

# QUALITY ASSURANCE & CONTROL OF CIVIL WORKS



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## **Acronyms and abbreviations**

## 1 Introduction

The successful implementation of projects is dependent on Quality control, which is vital to the Construction of infrastructure projects. Defects or failures in constructed facilities can result in large cost overruns and lead to delays of the implementation schedule. Even with minor defects, re-construction may be required and facility operations impaired and delayed. In the worst case, failures may cause personal injuries or fatalities. Sound project management of the Program supported by a thorough Quality Control System (QCS) ensures that the work is carried out professionally with value engineering. For the efficiency of the Quality Control Project Management it will be necessary to have a fair and transparent mechanism with clear communication and instructions on site.

The quality system described in this project quality plan (QCM) shall form the core activities and processes to be utilized to monitor and control throughout the success of this project.

The Quality Control Plan comprises:

- The Site Engineer will maintain an adequate inspection system and perform inspections that will ensure agreement compliance.
- The Site Engineer will maintain inspection records and make them available to the client.
- The Site Engineer will allow the client to do its own tests and inspections and requires the implementer to assist.
- The Site Engineer follow up tests and inspections will be for its benefit of project deliverables. The quality control obligations in the testing and inspection remain independent and unchanged.
- The Site Engineer to assist the client (owner) in ensuring completion of this project within the stated timeline, budget and quality.
- The Site Engineer to provide quality design management and construction management services that consistently meets clients' statutory and regulatory requirements.
- The Site Engineer to be responsive in implementing good engineering practices to eliminate potential quality deficiencies.
- The Site Engineer continuously to improve all functions within the project team in cooperation with the client through innovation and creativity.

## 2 Objectives

With a clear concise and manageable quality system each member of the Construction Supervision Team can ensure that it has played its part in the success and value of the project. Procedures that have been closely followed will ensure that the Employer/Client is confidently receiving a cost effective quality product in a timely manner.

It is vital that the quality system is reviewed regularly in order to revise procedures when necessary and/or 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 requirements. It describes the process that the PO will use to assure compliance with those requirements. The agreement is the foundation for the outcomes expected from the quality control plan.

### 3 Communication plan (Interaction)

In order to have thorough and clear communication at all times between all involved partners Site Engineer shall coordinate:

- All construction documents as there are Drawings, BoQ, Specifications, Submittals, Test reports, Inspection reports, Daily, Weekly and Monthly Reports, Safety reports will be available, maintained and stored in Site Engineer office for review.
- Site Engineer will be permanently on site and carry out inspections during construction on daily basis.
- Site Engineer shall constantly coordinate/liaise with the Client and Contractor during pre-construction (site preparations), construction, and post construction project cycle
- Routine joint inspection with Client, Site Engineer will document the actual status of the project to ensure that work activities in the site have been done in accordance to the contract. Agreement on observations will be noted and entered in separate daily inspection reports
- Client Engineer shall ensure that the quality control is applied in accordance to Quality control procedures
- Client Engineer will conduct inspection independently with contractor's representative and write notification in daily inspection report
- Client and Site Engineer will reach consensus on methods of inspection and testing according to the specifications in accordance to QCM.
- Client and Site Engineer will agree on the size of the construction task that its materials require to be tested in accordance with the Technical Specifications and QCM. Follow up joint witness inspections in test laboratory by Client and Site Engineer is mandatory
- Client and Site Engineer will reach consensus on defect rectification requirements and will be noted in separate defect log/reports.
- Client and Site Engineer will 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 Site Engineer, the matter will be forwarded to the head office.
- If the disagreement is not resolved between Client and Site Engineer and feels that the issue is serious and needs special attention, the problem should be brought to attention to the JV back stopping team for further expertize.
- Client and Site Engineer will update their QC and QA reports on daily basis and old issues will not be repeated after rectifications measures are taken and closed.
- Client and Site Engineer will conduct weekly QC meetings on site. Minutes of meetings have to be prepared by Site Engineer.

### 4 Duties, responsibilities and authority of QC personnel

#### 4.1 Client's representative

The Client, represented by the Site Engineer is responsible and accountable for the implementation of all activities. The Client will facilitate the efforts of the design and construction projects. The PM will facilitate the efforts of the design and construction teams in a coherent and efficient manner and will be ultimately responsible for ensuring the objects of the PO and PPAF as described in the agreement and supporting documentation.

## **4.2 PO representative**

Site Engineer is directly supervising and monitoring to assure the construction quality control system. Site Engineer will report directly on a day-to-day basis regarding the progress of the works. Site Engineer's Quality Control team ensures that the Program Quality Management and Safety System are being implemented according to the requirements of the PO. The Site Engineer oversees all technical aspects in the specified technical area of work including but not limited to assessment, design, Bill of Quantities (BOQ) calculation, tendering, technical specification, and monitoring.

## **4.3 Site engineer**

The Site Engineer is responsible for the directly supervision of contractors site engineers including contractors QC engineers. Provide field project control support by identifying, monitoring, project related issues, impacts and resolution. Directly liaise with contractors and Client when necessary and directly report to the Client for technical advice, support and field resolution when necessary. The Site Engineer oversees 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, tendering, technical specification, and monitoring. The Site Engineer is responsible for the design integrity, professional design standards and all services required by the agreement. Furthermore for the development of design quality control plan, incorporation and maintenance for the approved design schedule. Site Engineer's shall be responsible for ensuring that all designs, specifications and BOQ's produced for this award are in accordance with the requirements identified herein. The Site Engineer will be responsible to implement and manage the quality control program. In addition to implementing and managing the quality control program, the Site Engineer is required to perform submittal review and approval, ensure testing is performed and provide QC certification and documentation as required in the agreement. The Site Engineer is responsible for managing the coordinating personnel required by the agreement.

## **4.4 Contractor's project manager**

The contractor has based on the contract agreement to assign a Project Manager with required qualifications and skills to ensure the completion of the infrastructure project successful according to the approved implementation schedule in quality and quantity. He is overseeing the work of the site engineers. The PM will guarantee QCM standards are performed, and prepare QC certifications and documentation required by the agreement.

The PM shall be on the construction site during any shifts when construction work is performed. Duties and responsibilities according to the QCM are not limited to the contract agreement between the Employer and Contractor.

## **4.5 Contractor's site engineer(s)**

Site engineers oversees the whole construction process and shall assist the PM in processing and maintaining files for submittals, preparing and publishing reports, and meeting minutes. The Site Engineer is responsible to ensure the quality and quantity of the work based on the Design and Technical Specifications. He has to manage all processes on site, will be responsible for the material planning and timely provision, the planning of work force to ensure the project implementation in time, quality and quantity. The site engineer is empowered by the PM to suspend construction activities while deficiencies are corrected after the Client and Clients Representative are informed. There will be at least one site engineer per site but not limited if necessary and/or requested by the client or clients' representative. Duties and responsibilities according to the QCM are not limited to the contract agreement between the Employer and Contractor.

## 5 Design

### 5.1 Background

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

### 5.2 Purposes of this design quality control plan

- Maximize the use of local materials
- Maximize the use of local men-power
- Achieve the maximum possible yield from available resources

### 5.3 Subjected to the conditions

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

### 5.4 The components of design quality

#### 5.4.1 Proper team

The Design Company/ Contractor which is responsible for Design QC will provide or employ professional people who have good training and have experience in developing designs. All matters concerning the quality control of the project will be reported in written to the Client and Site Engineer.

#### 5.4.2 Proper Utilities

The Design Company/ Contractor will provide proper equipment and dependable software for Analysis, Design and Computer Aided Drawings.

#### 5.4.3 Adequate training

The Design Company/ Contractor that will have contributions to the designs will be trained about internationally accepted and used designs techniques and construction systems.

#### 5.4.4 Codes and standards

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

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

#### 5.4.5 The governing codes in 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

## 5.5 Main steps of quality achievement

- Clear understanding of the requirements of the Client
- Developing and proposing a satisfactory architectural preliminary that satisfies the code requirements
- The geographic & climatic requirements
- The cost efficiency requirements are satisfactorily
- Presentation of the above to the Client together with code analysis report.
- Achieving approval of the Client
- Selection of design criteria for application project, selection of materials of construction, technologies.
- Reporting to the Client together with possible alternatives.
- Achieving final approval of the Client
- Finalizing Architectural Designs according to comments of the Client and Site Engineer
- Achieving approval of the client
- 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.
- Achieving approval of the client
- Preparing quantitative calculations for tendering (BoQ)
- Preparing Technical Specifications (TS) to achieve desired quality and to enable correct cost estimation of bidders and to avoid future disputes

## 5.6 Design quality control methodology

- A network that is accessible to all designers will be established and all daily works will be stored to a common area in this network at the end of each working day.
- Architects and Engineers will proceed according to the items listed in the check lists as presented on Annexes and at the start of each activity will prepare a list of particulars of the requirement (e.g. main requirement of client or task, codes to be followed, min or maximum size requirements etc.).
- The Engineer of Record will examine the report, will invite the other engineers or architects for their comments if the task requires additional information from different disciplines etc. and will approve the report together with his/her additional comments.
- After achieving the mentioned approval the designer will proceed. The designer will provide a code confirmation list as soon as he completes the design.
- The design team will have one quality control meeting every week and will discuss the parts of the designs that were produced in the preceding week and all comments will be recorded and minutes will be provided to the Client and Site Engineer
- After completion of a specific design the complete 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, the codes etc.
- It is impossible for a design to remain 100% unchanged during the project life cycle. Considering this factor of design changes, a spreadsheet has to be produced to highlight where changes have been made and to which drawings and sites they apply.
- Any field design changes will be brought to acknowledgement and discussed with the Client and Site Engineer so that the reasons of the request will be clearly understood and negotiated. In case required, the client will be informed about the design changes accompanying a report explaining the reasons, effects on project and financial requirements and possibly time schedule effects of it.
- After approval of the request the designs will be revised and will be submitted to the client for the final approval.



## 6 Construction

### 6.1 Submittal procedures and initial submittal register

Site Engineer will administer and control the processing of contractors' submittals. After being reviewed for completeness, submittal documents will be transmitted to the relevant staff in Design Department for review and verification for compliance with contract requirements. Submittal documents need to be approved finally by the Client.

In case of Design/ Build contracts the submittal documents can be prepared in compliance between the design and construction department of the contractor but have to be finally approved by the design department.

#### 6.1.1 Submittal register

The contractor will submit and maintain a submittal schedule. The Site Engineer will review the schedule in accordance with the construction progress schedule.

The detailed progress schedule will be initially submitted within 14 days after the award of the contract and may be updated as required or after application of the contractor. If any changes apply the contractor need the approval by the Client or Clients Representatives.

Site Engineer will maintain a completed submittal schedule and list of products for all items requiring Clients 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)
- Highlighting any items that require expedited review to meet the project schedule
- Identify which submittals require Clients and/or Site Engineers approval

These schedules shall be presented in the attached form in both electronic and hard copy version and shall be updated and sent to the Clients and/or Site Engineers on a minimum monthly basis.

#### 6.1.2 Review period

Contractor will insure that Submittals will be prepared sufficiently in advance so that review and approval by the Site Engineer in coordination with the Client will be given before commencement of related work. The contractor is responsible for the preparation of Submittals according to the time schedule to avoid delays. If there any delays apply due to contractors fault penalties according to the contract will apply.

In case longer review and approval periods are required, Site Engineer and the contractor shall schedule work accordingly to avoid that progress schedules are not adversely impacted.

#### 6.1.3 Submittal reviewers

- The Contractors has to fill out and complete submittal forms and to submit in paper form and one electronic copy of all required submittals to the Site Engineer
- Site Engineer has to review the submittal documents to ascertain whether the package is complete. If submittal is incomplete the submittal will be returned to the contractor.
- The complete submittal documents and all copied attachments will be stored in Client Engineers data base and will be forwarded to the appropriate reviewer in the Design Department

- The Design team will review the submittal documents in compliance with the contract specification and agreement and return to the Site Engineer with comments and approval
- Site Engineer in accordance with the Client and will return the submittal to the contractor with a decision
- The Client reserve the right that submittal reviewers other than the Site Engineer, qualified in the disciplines will review and certify that the submittals meet the requirements of this agreement prior to certification or approval by the Site Engineer
- The contractors PM and/or site engineers and design engineers will be authorized to review and certify submittals prior to approval by the Site Engineer but it applies that the final decision will be taken by the Client

## **6.2 Changes in approved submittals**

Changes in approved submittals will not be allowed unless those approved submittals with changes have been resubmitted and approved as written in clause 6.1.

### **6.2.1 Supplemental submittals**

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

### **6.2.2 Engineering review**

- Submittals will be reviewed for conformance with the Technical Specifications, BoQ and the contract agreement.
- The review of a separate item will not constitute necessarily the review of an assembly in which the item functions.
- The reviewer, Designer, Contractor, Site Engineer, will indicate its reviews of the submittal and the action taken (approvals and non-approvals), signed and dated and submitted to the Client and
- Review actions will have the following meanings:
  - Approved: is an acceptance
  - Submittal appears to conform to the respective requirements of the specifications and agreement
  - Fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed; and that the submittal not need be resubmitted
  - 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.

## 7 Laboratory testing for material

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

### 7.1 Testing plan and logs

As tests are performed, the Contractors PM or Site Engineer shall record on the “Testing Plan and Log” the date the test was performed and the date the test results were forwarded to the Site Engineer. The Site Engineer has to submit all test results to the Client. A copy of the final “Testing Plan and Log” shall be provided in the Operations and Maintenance support documentation.

If required materials qualification testing will be done prior to construction to verify that the materials comply with requirements of the Contract Agreement, the Technical Specifications and BoQ. The contractor will obtain representative samples of the materials designated as the proposed source of the materials. Test samples will be sent by the contractor to the approved testing laboratories. The testing laboratory will report all test results for determination of materials quality. The testing will be performed by the laboratory, the contractor and monitored by the Site Engineer.

The Client will 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 has to 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 must be used or other acceptable materials must be sampled and tested as noted before prior to incorporating into the work.

### 7.2 List of materials under testing system

The below stated list of material is for sampling and not completed. The Client and Site Engineer reserve the right to require tests for material additional to the materials as stated below:

- Cement
- Concrete
- Asphalt
- Mortar
- Aggregates
- Reinforcement steel
- Wires
- Plaster
- Electrical Material
- Plumbing Material
- Sanitary Material
- Guard Rails
- Signs
- PPE
- Wood
- Shuttering Materials
- Others necessary (refer to technical specification, BOQ and Technical drawings recommendations)

All items for construction shall be covered under the Contract Agreement, the Technical Specifications and BoQ and shall meet IBC Standards. If required some of the items shall be provided as samples which the contractor must produce/purchase to the same standard.

### 7.3 Material method of testing and frequency

All quality assurance testing will be conducted in accordance with Project Specifications, the Contract Agreement, Technical Specifications and BoQ or in accordance with an individual project construction plan. The Site Engineer will observe all applicable testing methods, as previously identified. The documentation and reporting of test results will be included with the daily construction QC report and entered into QC system.

All test results have to be updated and filed separately and if required to be presented to the Client.

All tests shall be carried out in accordance with international codes and/or specifications.

### 7.4 Routine materials testing

The Site Engineers will routinely inspect and verify that labels, tags, manifests or the identifying documents of all construction materials conform to the approved material specifications.

The Site Engineers will also monitor testing of components and equipment to ensure that tests and results conform to intended criteria.

The Site Engineers reserve the right to be present to witness testing and observe constructed features before being covered or obscured by subsequent construction activities.

All daily routine inspections, testing monitoring, and independent testing performing personnel will be recorded and entered into the QC system and will be available to be viewed by the Site Engineers as required.

Site Engineer shall develop material testing procedure based on construction progress schedule and quantities according to plans, specifications, and other contract documents for every definable feature of work include activity, sampling frequency, date, number of samples, and location of test.

Below stated table needs to be adjusted according to the project specifications and required standards in the design.

Required Test	Test Method	Test Frequency	Acceptance Criteria (Verified By QC Manager )
Grading & Leveling			
As per IBC 1803	Land surveying	Prior to start excavation	<b>To Establish finish floor elevation as per specifications and drawings</b>
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 <sup>2</sup>	<b>Insure compact fill to 95% or higher grade of maximum density and layers of 20cm.</b>

Required Test	Test Method	Test Frequency	Acceptance Criteria (Verified By QC Manager )
<b>Concrete</b>			
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 cylinders reserve.	<b>Minimum strength based on technical requirements and structural design</b>
Water/Cement Ratio		Preliminary testing of mix Design	<b>Limit .45 by weight</b>
Slump Test	ASTM C143	1 per batch prior to pouring concrete	<b>Reinforced concrete 100mm Non reinforced concrete, sidewalks, SOG 75mm.</b>
<b>Reinforcement Steel</b>			
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	<b>Must meet specifications requirement of grade 60, &gt; / 420 MPa yield strength</b>
<b>Water</b>			
Clearness & Cleanness	ACI 318 Sec.3.4	Prior to concrete mix	<b>Insure free of oil, acids, salts, organic and other substances</b>
<b>Aggregate Concrete</b>			
Gradation, salt, harmful materials As per 318 Sec. 3.3	ASTM C33 & C330	One sample at source prior to commencement of work	<b>Insure physical requirement of coarse &amp; fine aggregate. Absence of harmful substances</b>
<b>Grout</b>			
<i>Minimum Compressive Strength</i>	ASTM C1019	Preliminary testing of mix design. Test once on a daily basis during grouting operations.	<b>(i) Compressive strength for MTC project remain at least 13.8 MPa) @ 28 days</b>  Compressive strength at least 3000 psi (21 MPa) @ 28 days
<b>Cement Mortar</b>			
<i>Type M and / or S Cement</i>	<i>ASTM C 270 -08a Building Code Requirements for Masonry Structures Table 2.2.3.2, Table 3.1.8.2, Table 5.4.2</i>	<i>Masonry cement mortar (pre-packaged). <u>Mix Ratio:</u> - Correct proportion of sand &amp; water to meet ACI 530.08 min. required strength. Ref. Mix Ratio for Type M &amp; S (refer: QC/SITE/7)</i>	<b><i>Type M: Compressive Strength ( 17.2 MPa) 2500 PSI @ 28 days.</i></b>  <b><i>(ii) Type S: Compressive Strength 1800 psi (12.4 MPa) @ 28 days</i></b>
<b>Masonry Block</b>			
Compressive strength & dimensions	Sampled and tested in accordance with ASTM C 140	Preliminary test of 3 samples of concrete blocks delivered on site	<b>Unit conforms to ASTM C90. ASTM do not required design standard. Only help assure compliance with the design. Compressive strength and not less than of 1500 psi</b>

Required Test	Test Method	Test Frequency	Acceptance Criteria (Verified By QC Manager )
<b>Ceramic tiles</b>			
Inspect Appearance and dimensions of tiles	As per manufacturer's approved specifications	Samples to be submitted for approval	<b>Conform to the requirement of ANSI A137.1.&amp; Specifications</b>
<b>Carpet</b>			
Adhesive as per ASTM D 6004	As per manufacturer's approved specifications	Samples to be submitted for approval	<b>Ensure compliance with approved sample and adhesive</b>
<b>Linoleum Flooring &amp; Vinyl Flooring</b>			
Thickness, resistance chemicals, heat light, flexibility, static load	ASTM F2034	Provide sample of Linoleum and adhesive for approval	<b>Insure approved materials, self-leveling cement used as per specs.</b>
<b>Insulation</b>			
Thickness, thermal conductivity, compressive strength, water absorption	ASTM C1153-97 ASTM D3564	Sample upon delivery	<b>Insure 5cm thick, thermal conductivity .032, strength 120 Pa as per specs.</b>
<b>Bituminous Roofing Membrane &amp; Roof Insulation</b>			
Tensile strength, rapture strength		Prior to application	<b>Insure tensile strength 600N/5cm, rapture strength130N/5cm, as per specifications</b>
Roof Insulation system / product	ASTM C 578-01 (extruded, expanded rigid thermal properties		
<b>Structural Steel Roof</b>			
Welding Req:- welding rod , Heaters 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	<b>Insure welding is in compliance with AWS D1.1, workmanship, technique, qualification of welders</b>
<b>Electrical wires &amp; Cables</b>			
Manufacturer's certificate	Inspection Electrical QC/ Design Engineers and NEC standards	Samples to submitted prior to installation	<b>To be approved by QC electrical Engineer</b>
<b>Plumbing Pipes</b>			
Manufacturer's certificate	Field Pressure test and IPC standards	After installation of plumbing pipes	<b>According to the mechanical specifications</b>
<b>Water Well</b>			
<b>Physical, Chemical &amp; Bacteriological</b>	<b>Test according to WHO requirements</b>	<b>Well water will be tested after drilling well</b>	<b>Tested by approved water testing lab.</b>

## 8 Complete rework items- procedures

Any indication of system deficiencies whether discovered as a result of the Client, Site Engineer and/or the Contractor/Designer checks and tests, will result in modifications to the system to correct these deficiencies.

The contractor shall be notified by the Site Engineer in writing when deficiency is discovered and shall immediately stop work, or use of the deficiency materials and shall repair /replace or correct deficiency before work continues. The Client has to be informed in writing.

If any dispute the contractor shall submit in writing for Client and Site Engineer.

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 for the Client, Site Engineer for approval.

For the purpose of this manual, deficiency shall be any variation from the plan or specification that result in lower quality of work, reduce useful life cycle of work and impair 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 Agreement, Technical Specifications and BoQ.

### 8.1 Responsibility

It is the responsibility of the Site Engineer to ensure identified construction defects are corrected in a timely manner. Also defects identified by Client and Site Engineer will be noted and rectified in a timely manner.

### 8.2 Item list

The Site Engineer will maintain a list of work that does not comply with the construction plans and Technical Specifications Contract Agreement and BoQ

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

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

### 8.3 Rework procedure

When executed work, materials, or installations are found in non-compliance with Technical Specifications and/or drawings, the Contractor's PM and Site Engineer under supervision of the Site Engineer shall ensure that non-conforming materials, work, or installation are identified and controlled storage and separated to prevent unintended use or delivery.

The Site Engineer will notify the contractor of any noncompliance. After receipt of such notice, the contractor shall take immediate corrective action.

Major deviations from the contract requirements and/or quality are non-conformance and must be formally documented for corrective action by the Contractor. A non-conformance report must be issued to the contractor for corrective action to be taken within 3 working days.

If the Contractor fails to correct a minor deficiency after 5 days of the notice, it will result in a non-conformance and be formally documented.

If the contractor fails to take corrective action regarding non-conformance within the specified period of time, a Stop Work Order will be issued to the contractor.

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

If possible, this stop work order will only affect the defective, deficient or unsafe work (areas) and the contractor may continue with any or all other project work.

After issuing the Stop Work Order, or if possible in advance, the Site Engineer has to inform the Client to help solve the issues with contractor's management.

#### **8.4 Preventive action**

Preventive actions will be taken to eliminate any cause or potential non-conformity. Continuous prevention measures are permanently needed to avoid occurrence of deficiencies.



## 9 Reporting

### 9.1 Responsibility

The Contractors PM and site engineer will maintain current and complete records of on-site and off-site quality control project operations and activities.

Site Engineer will maintain a second copy of all the quality control records in site office and guarantee the unlimited access through the Client.

Site Engineer is responsible for reviewing and approving Contractors PM and/or Site Engineer's daily, weekly and monthly construction monitoring report.

Contractors PM and/or Site Engineers are responsible for submitting 3 weeks look ahead work plan and weekly performance.

### 9.2 Daily inspection report

QC inspection reports, provided by the Site Engineer, will be submitted daily and will account for each calendar day throughout the life cycle of the project.

The Site Engineer shall inspect contractors daily work activities, ranging from manpower checks, tools and equipment, availability on site, start and stop times etc. and QC inspection of work activities.

The Site Engineer shall review, comment and approve the daily reports presented by the contractor.

Reports will include pertinent information including directions received, problems encountered during construction, work progress, safety hazards encountered, instructions given and corrective actions taken, delays encountered, a record of visitors to the work site, quality control problem areas, weather condition, photos, deviations from the QC plan, construction deficiencies encountered, and record of meetings held.

### 9.3 Monitoring and control of works program

The Site Engineer team shall undertake regular review of the Contractors Overall Works Program so that it shall be in line with the approved Master Implementation Plan (base line programmed). Critical Path Analysis shall be performed to identify critical activities. The Site Engineer would work with the contractor to mitigate any delays to keep the project on schedule. QC and site engineers shall submit weekly performance / productivity S curve chart together with 3 weeks look ahead programmed

### 9.4 Monthly QC report

The monthly progress report shall contain overall progress of work plan activities reported for the current month. Financial progress, milestones key dates, accomplishments, bottlenecks, materials certifications, tests performed, QC deficiencies corrected.

### 9.5 Test records

All testing activities will be recorded on the relevant construction QC Report, indicating the name and number of tests performed, specification paragraph reference, and location performed, and will be entered into computerized QC tracking system. Test results will be recorded on the daily construction QC report or attachments and entered in QC system. Actual test reports will be furnished promptly to the PO or as directed by the specification.

## **9.6 Site document control**

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.

## **9.7 Quality records**

The quality records to be maintained and kept for the program are as follows<sup>WS</sup>:

- Inspection Records
- Method Statements
- Non-conformances and corrective action reports
- QC plan and Audit reports
- Test records, certificates, warranties and guarantee
- Client, Contractor's and Consultant Progress Report
- Contractor's & Consultant Monthly Payment Report
- Incoming & Outgoing Correspondence
- Technical Drawing, Shop Drawing and As-built Drawing
- Document Register Log
- Design document records
- Tender document records
- Construction document records
- Other documents necessary

## **9.8 Documentation storage**

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

## 10 Annexes

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**Annex 1: 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	Enginee r	Fore man	Skilled Labor	Unskille d 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 send Separately	Remarks
Material Test Performed				
Routine Inspection				
Preparatory Inspection				
Initial Inspection				
Follow up Inspection				

---

**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
PHOTO	PHOTO
Description/ location	Description/ location
PHOTO	PHOTO

**Annex 2: Weekly progress report**

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

<b>Weather conditions</b> (brief description)		<b>Average Temperature in rep. period d/n</b>	<b>+5° C/ -4° C</b>
<b>Work on Stop(Y/N) / Day</b>	<b>If "Y" brief explanation</b>		

<b>Reported by</b>	

**1. Labour on site:**

Day								

**2. Equipment on site:**

Day							

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

<b>Date</b>	<b>No.</b>	<b>Issued by</b>	<b>Issued to</b>	<b>Description</b>	<b>Date of rectification</b>



#### 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 <b>(photos have to be compressed) 10-20 photos</b>	
Description/ location	Description/ location
Photo	Photo
Description/ location	Description/ location
Photo	Photo

**Annex 3: Request for testing (RFT)**

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

**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)

Received by (Contractor): \_\_\_\_\_ Date: \_\_\_\_\_  
(day/month/year)

**Test Result:** \_\_\_\_\_ **Lab No.:** \_\_\_\_\_

**Site Engineer's Comments:**

---

**Material Engineer's Comments**

---

Approved by:

Not Approved, Re-submit

Checked By: \_\_\_\_\_  
(day/month/year)

Date: \_\_\_\_\_

Approved By: \_\_\_\_\_  
(day/month/year)

Date: \_\_\_\_\_

**Annex 4: Request for survey (RFS)**

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

**DOCUMENT NO:**

**Rev No:**

**Request for Survey of the following works:**

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

**Type of Survey Check:**

- |  |   |
|--|---|
| <input type="checkbox"/> Dimensional Tolerance | <input type="checkbox"/> Benchmark & stations |
| <input type="checkbox"/> Alignment             | <input type="checkbox"/> Topographic pick-up  |
| <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)

Received by (Contractor): \_\_\_\_\_ Date: \_\_\_\_\_

(day/month/year)

**Survey Engineer's Comments/Recommendations:**

---

**Construction Engineer's Comments:**

---

Approved by:

Not Approved, Re-

submit

Checked By: \_\_\_\_\_

Date: \_\_\_\_\_

(day/month/year)

Approved By: \_\_\_\_\_

Date: \_\_\_\_\_

(day/month/year)

**Annex 5: Request for inspection (RFIP)**

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

**DOCUMENT NO:**

**Rev No:**

**Request for Inspection of the following works:**

- |  |   |
|--|---|
| <input type="checkbox"/> Embankment (Layer...)     | <input type="checkbox"/> Stone Masonry Work |
| <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:  
submit

Not Approved, Re-

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:

Prepared By:	Name:	Date:
Noted By:	Name:	Date:

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:	PO Representative:
Approve <input type="checkbox"/> Not Approve <input type="checkbox"/>	Name:
Comment:	Signature:                      Date:

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

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

### Annex 7: Request for audit testing

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

**DOCUMENT NO:**

**Rev No:**

**Request for Audit Test 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:** \_\_\_\_\_

Chainage/Station	Offset (m)

**Requested by:** \_\_\_\_\_ **Date:**  
\_\_\_\_\_ (day/month/year)

**Received by:** \_\_\_\_\_ **Date:**  
\_\_\_\_\_ (day/month/year)

**Test Result:** \_\_\_\_\_ **Lab No.:** \_\_\_\_\_

**(Lab) Comments/Recommendations:**

---

**Engineer's Comments:**

---

Approved by:  
submit

Not Approved, Re-

Checked By: \_\_\_\_\_

Date: \_\_\_\_\_ (day/month/year)

Approved By: \_\_\_\_\_

Date: \_\_\_\_\_ (day/month/year)

**Annex 8: Request for audit survey (RFS)**

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

**DOCUMENT NO:**

**Rev No:**

**Request for Survey of the following works:**

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

**Type of Survey Check:**     Dimensional Tolerance                       Benchmark & Stations  
    Alignment     Topographic pick-up

**Volume/Area/Length to be checked:** \_\_\_\_\_ **No. Points:** \_\_\_\_\_

**Location:** Km \_\_\_\_\_ to Km \_\_\_\_\_  
   Chainage    Offset (m)

--	--

Requested by: \_\_\_\_\_ Date: \_\_\_\_\_ (day/month/year)

Received by: \_\_\_\_\_ Date: \_\_\_\_\_ (day/month/year)

**Survey Engineer's Comments/Recommendations:**

---

**Engineer's Comments:**

---

Approved by:

Not Approved, Re-submit

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 Time		
Signed by:			
Site Engineer: _____		Date: _____(day/month/year)	
Client representative: _____		Date: _____(day/month/year)	
Contractor: _____		Date: _____(day/month/year)	
Attachments: - (Photos, sketches etc.)			

**Annex 10: Design checklist**

Project No.:  
 Project Name:  
 Contractor:

		Date		
<b>Project Title</b>				
<b>Province</b>				
<b>Specific Location</b>				
<b>Client</b>				
<b>ARCHITECTURAL REVIEW</b>		<b>Yes</b>	<b>No</b>	<b>Remarks</b>
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 Engineers?				
Have the designs been coordinated with Electrical Engineers?				
Have the designs been coordinated with Mechanical Engineers?				
Are title blocks labeled correctly?				
Are relevant calculations submitted?				
Are the drawings updated on the drawing register?				
<b>PO PM</b>		<b>Signature</b>		<b>Date</b>
<b>STRUCTURAL REVIEW</b>		<b>Yes</b>	<b>No</b>	<b>Remarks</b>
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 Engineers?				
Have the designs been coordinated with Mechanical Engineers?				
Are title blocks labeled correctly?				
Are relevant calculations submitted?				
Are the drawings updated on the drawing register?				
<b>PO PM</b>		<b>Signature</b>		<b>Date</b>
<b>MECHANICAL REVIEW</b>		<b>Yes</b>	<b>No</b>	<b>Remarks</b>
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 Engineers?				



Have the designs been coordinated with Electrical Engineers?						
Are title blocks labeled correctly?						
Are relevant calculations submitted?						
Are the drawings updated on the drawing register?						
PO PM			Signature		Date	
<b>ELECTRICAL REVIEW</b>				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 Engineers?						
Have the designs been coordinated with Mechanical Engineers?						
Are title blocks labeled correctly?						
Are relevant calculations submitted?						
Are the drawings updated on the drawing register?						
PO PM			Signature		Date	
<b>BILL OF QUANTITY REVIEW</b>				Yes	No	Remarks
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?						
PO PM			Signature		Date	

<b>PO COMMENTS ATTACHED</b>				<b>Signature</b>		<b>Date</b>
YES		NO				

<b>Submitted by</b>			<b>Signature</b>		<b>Date</b>
<b>Reviewed by</b>			<b>Signature</b>		<b>Date</b>
<b>Approved by</b>			<b>Signature</b>		<b>Date</b>