



**KENYA RAILWAYS CORPORATION**

**KENYA URBAN MOBILITY IMPROVEMENT (KUMIP)**

**TERMS OF REFERENCE FOR INDIVIDUAL CONSULTANT - RAILWAY  
ELECTRICAL SYSTEMS ENGINEERING EXPERT**



**SEPTEMBER 2026**

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## Abbreviation

| Term  | Meaning                                                      |
|-------|--------------------------------------------------------------|
| AFCS  | Automated Fare Collection Systems                            |
| BEMU  | Battery Electric Multiple Units                              |
| CHMP  | Cultural Heritage Management Plan                            |
| ERP   | Enterprise Resource Planning                                 |
| ESS   | Environmental & Social Commitment Plan                       |
| ESIA  | Environmental & Social Impact Assessment                     |
| ESMF  | Environmental & Social Management Framework                  |
| ESS   | Environment and Social Safeguards                            |
| FEED  | Front-End Engineering Design also known as Basic Engineering |
| GOK   | Government of Kenya                                          |
| KR    | Kenya Railways                                               |
| KUMIP | Kenya Urban Mobility Improvement Project                     |
| LMP   | Labour Management Procedure                                  |
| MDBs  | Multilateral Development Banks                               |
| NCR   | Nairobi Commuter Railways                                    |
| NEMA  | National Environment Management Authority                    |
| PIT   | Project Implementation Team                                  |
| RAP   | Relocation Action Plan                                       |
| RPF   | Resettlement Policy Framework                                |
| SA    | Sexual Assessment                                            |
| SEA   | Sexual Exploitation & Abuse                                  |
| SHP   | Sexual Harassment Plan                                       |
| SRA   | Sexual Risk Assessment                                       |
| SEP   | Stakeholder Engagement Plan                                  |
| TA    | Technical Assistance                                         |
| TOD   | Transit Oriented Development                                 |

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## **Terms of Reference for Railway Electrical Systems Engineering Expert Consultant for support to The Kenya Urban Mobility Improvement Project (KUMIP)**

### **1 Background**

Kenya Railways (KR) is a State Corporation established in 1978 pursuant to the Kenya Railways Act, Cap 397 Laws of Kenya. It is mandated to develop an integrated rail network and provide rail and inland waterways t Kenya Railways (KR) is a State Corporation established in 1978 pursuant to the Kenya Railways Act, Cap 397 Laws of Kenya. It is mandated to develop an integrated rail network and provide rail and inland waterways transport services in the Country.

The Government of Kenya (GOK) has applied for financing from World Bank toward the cost of the Kenya Urban Mobility Improvement (KUMIP) and intends to apply part of the proceeds for consulting services.

The Kenya Urban Mobility Improvement Project (KUMIP) is a World Bank-financed project under preparation that aims to transform urban mobility in the Nairobi Metropolitan Area through the development of an integrated, financially sustainable and low-carbon public transport network. The project addresses the chronic underperformance of the Nairobi Commuter Rail network, a metre gauge railway spanning four lines radiating from Nairobi Central Station which currently operates at low frequency, with aging diesel rolling stock, degraded track and civil infrastructure, inadequate stations and minimal integration with other public transport modes. The project will involve the modernization of the Nairobi Central to Thika corridor comprising full track and civil infrastructure renewal including bridges, drainage and level crossing upgrades; station modernization with universal access, gender-informed safety design and intermodal interchange; procurement of rolling stock; traction electrification; signalling and telecommunications upgrade; operationalization of the Makadara depot; and deployment of an Integrated Automated Fare Collection System. The project will also support transit-oriented development planning and land-based financing at priority station areas along the corridor, and the institutional strengthening of Kenya Railways Corporation and other transport related authorities involved in the project.

KR has engaged a Consultant to carry out the Feasibility Study and Front-End Engineering Design (FEED)/Basic Engineering Design for the entire Nairobi Commuter Rail (NCR) network. The Consultant for FEED/Basic Engineering Design is expected to complete the feasibility study within 24 months of contract effectiveness, with priority given to the Nairobi-Thika Line (Line 2). Given the technical complexity and safety-critical nature of railway signalling, telecommunication, and electrical systems, KR requires specialized expertise to ensure that the feasibility study and FEED/Basic Engineering Design meet internal best practices, safety standards, and World Bank Environmental and Social Framework (ESF) requirements. The consultant

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will provide independent technical review, strategic advisory services, and ensure compliance with all applicable standards throughout the project lifecycle.

### **Current status and requirements**

The rehabilitation and revitalization of the Meter Gauge Railway network and anticipated increase in traffic, particularly in the Nairobi Commuter Railway network, requires modern, efficient and reliable electrical power systems. The project encompasses both conventional diesel-electric operations and future electrification scenarios including traction power systems for electric/hybrid trains. A grid assessment study shall be conducted for the Nairobi Central Station to Thika Line (Line 2).

#### **Electrical Infrastructure Needs:**

- Station power supply and distribution systems for passenger facilities, lighting, and ancillary services;
- Backup power systems (UPS and generators) for critical railway operations;
- Feasibility assessment and design of electric traction systems including overhead catenary systems (OCS) or third rail;
- Depot and workshop electrical systems including maintenance facility power supply and distribution;
- Electromagnetic compatibility management (EMC) particularly for signaling and telecommunication systems;
- Electrical safety systems and earthing/grounding infrastructure.

## **2 Objectives of the Assignment**

The specific objectives of this consultancy are to:

- Review and assess the proposals for the commuter railway network electrification including traction power supply systems and overhead catenary systems (OCS) or third rail options;
- Review station power distribution systems, lighting systems and backup power installations (UPS and generators) to support modern commuter rail operations;
- Review depot and workshop power distribution systems to support the maintenance of the diesel electric multiple units;
- Ensure electromagnetic compatibility (EMC) compliance and coordination with signalling and telecommunication systems;
- Verify electrical safety systems protection schemes, and earthing/grounding infrastructure design;
- Review and comment on electrical testing facilities and commissioning procedures for ongoing maintenance and system verification for ongoing maintenance and system verification.

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### **3 Scope of Services**

The individual consultant shall provide technical advisory services covering the following scope of work:

#### **3.1 Technical Support & Advisory Services**

- Advise PIT on electrification technologies, overhead catenary systems (OCS), third rail, and electrical supply and distribution architectures as requested.;
- Support interpretation and implementation of electrical system recommendations from feasibility studies and design reports;
- Provide technical guidance on rolling stock electrical specifications and compatibility with power supply infrastructure.
- Provide technical advisory services on railway electrical power systems engineering, traction power design and green mobility electrical infrastructure as requested
- Advise KRC on the utility supply interface for traction power — including review of the KPLC grid connection capacity assessment, supply agreement terms, available fault level, grid voltage stability and redundancy arrangements at the traction substation connection points
- Utility capacity assessment and interface with Kenya Power and Lighting Company on grid connection capacity and stability for traction loads, directly relevant given the concerns about grid reliability; traction power simulation and load flow analysis review,
- Critically review and assess the FEED consultant's substation sizing and spacing calculations; regenerative braking energy recovery assessment, relevant to the energy efficiency case and to substation sizing; and
- SIL assessment at the traction power and signaling interface which is a safety-critical boundary that neither the Electrical nor the signaling TOR currently addresses explicitly.

#### **3.2 Review of Feasibility Study Reports**

- Review Inception report with specific focus on electrical power system concepts, traction power feasibility, and baseline power demand assessment;
- Review Draft Feasibility Study including electrical load analysis, power supply options, electrification scenarios and infrastructure requirements;
- Review Final Feasibility Report with comprehensive evaluation of recommended electrical infrastructure options and lifecycle cost analysis;
- Review compliance with World Bank Environmental and Social Framework (ESF) requirements including electrical safety.

#### **3.3 Review of Front-End Engineering Design (FEED)/Basic Engineering Design**

- Review of traction power simulation results including load flow analysis, fault level calculations, voltage drop performance, power quality compliance and

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regenerative braking energy balance. Verify that substation sizing and spacing are supported by the simulation results;

- High level review of station electrical designs including power distribution, lighting systems (normal and emergency), public address systems power, and HVAC systems; depot and workshop electrical systems including maintenance facility power distribution and electrical testing equipment
- Review backup power systems including UPS installations and diesel generator sets for critical railway operations;
- Verify electrical safety systems including protection schemes, earthing/grounding and lightning protection;
- Review the FEED consultant's earthing and bonding design, stray current analysis and cathodic protection provisions for traction return current impact on third-party infrastructure along the corridor
- Review the traction return current and stray current design for EMC compliance and together with the Signalling expert responsible for reviewing the signalling system immunity to EMI from traction and external sources. Both experts shall jointly review and sign off on the overall EMC management plan.

### **3.4 Review of Bidding Documents**

- Review technical specifications for electrical systems to ensure compliance with international standards (IEC, IEEE, BS, CENELEC);
- Review requirements and performance specifications including power quality requirements, reliability targets and safety standards;
- Review electrical drawings, single-line diagrams, and technical documentation for accuracy and completeness;
- Review design-build documents under FIDIC Yellow/Silver Book provisions with specific attention to technical requirements, testing and commissioning procedures and acceptance criteria.

### **3.5 Standard, Regulations and Safety Compliance**

- Verify compliance with applicable Kenya's Energy Act and associated Regulations and Kenya Bureau of Standards (KEBS) requirement;
- Ensure adherence to international standards including the IEC 60xxx Series, IEEE standards, BS standards, and CENELEC railway electrical standards;
- Review electrical safety management including arc flash analysis, electrical protection coordination, and safety procedures;
- Verify compliance with World Bank Environmental and Social Framework (ESF) including electrical safety and occupational health requirements.

### **3.6 Rolling Stock Integration and Compatibility**

- Review rolling stock technical specifications to ensure compatibility with power supply infrastructure (voltage levels, current ratings, power quality);

- 
- Verify electromagnetic compatibility between rolling stock and wayside electrical/electronic systems.

### **3.7 Capacity building and knowledge transfer**

- Support capacity building of PIT and KR electrical staff through mentoring, training sessions and knowledge transfer based on identified needs and agreed priorities.
- Provide guidance on establishing electrical maintenance procedures, testing protocols, and safety.

## **4 Outputs, Deliverables and reporting requirements**

The individual consultant shall prepare and submit the following deliverables:

### **4.1 Monthly Progress Reports**

Submit monthly progress reports containing summary of activities, key technical issues identified, status of document reviews, work plan for the following month and risk register with mitigation measures.

### **4.2 Technical Review Reports**

Provide comprehensive technical review reports (within two weeks of receiving the documents for review) covering the following:

- Review of Inception Report-electrical power system concept review, load analysis baseline;
- Review of Draft Feasibility report- electrification options assessment, power quality analysis and safety verification;
- Review Final Feasibility Report- comprehensive electrical infrastructure evaluation;
- Review of FEED/Basic Engineering Design- detailed design reviews covering all electrical systems components;
- Review of Bidding Documents- comprehensive review of electrical specifications and requirements.

Each technical review report shall include executive summary, detailed technical findings, compliance assessment, risk identification, and actionable recommendations with priority classification (critical/major/minor). The Consultant will facilitate technical discussions with KR, document resolutions, and participate in meetings with the FEED/Basic Engineering Design Consultant when requested by KRC

### **4.3 Adhoc technical Memoranda**

Prepare technical memoranda as required addressing specific electrical queries, design clarifications, standard interpretations and emerging technical issues. Response time for urgent technical queries shall be mutually agreed with KRC.

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#### **4.4 Capacity building and knowledge transfer**

A key objective of this assignment is to strengthen the technical capacity of Kenya Railways staff in railway electrical systems.

The consultant shall conduct training workshops covering modern electrical technologies, traction power systems, electrical safety and power systems analysis. Prepare and submit a comprehensive training report with the training materials, technical guidance notes, and knowledge management recommendations.

#### **4.5 Final Assignment Completion Report**

Submit a comprehensive final assignment completion report containing the executive summary, summary of all technical reviews, assessment of design consultant performance, performance metrics achieved, recommendations for implementation phase and capacity building recommendations.

### **5 Duration and Location of Assignment**

#### **5.1 Assignment Duration**

The total Level of Effort (LoE) shall be 12 person-months over a period of 24 months coinciding with the duration of the feasibility study and FEED/Basic Engineering Design phase.

The Consultant's inputs shall be intermittent and aligned with project requirements. The Consultant will undertake tasks as agreed with the Client, each assigned an indicative number of person-days prior to commencement. These person-days may be adjusted through prior consultation and mutual agreement between the Consultant and the Client.

#### **5.2 The Consultant shall not exceed the agreed LoE without prior written approval from the Client. Mode of Engagement**

The engagement will be structured as a hybrid arrangement with flexibility to accommodate project requirements. The Consultant is expected to provide intermittent inputs aligned with key project milestones including document review periods, design workshops, and technical meetings. Time inputs may be non-continuous and will be adjusted based on project progress and deliverable submission schedules from the design consultant

#### **5.3 Assignment location**

The in-country assignment will be primarily based in Nairobi, Kenya, at Kenya Railways offices. Periodic site visits to the Nairobi-Thika rail corridor and associated project sites will be required. Remote working arrangements may be accommodated for specific tasks such as document reviews, per agreement with the Client and ensuring effective communication and responsiveness.

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## **6 Minimum Requirements for Consultant's Qualification and Experience**

### **6.1 Academic Qualifications**

- Bachelor's degree in Electrical Engineering, Power Systems Engineering, Railway Systems Engineering or equivalent from a recognized institution of higher learning.

### **6.2 Professional Registration**

- Registered Professional Engineer with an internationally or nationally recognized engineering body; registration with the Engineers Board of Kenya or willingness to obtain temporary registration is desirable.

### **6.3 General Professional Experience**

- Minimum of 10 years of progressively responsible professional experience in electrical power systems engineering.

### **6.4 Specific Experience Requirements**

- At least 7 years of specialized experience in railway electrical systems design, specification, implementation, testing, and commissioning;
- Demonstrated experience with railway traction power systems including overhead catenary system (OCS), third rail systems, or onboard energy storage systems;
- Proven experience in electrical power distribution systems, backup power systems (UPS and generators), and electrical safety systems;
- Demonstrated personal responsibility for system-level technical review of railway electrical infrastructure including traction power systems on at least one railway modernization programme.
- Experience with EMC analysis and mitigation in railway environments;
- Experience in electrical testing facilities, commissioning procedures and quality assurance for electrical systems.

### **6.5 Knowledge of standards and regulations**

- Comprehensive knowledge of international electrical standards including IEC 60xxx series, IEEE standards, BS standards, and CENELEC railway standards or equivalent;
- Familiarity with electrical safety standards, arc flash analysis, and protection coordination studies;
- Knowledge of World Bank Environmental and Social Framework (ESF) requirements applicable to railway electrical infrastructure.

### **6.6 Technical Competences and Skills**

- Proven track record in electrical design review, technical specification development, and quality assurance;

- 
- Expertise in power systems analysis including load flow, short circuit, and protection coordination studies;
  - Proficiency with electrical design software tools;
  - Strong analytical skills for identifying electrical risks and developing mitigation strategies;
  - Demonstrated ability to challenge design assumptions and provide constructive technical critiques to design consultants;
  - Understanding of contract administration for design-build contracts (FIDIC Yellow Book or equivalent).

#### **6.7 Communication and interpersonal skills**

- Exceptional written and oral communication skills in English with ability to prepare clear, concise technical reports and present complex technical information to diverse audiences;
- Strong interpersonal skills with demonstrated ability to work collaboratively with multidisciplinary teams, government agencies, and international consultants;
- Ability to provide mentoring and capacity building support to client staff;
- Demonstrated leadership and sound judgment in technical decision-making.

#### **6.8 Desirable additional experience**

- Experience working in sub-Saharan Africa railway projects;
- Professional certifications in power systems or electrical safety;
- Experience with World Bank or other multilateral development bank (MDB) financed projects.

### **7 Reporting**

#### **7.1 Reporting structure**

The Individual Consultant shall report directly to the Project Team Leader of the Kenya Railways Project Implementation Team (PIT). The reporting structure is designed to ensure effective coordination, timely decision-making and clear accountability throughout the assignment.

#### **7.2 Working Relationships**

The Consultant will work closely with and interface with KR PIT, FEED/Basic Engineering Design Consultant, KR Operations and Engineering and Technical Services Department, World Bank task team and other project consultants as required.

#### **7.3 Coordination mechanisms**

- Bi-weekly technical coordination meetings with FEED consultant during active design periods;
- Regular joint inter-expert coordination sessions chaired by the PIT Team Leader.

- The expert is required to coordinate with the other individual technical experts involved in the project on a more frequent basis as needed.
- Monthly progress meetings with PIT senior management;
- Ad-hoc technical workshops and review sessions as required by project milestones.

## 8 Payment Schedule

### 8.1 Payment Basis;

Payments shall be made monthly based on actual person-days worked, supported by invoices and certified timesheets approved by the Project Team Leader.

### 8.2 Payment Frequency;

Payments shall be made monthly, subject to submission and approval of timesheets and brief progress reports.

### 8.3 Contract Ceiling;

The total payments shall not exceed the ceiling corresponding to twelve (12) person-months (264 person-days)

### 8.4 Approval of Payments;

All payments shall be subject to approval by the Project Team Leader.

### 8.5 Reimbursable Expenses;

Reimbursable expenses shall be limited to pre-approved travel and subsistence costs and shall be reimbursed at actual cost upon submission of supporting documentation.

### 8.6 Estimated Time-Input

Payments shall not be tied to deliverables but to approved time input.

**Table 1: Indicative Level of Effort Allocation**

| Item | Activity          | Activity Description                                                                                                                                                     | Output / Deliverable                                                | Estimated Expert Input Duration (Person-Months) |
|------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------|
| 1    | Inception Phase   | Review and familiarization with all relevant project documents, contracts, and feasibility study inception report and any other technical support related to the project | Expert's Inception Report and comments as applicable                | 1                                               |
| 2.1  | Feasibility Study | Review of Draft Feasibility Reports (as per Section 3(vii)) and any other                                                                                                | Review Report on Draft Feasibility Study and comments as applicable | 1                                               |

| Item | Activity                                         | Activity Description                                                                                                                                                                      | Output / Deliverable                                                                                                 | Estimated Expert Input Duration (Person-Months) |
|------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
|      |                                                  | technical support related to the project                                                                                                                                                  |                                                                                                                      |                                                 |
| 2.2  | Feasibility Study                                | Review of Final Feasibility Reports (as per Section 3(vii))                                                                                                                               | Review Report on Final Feasibility Study                                                                             | 1                                               |
| 3    | FEED / Basic Engineering Design (Corridor Level) | Review of Designs / FEED / Basic Engineering Reports and Bid Documents for Nairobi–Ruiru–Thika Line, Access Roads, and TOD and any other technical support related to the project         | Review Report on FEED / Basic Engineering Designs and Bid Documents (Nairobi–Ruiru–Thika) and comments as applicable | 2                                               |
| 4.1  | Network-Wide FEED Review                         | Review of Interim Design / FEED / Basic Engineering Report for Entire Commuter Rail Network, Access Roads, and TOD and any other technical support related to the project                 | Review Report on Interim FEED and comments as applicable                                                             | 1                                               |
| 4.2  | Network-Wide FEED Review                         | Review of Draft Final Design / FEED / Basic Engineering Report for Entire Commuter Rail Network, Access Roads, and TOD and any other technical support related to the project             | Comments and Review Report on Draft Final FEED and comments as applicable                                            | 2                                               |
| 4.3  | Network-Wide FEED Review                         | Review of Final Design / FEED / Basic Engineering Report and Bid Documents for Entire Commuter Rail Network, Access Roads, and TOD and any other technical support related to the project | Comments and Review Report on Final FEED and Bid Documents and comments as applicable                                | 1                                               |
| 5    | Investment Program                               | Review of Investment Program for NCR Network, Station Areas, Access Roads, and Transit-Oriented Development                                                                               | Review Report / Comments on Proposed Investment Program and comments as applicable                                   | 1                                               |
| 6    | Operations, Safety & Security                    | Review of Operations, Safety, and Security Plans and any other technical support related to the project                                                                                   | Review Report on Operations, Safety, and Security Plans and comments as applicable                                   | 1                                               |

| Item | Activity                       | Activity Description                                                                                                                                          | Output / Deliverable                                                    | Estimated Expert Input Duration (Person-Months) |
|------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------|
| 7    | Capacity Building & Completion | Input into Capacity Building Program for Counterpart Staff and Verification of Completion Deliverables and any other technical support related to the project | Capacity Building Review & Completion Report and comments as applicable | 1                                               |
|      | <b>Total</b>                   |                                                                                                                                                               |                                                                         | <b>12</b>                                       |

### 8.7 Withholding of Payments:

Payments may be withheld in case of unsatisfactory performance or missing reports.

### 8.8 Time Records and Audit;

Time records may be audited by KR and the World Bank.

### 8.9 Currency of Payment;

Payment shall be made in Kenya Shillings with a USD option for expatriate consultants.

## 9 Data, Services and Facilities

Kenya railways shall provide the Electrical Expert with access to: existing electrical infrastructure records and single-line diagrams; KPLC connection data and supply agreement; substation access for inspection; and the relevant outputs from FEED consultant study, office space, internet connectivity, meeting facilities, access to project information and data, site access, counterpart staff, and coordination with relevant agencies including utilities.

## 10 Obligations of the Consultant

### 10.1 Professional standards

The Consultant shall:

- Comply with Kenya Railways code of ethics

### 10.2 Resource provision

The Consultant shall:

- Provide all necessary resources including laptop computer, software licenses, technical reference materials, and professional subscriptions required to execute the assignment;
- Ensure availability and responsiveness throughout the assignment duration according to agreed time commitments

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### **10.3 Quality Assurance**

The Consultant shall:

- Ensure that all deliverables meet contractual requirements and professional quality standards;
- Conduct thorough self-review and quality checks before submission of reports and technical documents;
- Ensure technical outputs are consistent with contractual requirements, professional standards, legal frameworks, and international best practices;
- Respond to Client comments and revise deliverables as required within agreed timelines.

### **10.4 Communication and coordination**

The Consultant shall:

- Maintain regular communication with the Project Team Leader and report on assignment progress;
- Immediately notify the Client of any issues that may affect deliverable quality, schedule, or budget;
- Participate in coordination meetings, technical workshops, and review sessions as scheduled;
- Maintain professional and constructive working relationships with all project stakeholders.

### **10.5 Confidentiality and Data Security**

The Consultant shall:

- Maintain strict confidentiality of all project information, data, and documents not in the public domain;
- Sign a Non-Disclosure Agreement (NDA) with Kenya Railways prior to commencement of services;
- Implement appropriate cybersecurity measures to protect sensitive project data, particularly information related to traction power studies, utility connection data, substation locations, power load data and other electrical security-sensitive infrastructure details)
- Not disclose, reproduce, or utilize confidential information for purposes other than this assignment without prior written consent from Kenya Railways;
- Return or securely dispose of all confidential documents and data upon completion of the assignment.

### **10.6 Health Safety and environment**

The Consultant shall:

- Comply with all applicable health, safety, and environmental regulations during site visits and field activities;

- 
- Use required personal protective equipment (PPE) and follow KR safety protocols when accessing operational railway infrastructure;
  - Report any safety incidents or near-misses immediately to the Project Team Leader

### **10.7 Conflict of Interest**

The Consultant shall:

- Disclose any actual or potential conflicts of interest that may arise during the assignment;
- Not have any business or financial relationships with the FEED consultant or potential bidders for the design-build contract;
- Maintain independence and avoid any activities that could compromise objectivity in technical reviews and recommendations.

### **10.8 Compliance with laws and regulations**

The Consultant shall comply with all applicable laws, regulations, and administrative requirements of the Republic of Kenya, as well as World Bank procurement and safeguards policies applicable to the assignment.