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**PROVINCIAL RECONSTRUCTION,
REHABILITATION & SETTLEMENT AUTHORITY**

[Draft] Quality Assurance & Quality Control Manual

**PROVINCIAL DISASTER MANAGEMENT AUTHORITY, Government
of Khyber Pakhtunkhwa**

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Abbreviations & Acronym

ACI	American Concrete Institute
ASCE	American Society of Civil Engineer
ASTM	American Society for Testing and Materials
BOQ	Bill of Quantities
C&W	Communication & Works
CBR	California Bearing Ratio
IBC	International Building Code
KPRP	Khyber Pakhtunkhwa Reconstruction Program
NFPA	National Fire Protection Association Code
PHED	Public Health Engineering Department
PM	Project Manager
QA	Quality Assurance
QC	Quality Control
QCM	Quality Control Management
QS	Quality System
SOW	Scope of work
TS	Technical Specifications
UFAS	Uniform Federal Accessibility Standards
USAID	United States Agency for International Development

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Introduction

a) Khyber Pakhtunkhwa Reconstruction Program (KPRP)

The USAID funded Khyber Pakhtunkhwa (KP) Reconstruction Program supports the KP Government's efforts to rebuild public infrastructure destroyed during the 2009 military operations and the 2010 flooding. The Program rebuilds education, health, water, sanitation, and irrigation facilities. It is also working closely with the KP Government to improve its capacity to deliver essential services.

Objectives

The Program's objectives are to rebuild conflict-affected public schools, health and water infrastructure; improve the learning environment in public schools by providing essential furniture and laboratory equipment; and to rehabilitate essential irrigation and communication infrastructure damaged by the 2010 flash floods.

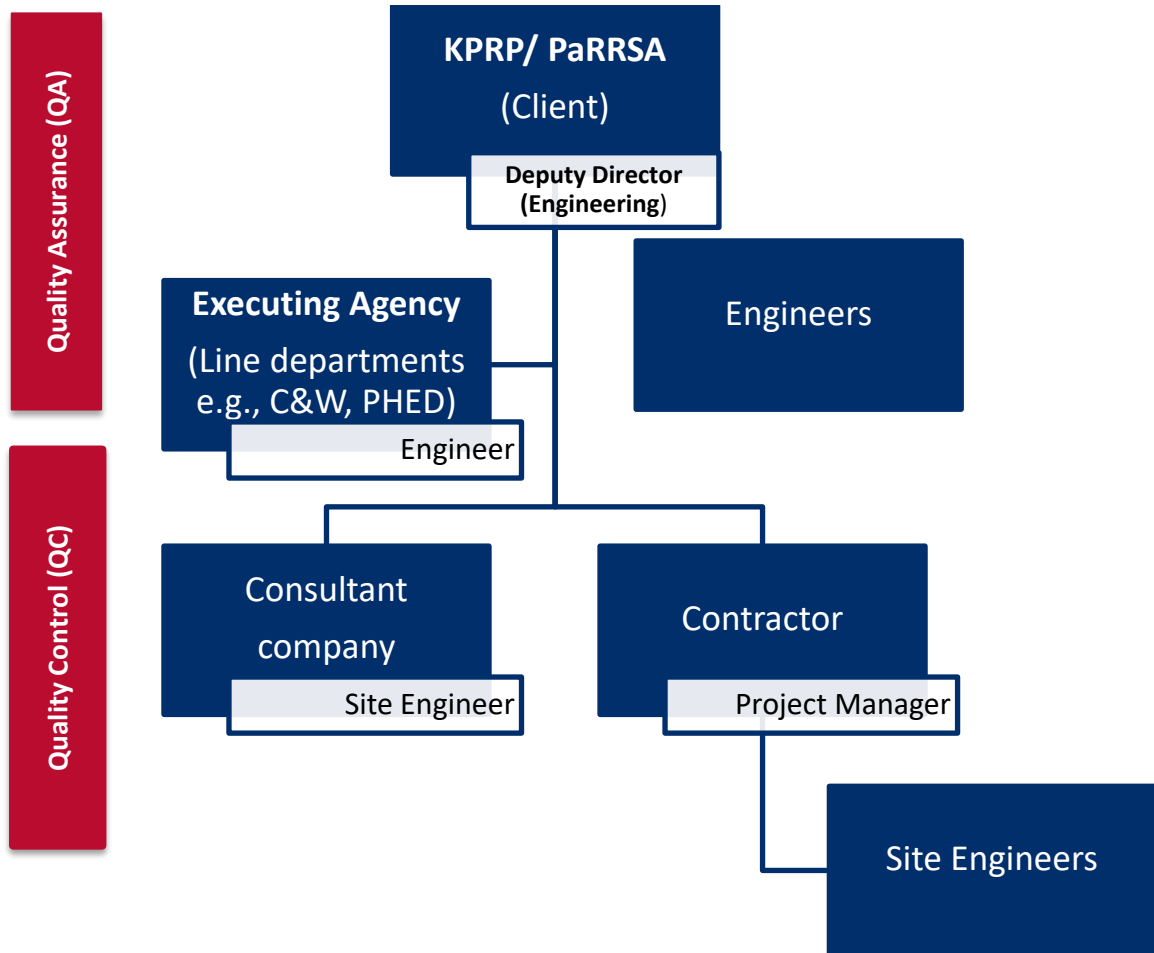
Main Activities

- Reconstruct and rehabilitate militancy affected public schools
- Rehabilitate and improve outdated water systems
- Rehabilitate and restore flood-damaged infrastructure
- Provide essential equipment to damaged health facilities, and furniture and lab equipment to schools
- Provide consultative services to improve the capacity of the KP government to manage reconstruction programs

b) Quality Assurance and Quality Control function in KPRP/PaRRSA

The quality assurance (QA)/ quality control (QC) function in KPRP is a robust mechanism encompassing different layers of site monitoring to ensure that quality of construction is in accordance with the specifications and other contractual quality parameters. QC mechanism comprises of site engineers of contractor and consultant companies, respectively. While the QA mechanism comprises of designated engineers of Executing Agencies (i.e., C&W, PHED etc.) and KPRP/PaRRSA. Please refer to the following graphic for the details of QA and QC mechanism of KPRP/PaRRSA for construction related activities:

Organogram of QA/QC functions



Section I: Definitions

Quality is a desirable characteristic (based on the expectations set by all stakeholders) in construction. At its core, quality in construction means that a construction project is completed within the defined guidelines set out in the Scope of Work (SOW). SOW serves as a set of rules for the project based on the client's expectations, and sheds light on how to execute the project in a way that meets these standards.

Quality Assurance (QA): is a set of planned and systematic actions which are laid out before and after a construction project starts. This is an additional layer of quality review (in addition to the QC cycle) to provide adequate confidence that the construction work satisfies quality requirements.

Quality Control (QC): The operational techniques and activities (such as reviewing, checking, inspecting, testing, etc.) that are used to fulfill requirements for quality in construction works. In simple words QC is the process of inspecting the construction site to identify and correct defects.

Quality System (QS): A set of documented processes that seeks to provide confidence that the project outputs will fulfill the functional requirements. The Quality System should enclose the organization, responsibilities, human resources, materials, equipment, processes, inspections, testing, and other parameters of subproject. A key element of QS is the QA / QC Manual.

Deficiency: This shall be any deviation from the plan or specification that results in lower quality of work, reduces useful life circle of work and impairs functionality of work and unsafe condition, or materials change in the appearance than is deemed by the Site Engineer to be unsatisfactory and to require fulfillment according to the contract, technical specifications and Bill of Quantities (BOQ).

Section 2: Introduction of QA/QC Manual

Successful execution of construction projects is dependent on quality control, which is essential to the construction of infrastructure projects. Deficiencies in constructed facilities can result in huge cost overruns and lead to delays of the construction schedule. Even with minor deficiencies, re-construction may be required, which causes delays. In the worst case, failures may cause personal injuries or fatalities. Sound project management supported by a thorough quality control system (QCS) ensures that the construction work is executed professionally with value engineering. For efficiency of the quality control mechanism, it is mandatory to have a fair and transparent mechanism with clear communication and instructions on construction site.

The quality system described in this manual shall form the basic activities and processes to be utilized to monitor and control throughout the success of any construction project.

The quality control plan requires the engineer to:

- Maintain sufficient inspection system and perform inspections that will ensure compliance with agreed specifications.
- Maintain inspection records and make them available to KPRP.
- Allow KPRP to conduct its own tests and inspections.
- Make follow ups on tests and inspections for its benefit to the project deliverables. The quality control obligations in the testing and inspection remain independent and unchanged.
- Assist KPRP in ensuring completion of the project within the approved timeline, budget, and quality.
- Provide quality design management and construction management services that consistently meet KPRP statutory and regulatory requirements.
- Be responsive in executing good engineering practices to eliminate potential quality defects.
- Continuously improve all functions within the project team in collaboration with the client through innovation and creativity.
- Ensure to rectify deficiencies and to prevent future defects.
- Define and share the acceptance criteria for any construction project.

Section 3: Objectives of QA/QC Manual

The main objective of quality control is to ensure that the under-construction facility is achieving the approved standards and agreed specifications. With a clear and brief quality system each member of the construction supervision team can ensure that it has played its part in the success and value of the construction project. Procedures that have been strictly followed will make sure that KPRP is receiving a cost-effective quality construction in a timely manner.

It is essential that the quality system is evaluated regularly in order to revise procedures as and when required. Suggestions for improvements in procedure changes and revisions from all parties involved in the program are necessary.

This quality control plan does not endeavor to repeat or summarize agreement/contract requirements. It describes the process and procedures that the consultants' engineers will use to ensure compliance with those requirements. The agreement/contract is the foundation for the outcomes expected from the quality control plan.

Section 4: Communication Plan for Construction Site

A formal communication chain is the foundation of a successful construction project. All team members should have a point of contact.

In order to have clear communication between KPRP, line department, consultant and contractor, engineers of the parties involved shall have the following responsibilities:

- All construction documents like approved drawings, BOQ's, specifications, submittals, test reports, inspection reports, daily/ weekly /monthly reports, safety reports shall be available, maintained and stored in Site Engineer office for review.
- Engineers shall be available on construction site and perform inspections during construction on daily basis.
- Consultant's engineer shall continuously coordinate/liaise with the client and contractor during pre- construction (site preparations), construction, and post construction project cycle.
- Consultant's engineer shall carry out routine joint inspections with client, site engineer to document the actual status of the project to ensure that work activities at site have been done in accordance with the signed contract. Agreement on observations shall be noted and entered in separate daily inspection reports.
- Client engineer shall ensure that the quality control is applied in accordance with quality control procedures.
- Client engineer shall conduct inspection independently with contractor's representative and write notification in daily inspection report.
- Client and site engineer shall reach consensus on methods of inspection and testing according to the specifications in accordance with QA/QC Manual.
- Client and consultants' site engineers shall agree on the size of the construction task and the required materials for the tasks require to be tested in accordance with the technical specifications and QA/QC. Follow up joint witness inspections at the test laboratory by client and site engineer is mandatory.
- Client and Site Engineer shall reach consensus on defect rectification requirements which shall be noted in separate defects log/reports.
- Client and site engineer shall be bound to rectify all such defects and to notify the contractor to take immediate action in accordance with "Rework" section of this Manual.
- In case of any differences on defects between client and consultant site engineer, the matter will be forwarded to the KPRP head office for further expertise.
- Client and site engineer shall update their QC and QA reports on daily basis and old issues shall not be repeated after rectifications measures are taken and closed.
- Client and site engineer shall conduct weekly QC meetings on site. Minutes of the meetings have to be prepared by site engineer.

Section 5: Duties, Responsibilities, and Authority of QC Personnel

5.1 KPRP/Client's Engineer

The client's engineer role is very important to the overall success of construction project. They play an active role in approving project plans, requesting changes, raising issues and risks, approving milestones, releasing payments, and accepting (or declining) the final deliverables of the project.

The client engineer is responsible and accountable for the execution of all activities from the start to the end of the project. The client shall facilitate the efforts of the design and construction projects.

5.2 Consultant Engineer

The role of consultant engineer is supervision and monitoring of the site to assure the construction quality control system. Site engineer shall report directly on daily basis regarding the progress of the construction works. Site engineer's quality control team ensures that the program quality management and safety systems are being implemented according to the requirements of the client. The site engineer oversees all technical aspects in the specified technical area of the work including but not limited to assessment, design, Bill of Quantities (BOQ) calculations, technical specification, monitoring and other related tasks.

The site engineer's responsibilities include managing different parts of construction projects, supervision of his team members, preparing estimates for time and material costs, completing quality assurance, observing health and safety standards, and compiling reports for different stakeholders.

The site engineer also supervises contractors' site engineers including contractors QC engineers. He/she shall provide field project control support by identifying and monitoring project related issues. He/she shall directly communicate with contractors and client when necessary and directly report to the client for technical advice, support, and field resolution when necessary. The site engineer shall supervise all technical aspects of infrastructure project implementation work in the specified technical area of work including but not limited to assessment, design, Bill of Quantities (BOQ), calculation, technical specification, and monitoring of work. The site engineer shall be responsible for the design integrity, professional design standards and all services required by the agreement. In addition to implementation and management of the quality control program, the site engineer is required to perform submittal review and approval, make sure testing is performed and provide QC certification and documentation as required in the agreement.

5.3 Contractor's Project Manager

A Project Manager oversees the planning and delivery of construction projects to ensure the work is completed as per agreed specifications, on time and within budget. With so many facets to consider in both pre- and post-construction, the Project Manager works closely with engineers, architects and more to drive the best outcome.

In the approved contract agreement, the contractor is bound to assign a Project Manager

with required qualifications and skills to ensure the completion of the infrastructure project according to the approved construction schedule. The Project Manager shall ensure that Quality Control Management (QCM) standards are executed, and the QC certifications and documentation are prepared as required under the agreement.

The Project Manager shall be on the construction site during any shifts when construction work is in progress.

5.4 Contractor's Engineer(s)

The role of contractor site engineers is to supervise all construction activities of site and shall assist the Project Manager in processing and maintaining files for submittals, reports, and meeting minutes. The site engineer shall be responsible for:

- To ensure the quality and quantity of the work based on the design and technical specifications.
- Manage all processes on site and be responsible for the material planning and timely provision, the planning of work force to ensure the project implementation in time.

The site engineer is empowered by the Project Manager to suspend construction activities while defects are corrected after informing the client's representative. There shall be at least one site engineer present per site.

Section 6: Design Stage of Infrastructure Project

6.1 Background

Considering the limited resources, and the social and economic conditions and aiming to produce and achieve the highest yield, quality control and quality assurance are gaining considerably large importance.

6.2 Purposes of Design Quality Control Plan

The purpose of the design quality control plan is to:

- Align the project outputs as per Client's needs
- Decrease the design and development cost in terms of time and money
- Maximize the use of local construction materials like sand, stone, bricks, etc.
- Maximize the use of local men-power (skilled and un-skilled labor)
- Achieve the maximum possible yield from available resources

6.3 Conditions of Design Quality Control

The safety, durability, comfort, and aesthetical requirements of universally accepted standards and codes such as ASCE, IBC or equivalent are fulfilled technology proposed should be applied in the location technology proposed is tutorial and educative to local people.

6.4 Components of Design Quality

6.4.1 Proper Team

The consultant responsible for design QC shall provide or recruit trained professionals who have experience in developing designs. All matters concerning the quality control of the project shall be reported in writing to the client and site engineer.

6.4.2 Proper Utilities

The consultant shall provide proper equipment and dependable software for analysis, design, and computer aided drawings.

6.4.3 Adequate Training

The consultant engineer who will have contributions to the designs shall be trained about internationally accepted codes designs techniques and construction systems.

6.4.4 Codes and Standards

Conformation of the designs to the following codes and standards will be achieved by:

- Training of team
- Spontaneous checks during all phases of design
- By preparation of code conformation reports at the milestones of the design schedule

6.4.5 Governing Codes of Quality Control

-
- IBC, International Building Code
 - ACI, American Concrete Institute Code
 - NFPA, National Fire Protection Association Code
 - UFAS, Uniform Federal Accessibility Standards
 - ADA, Standards of Accessibility Design, Department of Justice
 - ASTM, ACI Construction Standard Index

6.5 Key Steps in Achieving Desired Quality

6.5.1 Client Needs Assessment

- Clear understanding of the requirements of the Client
- Developing and proposing a satisfactory architectural preliminary design that satisfies the above-mentioned code requirements
- Documentation of geographic and climatic requirements
- Documentation of cost efficiency requirements
- Presentation of the above to the Client together with code analysis report.
- Obtaining approval of the Client

6.5.2 Design Criteria and Construction Materials

- Selection of design criteria for construction project, selection of materials of construction, technologies.
- Reporting to the Client together with possible alternatives.
- Obtaining final approval of the Client for design and construction materials
- Finalizing architectural designs according to comments of the Client and Consultant's Site Engineer
- Obtaining approval of the client for architectural designs

6.5.3 Finalizing Drawings, BOQ and Technical Specifications

- Developing structural, mechanical, electrical designs considering the seismic, dynamic, live load evaluations, permissible or ultimate stresses, alternate loadings possible, heat and electric energy requirements, applicable codes and technologies.
- Presenting and reporting the designs and calculations to the Client, accompanied by code analysis.
- Preparing quantitative calculations for tendering (BOQ)
- Preparing Technical Specifications (TS) to achieve desired quality and to enable the bidders to submit the correct cost estimation to avoid future disputes
- obtaining approval of the client

6.6 Design Quality Control Methodology

The following steps shall be followed while designing any construction activity:

- A network that is accessible to all designers shall be established and all daily works shall be stored to a common area in this network at the end of each working day.
- Architects and Engineers shall proceed according to the items listed in the checklists as presented on Annexes-10 and at the start of each activity shall prepare a list of particulars of the requirement (e.g. main requirement of client or

task, codes to be followed, minimum or maximum size requirements etc.).

- The Engineer of Record shall examine the report, shall invite the other engineers or architects for their comments if the task requires additional information from different disciplines etc. and shall approve the report together with his/her additional comments.
- After achieving the mentioned approval, the designer shall proceed. The designer shall provide a code confirmation list as soon as he completes the design.
- The design team shall have one quality control meeting every week to discuss the parts of the designs that were produced in the preceding week. All comments shall be recorded, and minutes be provided to the Client and site Engineer.
- After completion of a specific design the design team will make a final review of the work and check whether it fulfills all the requirements of the Client, checklists of this QC plan, and the codes.
- A spreadsheet highlighting the changes shall be made accordingly.
- Any field design changes will be brought to the knowledge of the Client and Site Engineer so that the reasons of the request are clearly understood and negotiated. If required, the client shall be informed about the design changes accompanying a report explaining the reasons, effects on the project and financial requirements.
- After approval of the request by the Client, the designs shall be revised and submitted to the client for the final approval.

Section 7: Construction of Infrastructure Work

7.1 Contractor's Submittals Procedures

In construction, submittals are a contractor's proof of complying with construction documents or a permitted plan set. These include shop drawings, specifications, technical data, and samples for items such as steel, bricks, sanitary fitting etc.

Consultant's Site Engineer shall manage and control the processing of contractors' submittals. After being reviewed for completeness, submittal documents shall be passed on to the relevant staff in consultant design team for review and verification for compliance with the requirements of contract. Submittal documents need to be approved finally by the Client.

The detailed progress schedule shall be submitted within 14 days after the award of the contract and may be updated as required or as per request by the contractor. If any changes apply, the contractor shall get it approved by the Client.

Site Engineer shall maintain a completed submittal schedule and a list of products for all items requiring Client's review and approval, as follows:

- Submittals, including description of the item and the name of the manufacturer, trade name, and model number
- Specification and BOQ reference
- Intended submission/resubmission date(s)
- Lead time to delivery/anticipated delivery date(s)
- Highlight any items that require expedited review to meet the project schedule
- Identify which submittals require Client's and/or Site Engineer's approval

These schedules shall be presented in the prescribed form in both electronic and hard copy versions and shall be updated and sent to the Client and/or Site Engineer on a monthly basis.

7.1.1 Review Period

Contractor shall ensure that submittals are prepared in advance to enable the Client (in coordination with site engineer) to conduct a review and accord approval before commencement of the related work. The contractor is responsible for the preparation of submittals according to the time schedule to avoid delays. If any delays occur due to contractor's default, penalties shall be applied according to the terms of contract.

7.1.2 Submittal Reviewers

- The Contractor shall submit all the required submittal forms in paper as well as in electronic form to the Site Engineer.
- Site Engineer shall review the submittal documents and assess whether the package is complete. If submittal is incomplete the submittal shall be returned to the contractor.
- The complete submittal documents (along with all the attachments) shall be stored in client engineers' database and shall be forwarded to the relevant

reviewer of the consultant's design department.

- The consultant design team shall review the submittal documents and ensure that the submittal is in compliance with the contract specifications and will accord its approval if the submittal documents were in agreement the specifications. However, in the consultant will require explanations then the consultant will return to the Site Engineer with comments.
- Site Engineer, in consultation with the client, shall re-submit the submittal to the contractor with his/her determination.
- The contractor's Project Manager and/or site engineers and design engineers shall be authorized to review and certify submittals prior to its submission to the consultant Site Engineer. The Client shall accord the final approval after the submittal is approved by the Consultant.

7.2 Changes in Approved Submittals

Changes in approved submittals shall not be allowed unless these approved submittals with changes have been resubmitted and approved as prescribed in section 7.1.

7.2.1 Supplemental Submittals

Supplemental submittals initiated by the contractors for consideration of corrective procedures shall contain sufficient data for review. Supplemental submittals shall be made in the same manner as initial submittals.

7.2.2 Engineering Review

- Submittals shall be reviewed for conformance with the TS, BOQ and the contract agreement.
- Review actions shall have the following meanings:
 - Approved: is an acceptance
 - Submittal appears to conform to the respective requirements of the specifications and agreement
 - Disapproved: is a non-acceptance
 - Means that the submittal is deficient to the degree that the reviewer cannot make a thorough review of the submittal
 - The submittal needs revision and is to be corrected and resubmitted.

Section 8: Laboratory Testing for Construction Materials

Construction materials testing involves the essential examination of all structural materials used in the construction of a project. Materials testing helps us to quantify and understand whether a material or product is suitable to a certain application. Materials testing points us to limits of a material to handle a load or an operating condition. Materials that have not been tested and directly used in a product can be extremely dangerous. The data collected during testing and the final test results can be very useful to engineers and designers.

If required, the Client and Site Engineer reserves the right to require the contractor to conduct materials testing through approved laboratories for onsite and off-site testing. The selected laboratory for each location needs to be approved by the Client and Site Engineer.

8.1 Testing Plan and Logs

A testing plan is a detailed document that describes the testing strategy, objectives, schedule, estimation, deliverables, and resources required to perform testing of a construction work. Testing Plan helps to determine the efforts needed to validate the quality of the materials being tested.

When the tests are performed, the Contractor's Project Manager or site engineer shall record on the "Testing Plan and Log" the date the test was performed and the date the test results were sent to the Site Engineer. The site engineer shall submit all test results to the Client.

If necessary, materials qualification testing shall be done before commencement of construction activity to verify that the materials comply with the requirements of the contract, the technical specifications and BOQ. The contractor shall obtain representative samples of the materials designated as the proposed source of the materials. Test samples shall be sent by the contractor to the approved testing laboratories. The testing laboratory shall report all test results for determination of materials quality.

The Client shall periodically inspect the material being used. If determined that the characteristics of the material being used differ from the material initially tested or designed, the contractor shall repeat the qualification testing. If the new material qualification test results meet the criteria of the technical specification as determined, the materials may be used for the work, otherwise, previously approved materials shall be used or other acceptable materials shall be sampled and tested as noted above.

8.2 List of Construction Materials for Testing

Following is the list of materials which are essential to be tested before and during construction of project. The client and site engineer reserve the right to require testing of materials in addition to the materials as stated below:

- Cement
- Sand

- Crush
- Bricks
- Asphalt
- Mortar
- Aggregates
- Concrete
- Reinforcement steel
- Wires
- Plaster
- Electrical Material
- Plumbing Material
- Sanitary Material
- Guard Rails
- Signs
- PPE
- Wood
- Shuttering Material
- Other as necessary (refer to technical specification, BOQ, and technical drawings recommendations)

8.3 Construction Materials Method of Testing and Frequency

All quality assurance testing shall be conducted in line with project specifications, the contract, technical specifications, BOQ and individual project construction plan. The Site Engineer shall observe all relevant testing methods, as previously identified. The documentation and reporting of test results shall be included with the daily construction quality control report and entered QC system.

All test results shall be updated, filed separately and be presented to the Client. All tests shall be carried out in accordance with international codes and/or specifications.

The table below shall be adjusted according to the project specifications and required standards in the design:

Required Test	Test Method	Test Frequency	Acceptance Criteria (Verified by consultant Engineer)
Grading & leveling			
As per IBC 1803	Land surveying	Prior to start excavation	To establish finish floor elevation as per specifications and drawings
Compaction			
CBR Test Modified Proctor compaction test	ASTM D 1883 & ASTM D1557	One sample of material delivered 5 samples of compacted material for each 400m ²	Ensure compact fill to 95% or higher grade of maximum density and layers of 20cm.

Required Test	Test Method	Test Frequency	Acceptance Criteria Verified by Consultant Engineer)
Concrete			
Compressive Strength	ASTM C39	Preliminary testing of mix design (Test at first 7 day and 28 days). Samples of strength test will be taken not less than once (Five samples) for every 100 m3, or less than once for each 465 m2, nor less than once a day. 3 cylinders @ 7days, 3 cylinders @ 28days and 2	Minimum strength based on technical requirements and structural design
Water/Cement Ratio		Preliminary testing of mix	Limit .45 by weight
Slump Test	ASTM C143	1 per batch prior to pouring concrete	Reinforced concrete 100mm Non reinforced concrete, side
Reinforcement Steel			
Minimum Yield Strength	ACI 318 Section 3.5	On delivery on site samples will be taken from every type of rebar prior to installation and suppliers' certificate	Must meet specifications requirement of grade 60, > / 420 MPa yield strength
Water			
Clearness & Cleanness	ACI 318 Sec.3.4	Prior to concrete mix	Insure free of oil, acids, salts, organic and other substances
Aggregate Concrete			
Gradation, salt, harmful materials As per 318 Sec. 3.3	ASTM C33 & C330	One sample at source prior to commencement of work	Insure physical requirement of coarse & fine aggregate. Absence of harmful substances
Grout			
Minimum Compressive Strength	ASTM C1019	Preliminary testing of mix design. Test once on a daily basis during grouting operations.	(i) Compressive strength for MTC project remain at least 13.8 MPa) @ 28 days Compressive strength at least 3000 psi (21 MPa) @ 28 days
Cement Mortar			
Type M and / or S Cement	ASTM C 270 -08a Building Code Requirements for Masonry Structures Table 2.2.3.2, Table 3.1.8.2, Table 5.4.2	Masonry cement mortar (pre-packaged). <u>Mix Ratio:</u> - Correct proportion of sand & water to meet ACI 530.08 min. required strength. Ref. Mix Ratio for Type M & S (refer: QC/SITE/7)	Type M: Compressive Strength (17.2 MPa) 2500 PSI @ 28 days. (ii) Type S: Compressive Strength 1800 psi (12.4 MPa) @ 28 days

Required Test	Test Method	Test Frequency	Acceptance Criteria Verified by Consultant Engineer)
Masonry Block			
Compressive strength & dimensions	Sampled and tested in accordance with ASTM C 140	Preliminary test of 3 samples of concrete blocks delivered on site	Unit conforms to ASTM C90. <i>ASTM do not require design standard. Only help assure compliance with the design.</i> Compressive strength and not less than of 1500 psi
Ceramic Tiles			
Inspect Appearance and dimensions of tiles	As per manufacturer's approved specifications	Samples to be submitted for approval	Conform to the requirement of ANSI A137.1.& Specifications
Carpet			
Adhesive as per ASTM D 6004	As per manufacturer's approved specifications	Samples to be submitted for approval	Ensure compliance with approved sample and adhesive
Linoleum Flooring & Vinyl Flooring			
Thickness, resistance chemicals, heat light, flexibility, static load	ASTM F2034	Provide sample of Linoleum and adhesive for approval	Ensure approved materials, self-leveling cement used as per specs.
Insulation			
Thickness, thermal conductivity, compressive strength, water absorption	ASTM C1153-97 ASTM D3564	Sample upon delivery	Insure 5cm thick, thermal conductivity .032, strength 120 pa as per specs.
Bituminous Roofing Membrane & Roof Insulation			
Tensile strength, rapture strength Roof Insulation system / product	ASTM C 578-01 (Extruded, expanded rigid thermal properties	Prior to application	Ensure tensile strength 600N/5cm, rapture strength 130N/5cm, as per specifications
Structural Steel Roof			

Required Test	Test Method	Test Frequency	Acceptance Criteria Verified by Consultant Engineer)
Welding Reqr: welding rod , Heater's inspection materials, Dye Penetrant, magnetic flux	Inspection according to AWS D1.1 and IBC 1704 AWS D 1.1 & 1.8	Inspection continuous onsite and shop	Ensure welding is in compliance with AWS D1.1, workmanship, technique, qualification of welders
Electrical wires & Cables			
Manufacturer's certificate	Inspection Electrical QC/ Design Engineers and NEC standards	Samples to submitted prior to installation	To be approved by QC electrical Engineer
Plumbing Pipes			
Manufacturer's certificate	Field Pressure test and IPC standards	After installation of plumbing pipes	According to the mechanical specifications
Water Well			
Physical, Chemical & Bacteriological	Test according to WHO requirements	Well water will be tested after drilling well	Tested by approved water testing lab.

Section 9: Complete Rework Items Procedures

Any sign of system deficiencies whether discovered by the Client, Site Engineer and/or the Contractor/Designer, shall result in modifications to the system to correct these defects.

The contractor shall be informed by the Site Engineer in writing when a defect is identified and shall immediately stop work or use of the defective materials. The contractor shall repair /replace or correct deficiency before work commences.

If the contractor believes a suitable repair is possible, executed at their expenses, the Contractor has to prepare a plan to affect repair or correction and submit to the Client and Site Engineer for approval.

9.1 Responsibility

It is the responsibility of the Site Engineer to ensure that identified construction defects are corrected in a timely manner. Defects identified by the client shall also be noted and rectified in a timely manner.

9.2 Item List for Rework

The Site Engineer shall maintain a list of works that do not comply with the construction plans, technical specifications, contract and BOQ. The list shall have the following details:

- Identification, what items need to be reworked
- The date the defect was originally discovered
- The date the item was corrected

An item that is corrected on the same day it is discovered shall not be reported in this log, but in the daily quality control report.

9.3 Rework Procedure for Construction Work

When non-compliances with technical specifications or drawings are observed in the executed construction works, materials and installations, the contractors' project manager and Site Engineer shall make sure that non-conforming materials, works, or installations are identified and separately stored to prevent unintended use.

The Site Engineer shall immediately inform the contractor of any non-compliances. After receipt of such notice, the contractor shall take corrective actions immediately.

Variations from the contract requirements and/or quality shall be documented for corrective actions by the contractor. A non-conformance report shall be issued to the contractor for corrective actions to be taken within 3 working days.

If the contractor fails to correct a minor defect after 5 days of the notice, it shall result in a non-conformance which shall be formally documented.

If the contractor fails to take corrective actions regarding the identified non-conformances within the specified period of time, a Stop Work Order shall be issued to the contractor.

Related or continuing activities of construction shall be stopped forthwith until the rectification of deficiencies that are critical to the integrity of the structure or the facility and/ or safety of public.

After issuing the Stop Work Order, the site engineer shall inform the client to help resolve the issues with contractors' management.

Section 10: Reporting for Construction Works

10.1 Daily Inspection Report

Daily inspection reports shall be prepared by consultant's site engineer to document complete details of the day-to-day progress on site.

The Site Engineer shall inspect contractor's daily construction work, efficiency of deployed manpower, tools, and equipment, start and stop times, and QC inspections of work activities.

The Site Engineer shall review, comment, and approve the daily reports presented by the contractor. Reports shall include pertinent information including problems encountered during construction, work progress, safety hazards encountered, instructions given, and corrective actions taken, delays encounters, a record of visitors to the work site, quality control problem areas, weather conditions, photographs, deviations from the QC plan, construction deficiencies encountered, and record of meetings held.

10.2 Monthly Progress Report

The monthly progress reports shall contain overall progress of project activities reported for the current month including financial progress, milestones, key dates, accomplishments, bottlenecks, materials' certification, tests performed, and QC deficiencies corrected.

10.3 Materials Testing Record

Results of materials testing are also important record to be maintained at construction site as a proof of construction quality. Test results of all the construction materials are recorded in the record book maintained on the construction site to improve the quality of work.

All testing activities shall be recorded on the relevant construction QC Report, indicating the name and number of tests performed, specification paragraph reference, and location performed. It shall be entered into computerized QC tracking system.

10.4 Site Document Control

Document controllers shall maintain project documents. These documents ensure that accurate information is distributed throughout the organization, on time, to the people who need it.

The Document Controller (Administration support staff) shall implement the project quality system to control the identification, numbering, modification, approval, distribution and filing of all documents, data and drawings.

The checking, approval, identification and distribution of the document and drawings are as indicated in the Project Quality System Procedure (PQSP). Each document shall be assigned a unique number in accordance with standard numbering procedures.

10.5 Quality Records

The quality records to be maintained and kept for the program are as follows:

- Inspection Records
- Method Statements
- Non-conformances and corrective reports

- QC plan and audit reports
- Test records, certificates, warranties, and guarantee
- Client, contractor, and consultant progress reports
- Contractor and consultant monthly payment reports
- Incoming and outgoing correspondence
- Technical drawings, shop drawing and as-build drawings
- Document register log
- Design documents
- Tender documents
- Construction records
- Other related records

10.6 Documentation Storage

QC team shall maintain all construction related documents and submittals in a combination of a secure e-document filing and storage system. The computerized document control tracking system shall be archived in consultant's network server. Internal project QC audit shall be conducted at a random interval on the document controls system when necessary.

Section I I: Annexes

- Annex 1: Daily Progress Report
- Annex 2: Weekly Progress Report
- Annex 3: Request for Testing (RFT)
- Annex 4: Request for Survey (RFS)
- Annex 5: Request for Inspection (RFIP)
- Annex 6: Non-conformance Report
- Annex 7: Request for Audit Testing
- Annex 8: Request for Audit Survey (RFS)
- Annex 9: Request for Information
- Annex 10: Design Checklist

Annex I: Daily Progress Report

DPR Date			
Site No.			
Project Title			
Location		Province	
Coordinates			
Contractor			
Date of Contract Signature			
Date of Construction Start			
Date of Completion (Contract)			
New Completion Date (Time Amendment)			
Percentage of Project Complete			
Is project on schedule Y/N			

Weather/ precipitation		Temp. day (°C)		Temp. night (°C)	
Work on Stop	If "YES", short explanation				

Reported by	
-------------	--

1. Personnel on Site:

Contractor	Super visor	Engineer	Fore man	Skilled Labor	Unskilled Labor	Operators	Others

2. Major equipment/machinery on site:

Type:	Number	Acceptable Quality: Y/N	Remarks

3. Supplied Material:

Type	Quantity Delivered	Acceptable Quality Y/N	Total Quantity Acceptable	Approved Y/N	Remarks

4. Work Progress :

Building/ Structure	BoQ No	Work	Description

5. Inspection & Testing:

Type	Y/N	Forms Attached	Forms Sent Separately	Remarks
Material Test				
Routine Inspection				
Preparatory Inspection				
Initial Inspection				
Follow up				

6. Issued documents (RFI, Non Conformity, Non Compliance etc.) :

Date	No.	Issued by	Issued to	Description	Date of rectification

7. Instructions to the Contractor:

Occasion	Instructions for rectifying	Date for rectification

8. Design Issues:

Date	No.	Issued by	Issued to	Description	Date of rectification

9. QA Report : (Deficiency Ongoing / completed)

Deficiency	Status	Remarks

10. Safety Issues:

Attended by	Safety issues discussed	Date for rectification

11. Other Discussions/ Meetings:

With	Discussed	Comments

12. Visitors

Visitor	Reason for visit	Comments

13. Pictures:

Please insert pictures documenting activities and defects and describe when necessary, the number of photos is not limited	
Description/ location	Description/ location
P H O T O	P H O T O
Description/ location	Description/ location
P H O T O	P H O T O

Annex 2: Weekly Progress Report

WPR Date	2014-MM-DD	Report Period	DDth to DDth of MM. YY	
Site No.				
Project Title				
Location		Province		
Contractor				
Date of Contract Signature				
Date of Construction Start				
Date of Completion (Contract)				
New Completion Date (Time Amendment)				
Percentage of Project Complete				
Is project on schedule?				

Weather conditions (brief description)		Average Temperature in rep.	+5° C / -4° C
Work on Stop(Y/N) / Day	If “Y” brief explanation		

Reported by	

1. Labor on site:

Day							

2. Equipment on site:

Day							

3. Issued documents (RFI, Non-Conformity, Non Compliance etc.) :

Date	No.	Issued by	Issued to	Description	Date of rectification

4. Instructions:

Occasion	Instructions to contractor/ subcontractor/ supplier	Date of rectification

5. Design Issues:

Date	No.	Issued by	Issued to	Description	Date of rectification

6. Safety and Security Issues:

Attended by	Day	Safety Issues discussed	Date for rectification

7. Other Discussions:

With	Day	Discussed	Comments

8. Visitors:

Visitors	Day	Reason for visit	Comments

9. Pictures:

Please insert pictures documenting activities and defects and describe when necessary (photos have to be compressed) 10-20 photos	
Description/ location	Description/ location
P H O T O	P H O T O
Description/ location	Description/ location
P H O T O	P H O T O

Annex 3: Request for Testing (RFT)

**Project
No.:
Project
Name:
Contract
or:**

DOCUMENT NO:

Rev No:

Request for Testing of the following works:

- Embankment (Layer...)
- Embankment Top (Layer...)
- Base Course (Layer...)
- Structural Concrete
- Others.....
- Stone Masonry Work
- Culvert
- Material Source

Type of Test: _____

Location: Km _____ to _____ Km

Test Frequency: _____ **Volume/Area/Weight Tested:**

_____ **No. tests:** _____

This will be ready for test on: Date: _____ Time:

Contractor's comment/Description:

Requested by (Contractor): _____ Date: _____

(day/month/year)

Date: _____

Received by (Contractor):

(day/month/year)

Test Result:

Lab No.:

Site Engineer's Comments:

Material Engineer's Comments

Approved by:
Approved, Re-
submit

Not

Checked By:

Date: _____

(day/month/year)

Date: _____

Approved By:

(day/month/year)

Annex 4: Request for Survey (RFS)

**Project
No.:
Project
Name:
Contract
or:**

DOCUMENT NO:

Rev No:

Request for Survey of the following works:

- | | |
|--|----------------------------------|
| <input type="checkbox"/> O.G.L
Drainage Structure | <input type="checkbox"/> |
| <input type="checkbox"/> Embankment
Structure | <input type="checkbox"/> Culvert |
| <input type="checkbox"/> Embankment Top
Course | <input type="checkbox"/> Base |
| <input type="checkbox"/> Others..... | |

Type of Survey Check:

- | | |
|--|---------------------------------|
| <input type="checkbox"/> Dimensional Tolerance

ark & stations | <input type="checkbox"/> Benchm |
| <input type="checkbox"/> Alignment
Topographic pick-up | <input type="checkbox"/> |

<input type="checkbox"/> Volume/Area/Length to be checked:	No. Points:
---	--------------------

Location: Km _____ to _____ Km

Chainage/Station	Offset (m)
------------------	------------

This will be ready for survey on: Date: _____ Time: _____

Contractor's comment/Description:

Requested by (Contractor):

Date: _____

(day/month/year)

Date: _____

Received by (Contractor):

(day/month/year)

Survey Engineer's Comments/Recommendations:

Construction Engineer's Comments:

Approved by:
Approved, Re-

Not

submit

Checked By: _____

Date: _____

(day/month/year)

Approved By: _____

Date: _____

(day/month/year)

Annex 5: Request for Inspection (RFIP)

**Project
No.:**
**Project
Name:**
**Contract
or:**

DOCUMENT NO:

Rev No:

Request for Inspection of the following works:

- | | |
|--|--|
| <input type="checkbox"/> Embankment (Layer...)
Work | <input type="checkbox"/> Stone Masonry |
| <input type="checkbox"/> Embankment Top (Layer...) | <input type="checkbox"/> Culvert |
| <input type="checkbox"/> Base Course (Layer...) | <input type="checkbox"/> Material Source |
| <input type="checkbox"/> Structural Concrete | <input type="checkbox"/> Others |

Type of Inspection: _____

Location: Km _____ to _____ Km

Inspection Frequency: _____ **Volume/Area/Weight inspected:**

_____ **No. Inspection:** _____

This will be ready for inspection on: Date: _____ Time: _____

Contractor's comment/Description:

Requested by (Contractor): _____ Date:

_____ (day/month/year)

Received by (Contractor): _____ Date:

_____ (day/month/year)

Test Result: _____ **Lab No.:** _____

Site Engineer's Comments:

Materials Engineer's Comments:

Approved by:
Approved, Re-
submit

Not

Checked By: _____ Date:

_____ (day/month/year) Approved By:

_____ Date:

_____ (day/month/year)

Annex 6: Non-conformance Report

**Project
No.:**
**Project
Name:**
Contractor:

DOCUMENT NO:

Rev No:

NCR No.:	Rev No:	Date Issued	Issued By:	Page: 1 of 2
----------	---------	-------------	------------	--------------

Description of Non-Conformance:	(List Specification/Drawings, Other attachment)
Effect on Construction Schedule:	

Proposed
Disposition/Action to
Resolve: Accept as is:

- Remove and replace:
- Repair:
- Other (Explain):
- Comment

Pre	Na	Dat
par	m	e:

Acknowledgement of receipt by Contractor:	
Name:	Signature:
Date:	

Contractor Proposed Action/Remedial Measure:	
Remedial Work will be carried out by the Date:	
Contractor's QC Manager/Representative	
Name:	Signature:
Date:	
Contractor's Project Manager	
Name:	Signature:
Date:	

PO Approval to Proposed Action/Remedial Measure: Approve <input type="checkbox"/> Not Approve <input type="checkbox"/>	PO Representative: Name:
Comment:	Signature: Date:

Confirmation/Inspection of Action/Remedial Measure: Approve <input type="checkbox"/> Not Approve <input type="checkbox"/>	PO Representative: Name:
Comment:	Signature: Date:

Non-Conformance Close-Out: Re-issued <input type="checkbox"/> Close-Out <input type="checkbox"/>	PO Representative: Name:
PO Representative: Verification Non-Conformance Close-Out:	
Name:	Signature:
Date:	

Annex 7: Request for Audit Testing

**Project
No.:**
**Project
Name:**
**Contract
or:**

DOCUMENT NO:

Rev No:

Request for Audit Test of the following works:

- | | |
|--|--|
| <input type="checkbox"/> Embankment (Layer...) | |
| <input type="checkbox"/> Embankment Top (Layer...)
Work | <input type="checkbox"/> Stone Masonry |
| <input type="checkbox"/> Base Course (Layer...) | <input type="checkbox"/> Culvert |
| <input type="checkbox"/> Structural Concrete | <input type="checkbox"/> Material Source |
| <input type="checkbox"/> Others _____ | |

Type of Test: _____

Location: Km _____ to _____ Km

Test Frequency: _____ **Volume/Area/Weight Tested:** _____ **No. tests:** _____

Chainage/Station
set (m)

Off

Requested by: _____ Date: _____

(
day/month/year) Received by: _____ Date: _____

(day/month/year)

Test Result: _____ **Lab No.:** _____

(Lab) Comments/Recommendations:

Engineer's Comments:

Approved by:
Approved, Re-
submit

Not

Checked By: _____

Date: _____(day/month/year)

Approved By: _____

Date: _____(day/month/year)

Engineer's Comments:

Approved by:
Approved, Re-submit

Not

Checked By: _____ Date: _____
_____ (day/month/year)

Approved By: _____ Date: _____
_____ (day/month/year)

Annex 9: Request for Information

**Project
No.:
Project
Name:
Contractor:**

Project Code / Location:	RFI No.:		
Project Manager:	Report Date:		
Site QC Engineer:	Response Status: /	/ Date By:	
Documents Ref:	Division:		
Area of Concern:	Subject Matter:		
(i) Issues:			
(ii) Impact:			
(iii) Recommendations by			
Proposed Solution / follow up Action:			
Submitted By:	Signature :	Date:	
Issue closed/open	Changes :	Yes	No
By:	1.Design		
Date:	2.Construction		
	3.Cost Impact		
	4.Extension of		
Signed by:			
Site Engineer: _____		Date: _____	
(day/month/year)			
Client representative: _____		Date: _____	

Attachments: - (Photos, sketches etc.)

Annex I0: Design Checklist

**Project
No.:
Project
Name:
Contract
or:**

					Date	
Project Title						
Province						
Specific Location						
Client						
ARCHITECTURAL REVIEW				Yes	No	Remarks
Have all previous design comments been answered?						
Do the drawings comply with the BoQ?						
Do the drawings comply with the technical specifications?						
Have the designs been coordinated with Structural						
Have the designs been coordinated with Electrical						
Have the designs been coordinated with Mechanical						
Are title blocks labeled correctly?						
Are relevant calculations submitted?						
Are the drawings updated on the drawing register?						
PO PM		Signature			Date	
STRUCTURAL REVIEW				Yes	No	Remarks
Have all previous design comments been answered?						
Do the drawings comply with the BOQ?						
Do the drawings comply with the technical specifications?						
Have the designs been coordinated with Architects?						
Have the designs been coordinated with Electrical						
Have the designs been coordinated with Mechanical						
Are title blocks labeled correctly?						
Are relevant calculations submitted?						
Are the drawings updated on the drawing register?						
PO PM		Signature			Date	
MECHANICAL REVIEW				Yes	No	Remarks
Have all previous design comments been answered?						
Do the drawings comply with the BOQ?						
Do the drawings comply with the technical specifications?						
Have the designs been coordinated with Architects?						

Have the designs been coordinated with Structural			
Have the designs been coordinated with Electrical			
Are title blocks labeled correctly?			
Are relevant calculations submitted?			
Are the drawings updated on the drawing register?			
P O P M	Signature	Date	

ELECTRICAL REVIEW	Yes	No	Remark
Have all previous design comments been answered?			
Do the drawings comply with the BOQ?			
Do the drawings comply with the technical specifications?			
Have the designs been coordinated with Architects?			
Have the designs been coordinated with Structural			
Have the designs been coordinated with Mechanical			
Are title blocks labeled correctly?			
Are relevant calculations submitted?			
Are the drawings updated on the drawing register?			
P O P M	Signature	Date	

BILL OF QUANTITY REVIEW	Yes	No	Remark
Have all previous review comments been answered?			
Does the BOQ comply with the drawings?			
Does the BOQ comply with the technical specifications?			
Has a spell check been carried out?			
Are the titles of the BOQ correct?			
Are the drawings updated on the drawing register?			
P O P M	Signature	Date	

PO COMMENTS ATTACHED			Signature	Date
YES		NO		

Submitted by	Signature	Date
---------------------	-----------	------

Reviewed by		
Approved by		