



BASIC TRAINING PLAN FOR GRADUATE ENGINEERS

Civil Engineering Discipline

EBK/CBA/GEIP/13

VERSION: A

REVISION: 01

	NAME	DESIGNATION	DATE	SIGNATURE
Approved by:				

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PREAMBLE

Foreword

It is with great pleasure that I present the Basic Training Plan developed by the Engineers Board of Kenya. This initiative marks a significant step in our commitment to professional growth of our graduate engineers in Kenya. The Engineers Act 2011 provides that graduate engineers must undergo training for three years before they can apply to be registered as professional engineers. This Training Plan (TP) serves as a critical tool in fulfilling this requirement, ensuring that our engineers are well-prepared to meet professional standards and excel in their careers.

The purpose of the TP is to provide graduate engineers, employers and mentors with a detailed guide on the scope and content of the training necessary for preparing graduate engineers for registration as professional engineers. The creation of this TP was a collaborative effort of experts from academia and industry who worked diligently to develop this plan, drawing on training plans from the State Department of Roads (SDoR) and the Kenya National Highways Authority (KeNHA). This collaborative approach ensures that our training plan is both rigorous and relevant to the needs of the industry.

This training plan aligns with the strategic intent of the EBK to register 10,000 professional engineers by 2027. By providing a clear and structured training pathway, we are not only enhancing the skills and capabilities of our engineers but also contributing to the national goal of increasing the number of qualified professionals in the engineering sector.

I extend my sincere gratitude to all those who contributed to the development of this plan. Your dedication and expertise have been instrumental in creating a valuable resource that will greatly benefit our graduate engineers and the engineering profession as a whole.



Eng. Margaret Ogai
Registrar/CEO
Engineers Board of Kenya

PREFACE

The practice of engineering is critically important in all sectors of the Kenyan. To ensure professionalism and upholding of ethical behavior in the engineering practice, the Government of Kenya and other keystakeholders have established various structures and institutions which are legally mandated to provide oversight and related services to all strategic players in the economy.

The Engineers Board of Kenya is a statutory body established under Section 3(1) of the Engineers Act, 2011. The Board is responsible for the registration of engineers and engineering firms, regulation of engineering professional services, setting of standards, development and general practice of engineering.

The Act allows only registered engineers to engage in professional engineering work and/or services. Registration is thus a license and the only way of ensuring that one is professionally qualified to practice engineering. To qualify for registration in the categories of professional engineer one must acquire adequate professional competence and experience in areas specified by the Board.

One of the functions of the Board is to promote and provide opportunities and facilities for the study of, and for professional training in engineering. Thus, in order to help graduate engineers acquire sufficient professional competence within a period of two years, the Board has conceived and designed a structured professional training programme known as the Graduate Engineers Internship Programme (GEIP).

The programme is designed to enable young graduates to gain hands-on professional experience under close supervision by senior registered professional members of the profession. Under the Programme trainee engineers will undergo professional training, following training guidelines specific to one's field of engineering practice and on non-technical areas. GEIP is, therefore, intended to ensure that trainee engineers are equipped to pursue their professional careers with precision and confidence thereby becoming competitive and able to effectively play their roles in national development. GEIP is a structured internship programme for engineers.

Purpose of the Training Plans

The TP aim to equip graduate engineers, employers, and mentors with a clear and detailed guide on the training required for preparing graduate engineers for registration as professional engineers. This plan outlines the essential areas of knowledge, practical skills, and professional competencies that graduate engineers need to develop during their three-year training period. By adhering to this structured approach, graduate engineers will gain the technical proficiency, hands-on experience, and professional judgment necessary to meet the rigorous standards of the engineering profession.

For employers and mentors, the TP serves as a valuable resource in designing and implementing effective training programs. It provides a comprehensive framework that details key training objectives, performance benchmarks, and assessment criteria, ensuring that the training is thorough and aligned with industry best practices. This guidance helps employers and mentors offer targeted support and mentorship, creating an environment where graduate engineers can develop and excel. By bridging the gap between academic knowledge and practical application, the TP ensures that graduate engineers are well-prepared to contribute significantly to their fields and progress toward becoming registered professional engineers.

Preparation of the Training Plans

The TP was developed through a collaborative effort involving a task force of experts from academia and industry. These professionals worked diligently to create a comprehensive and effective plan by leveraging successful training models from the SDoR and KeNHA.

This approach ensured that the TP is both rigorous and relevant to the industry's needs. The collective expertise and experience of the task force members contributed to a robust framework designed to meet the high standards required for professional engineering registration.

List of Training Plans

The Board has developed Training Plans in the following disciplines:

- a. Agricultural and Biosystems Engineering
- b. Mechanical Engineering
- c. Civil Engineering
 - i. Water,
 - ii. Building & Structures
 - iii. Highways
- d. Electrical Engineering

Acknowledgement

The Engineers Board of Kenya (EBK) sincerely thanks Eng. Samuel Maugo and Eng. Nelson Bosuben and Eng. Oscar Wafula for their invaluable contributions to developing the Training Plan for Civil Engineering. Their expertise, dedication, and collaborative efforts have been crucial in creating high-quality training plans that align with Board's mission to enhance engineering standards and practices in Kenya.

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ACRONYMS

EBK	Engineers Board of Kenya
GEIP	Graduate Engineers Internship Programme
OSHA	Occupational Safety and Health Act
TP	Training Plan



CHAPTER 1 – INTRODUCTION

1.1 Background

The Engineers Board of Kenya (EBK) is a statutory body established under Section 3(1) of the Engineers Act, 2011. The Board is responsible for the registration of engineers and engineering firms, regulation of engineering professional services, setting of standards, development and general practice of engineering.

According to Section 7(1)(o) of the Engineers Act 2011, the Board is mandated to ‘establish a school of engineering and provide facilities and opportunities for learning, professional exposure and skills acquisition. Section(1)(r) mandates the Board to collaborate with engineering training institutions, professional associations, engineering organizations and other relevant bodies in matters relating to training and professional development of engineers.

The Government of Kenya has developed Vision 2030 whose main objective is to turn Kenya into a globally competitive and prosperous nation with a high quality of life by the year 2030. Vision 2030 is anchored on three key pillars: Economic, Social and Political. Each pillar has a number of strategies designed to deliver different components of the Vision. Engineers are expected to play a key role in the delivery of the vision, especially in the realization of the necessary infrastructure, the industrialization process, and development of new technologies led by the ICT sector. All these activities will be key serving as a catalyst for wealth creation in ‘Kenya’s quest to become a middle-income country by 2030.

Professional registration is practiced by various countries around the world to primarily protect the safety, well-being and interests of the public. In Kenya, professional registration allows one to ‘offer his professional engineering services to the public for gain or reward or by way of trade or for employment in the engineering discipline or category in which he is registered. There is therefore need to provide structured training for graduate engineers to enable them gain the requisite training and experience before transitioning to professional engineers.

Graduate engineers are expected to have several desirable attributes that may be expressed in terms of:

- Technical competencies; and
- Non-technical competencies.

The technical competencies may be categorized into two distinct areas – the science of engineering, and the practice of engineering. The ‘science of engineering is the set of mathematical and scientific tools used to solve engineering problems, while the practice of engineering is the recognition and formulation of a problem and its solution.’ Mentorship in these two key areas will enable the graduate engineers to enter the job market with greater confidence and apply for professional status within the shortest time possible.

Consequently, the Board has developed the Training Plan (TP) to guide the process of structured of graduate engineers over a period of thirty-six months as required by the Engineers Rules 2019.

1.2 Objectives

The objectives of the BTP are to: -

- i) Provide structured training for the graduate engineers to enable them gain professional competencies in preparation for registration as professional engineers
- ii) Guide mentors and supervisors on areas of training for graduate engineers.
- iii) Facilitate job rotation by employers

1.3 Target users

This TP is expected to be used by graduate engineers and their supervisors and mentors in the discipline of Civil Engineering. It is intended to support a program of training and experience incorporating good practice elements.

This guide applies to persons who have:

- i) Completed the education requirements by obtaining an accredited BEng-type qualification, or a Washington-Accord recognized qualification or through evaluation/assessment;
- ii) Registered as Graduate Engineers by the Engineers Board of Kenya

1.4 Programme Duration

The programme shall be conducted over a period of not less than 36 months. The estimated periods through the training cycle shall be as indicated in the matrix below (Table 1)

Table 1: Estimated duration of the technical training cycle.

No	Description	Duration (months)
1.	Planning and studies	6
2.	Design	12
3.	Construction, Operation and Maintenance	12
4.	Management	6
TOTAL		36

CHAPTER 2 – COMPETENCY STANDARDS

2.1 Professional Competence

A professionally competent person has the attributes necessary to perform activities within the profession to the standards expected in professional employment or independent practice. The Board's Competency Standard gives insight into the elements of competency necessary for competent performance that the graduate engineer is expected to demonstrate in a holistic way at the stage of application for transitioning from graduate to professional registration.

To meet the minimum standard of competence, the graduate engineers must demonstrate that they are able to practice competently in their practice area to the standard expected of a reasonable Professional Engineer. The extent to which the person can perform each of the elements in their practice area will be taken into account in assessing whether or not they meet the overall standard.

2.2 Expected Outcomes

The desired outcomes of the engineering activities undertaken by the candidate are classified under four (4) categories:

- Category I: Engineering Problem Solving.
- Category II: Managing Engineering Activities.
- Category III: Evaluation of Impacts of Engineering Activities; and
- Category IV: Upholding Professional Practice.

2.3 Category I Outcomes: Engineering Problem-Solving

This group of outcomes requires the candidate to apply appropriate theoretical and practical methods to identify, analyze and solve engineering problems.

2.3.1 Outcome 1: Identification and Definition of an Engineering Problem

This outcome is concerned with the discerning, understanding, contextualizing and judgement of a problem. Engineering problems require in-depth, fundamental, and specialized engineering knowledge that facilitates an analytical approach from first principles.

Engineering problems should be high level problems that require judgement in decision-making in uncertain contexts and include components parts or sub problems and should demonstrate the inclusion of one or more of the following:

- Solutions to engineering problems that are not obvious and require abstract thinking or originality in analysis to formulate suitable models.
- Engineering problems that are outside the scope of standards and codes.
- Engineering problems that require information from a variety of sources that is complex, abstract or incomplete.

- Complex engineering problems that involve wide-ranging or conflicting issues such as technical and engineering issues and interested or affected parties.

The engineering problem may be:

- A design requirement,
- An applied research and development requirement
- A maintenance requirement or
- A problematic situation in an existing component, system or process.

2.3.2 Outcome 2: Design / Development of Engineering Solution

This Outcome 2 is concerned with the solution. The solution may be the design of a component, system or process or a recommendation of the remedy to a problematic situation. The design or developed solution will be evidenced by the following indicators: -

- Identified and analyzed design/ planning requirement and drawn up detailed requirements specification;
- Synthesized a range of potential solutions to problem or approaches to project execution;
- Evaluated the potential approaches against requirements and impacts outside requirements;
- Fully developed design of selected option; and
- Produced design documentation for implementation.

2.3.3 Outcome 3: Application of Advanced Knowledge

Outcome 3 involves the comprehension and application of advanced knowledge including principles underpinning good practice, specialist knowledge, jurisdictional knowledge and local knowledge. Applicable knowledge includes:

Specialist knowledge that has depth in the practice area and is underpinned by the fundamental knowledge of an engineering discipline or cross-disciplinary area. In-depth specialist knowledge in the practice area supports a fundamentals-based, first-principles analytical approach and develops models as required;

- A working knowledge of interacting disciplines (engineering and other) to underpin teamwork; and
- Jurisdictional knowledge that includes legal and regulatory requirements in addition to locally relevant codes of practice.

2.4 Category II Outcomes: Managing Engineering Activities

This group of outcomes requires the candidate to demonstrate technical leadership and effective interpersonal skills.

2.4.1 Outcome 4: Management of Engineering Activities

This outcome requires the candidate to demonstrate their capability to manage part or all of one or more engineering activities. Management is directed at achieving engineering results through the management of people, resources, processes, systems and money. Management involves:

- i) Planning engineering activities;
- ii) Organizing engineering activities;
- iii) Coordinating engineering activities;
- iv) Leading engineering activities; and
- v) Controlling engineering activities.

2.4.2 Outcome 5: Communication

The candidate is required to demonstrate their capacity to communicate effectively and clearly with others in the course of the engineering activities including:

- i) Communication: strategic, managerial, technical and wider impacts of engineering work.
- ii) Material communication: concepts, analyses, proposals and informative subjects.
- iii) The audience: peers, superiors, persons implementing designs and other work, persons in other disciplines, clients and wider stakeholders.
- iv) Communication functions

2.5 Category III Outcomes: Evaluation of Impacts of Engineering Activity

This group of outcomes requires the candidate to demonstrate recognition of an obligation to society, the profession and the environment, to make an evaluation of the outcomes and impacts of engineering activities and to make a commitment to abide by the Professional Code of Conduct.

2.5.1 Outcome 6: Recognition of Obligations to Society

The candidate is expected to be able to recognize and address the reasonably foreseeable social, cultural and environmental effects of engineering activities including:

- i) Recognition that protection of society is the highest priority
- ii) Due regard for the principles of sustainability
- iii) Direct, indirect, immediate and long-term effects of engineering solutions

2.5.2 Outcome 7: Legal and Regulatory Requirements

Meet all legal and regulatory requirements and protect the health and safety of persons during his/her complex engineering activities, including:

- i. Impacts and regulatory requirements
- ii. Regulatory requirements that are explicit for the context and are generally applicable.

2.5.3 Outcome 8: Judgement in Decision Making

Exercise sound judgement during execution of engineering activities. Judgement in decision-making involves consideration of:

- i) Diverse and wide-ranging risk factors.
- ii) Significant consequences in a range of contexts; and
- iii) Wide ranges of interested and affected parties with widely varying needs.

2.5.4 Outcome 9: Responsibility

The outcome requires the candidate to be responsible for the decision-making for part or all of the engineering activities. It encompasses responsibility exercised for outcomes of significant parts of one or more engineering activities.

2.6 Category IV Outcomes: Upholding Good Professional Practices

This group of outcomes requires a candidate to conduct uphold the code of ethics and conduct for engineers in undertaking engineering activities.

2.6.1 Outcome 10: Upholding Code of Ethics and Conduct

Conduct engineering activities ethically. Ethical behavior of no less than that defined by the Code of Conduct.

2.6.2 Outcome 11: Continuing Professional Development

This outcome requires a candidate to demonstrate a commitment to lifelong learning. And to undertake sufficient professional development activities to maintain and extend competence. Professional development includes:

- i) Planning own professional development strategy;
- ii) Selecting appropriate professional development activities; and
- iii) Recording of professional development strategy and activities while displaying independent learning ability.

CHAPTER 3 – PROGRAMME COMPONENTS

3.1 Civil Engineering

Civil engineering is a broad field of engineering that deals with the design, construction, and maintenance of infrastructure projects and systems. These projects can range from bridges, roads, and buildings to water supply networks, environmental systems, and transportation facilities. Civil engineers play a crucial role in shaping the physical infrastructure of societies, ensuring functionality, safety, and sustainability of various structures and systems.

Key Competencies Associated with a Trainee in Civil Engineering:

- **Technical Proficiency:** Trainees should have a strong foundation in mathematics, physics, and engineering principles. They must be proficient in using various software tools for design, analysis, and drafting.
- **Problem-Solving Skills:** Civil engineers often encounter complex challenges. Trainees need to develop analytical and critical thinking skills to solve problems related to design, construction, and maintenance of infrastructure projects.
- **Project Management:** Understanding project management concepts, including budgeting, scheduling, and resource allocation, is essential. Trainees should learn how to manage projects effectively, ensuring they are completed on time and within budget.
- **Communication Skills:** Civil engineers work in multidisciplinary teams and interact with clients, government officials, and contractors. Effective communication skills, both written and verbal, are crucial for conveying ideas and project requirements clearly.
- **Ethics and Professionalism:** Trainees should be aware of ethical considerations in engineering practice, including environmental sustainability, safety standards, and social responsibility. Upholding professional ethics is vital in civil engineering.
- **Knowledge of Regulations and Codes:** Familiarity with building codes, safety regulations, and environmental standards is essential. Engineers must design projects that comply with legal requirements and industry standards.
- **Construction Knowledge:** Understanding construction processes and materials is important for civil engineers. Trainees should be familiar with construction techniques, equipment, and materials used in different types of projects.
- **Adaptability:** The field of civil engineering is constantly evolving with new technologies and methods. Trainees should be adaptable and willing to learn and incorporate new advancements into their work.

3.2 Training Curriculum

The Board has developed a basic training plan that graduate engineers in civil engineering will go through to acquire the technical and non-technical competencies (Table 2) in the following subdisciplines:

1. Highways
2. Water
3. Structu

Table 2: Roads & Highways Training Curriculum

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
1	Introduction to design process	1.1	Module 1	- Familiarization with specifications & standards - Familiarization with the codes of practice - Familiarization with the regulatory, legislative frameworks and applicable policies - Strategic planning	1
2	Feasibility studies	2.1	Module 1	- Route Selection - Economic analysis using investment appraisal models (NPV, IRR, PI, PBP) and selection of most suitable alternative. - Sustainability analysis - Modelling	2
3	Preliminary design	3.1	Module 1	- Concept design - Establishment of concept design criteria - Project requirements - Documentation of the project	6
		3.2	Module 2	Scheme Design - Preparation of reconnaissance reports - Completion of soil and material investigation reports - Hydrological data - Vertical and horizontal alignments - Determination of cross-sections - Determination of project cost estimates	
4	Detailed Design	4.1	Module 1	Materials Investigation and Testing Natural Environment - Climate and Natural Materials and Soils Earthworks - Cuttings - Type of Material to be Excavated - Water Table and Springs - Determination of the Angle of Slope - Embankments - Foundation Conditions and Settlement - Fill Material and Stability of Slopes & Placing and Compaction of Fills Subgrade - Classification of Kenyan Soils - Classes of Subgrade Bearing Strength - Classification of the Most Common Kenyan Subgrade Materials - Determining the Subgrade Strength - Recommended Subgrade CBR Test Procedure - Subgrade Compaction & Estimating Subgrade Moisture Content - Determining Subgrade Design Strength - Subgrade Requirements for Pavement Design - Materials Suitable for Pavement Support & Improved Subgrade - Influence of Improved subgrade on Subgrade Bearing Strength - Lime Treated Subgrade	12
		4.2	Module 2	Engineering Surveying - Introduction to various types of survey equipment - Topographic surveying - Controlling levels of the works	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
		4.3	Module 3	Geometric Design Road system • Road classification • Control of access • Road reserves Design controls and criteria • Topography, land use and physical features • Environmental consideration • Road safety considerations Road function and level of access control • Traffic volume and capacity • Design speed and other speed controls • Design vehicles • Economic consideration The cross-section • Standard cross-sections • The choice of cross -section • Side ditches and cut-off ditches » Expected flow in side ditches » Capacity of side ditches » Scour protection » Economics and aesthetics Alignment • Sight distance » Stopping sight distance » Meeting sight distance » Passing sight distance » Sight distance at junctions » Control of sight distance • Horizontal alignment » The straight and circular curve » Gradients and Vertical curves • Climbing lanes » Co-ordination of horizontal and vertical alignment » The transition curve and Super elevation » Widening in curves » Vertical alignment At grade junctions • Definitions » A junction, an access, junction manoeuvres, junction design speed and the major road • Design requirements » Safety and operational comfort » Capacity and economy • Junction design procedure » Data collection and basic junction layout & capacity • Principal of junction design » Distance between adjoining junctions » Visibility splays and turning lanes » Central reserves, traffic islands and minor road widening » Alignment of the major road • Roundabouts: the use of roundabouts, general layouts and definitions • Design requirements and detailed design.	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
				Grade separated junctions - Choice of scheme - Geometric standards » Design speed » Visibility » Acceleration and deceleration lanes » Horizontal curves and super-elevation » Vertical curves » Widths of slip roads » Gradients » Clearances - Design principles and types of junctions Road furniture - Traffic islands - Kerbs - Marker posts - Safety fences and gates » Traffic signs and road markings	
		4.4	Module 4	Pavement design - Design Principles » Thicknesses and Materials Characteristics » Design Period & Stage construction & Safety Factor » Minimizing Base and Surfacing Thicknesses - Practical and Experimental Considerations » Use of Flexible Pavements & Influence of Subgrade » The Behavior of Pavement Materials - Calculation of Stress, Strain, Deflection and Layer Thickness » Calculation of Stress, Strain and Deflection » Determination of Layer Thickness - Construction Principles » Minimum Layer Thickness » Minimum Significant Thickness Increments » Compliance with Specification - The Standard Pavement Structures » Type of Pavement & The Standard Pavement Structures Use » Other Types of Pavement - Method of Use & Examples of Pavement Design	
		4.5	Module 5	Traffic Surveying - Axle Load Distribution » Present Kenya Legislation & Axle Load Distribution - Equivalence Factor » Axle Load Equivalence Factor & Vehicle Equivalence Factor - Evaluation of Traffic for Design Purposes » Estimating the Initial Daily Number of Commercial Vehicles » Estimating the Initial Daily Number of Standard Axles » Estimating the Cumulative Number of Standard Axles - Traffic Classification » Use of Cumulative Number of Standard Axles & Traffic Classes	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
5	Tender Stage	5.1	Module 1	Introduction to Contract Administration - What is a Contract? - Parties to a Contract - The Employer - The Engineer/Employer's Representative - The Contractor - Needs for Parties to a Contract - Classification of Contracts - From Tender to Contract - Identification of Requirement - Procurement planning - Determining procurement method - Procurement tender processing - Preparation and publication of tender documents - Bid/proposal submission and opening - Bid/proposal evaluation - Contract award recommendation - Contract negotiations - Contract signing - Documents that form the contract - Contract Effectiveness	2
		5.2	Module 2	Preparation of Tender Documents - Employer's Requirements - Preparation of specifications - Preparation of bill of quantities and cost estimates - Preparation tender drawings - Preparation of Tendering Forms - Preparation of conditions of contract and contract forms	
		5.3	Module 3	Tender Evaluation Process	
6	Contract Administration Stage	6.1	Module 1	Project Management - Site management and organization - Planning and programming of construction; - Communication on site including issuance of site instructions - Design reviews and appraisals; - Resource planning, allocation and control - Methods of construction and their pertinent details. - Setting out of works and surveying instruments. - Familiarization with Mechanical plant and their application output, capacity and associated costs. - Knowledge of characteristics of materials, their cost, storage and handling. - Attending site, technical and progress meetings	12
		6.2	Module 2	Contract Administration - Handling variations - Review of contract claims - Determination of claims - Dispute resolution methods	
		6.3	Module 3	Quality Control and Quality Assurance - Inspection - Materials testing - Approval process - Keeping of site records - Preparation of reports (Daily, Monthly, Quarterly, Yearly) - Surveying	
		6.4	Module 4	Cost Control - Measurement of works - Assessment of variations - Issuance of interim payment certificates - Earned value management - Resourced workplan; Plant equipment, budget/resources, timelines, cashflow	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
		6.5	Module 5	Environmental & Social Safeguards - Monitoring contractor's ESMP – Environmental & Social Management Plan - OSHA (Occupational Safety & Health Act) Compliance - Road safety monitoring - Stakeholders' management - Redress and grievances management - Social safeguards	
7	Operations & Maintenance	7.1	Module 1	Maintenance - Infrastructure condition evaluation using visual inspection and equipment - Design/planning of required maintenance interventions; - Preparation of specifications - Processing supply, scheduling utilization and recording of materials, labour and plant - Preparation and implementation of work programs - Measurement and costing of works - Quality control - Preparation or acquisition of operations and maintenance manuals, guarantees and warranties. - Preparation or acquisition of as-built drawings and documentation - Preparation of project final accounts - Preparation and issuance of the project completion report.	3

Table 3: Soft Skills Training Plan

S/No.	Training	Module	Objectives and Area to be Covered
8.	Soft skills and non-technical components	Module 1	Professional Examination Reports Writing • Training and experience report » Summary of Training and Experience » Summary of Time Spent » Detailed report on training and practical experience » Organization chart of the current firm where the candidate is working • Project report for structural engineers » Introduction » Design information » design calculations » drawings » taking off sheets and bill of quantities • Project report for highway engineers » Introduction » Design process Objectives: » Analysis of possible solutions Preferred solution: » Design of the chosen project » Drawings » Taking off sheets and bill of quantities » Implementation of the project » Conclusion
		Module 2	Communication skills for professional interview preparations • Goals of Communication • Importance of Communication skills • Preparing for interviews • The interview experiences • Ways to improve communication skills • Questions to expect and to ask • Conclusion
		Module 3	Code of ethics and conduct for engineers • The fundamental principles • The fundamental canons • Obligations to society • Obligations to employer or client • Integrity of an engineer • Disclosure of information • Conflict of interest • Compensation improper • Unfair means engineering practice • Recognition of proprietary interests • Cooperation, development and advancement of engineers • Advertisement or writing of articles for publication • Breach of code of conduct • Penalties
		Module 4	Other Soft Skills • Self-management • Human resource management • Emotional intelligence • Cultural intelligence

Table 4: Building Structures & Bridges

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
1	Introduction to design process	1.1	Module 1	- Familiarization with specifications & standards - Familiarization with the codes of practice - Familiarization with the regulatory, legislative frameworks and applicable policies - Strategic planning	1
2	Feasibility studies	2.1	Module 1	- Route Selection - Economic analysis using investment appraisal models (NPV, IRR, PI, PBP) and selection of most suitable alternative. - Sustainability analysis - Modelling	2
3	Preliminary design	3.1	Module 1	Concept design - Establishment of concept design criteria - Project requirements - Documentation of the project - Structural planning (Functionality, Aesthetics, Stability) & synthesis - Approximate analysis - Development of structural forms.	6
		3.2	Module 2	Scheme Design - Modelling of structures - Preparation of reconnaissance reports - Geotechnical investigation reports - Hydrological data collection - Environmental (Wind, rainfall, temperature, earthquakes) and geological data collection - Vertical and horizontal alignments - Determination of cross-sections - Determination of project cost estimates - Determination of materials to use. - Types of foundations Geotechnical Investigation and Testing Field and Insitu Testing - Plate bearing testing - CPT - SPT - Seismic Testing Laboratory Testing - Soil identification tests - Soil classification - Strength test FOR BRIDGES: Bridge Design - Historical perspectives, - Bridge aesthetics, - Conceptual and preliminary design of bridges. Bridge Deck Loading and Analysis - Loading to BS, EC1, AASHTO; - Traffic loads - Load combinations, - Shrinkage and temperature loads. - Influence lines. - Bridge deck types; - Load distribution; - articulation; - skewed and curved decks; - semi-integral and integral bridges. - Analysis methods – grillage, finite element, yield lines etc.	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
	Detailed Design	4.1	Module 1	Additional Geotechnical Investigation and Testing Field and Insitu Testing • Plate bearing testing • CPT • SPT • Seismic Testing • Interpretation of field and insitu testing results Laboratory Testing • Soil identification tests • Soil classification • Strength test • Interpretation of laboratory testing results	2
		4.2	Module 2	Substructures / Foundations • Substructure types, • loading, bearings, • abutment types and design of, bridge pier and design of, bridge foundation types, • integral bridge substructures; • soil structure interaction, scour assessment and design, bridge hydraulics. Fundamentals of Bridge Design and Construction • Investigation for Bridges » Site Selection » Data Collection, Span Determination • Types of Bridges and their Selection » Types of Bridges » Selection of Bridges • Bridge Loading » Types of Loads » Distribution of Loads • Superstructure » Reinforced Concrete Superstructures » Steel Superstructures » Composite Superstructures » Arches, Cable stayed, Suspension • Substructures » Piers » Abutments » Wing Walls » Scour Protection • Bearings and Railings » Bearings » Railings • Culverts and Low-Level Water Crossings » Culverts » Low Level Water Crossings • Bridge Inspection and Maintenance » Bridge Inspection » Bridge Maintenance	4
		4.3	Module 3	Engineering Surveying • Introduction to various types of survey equipment • Topographic surveying • Controlling levels of the works	1
		4.4	Module 4	Geometric Design • Aspects of geometric design (For roads)	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
		4.5	Module 5	Traffic Surveying • Axle Load Distribution » Present Kenya Legislation & Axle Load Distribution • Equivalence Factor » Axle Load Equivalence Factor & Vehicle Equivalence Factor • Evaluation of Traffic for Design Purposes » Estimating the Initial Daily Number of Commercial Vehicles » Estimating the Initial Daily Number of Standard Axles » Estimating the Cumulative Number of Standard Axles • Traffic Classification » Use of Cumulative Number of Standard Axles & Traffic Classes	3
5	Tender Stage	5.1	Module 1	Introduction to Contract Administration • What is a Contract? • Parties to a Contract • The Employer • The Engineer/Employer's Representative • The Contractor • Needs for Parties to a Contract • Classification of Contracts • From Tender to Contract » Identification of Requirement » Procurement planning » Determining procurement method » Procurement tender processing » Preparation and publication of tender documents » Bid/proposal submission and opening » Bid/proposal evaluation » Contract award recommendation » Contract negotiations » Contract signing • Documents that form the contract • Contract Effectiveness	2
		5.2	Module 2	Preparation of Tender Documents • Employer's Requirements » Preparation of specifications » Preparation of bill of quantities and cost estimates » Preparation tender drawings • Preparation of Tendering Forms • Preparation of conditions of contract and contract forms	
		5.3	Module 3	Tender Evaluation Process	
6	Contract Administration Stage	6.1	Module 1	Project Management • Site management and organization • Planning and programming of construction; • Communication on site including issuance of site instructions • Design reviews and appraisals; • Resource planning, allocation and control • Methods of construction and their pertinent details. • Setting out of works and surveying instruments. • Familiarization with Mechanical plant and their application output, capacity and associated costs. • Knowledge of characteristics of materials, their cost, storage and handling. • Attending site, technical and progress meetings	12
		6.2	Module 2	Contract Administration • Handling variations • Review of contract claims • Determination of claims • Dispute resolution methods	

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
		6.3	Module 3	Quality Control and Quality Assurance • Inspection • Materials testing • Approval process • Keeping of site records • Preparation of reports (Daily, Monthly, Quarterly, Yearly) • Surveying	
		6.4	Module 4	Cost Control • Measurement of works • Assessment of variations • Issuance of interim payment certificates • Earned value management • Resourced workplan; Plant equipment, budget/resources, timelines, cashflow	
		6.5	Module 5	Environmental & Social Safeguards • Monitoring contractor's ESMP – Environmental & Social Management Plan • OSHA (Occupational Safety & Health Act) Compliance • Road safety monitoring • Stakeholders' management • Redress and grievances management • Social safeguards	
7	Operations & Maintenance	7.1	Module 1	Maintenance • Infrastructure condition evaluation using visual inspection and equipment • Design/planning of required maintenance interventions; • Preparation of specifications • Processing supply, scheduling utilization and recording of materials, labour and plant • Preparation and implementation of work programs • Measurement and costing of works • Quality control • Preparation or acquisition of operations and maintenance manuals, guarantees and warranties. • Preparation or acquisition of as-built drawings and documentation • Preparation of project final accounts • Preparation and issuance of the project completion report.	3

Table 5: Water

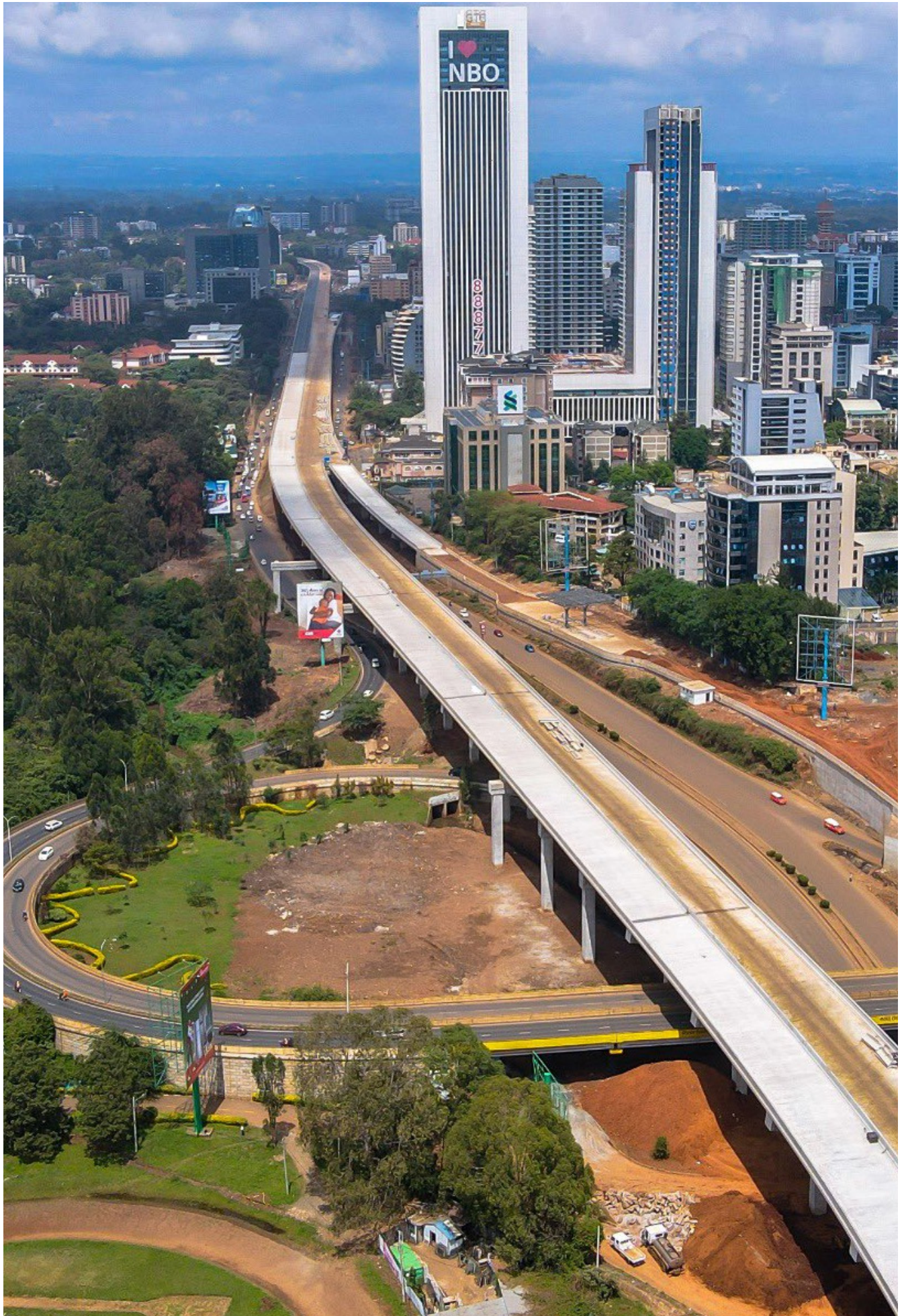
S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
1	Introduction to design process	1.1	Module 1	- Familiarization with specifications & standards - Familiarization with the codes of practice & design manuals - Familiarization with the regulatory, legislative frameworks and applicable policies - Strategic planning	1
2	Feasibility studies	2.1	Module 1	- Population to be served - Project area - Demand calculations (Water/Waste water) - Economic analysis using investment appraisal models (NPV, IRR, PI, PBP) and selection of most suitable alternative. - Sustainability analysis - Modelling	2
3	Preliminary design	3.1	Module 1	Concept design - Establishment of concept design criteria - Project requirements - Documentation of the project - Planning (Functionality, Aesthetics, Suitability) & synthesis - Approximate analysis - Alternative technologies: - » Drinking water treatment » Ground water treatment » Waste water treatment, process, design and selection » Water transport and distribution » Sludge treatment and resource recovery	6
		3.2	Module 2	Scheme Design - Modelling of pipeline network - Preparation of reconnaissance of the project area - Topographical surveys - Hydrological data collection - Environmental (Wind, rainfall, temperature, earthquakes) and geological data collection - Profile surveys of the alignment - Determination of cross-sections - Determination of project cost estimates - Determination of materials to use.	
4	Detailed Design	4.1	Module 1	Additional Geotechnical Investigation and Testing Field and Insitu Testing - SPT - Interpretation of field and insitu testing results Laboratory Testing - Soil identification tests - Soil classification - Interpretation of laboratory testing results	2
		4.2	Module 2	Superstructure - Reinforced Concrete Superstructures - Steel Superstructures - Composite Superstructures - Arches, Cable stayed, Suspension Substructures - Piers - Abutments - Wing Walls - Scour Protection	4
		4.3	Module 3	Engineering Surveying - Introduction to various types of survey equipment - Topographic surveying - Controlling levels of the works	1

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
5	Tender Stage	5.1	Module 1	Introduction to Contract Administration - What is a Contract? - Parties to a Contract - The Employer - The Engineer/Employer's Representative - The Contractor - Needs for Parties to a Contract - Classification of Contracts - From Tender to Contract - Identification of Requirement - Procurement planning - Determining procurement method - Procurement tender processing - Preparation and publication of tender documents - Bid/proposal submission and opening - Bid/proposal evaluation - Contract award recommendation - Contract negotiations - Contract signing - Documents that form the contract - Contract Effectiveness	2
		5.2	Module 2	Preparation of Tender Documents - Employer's Requirements - Preparation of specifications - Preparation of bill of quantities and cost estimates - Preparation tender drawings - Preparation of Tendering Forms - Preparation of conditions of contract and contract forms	
		5.3	Module 3	Tender Evaluation Process	
6	Contract Administration Stage	6.1	Module 1	Project Management - Site management and organization - Planning and programming of construction; - Communication on site including issuance of site instructions - Design reviews and appraisals; - Resource planning, allocation and control - Methods of construction and their pertinent details. - Setting out of works and surveying instruments. - Familiarization with Mechanical plant and their application output, capacity and associated costs. Knowledge of characteristics of materials, their cost, storage and handling. - Attending site, technical and progress meetings	12

S/No.	Training Area		Module	Objectives and Area to be Covered	Duration (Months)
		6.2	Module 2	Contract Administration - Handling variations - Review of contract claims - Determination of claims - Dispute resolution methods	
		6.3	Module 3	Quality Control and Quality Assurance - Inspection - Materials testing - Approval process - Keeping of site records - Preparation of reports (Daily, Monthly, Quarterly, Yearly) - Surveying	
		6.4	Module 4	Cost Control - Measurement of works - Assessment of variations - Issuance of interim payment certificates - Earned value management - Resourced workplan; Plant equipment, budget/resources, timelines, cashflow	
		6.5	Module 5	Environmental & Social Safeguards - Monitoring contractor's ESMP – Environmental & Social Management Plan - OSHA (Occupational Safety & Health Act) Compliance - Road safety monitoring - Stakeholders' management - Redress and grievances management - Social safeguards	
7	Operations & Maintenance	7.1	Module 1	Maintenance - Infrastructure condition evaluation using visual inspection and equipment - Design/planning of required maintenance interventions; - Preparation of specifications - Processing supply, scheduling utilization and recording of materials, labour and plant - Preparation and implementation of work programs - Measurement and costing of works - Quality control - Preparation or acquisition of operations and maintenance manuals, guarantees and warranties. - Preparation or acquisition of as-built drawings and documentation - Preparation of project final accounts - Preparation and issuance of the project completion report.	3

Table 5: Soft Skills & Non-Technical Components

S/No.	Training	Module	Objectives and Area to be Covered
1.	Soft skills and non-technical components	Module 1	Professional Examination Reports Writing • Training and experience report » Summary of Training and Experience » Summary of Time Spent » Detailed report on training and practical experience • Organization chart of the current firm where the candidate is working » Project report for structural engineers » Introduction » Design information » design calculations » drawings » taking off sheets and bill of quantities • Project report for highway engineers » Introduction » Design process Objectives: » Analysis of possible solutions Preferred solution: » Design of the chosen project » Drawings » Taking off sheets and bill of quantities » Implementation of the project » Conclusion
		Module 2	Communication skills for professional interview preparations • Goals of Communication • Importance of Communication skills • Preparing for interviews • The interview experience • Ways to improve communication skills • Questions to expect and to ask • Conclusion
		Module 3	Code of ethics and conduct for engineers • The fundamental principles • The fundamental canons • Obligations to society • Obligations to employer or client • Integrity of an engineer • Disclosure of information • Conflict of interest • Compensation improper • Unfair means engineering practice • Recognition of proprietary interests • Cooperation, development and advancement of engineers • Advertisement or writing of articles for publication • Breach of code of conduct • Penalties
		Module 4	Other Soft Skills • Self-management • Human resource management • Emotional intelligence • Cultural intelligence





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