydrological issues, including:

i) Evaluation of existing drainage structures to ascertain the level of blockage and ingress of vegetation;
ii) Assessment of sections of the NCR network with occurrences of track overflows during heavy rains;
iii) Assessment of the structural integrity of existing drainage structures and their capacity for the relevant flood return period; and
iv) Evaluation of the structural integrity of existing drainage structures.

Note that the findings of the Flood Risk Assessment and Developing Management Plan Recommendations for the Commuter Rail System study mentioned in 4.3.1 above apply to this activity.

The assessment will recommend remedies for addressing deficiencies and where justified, construction of new bridges, especially at critical road crossings.

4.3.4.3 Bridges & Structures;

The Consultant shall review and assess NCR bridges and structures, including bridges at road crossings. This will include:

- Assessment of the structural condition of bridges and other structures for damage and corrosion.
- Assessment of the condition of bridge handrails and walkways.

The assessment will recommend and design remedies for addressing deficiencies and where justified, construction of new bridges, especially at critical road crossings. The aim will be to reduce level crossings to the bare minimum.

4.3.4.4 Track infrastructure;

The Consultant shall review and assess the track condition of the NCR network. This assessment should detail the condition of ballast, sleepers, crossings, turnouts and switching mechanisms, rails, rail pads and fastenings. The Consultant should also opine on the state of the layer works and the overall integrated rail track structure. Based on the assessment the Consultant shall specify what components need to be repaired/replaced to provide the train services described in this Task 3. The Consultant shall also determine the optimal timing for construction of a second railway track where there is only one track at present. The report shall include the Track Quality Index (TQI) per 1000m and recommendations on the track geometry measurement, status and standards compliance.

4.3.4.5 Signaling and communication system;

The Consultant shall assess the existing signaling, communications and train movement control systems of the NCR considering the commuter train service, ideally to Safety Integrity Level 4 (SIL4) and the requirement to also handle freight trains ideally Safety Integrity Level 3 (SIL3) on some sections of the NCR. Where feasible, this assessment should identify the limitations, gaps, and potential areas of improvement in the current systems.

As part of the assessment, the Consultant shall evaluate the formal and informal level crossings, including taking traffic counts, assessing risks and recommending interventions for level crossing protection.

Based on this assessment, and after consulting with KR, the Consultant shall recommend a cost-efficient technological option that satisfies NCR's needs considering technological developments in all major regions globally.

4.3.5 Rolling stock

The Consultant shall assess the adequacy of the KR rolling stock fleet to meet the demand requirements as forecasted in Task 2 as well as examining the existing passenger rolling stock available to NCR and the age profile of existing passenger rolling stock to assess the demand for rolling stock considering the replacement of over age units. Further, an assessment shall be carried out on the current fleet for its functionality to either bridge the time until new rolling stock can be purchased or to augment new rolling stock. Moreover, the assessment of the rolling stock fleet should check their adequacy in providing space and access requirements for people with special needs including those with disability aids, expectant women and the elderly. Finally, the Consultant will hold stakeholder engagements with different focus groups to identify any barriers in the Commuter Rail Service trains to be addressed.

While undertaking this assessment, the consultant will review the viability assessment report for the electric battery option for commuter rail trains, and the operations simulation and assessment of motive power (diesel, diesel battery hybrid, hydrogen) which the World Bank is carrying out concurrently to support the project preparation.

4.3.6 Rolling stock trip replenishment, repair and maintenance facility

Based on the findings of the Nairobi Commuter Rail Master Plan, KR intends to build and equip a trip replenishment, repair and maintenance facility for KR commuter rail rolling stock at Makadara station. Under this assignment, focus is only on multiple unit (MU) facilities and not conventional trains.

The consultant shall develop a plan for the Makadara site, and identify the equipment necessary for the workshop. The facility must be scalable, provide a plan for phasing the

investment in the facility to accommodate enlargement of the fleet and introduction of a second fleet type, which will be partially procured under KUMIP. The plan for Makadara workshop should be part of the station area development plan for Makadara as discussed below.

4.3.7 Automated Fare Collection System

The Consultant shall establish the viability and feasibility of a National Integrated Fare Collection System (NIFCS) across NCR, KR and other bus operators and Matatus. At its core the NIFCS shall consist of the following typical logical components of a Fare Collection System (FCS), namely:

- *Coverage* – meaning the legal, geographic and contractual scope to which a particular FCS applies.
- *Business Rules* –compriing the roles of the members participating in a particular FCS and the rules to be followed by them.
- *Fare Media (FM),* which refers to the payment media used to pay fares in public transportation modes to which a specific FCS applies.
- *Fare Media Validation System (FMVS)* – referring to a system used to collect public transportation fares or fare transaction records through the FM used by passengers when using public transportation in public transportation to which a specific FCS is applied.
- *Transaction Aggregation System* – referring to a system that collects and stores fares or fare transaction record collected through FMVS in public transportation modes to which a specific FCS is applied.
- *Clearing and Settlement System* – that receives the fare transaction records collected by the Transaction Aggregation System to which a specific FCS is applied, delivers the fare transaction records to the FM issuer that generated the fare transaction record, collects the amount corresponding to the transaction records, and delivers them to operators of public transportation modes.
- *Apportionment System* – referring to a system that executes the distribution of fares, collected in a public transportation system to which a specific FCS is applied,

among public transportation operators in the case that the operators agree on the rule of distribution.

Furthermore, given a shift in policy to open up the KR network for multiple operators, the Consultant shall then determine the best coverage type such as Regional System type, Operator System type, Inter-operator System type, and Route System type.

The Consultant shall then specify the most appropriate FCS scheme of business rules for the: i) Fare Structure for AFCS, ii) Fare Collection Procedure, iii) Clearing and Settlement Rules, iv) Apportionment Rules, v) Definition of AFCS Participating Entities and their Roles and Responsibilities, and vi) the Z Technological Specifications.

The Consultant shall evaluate and agree with the Client what Fare Media to include in the Feasibility Study, with due consideration given to: i) Cash or M-pesa, ii) Tickets, iii) Pre-paid E-purse in Transit Card (compliant to ISO 14443 and ISO 7816), iv) Post-paid Account in Transit Card, linked to Issuer System, v) Fare Products (Single Journey or Multiple Journeys) in various form factors, vi)Mobile Payment Media (QR Code and/or NFC), EMV Card (Prepaid, Post Paid), and New Technology Application such as Biometrics.

If the NIFCS is shown not viable then the Consultant shall proceed with the Feasibility to develop the AFCS purely for NCR internal use only.

The following physical fare medium technologies shall be included in the Feasibilitty study:

1) Contactless smart card technology;

2) Contactless smart card technology with EMV standard

3) Mobile Near Field Communication (NFC) technology; and

4) QR Code technology.

The Consultant shall consider the feasibility of developing a national standard specification for a Transit Card (TCD), on which a native chip operating system (COS) can be developed by any chip supplier without any interruption of intellectual property claim.

4.3.8 Passenger Information System

The Consultant shall develop the Feasibility for a Passenger Information System (PIS) including facilities that will provide information to commuters including: route maps, running schedule, dwell time at stations / halts / connecting stops, fare and ticket information, and live track & trace), pre-trip, at-the stations, and while on-board.

4.3.9 Station and Station Area Development and Access Roads

The consultant shall review the station layouts for the commuter stations identified in the NCR Master Plan stations as well as any new recommended stations on the NCR network with an aim to:

Stations Assessment :

1. Establish station categories based on the anticipated demand forecast and function such as a transfer station to determine the basic standards for station facilities;
2. Enhance safe, comfortable, modern, clean, and pleasant passenger amenities and services at stations, including commercial development in and around the station;
3. Ensure that facilities are convenient and easy to use for both regular and unfamiliar passengers, and that amenities and services for the old, infirm, and physically challenged passengers are provided;
4. Employ leading edge technologies and design for innovative services and solutions, including state of the art passenger information and display systems, security systems and fire safety systems. Incorporate green building techniques and climate adaptation techniques such as those used for heat and flood risk reduction;
5. Provide for efficient passenger circulation in stations and for smooth arrival/departure of customers;
6. Recommend areas for commercial development within the stations such as advertising and for supporting establishments such as coffee shops, kiosks, food stores, restaurants, bookshops and convenience stores;

7. Recommend areas for commercial development within the stations such as advertising and for supporting establishments such as coffee shops, kiosks, food stores, restaurants, bookshops and convenience stores;

Station Accessibility:

1. Review accessibility to stations within a 3km radius and recommend interventions to enhance it, including upgrading of access roads, development of NMT facilities, drainage, and streetlighting;
2. Provide for multimodal connectivity including sidewalks for pedestrians, bikes ways and bicycle parking, pickup and drop off facilities for taxis and matatus, connections to BRT and parking at stations;
3. Review the location and status of existing bridges over the railway. Evaluate the bridges' condition and their compatibility with future rolling stock and power supply. Identify where upgrades or additional crossovers may be needed
4. Access roads with Non – Motorized Traffic (NMT) facilities with street lights; and
5. Ensure that the proposed station and station area interventions are aligned with the TOD Corridor and Station Area Plans.

4.3.10 Validation workshop for Technical and Functional overview of commuter railway

The Consultant shall consult with PIT[5] members on technical and functional overview of the NCR, and incorporate PIT members' comments on the output. The Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the integrated survey results and travel demand forecast. Consultant to organize validation workshop for the Assessment Report.

4.3.11 Task 3 Outputs

The Consultant shall report the findings of Task 3 for the entire NCR network in a Functional and Technical Report with requisite technical notes in annexures.

[5] Project Implementation team comprises of KRC-KUMIP team, and representatives of key stakeholders.

4.4 Task 4: Transit Oriented Development (TOD) Potentials

4.4.1 Development of Transit Oriented Development (ToD) Methodology

The Consultant shall review the existing institutional, legal, regulatory and operational frameworks as pertains to Transit oriented planning and development, at National, County and Urban levels. Based on this review, the consultant shall (i) identify any institutional and regulatory gaps and barriers in the implementation of TOD activities towards supporting commuter railway operations within the Nairobi Metropolitan Area and recommend actions towards addressing these barriers, and (ii) map all the relevant stakeholders and their interests and engagement in the implementation of TOD activities within the Nairobi Metropolitan Area, as aligned with the project stakeholder engagement plan prepared under Task 1 Inception Stage. The reviews shall be consolidated with and draw synergies from the desktop review under Task 1 on preparation of the inception report and Task 3, section 4.3.1 on the Review of Policies and Policy Papers.

The consultant shall propose a step-by-step methodology following global TOD guiding principles that shall guide the preparation of the TOD corridor plan and detailed TOD Station Area Plans. The methodology proposed shall be aligned with (i) principles used in the preparation of the Nairobi Railway City master plan, (ii) relevant planning laws and regulations in Kenya as assessed previously, (iii) international best practice,*6* and (iv) local real estate market characteristics and trends. The methodology shall incorporate low carbon development and disaster risk management principles to mitigate relevant risks including flooding, and shall incorporate findings and recommendations from ongoing flood and heat vulnerability assessments for the commuter rail.

4.4.2 Preparation of a Nairobi Central Station-Thika Corridor TOD Plan

In close collaboration with the relevant stakeholders identified in task 4.4.1, the consultant shall prepare the Nairobi Central Station-Thika Corridor TOD plan, for a 10-year planning period, at a scale of 1:5,000. An area of 1km on both sides of the railway line will be

6 The consultant may refer to among others, ToD manuals, including the one published by the World Bank, TOD IMPLEMENTATION RESOURCES & TOOLS SUPPORTED BY GLOBAL PLATFORM FOR SUSTAINABLE CITIES *https://www.thegpsc.org/sites/gpsc/files/todknowdoc/0_introduction_0.pdf*

considered as the planning area, that would ensure concurrence between specific detailed station areas TOD plans prepared under task 4.4.3, but also ensure complementarity in developments and inter-modal connectivity between commuter stations as a network of transit-oriented spaces.

The TOD Corridor Plan shall follow the methodology prepared in task 4.4.1 and be in accordance to existing planning and mobility legal frameworks, and aligned to existing plans including the Nairobi Metropolitan Spatial Plan, the Nairobi Integrated Urban Mobility Plan (under preparation), the Nairobi Integrated Urban Development Master Plan (NIUPLAN) and Kiambu County Spatial Plan. The TOD Corridor Plan shall identify options for enhancing non-motorized transport along the corridor.

The TOD Corridor Plan shall consist of, but not limited to, a phased implementation plan, and implementation framework and a monitoring and evaluation framework, as significant components of the plan.

4.4.3 Preparation of TOD Station Area Plans for Nairobi Central Station-Thika Corridor

The Government of Kenya prepared 11 conceptual land use plans along the Nairobi-Thika Line[7] under the Interdisciplinary Land-Use and Transport Metropolitan Analysis within the Nairobi Metropolitan Region study (ILUT, 2016). The Government has also supported the preparation and approval of a comprehensive ToD Plan for the Nairobi Central Railway City that is currently under implementation.

The Consultant shall prepare detailed TOD station area plans for a planning area of within 1km radius from the commuter station, while considering access to station for the catchment area of 3km radius. The plans shall be prepared for a 10-year planning period, at a scale of 1:2,500. The TOD station area plans shall be prepared in accordance with the Corridor TOD Plan prepared under section 4.4.2 and aligned to the overarching land use planning laws and regulations and County land use plans including NIUPLAN and

[7] Thika, Juja, Ruiru, Kahawa, Githurai, Mwiki, Dandora, Kariobangi South, Umoja, Makadara and Kenyatta University stations. A total of 31 conceptual plans were prepared for the whole NMA commuter railway network, at 1 km radius from the commuter station /halt. These conceptual plans provided guidance under the program in determining accessibility infrastructure needs to the commuter stations and population and land use characterization.

the Kiambu County Spatial Plan. The TOD Station Area Plans should also consider the results of the assessment under section 4.3.12 on Station and Station Accessibility.

The scope shall include:

i) Review ten (10) ILUT conceptual station area plans,*8* and update them to detailed TOD Station Area Plans in accordance with the overarching legal and regulatory frameworks and existing planning instruments.

ii) Prepare the detailed TOD Station Area Plan for Makadara that shall align to existing development and land use plans including Eastlands Redevelopment Plan, NIUPLAN, ongoing and proposed affordable housing developments in the area, and Makadara ILUT Concept Plan; and align with any planned or ongoing KRC activities or plans for the station including the KRC Makadara Logistics/Commercial Plan, investments proposed in the Kenya Threshold Program, and proposed KRC freight marshalling area and workshop as proposed in the Commuter Railway Master Plan.

iii) Prepare additional detailed TOD Station Area Plans for the remaining station areas (8 stations as per master plan including KPCU, Maili Saba, Bridge, Gitambaya, Kalimoni, Juja, Thika East and Thika South) and any additional new stations proposed based on the results of assessment undertaken under Task 3, on Station and Station Area Development.

4.4.4 Stakeholder Consultation workshop for TOD Corridor Plan and TOD Station Area Plans

As part of the overall project stakeholder engagement plan developed under Task 1, the following workshops shall be organized as part of the process in development of outputs under this Task 4:

a) Nairobi Central – Thika TOD corridor plan: at least 3 stakeholder engagement workshops to be undertaken at visioning, presentation of draft corridor plan and at validation of final plan. The consultant shall propose a methodology that integrates stakeholders from Nairobi and Kiambu Counties in the planning process.

8 Thika, Juja, Ruiru, Kahawa, Githurai, Mwiki, Dandora, Kariobangi South, Umoja, and Kenyatta University stations

b) Station area TOD plans: at least 3 Stakeholder engagement workshops shall be undertaken at the three stages: visioning, draft plan, and validation of final plan for each station area plan. The consultant may propose an effective approach to undertaking the workshops, without compromising the level of stakeholder engagement in the preparation process in alignment with Physical and Land Use Planning Act (PLUPA).
c) The Consultant shall provide technical support if needed to the Nairobi and Kiambu County Governments towards publishing of the relevant gazette notices during the plan preparation processes as proscribed in the PLUPA and local physical and land use development plan regulations of 2021.
d) The stakeholder consultation reports shall be attached as annexes to the respective plans and reports

4.4.5 Task 4 Outputs

1. Methodological note for development of TOD plans under KUMIP (Task 4.4.1),: the note shall contain the findings and recommendations of the assessment and the proposed Methodology.
2. Nairobi Central - Thika Corridor TOD Plan (Task 4.4.2), shall be packaged as a singular report. The Government shall be responsible for subjecting the corridor plan through the approval processes, to ensure its approval.
3. Detailed TOD Station Area Plans (task 4.4.3) shall be consolidated into one compendium, with each plan having its own section in the compendium. The Government shall be responsible for subjecting the individual plans through the required approval process.

4.5 Task 5: Development of the Operating Concept

4.5.1 Development of Nominal Train Schedule

The Consultant shall prepare Nominal Train Schedules for the current and traffic forecasts determined in Task 2 for peak and off-peak commuter demand during weekdays, weekends and public holidays. Headways must be optimised for traffic density given the safe commuter flows to en-train and de-train at major stations, mini stations and halts

along the route. The train schedule must also allow for trains to be replenished, cleaned, maintained and staged otherwise at specific locations to be agreed with KRC. On-track maintenance slots and slots for freight trains must be provided for in the train schedules.

4.5.2 Development of Nominal Train Configurations

To optimize rolling stock, multipe unit (MU) train configurations must be standardized in longer peak-hour and shorter off-peak, weekend and public holidays train lengths (for example, dependent on the traffic density and headways, if 8-car peak-hour trains are optimal, then 4-car off-peak, weekend and public holidays trains are probable).

4.5.3 Development of Train Movement Control up to Jam Capacity

Given the Nominal Train Schedules developed in this Task 3, the Consultant must determine: i) the Jam Capacity of the current network layout; and ii) the optimal Train Movement Control approach, including deciding on: i) fixed-block track allocation for trains based on the maximum train length while considering some of the NCR track will be shared with long freight trains, ii) simple moving-block track allocation for trains also considering some of the NCR track will be shared with long freight trains, or iii) flexible-length moving-block track allocation for trains addressing dynamical capacity allocation. If the Consultant has determined that Jam Capacity is reached at some time in the future given the Traffic Forecast, the Consultant must include a section on how and when the network should be augmented accordingly.

4.5.4 Development of Commuter Flow Control at Stations

Given the Traffic Forecasts determined in Task 2, and the Assessment Report in Task 3, the Consultant must develop the optimal Commuter Flow Control for the major stations, minor stations and halts to ensure safe en-training and de-training. Due consideration must be given to the impact of the vehicle gauges on the platform-train interface.

4.5.5 Develop the Business Continuity solution

The Consultant shall assess the NCR operating risks and develop a heat map. The Consultant shall develop risk mitigations measures for the all likely with severity risks.

4.5.6 Consultation workshop for Operating Concept

The Consultant shall consult with PIT members on the Operating Concept, and incorporate PIT members' comments on the output. The Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the Nominal Train Schedule, Nominal Train Configurations, proposed Train Movement Control, the Jam Capacity, the optimal Commuter Flow Control.

4.5.7 Task 5 Outputs

The Consultant shall report the findings of Task 5 in an Operating Concept Report with all current and future train schedules, rolling stock configurations, and risk heat matrices contained in annexures.

4.6 Task 6: Generation of the Preferred Option and Preliminary Design (FEED/Basic Engineering)

4.6.1 Establishment of the Commuter Rail Design Standards

The Consultant shall carry out a review of existing standards (local and international) and recommend an appropriate set of standards for use on the NCR network. These standards shall cover permanent way, signaling and communications systems, automatic fare collection system, rolling stock and equipment. Such standards shall be discussed and agreed with KRC.

4.6.2 Generation of Design Options

Based on the service requirements of the NCR developed in Task 5 and the design standards established in this Task 5, the consultant shall analyze at least 2 design options for the NCR and rank them using a multi-criteria analysis (MCA) that includes considerations of technical suitability, environmental and other relevant concerns, and high-level financial and economic feasibility. Financial and economic analysis to be prepared only for the selected design option after the alternative analysis for the preliminary design option. The Consultant shall consult and agree with KR on criteria and weight of each criterion for MCA.

4.6.3 Preparation of preliminary designs

The Consultant shall prepare preliminary designs for the design options ranking (1-3), for the works to upgrade the permanent way, signaling and communications systems, rolling stock and equipment. The designs for the section from Nairobi Central Station to Thika shall be prioritized in time and effort.

4.6.4 Determination of Cost Estimates

Applying the design options selected the Consultant shall prepare cost estimates for the permanent way, signaling and communications systems, rolling stock and equipment required to upgrade the NCR network as well as the stations, associated access roads and station area development and TOD investments in prioritized stations.

Consultation workshop for the Preliminary Designs

The Consultant shall consult with PIT members on the Preliminary Designs, and incorporate PIT members' comments on the output. The Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the Design Standards, the MCA and the Preliminary Designs.

Upon receipt and incorporation of comments from the client, the Consultant shall carry out final preliminary design (FEED/ Basic Engineering):

i) NCR network and associated facilities (operations, track infrastructure and signaling and communications systems);
ii) Access roads and Station area development; and
iii) Implementation of TOD plans (only the Nairobi Central - Ruiru - Thika line).
iv) Rolling stock.
v) Makadara workshop and ather associated facilities.
vi) Preparation of bidding documents for buying the first phase of trainsets subject toe the outcome of the Battery Electric Multiple Unit (BEMU) study.

4.6.5 Task 6 Outputs

The Consultant shall report the findings of Task 6 in a Preliminary Design Report with all the design standards, the MCA and the preliminary designs contained in annexures.

4.7 TASK 7: Financial and Economic Analysis of the Preferred Options

The Consultant shall conduct economic analysis of the preliminary design option developed in sub task 4.6.3. This would include *inter alia* time savings, reduced road deterioration, accident cost reductions, reduction in maintenance costs, and reductions in other environmental and social externalities. The analysis shall include:

- Determination of the economic internal rate of return (EIRR) and the net present value (NPV) for all identified alternatives, compared to a defined “do-minimum” alternative;
- All economic costs and benefits should be shadow-priced, as appropriate, to reflect local conditions, e.g. labour costs, value of freight time, vehicle costs, fuel subsidy, taxes and levies, etc. Growth in the real value of time and value of life should be included in the analysis;
- The economic appraisal should include, where appropriate, the costs associated with any necessary expropriation of land and property. Economic analysis should include the Greenhouse Gas Accounting and Shadow Price of Carbon as per the World Bank Guidance note which will be provided to the Consultant. The Consultant should ensure that they secure adequate information on prevailing compensation rates for land and the different types of buildings in the region;
- As part of value engineering, alternative design standards, different alignments, different reconstruction, rehabilitation and upgrading options, different levels of service and service modalities, and staged implementation should be investigated, taking into consideration capital and recurrent costs and relevant economic and financial rates of return;
- The Consultant is expected to undertake sensitivity and formal risk analyses (explaining clearly the analysis for an educated non-technical audience) on the parameters that are estimated with the greatest uncertainty, e.g. traffic and travel time forecasts, cost estimate etc. The Consultant is also expected to calculate the switching values of critical parameters;
- The economic analysis should be prepared such that the return on investment from individual lines as well as entire network is determined;

- The economic analysis should include Station area investments following TOD plans and,
- Use a multi-criteria methodology to prioritize the development of the various lines of the NCR.
- Station area investments following TOD plans should be analyzed.

4.7.1 Economic Feasibility Analysis

The Consultant shall incorporate the comments on the preliminary design and conduct economic analysis.

4.7.2 Financial Sustainability Analysis

The consultant shall incorporate the comments on the preliminary design and carry out a financial analysis of the designed NCR to establish its future financial sustainability.

Task 6 shall cover the entire NCR network with specific priority given to fast tracking the designs for the Nairobi Central - Ruiru - Thika line which is earmarked for implementation with the available funding from the World Bank.

4.7.3 Preparation of a Feasibility Study Report

The Consultant shall prepare a Feasibility Study report including the preliminary design options and economic analysis of the options.

4.7.4 Consultation Workshop for the Financial and Economic Analysis

The Consultant shall consult with Project Implementation Team [9] members on the Financial and Economic Analysis, and incorporate PIT members' comments on the output. The Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the outcome of Financial and Economic Analysis.

4.7.5 Task 7 Outputs

The Consultant shall prepare a Feasibility Study Report together with the financial and economic analysis tables contained in annexures.

[9] Project Implementation team comprises of KRC-KUMIP team, and representatives of key stakeholders.

4.8 Task 8: Undertake environment, job creation assessment,social and gender impact study based on various options

The Consultant shall undertake a scoping study of the expected environmental, Job creation Assessment, social and gender impacts of the proposed NCR service and the defined investments, in a manner consistent with the World Bank Guidelines for Environmental and Social Framework and relevant laws of Kenya. The screening should provide a definition of the scale and type of project; identify valued ecosystem components (VECs) in the study area; establish the general nature and magnitude of the potential impacts. VECs are defined here as the social and environmental components of value in the project area (for whatever reason). These can be ecological, social, economic, or cultural. Some examples might be a watershed, key species, potable water supply, historical area, population center, or an air shed.

The Consultant shall suggest potential mitigation measures for addressing environmental, social and gender impacts and estimate their cost.

The Consultant shall ensure that the design is to detail to incorporate toilet facilities, ease of station and platform access as well as setting aside a sitting area for vulnerable groups (people with disability, the elderly, pregnant mothers etc.) within the train including any other such facilities for ease of movement and use of the station. Additionally, the station design and or reorganization should allow ease of use for nursing mothers on transit. Finally, the design should allow for signage requirements for areas and sections set aside for PWDs and vulnerable groups.

This task will run concurrently with the preliminary design and the outcomes will be incorporated in the feasibility study.

4.9 Task 9: Assessment and integration of universal access in design

The consultant shall conduct a needs assessment for universal access design in the commuter rail project outline a systematic approach to identify and address the accessibility requirements of diverse passenger groups. This assessment aims to comprehensively evaluate the current state of accessibility within the commuter rail system, encompassing both station infrastructure and onboard facilities.

Key components of the assessment include:

- Identification of Stakeholders: Engaging with relevant stakeholders, including individuals with disabilities, elderly passengers, advocacy groups, and transportation authorities, to understand their needs, preferences, and challenges related to rail travel.
- Data Collection and Analysis: Utilizing a combination of qualitative and quantitative methods to gather information on passenger demographics, travel patterns, and accessibility barriers at stations and on trains.
- Evaluation of Infrastructure: Assessing the physical infrastructure of rail stations, platforms, entrances, exits, ticketing areas, restrooms, and other facilities to identify areas for improvement in terms of accessibility features such as ramps, elevators, tactile paving, and signage.
- Onboard Facilities: Reviewing the design and layout of trains, including seating arrangements, priority seating for passengers with disabilities, wheelchair spaces, and accessibility features in restrooms.
- Information and Communication: Examining the availability and effectiveness of accessible information and communication tools, including signage, announcements, digital displays, and ticketing systems.

Recommendations: Developing actionable recommendations and design guidelines for enhancing universal access throughout the commuter rail system, prioritizing measures that address identified barriers and improve the overall passenger experience

4.9.1 Consultation Workshop for the environmental social and gender impact study

The Consultant shall consult with Project Implementation Team[10] members on the environmental social and gender impact study, and incorporate PIT members' comments on the output. The Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the outcome of the environmental social and gender impact study.

4.9.2 Task 9 Outputs

The Consultant shall prepare an Environmental Social and Gender Impact Study Report together with the records of engagements contained in annexures.

[10] Project Implementation team comprises of KRC-KUMIP team, and representatives of key stakeholders.

4.10 Task 10: Prepare detailed engineering design (FEL-3 Project Definition / FEED (Basic Engineering) to 85% cost accuracy) for the optimal option.

The Consultant, shall prepare detailed designs for the optimal design option for the works to upgrade the permanent way, signaling and communications systems, rolling stock and equipment. The designs for the section from Nairobi Central Station to Thika shall be prioritized in time and effort.

4.10.1 Determination of Cost Estimates

Upon completion of detailed design, the Consultant shall prepare cost estimates for the permanent way, signaling and communications systems, rolling stock and equipment required to upgrade the NCR network as well as the stations, associated access roads and station area development and Transit Oriented Development investments in prioritized stations.

4.10.2 Consultation workshop for the Detailed Designs

The Consultant shall consult with PIT members on the Detailed Designs, and incorporate PIT members' comments on the output. Upon receipt and incorporation of comments from the client, the Consultant shall carry out final detailed design for:

i) NCR network and associated facilities (operations, track infrastructure and signaling and communications systems);
ii) Access roads and Station area development; and
iii) Implementation of Transit Oriented Development plans (only the Nairobi Central - Ruiru - Thika line).
iv) Rolling stock.
v) Makadara workshop and other associated facilities.
vi) Preparation of bidding documents for buying the first phase of trainsets subject to the outcome of the Battery Electric Multiple Unit (BEMU) study.

The Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the Final Detailed Design Report (FEL-3 Project Definition / FEED (Basic Engineering) to 85% cost accuracy).

4.10.3 Task 10 Outputs

The Consultant shall report the findings of this Task 9 in a Detailed Design Report FEL-3 Project Definition / FEED (Basic Engineering) to 85% cost accuracy) together with the drawings and cost estimates contained in annexures.

4.11 Task 11: Prepare the client's Engineering Requirement and draft the Bidding Documents.

The Consultant shall prepare the engineering requirement and draft the bidding documents design-build under the FIDIC Yellow Book form of contract.

4.11.1 Determine the preferred Procurement Process

The Consultant must assess the Government of Kenya and the World Bank procurement life cycle processes from Request for Information to Expression of Interest to Prequalification to Request for Proposal to Award of Preferred and Standby Bidders to Final Contract and Site Establishment. The Consultant must then recommend the preferred procurement process for the project.

4.11.2 Determine the Bid Packages

The Consultant must develop the suite of Bid Packages given the scope of work, the diversity and potential concurrency of tasks, the programme of projects funding strategy and other considerations.

4.11.3 Finalise the Engineering Requirement

The Consultant must develop the client's Engineering Requirement for each Bid Package and estimate the time and effort required to complete the works.

4.11.4 Consultation Workshop for the engineering requirement and bidding documents

The Consultant shall consult with PIT[11] members on the Engineering Requirement and Bidding Documents, and incorporate PIT members' comments on the output. The

[11] Project Implementation team comprises of KRC-KUMIP team, and representatives of key stakeholders.

Consultant shall support PIT (KRC/GoK) in organizing a consultation workshop to present the outcome of the drafted bid packages.

4.11.5 Task 11 Outputs

The Consultant shall submit the procurement-ready suite of Bid Packages detailing the procurement process, timelines, scope of work statements and engineering requirement, and providing the preliminary designs in annexures. Furthermore the Consultant shall prepare the overall programme of projects in accordance with the recognized project management principles described in the Project Management Institute's (PMI) Project Management Book of Knowledge (PMBOK) or the similar practice that is acceptable to the Government of Kenya, KRC and the World Bank.

4.12 Task 12: Investment programme

In line with the final design, the Consultant shall carry out draft business model and an investment programme for the NCR system.

The investment programme shall cover among others:

i) Rolling stock;
ii) Trip refurbishment, repair and maintenance workshop;
iii) Track upgrade;
iv) Signaling & communication system;
v) Access roads & station area improvement;
vi) TOD (only the Nairobi Central - Ruiru - Thika line); and
vii) Makadara workshop.

This task shall cover the entire NCR network with specific priority given to fast tracking the on the designs for the Nairobi Central - Ruiru - Thika line which is earmarked for implementation with the available funding from the World Bank.

4.12.1 Task 12 Outputs

The Consultant shall come up with the following outputs among others under Task 12:

i) Draft business model;
ii) Rolling investment programme;
iii) Workshop investment programme;
iv) Track upgrade programme;

v) Signaling and communication investment programme;
vi) Access roads and Station Area Improvement programme; and
vii) TOD investment programme;
viii) Station Area Investment Program.

4.13 Task 13: Prepare operations, security and safety plan

In line with the final designs, the Consultant shall provide technical support to KR in updating the existing operations, security and safety plan to incorporate enhanced schedules the upgraded system. The plan should adhere to the stringent safety requirements of the railways, align with the other train operations within the network as well as the requirements of the railway police division and the national security protocols.

4.13.1 Review and Update of Manuals/Rulebooks and Practices /Business Continuity Plan

The plan shall review the KR manuals and rulebooks to recommend updates and additional documentation required to adapt them to modern/new technologies such as modern signaling systems.

Review existing time schedules, crew management and train controlling practices and make recommendations for improvements, considering the enhanced schedules to be operated.

Review and make recommendations to update maintenance standards and practices considering the technologies that will be introduced by the NCR upgrade.

Review existing practices of occupational safety standards and update safety codes.

The Consultant shall define protocols and solutions to mitigate the risks identified for the Operating Concept in Task 5 .

In preparing this plan, the Consultant will conduct stakeholder engagements with:

i) The KR Operations Team;
ii) The KR Safety Team;
iii) The KR Security Team; and
iv) The Railway Police Division as well as the necessary wings of the Kenya National Police

The prepared plan will be aligned with global best practices.

4.13.2 Task 13 Output

Future operating concept of the NCR and recommendations to any changes and updates to manuals/rulebooks and practices.

4.14 Task 14: Undertake capacity building of KR and counterpart staff

The Consultant shall prepare and implement a robust capacity building program for Counterpart Staff (technical and non-technical) members throughout the study in consultation with KR.

Key areas for capacity development include among others, but not limited to:

- Six (6) Counterpart Staff for Railway Engineering Design including the relevant software for digital terrain modelling and alignment design;
- Six (6) Counterpart Staff for Railway operations design;
- Six (6) Counterpart Staff for Railway safety; and
- Thirty (30) Counterpart Staff for TOD planning, financing and implementation.

5 EXPECTED DELIVERABLES, PRELIMINARY TIMELINE AND PAYMENT SCHEDULE

The Consultant shall prepare and submit to the Kenya Railways the following deliverables and the payment shall be made in accordance with the schedule contained in *Table 1* below.

Table 1: Deliverables, Timeline and Payment Milestones

Deliverable	Time from Commencement date	Payment Milestones
Advance payment		5%
Inception report [Task 1]	1 Month	5%
Draft Feasibility Report comprising of: i. Traffic Forecast Report [Task 2]; ii. Assessment Report [Task 3];	7 Months	20%

Deliverable	Time from Commencement date	Payment Milestones
iii. Transit Oriented Development Potentials Report [Task 4]; iv. Operating Concept Report [Task 5]; v. Preliminary Design Report [Task 6]; vi. Financial and economic analysis of the preferred option [Task 7]; andEnvironment, Job creation, Social and Gender Impact Study Report [Task 8]		
Final Feasibility Study Report and Stakeholder Workshop. [Task 7]	8 Months	5%
Preliminary Design/FEED/Basic Engineering Report and Bidding documents for Nairobi – Ruiru – Thika line, access roads and TOD [Task 9 and Task 10]	11 Months	20%
Procurement-ready suite of Bid Packages detailing the procurement process, timelines, scope of work statements and engineering requirement, and providing the preliminary designs in annexures. Overall programme of project [Task 11]	20 Months	30%
Investment Programme [Task 12] : i. NCR network including station areas; ii. Access roads; and iii. Transit Oriented Development	22 Months	3%
Operations, Security and Safety Plan [Task 12]	23 Months	2%
Capacity building of counterpart staff [Task 14]	23 Months	5%
Verification of completion of project deliverables	24 Months	5%

General requirements for all reports include:

1. Reports will be provided in English.
2. All reports should be submitted in both hard and soft copies to the Client as five (5) hard cover bound copies and two (2) soft copies of all reports - one in editable format (specifically Microsoft's doc, xls, ppt and OpenDesign Alliance's dwg) and one in Adobe's pdf. Hard copy reports will be provided in A4 format, except for

drawings and other documents which will be in the appropriate size approved by the client.

3. All data, spreadsheets, business model, engineering model, financial model and analysis undertaken will be submitted in modifiable version with English coding/language and will remain the property of the Client. Data includes any digitized databases generated from paper records, as well as summary databases or data files developed under this ToR, and used in producing final deliverable outputs, such as, but not limited to reports, tables, and visualizations. Data documentation should clearly describe the data and use corresponding variable labels. All values should include their source and any assumptions made regarding the value or how it enters the analysis; data and code/formula files based in application used for analysis (e.g., MS-Excel) should be provided.
4. All spatial data or maps shall be georeferenced and submitted as part of the planning reports in soft and hard copies, in the proscribed scales. Additionally, the consultant is expected to submit the spatial data as editable GIS files or any other formats as will be agreed with the client, upon final delivery of the outputs.

6 Contract Management / Reporting Arrangement

The client for this contract is Kenya Railways Corporation represented by the Managing Director. The consultants will report to the Project Manager appointed by the Client. A number of counterpart staff shall be stationed at the consultant's office for capacity building and knowledge transfer throughout the period of the assignment. The Consultant shall prepare and present monthly progress reports to the Project Manager. All reports and deliverables will be reviewed and approved by the PIT of KR and KUMIP project team including the steering committee, which composed of multiple agencies of national and local governments.

The Kenya Railways shall own all rights, title and interest, including all intellectual property rights, in and to any reports, document, computer software (in source code and object code form), or other deliverable (whether in hard-copy or digital files) created or

used under this assignment. The Team will provide additional soft copies of all calculation data in Microsoft Excel formats. For the avoidance of doubt, this will include all data used in the development of assignment tasks such that all analysis should be replicable after completion of the assignment without requiring any additional data sources.

6.1 Facilities and support to be provided by KRC

The client will provide liaison with the Government Ministries and Departments, County Governments, and all the relevant State Agencies.

The client will make available the documents at KRC relevant to the assignment where necessary and may facilitate obtaining documents outside KRC.

The Client will provide introductory letters to facilitate the consultant to obtain relevant information from outside authorities in connection with the assignment.

6.2 Facilities to be provided by the Consultant

The Consultant shall be responsible for arranging all necessary office and living accommodation and transportation for its staff and operations.

The Consultant shall be responsible for arranging all necessary office equipment and relevant software and any other technical requirements for the assignment.

6.3 Consultant Qualifications and Staffing Requirements

The consulting firm or consortium of firms undertaking this assignment shall demonstrate the following experience and qualifications:

The Consultant shall present evidence of assignments of size (USD 1.5 Million) relevant and completed in the last 10 years, both within the region and internationally.

Must demonstrate the ability of building capacity for absorption of least 20% of experts in the execution of the assignment.

The Consultant is responsible for proposing a senior and high-quality team appropriate for undertaking the assignment as envisaged in the Terms of Reference, to the required standard. It is expected that the team will include the following key staff, who should ideally be full-time employees of the consultant. The consultant shall justify the inclusion of the proposed staff based on these Terms of Reference.

Table 2: Required qualifications of Key Staff (All Key Staff should be fluent in written and spoken communication using the English language)

	Staff	Qualifications
1.	Team Leader	**Education:** • Master degree in Engineering/Transportation Engineering from an internationally recognized University. • Bachelor's degree in Engineering. **Experience:** • Experience in Railway Related Field: At least Fifteen (15) years relevant experience and 10 years railway related specific experience. • Experience in design and/or construction supervision for at least two large (procurement cost > USD 100 million) railway project under International Competitive Bidding (ICB) contract • At least two (2) experiences in leading a consultancy team in carrying out a feasibility study, detailed design and preparation of bidding documents for an urban commuter railway project as Team Leader or Deputy Team Leader **Professional Registration** • Must be a Professionally Chartered / Registered Engineer.. • The registration body must be Internationally recognized

	Staff	Qualifications
2.	Traffic Engineer	**Education:** • Bachelor in relevant course (Civil/Traffic/Transportation Engineering) • **Experience:** • Experience in traffic forecasting and analysis: ten (10) years or more • At least two (2) projects forecasting urban rail passenger demand and two(2) projects on urban traffic studies. **Professional Registration** • Must be a Professionally Chartered / Registered Engineer. The registration body must be internationally recognised.
3.	Track Infrastructure Expert	**Education:** • Bachelor in Civil Engineering or other relevant Engineering course. **Experience:** • Ten (10) years or more experience in design, construction, maintenance, and rehabilitation of railway track infrastructure. • Experience as track infrastructure expert in feasibility studies of two (2) railway projects of size > USD 50 million in construction cost **Professional Registration** • Must be a Registered Engineer with Engineers professional body of the country of origin. • Must be a Professionally Chartered / Registered Engineer. • The registration body must be internationally recognised.

	Staff	Qualifications
4.	Signalling & Telecommunications Expert	**Education:** Bachelor in Electrical and Communications Engineering, Electrical and Telecommunications Engineering or Mechatronics Engineering **Experience:** • Ten (10) years or more experience in design, installation, and maintenance of railway signaling and telecommunications systems. • Experience as signaling and telecommunications expert in feasibility studies of two (2) railway projects of size > USD 10 million in construction cost **Professional Registration** • Must be a Professionally Chartered / Registered Engineer. The registration body must be internationally recognised.
5.	Rolling stock Expert	**Education:** • Bachelor's degree in Mechanical Engineering/Electrical Engineering/Mechatronics Engineering or equivalent **Experience:** • Experience in procurement, operations and maintenance of railway passenger rolling stock: Ten (10) years or more • Experience as railway rolling stock expert in two (2) studies of railway passenger rolling stock of size > USD 30 million in cost **Professional Registration** • Must be a Professionally Chartered / Registered Engineer.

	Staff	Qualifications
		• The registration body must be internationally recognised.
6.	Transport Economist	**Education:** • Master's degree in Transportation Engineering or Economics, MCom or MBA. • Bachelor's degree in Economics/Civil Engineering. The Transport Economist does not have to be an Engineer. **Experience:** • Ten (10) years or more experience in economic analysis of transport investments: • Experience performing economic analysis for feasibility studies for two (2) railway projects of size > USD 30 million in construction/procurement cost
7.	Financial Analyst	**Education:** • Masters degree in Finance • Bachelor's degree in Finance **Experience:** • Ten (10) years or more experience in financial analysis of railways • Experience as financial analyst forecasting financial results in two (2) studies railway investments
8.	Environmental Specialist	**Education:** • Masters degree in environmental science • Bachelor degree in environmental science **Experience:** • Ten (10) years general experience in

	Staff	Qualifications
		environmental safeguards requirements for International Financial Institutions-funded projects • General Experience in environmental safeguards in at least two World Bank projects • Specific Experience in environmental issues in at least two (2) railway feasibility studies of large projects (size > USD 50 mil in construction cost) • Must be registered as a Lead Expert by National Environemtal Management Authority (NEMA)
9.	Social Specialist	**Education:** • Masters degree in Sociology/Anthropology • Bachelor degree in Sociology/Athropology **Experience:** • Ten (10) years general Experience in social safeguards requirements for for International Financial Institutions-funded project (IFI)-funded projects • General Experience in social safeguards in at least two World Bank projects • Specific Experience in social issues in at least two (2) transport feasibility studies of large projects (size > USD 50 million in Consultancy/construction cost)
10.	Roads Engineer	**Education:** • Bachelor degree in Civil/Highway Engineering **Experience:** • Fifteen (15) years or more experience in geometric and pavement design: fifteen (15) years or more • At least five (5) projects on feasibility studies

	Staff	Qualifications
		and design of urban roads. **Professional Registration** • Must be a Professionally Chartered / Registered Engineer. • The registration body must be internationally recognised.
11.	Engineering Surveyor	**Education:** • Bachelor degree in Surveying/Geomatics/Geospatial or equivalent **Experience:** • Experience in Engineering Survey: ten (10) years or more • At least two (2) projects on feasibility studies and design of urban transport systems. **Professional Registration** • Must be a Professionally Chartered / Registered/licenced Surveyor. • The registration body must be internationally recognised.
12.	TOD Specialist	**Education:** • Postgraduate degree in urban and regional planning or equivalent. • Bachelors degree in Planning/Land Economics/Real Estate/or equivalent **Experience:** • At least 10 years' experience in designing and structuring TOD projects • Familiarity with the real estate markets, zoning rules and other aspects of real estate development in Nairobi. **Professional Registration** • Must be a Professionally Chartered /

	Staff	Qualifications
		Registered/in relevant body • The registration body must be internationally recognised.
13.	Urban Planner	**Education:** • Postgraduate graduate degree in urban planning/urban management • Post graduate studies in transportation planning is an added advantage • Bachelors degree in urban planning/urban management or equivalent **Experience** • More than 7 years' experience in urban planning practice in Kenya **Professional Registration** • Must be a Professionally Chartered / Registered/in relevant body • The registration body must be internationally recognised..
14.	Architect	**Education:** • Bachelors degree Architecture or equivalent **Experience** • More than 10 years' experience in Architectural/Urban Design practice **Professional Registration** • Must be a Professionally Chartered / Registered/in relevant body • The registration body must be internationally recognised..
15.	Real Estate Specialist	**Education** • Postgraduate degree in any relevant course (e.g., Finance, Engineering, Architecture) • Bachelor's Degree in relevant field **Experience**

	Staff	Qualifications
		• 5-10 years' experience in undertaking real estate market analysis linked to transit systems in the region **Professional Registration** • Must be a Professionally Chartered / Registered/in relevant body • The registration body must be internationally recognised.
16.	Gender specialist	**Education** • Postgraduate degree in gender studies or any relevant course (e.g. Sociology, Anthropology) • Bachelors Degree in Gender Studies/Sociology/Anthropology or equivalent **Experience** • 5-10 years' experience in undertaking projects of a similar nature in a similar environment. **Professional Registration** • Must be a Professionally Chartered / Registered/in relevant body • The registration body must be internationally recognised.