SSIGL 28

NATIONAL GUIDELINES

For Small Scale Irrigation Development in Ethiopia

Construction Supervision

November 2018

Addis Ababa

MINISTRY OF AGRICULTURE

National Guidelines for Small Scale Irrigation Development in Ethiopia

SSIGL 28: Construction Supervision

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First Edition 2018

Ministry of Agriculture
Small-Scale Irrigation Development Directorate
P. O. Box 62347
Tel: +251-1-6462355
Fax: +251-1-6462355
Email: SSIDdirectorate@moa.gov.et
SSIDdirectorate@gmail.com
eDMS (intranet): MoA SSID DMS (http://172.28.1.188:8080/DMS/login.jsp)
Website: www.moa.gov.et

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DISCLAIMER

Ministry of Agriculture through the Consultant and core reviewers from all relevant stakeholders included the information to provide the contemporary approach about the subject matter. The information contained in the guidelines is obtained from sources believed tested and reliable and are augmented based on practical experiences. While it is believed that the guideline is enriched with professional advice, for it to be successful, needs services of competent professionals from all respective disciplines. It is believed, the guidelines presented herein are sound and to the expected standard. However, we hereby disclaim any liability, loss or risk taken by individuals, groups, or organization who does not act on the information contained herein as appropriate to the specific SSI site condition.

FORWARD

Ministry of Agriculture, based on the national strategic directions is striving to meet its commitments in which modernizing agriculture is on top of its highest priorities to sustain the rapid, broad-based and fair economic growth and development of the country. To date, major efforts have been made to remodel several important strategies and national guidelines by its major programs and projects.

While efforts have been made to create access to irrigation water and promoting sustainable irrigation development, several barriers are still hindering the implementation process and the performance of the schemes. The major technical constrains starts from poor planning and identification, study, design, construction, operation, and maintenance. One of the main reasons behind this outstanding challenge, in addition to the capacity limitations, is that SSIPs have been studied and designed using many ad-hoc procedures and technical guidelines developed by various local and international institutions.

Despite having several guidelines and manuals developed by different entities such as MoA (IDD)-1986, ESRDF-1997, MoWIE-2002 and JICA/OIDA-2014, still the irrigation professionals follow their own public sources and expertise to fill some important gaps. A number of disparities, constraints and outstanding issues in the study and design procedures, criteria and assumptions have been causing huge variations in all vital aspects of SSI study, design and implementation from region to region and among professionals within the same region and institutions due mainly to the lack of agreed standard technical guidelines. Hence, the SSI Directorate with AGP financial support, led by Generation consultant (GIRDC) and with active involvement of national and regional stakeholders and international development partners, these new and comprehensive national guidelines have been developed.

The SSID guidelines have been developed by addressing all key features in a comprehensive and participatory manner at all levels. The guidelines are believed to be responsive to the prevalent study and design contentious issues; and efforts have been made to make the guidelines simple, flexible and adaptable to almost all regional contexts including concerned partner institution interests. The outlines of the guidelines cover all aspects of irrigation development including project initiation, planning, organizations, site identification and prioritization, feasibility studies and detail designs, contract administration and management, scheme operation, maintenance and management.

Enforceability, standardization, social and environmental safeguard mechanisms are well mainstreamed in the guidelines, hence they shall be used as a guiding framework for engineers and other experts engaged in all SSI development phases. The views and actual procedures of all relevant diverse government bodies, research and higher learning institutions, private companies and development partners has been immensely and thoroughly considered to ensure that all stakeholders are aligned and can work together towards a common goal. Appropriately, the guidelines will be familiarized to the entire stakeholders working in the irrigation development. Besides, significant number of experts in the corresponding subject matter will be effectively trained nationwide; and the guidelines will be tested practically on actual new and developing projects for due consideration of possible improvement. Hence, hereinafter, all involved stakeholders including government & non-governmental organizations, development partners, enterprises, institutions, consultants and individuals in Ethiopia have to adhere to these comprehensive national guidelines in all cases and at all level whilst if any overlooked components are found, it should be documented and communicated to MOA to bring them up-to-date.

Therefore, I congratulate all parties involved in the success of this effort, and urge partners and stakeholders to show a similar level of engagement in the implementation and stick to the guidelines over the coming years.

H.E. Dr. Kaba Urgessa
State Minister, Ministry of Agriculture

SMALL SCALE IRRIGATION DEVELOPMENT VISION

Transforming agricultural production from its dependence on rain-fed practices by creating reliable irrigation system in which smallholder farmers have access to at least one option of water source to increase production and productivity as well as enhance resilience to climate change and thereby ensure food security, maintain increasing income and sustain economic growth.

ACKNOWLEDGEMENTS

The preparation of SSIGLs required extensive inputs from all stakeholders and development partners. Accordingly many professionals from government and development partners have contributed to the realization of the guidelines. To this end MOA would like to extend sincere acknowledgement to all institutions and individuals who have been involved in the review of these SSIGLs for their comprehensive participation, invaluable inputs and encouragement to the completion of the guidelines. There are just too many collaborators involved to name exhaustively and congratulate individually, as many experts from Federal, regional states and development partners have been involved in one way or another in the preparation of the guidelines. The contribution of all of them who actively involved in the development of these SSIGLs is gratefully acknowledged. The Ministry believes that their contributions will be truly appreciated by the users for many years to come.

The Ministry would like to extend its appreciation and gratitude to the following contributors:

- Agriculture Growth Program (AGP) of the MoA for financing the development and publication of the guidelines.
- The National Agriculture Water Management Platform (NAWMP) for overseeing, guidance and playing key supervisory and quality control roles in the overall preparation process and for the devotion of its members in reviewing and providing invaluable technical inputs to enrich the guidelines.
- Federal Government and Regional States organizations and their staff for their untiring effort in reviewing the guidelines and providing constructive suggestions, recommendations and comments.
- National and international development partners for their unreserved efforts in reviewing the guidelines and providing constructive comments which invaluably improved the quality of the guidelines.
- Small-scale and Micro Irrigation Support Project (SMIS) and its team for making all efforts to have quality GLs developed as envisioned by the Ministry.

The MOA would also like to extend its high gratitude and sincere thanks to AGP's multi development partners including the International Development Association (IDA)/World Bank, the Canada Department of Foreign Affairs, Trade and Development (DFATD), the United States Agency for International Development (USAID), the Netherlands, the European Commission (EC), the Spanish Agency for International Development (AECID), the Global Agriculture and Food Security Program (GAFSP), the Italy International Development Cooperation, the Food and Agriculture Organization (FAO) and the United Nations Development Program (UNDP).

Moreover, the Ministry would like to express its gratitude to Generation Integrated Rural Development Consultant (GIRDC) and its staff whose determined efforts to the development of these SSIGLs have been invaluable. GIRDC and its team drafted and finalized all the contents of the SSIGLs as per stakeholder suggestions, recommendations and concerns. The MoA recognizes the patience, diligence, tireless, extensive and selfless dedication of the GIRDC and its staff who made this assignment possible.

Finally, we owe courtesy to all national and International source materials cited and referred but unintentionally not cited.

Ministry of Agriculture

DEDICATIONS

The National Guidelines for Small Scale Irrigation Development are dedicated to Ethiopian smallholder farmers, agro-pastoralists, pastoralists, to equip them with appropriate irrigation technology as we envision them empowered and transformed.

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ACRONYMS

ACV	Aggregate Crushing Value
AGP	Agricultural Growth Program
AIDS	Acquired Immune Deficiency Syndrome
ASAE EP	American Society of Agricultural Engineering
AutoCAD	Automatic Computer-Aided Design
BOQ	Bill of Quantities
BS	British Standard
cm	Centimeter
ConMIS	Construction Management Information System
CST	Construction Supervision Team
DN	Nominal Diameter
EME	Electro-Mechanical Equipment
EMP	Environmental Management Plan
Es	Modules of elasticity
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Frame
fs	Yield points stress
g	Specific Gravity
GCC	General Condition of Contract
GIRDC	Generation Integrated Rural Development Consultant
GL	Guideline
HCB	Hallow Concrete Block
HDP	High Density Pipe
HDPE	High Density Polyethylene
HFL	High Flood Level
HIV	Human Immunodeficiency Virus
HME	Hydro-Mechanical Equipments
kg	Kilogram
m	Meter
m2	Square Meter
m3	Cubic Meters

mm	Millimeter
MoANR	Ministry of Agriculture and Natural Resources
MOWIE	Ministry of Water, Irrigation and Electricity
MPa	Mega Pascal
MS-Project	Micro Soft Project
N	Newton
PBOQ	Priced Bill of Quantities
PN	Nominal Pressure
PSGMs	Permanent Survey Ground Markers
RE	Resident Engineer
ROW	Right of Way
s	Second
SCC	Specific Condition of Contract
SSID	Small Scale Irrigation Development
SSIGL	Small Scale Irrigation Guideline
SSIP	Small Scale Irrigation Project
TS	Tensile strength
uPVC	Un-plasticized Polyvinyl Chloride
VAT	Value Added Tax
VO	Variation Order
ys	yield strength

PREFACE

While irrigation development is at the top of the government's priority agendas as it is key to boost production and improve food security as well as to provide inputs for industrial development. Accordingly, irrigated land in different scales has been aggressively expanding from time to time. To this end, to enhance quality delivery of small-scale irrigation development planning, implementation and management, it has been decided to develop standard SSI guidelines that must be nationally applied. In September 2017 the Ministry of Agriculture (MoA) had entrusted Generation Integrated Rural Development Consultant (GIRDC) to prepare the National Small-scale Irrigation Development Guidelines (SSIGLs).

Preparation of the SSIGLs for enhancing development of irrigated agriculture is recognized as one of the many core initiatives of the MoA to improve its delivery system and achieve the targets in irrigated agriculture and fulfill its mission for improving agricultural productivity and production. The core objective of developing SSIGLs is to summarize present thinking, knowledge and practices to enable irrigation practitioners to properly plan, implement and manage community managed SSI schemes to develop the full irrigation potential in a sustainable manner.

As the SSIGLs are prepared based on national and international knowledge, experiences and practices, and describe current and recommended practice and set out the national standard guides and procedures for SSI development, they serve as a source of information and provide guidance. Hence, it is believed that the SSIGLs will contribute to ensuring the quality and timely delivery, operation and maintenance of SSI schemes in the country. The SSIGLs attempt to explain and illustrate the important concepts, considerations and procedures in SSI planning, implementation and management; and shall be used as a guiding framework for professionals engaged in SSI development. Illustrative examples from within the country have been added to enable the users understand the contents, methodologies presented in the SSIGLs.

The intended audiences of the SSIGLs are government organizations, NGOs, CSOs and the private sector involved in SSI development. Professionally, the SSIGLs will be beneficial for experienced and junior planners, experts, contractors, consultants, suppliers, investors, operators and managers of SSI schemes. The SSIGLs will also serve as a useful reference for academia and researchers involved and interested in SSI development. The SSIGLs will guide to ensure that; planning, implementation and management of SSI projects is formalized and set procedures and processes to be followed. As the SSIGLs provide information and guides they must be always fully considered and applied by adapting them to the local specific requirements.

In cognizance with the need for quality SSIGLs, the MoA has duly considered quality assurance and control during preparation of the guidelines. Accordingly, the outlines, contents and scope of the SSIGLs were thoroughly discussed, reviewed and modified by NAWMP members (senior professionals from public, national and international stakeholder) with key stakeholders in many consultative meetings and workshops. Moreover, at each milestone of SSIGL preparation, resource persons from all stakeholders reviewed and confirmed that SSIGLs have met the demands and expectations of users.

Moreover, the Ministry has mobilized resource persons from key Federal, National Regional States level stakeholders and international development partners for review, validation and endorsement of the SSIGLs.

Several hundreds of experienced professionals (who are very qualified experts in their respective fields) from government institutions, relevant private sector and international development partners have significantly contributed to the preparation of the SSIGLs. They have been involved in all aspects of the development of SSIGLs throughout the preparation process. The preparation process included a number of consultation meetings and workshops: (i) workshop to review inception report, (ii) workshop on findings of review of existing guidelines/manuals and proposed contents of the SSIGLs, (iii) meetings to review zero draft SSI GLs, (iv) review workshop on draft SSI GLs, (v) small group review meetings on thematic areas, (vi) small group consultation meetings on its final presentation of contents and layout, (vii) consultation mini-workshops in the National States on semi-final versions of the SSIGLs, and (viii) final write-shop for the appraisal and approval of the final versions of SSIGLs.

The deliberations, concerns, suggestions and comments received from professionals have been duly considered and incorporated by the GIRD Consultant in the final SSIGLs.

There are 34 separate guidelines which are categorized into the following five parts concurrent to SSI development phases:

Part-I. Project Initiation, Planning and Organization Guideline which deals with key considerations and procedures on planning and organization of SSI development projects.

Part-II. Site Identification and Prioritization Guideline which treats physical potential identification and prioritization of investment projects. It presents SSI site selection process and prioritization criteria.

Part-III. Feasibility Study and Detail Design Guidelines for SSID dealing with feasibility study and design concepts, approaches, considerations, requirements and procedures in the study and design of SSI systems.

Part-IV. Contract Administration and Construction Management Guidelines for SSI development presents the considerations, requirements, and procedures involved in construction of works, construction supervision and contract administration.

Part-V. SSI Scheme Management, Operation and Maintenance Guidelines which covers SSI Scheme management and operation.

Moreover, Tools for Small Scale Irrigation development are also prepared as part of SSIGLs.

It is strongly believed and expected that; the SSIGLs will be quickly applied by all stakeholders involved in SSI development and others as appropriate following the dissemination and familiarization process of the guidelines in order to ensure efficient, productive and sustainable irrigation development.

The SSIGLs are envisioned to be updated by incorporating new technologies and experiences including research findings. Therefore, any suggestions, concerns, recommendations and comments on the SSIGLs are highly appreciated and welcome for future updates as per the attached format below. Furthermore, despite efforts in making all types of editorial works, there may still errors, which similarly shall be handled in future undated versions.

.

UPDATING AND REVISIONS OF GUIDELINES

The GLs are intended as an up-to-date or a live document enabling revisions, to be updated periodically to incorporate improvements, when and where necessary; may be due to evolving demands, technological changes and changing policies, and regulatory frameworks. Planning, study and design of SSI development interventions is a dynamic process. Advancements in these aspects are necessary to cope up with the changing environment and advancing techniques. Also, based on observation feedbacks and experiences gained during application and implementation of the guidelines, there might be a need to update the requirements, provisions and procedures, as appropriate. Besides, day-by-day, water is becoming more and more valuable. Hence, for efficient water development, utilization and management will have to be designed, planned and constructed with a new set up of mind to keep pace with the changing needs of the time. It may, therefore, be necessary to take up the work of further revision of these GLs.

This current version of the GLs has particular reference to the prevailing conditions in Ethiopia and reflects the experience gained through activities within the sub-sector during subsequent years. This is the first version of the SSI development GLs. This version shall be used as a starting point for future update, revision and improvement. Future updating and revisions to the GLs are anticipated as part of the process of strengthening the standards for planning, study, design, construction, operation and management SSI development in the country.

Completion of the review and updating of the GLs shall be undertaken in close consultation with the federal and regional irrigation institutions and other stakeholders in the irrigation sub-sector including the contracting and consulting industry.

In summary, significant changes to criteria, procedures or any other relevant issues related to technological changes, new policies or revised laws should be incorporated into the GLs from their date of effectiveness. Other minor changes that will not significantly affect the whole nature of the GLs may be accumulated and made periodically. When changes are made and approved, new page(s) incorporating the revision, together with the revision date, will be issued and inserted into the relevant GL section.

All suggestions to improve the GLs should be made in accordance with the following procedures:

I. Users of the GLs must register on the MOA website: Website: www.moa.gov.et
II. Proposed changes should be outlined on the GLs Change Form and forwarded with a covering letter or email of its need and purpose to the Ministry.
III. Agreed changes will be approved by the Ministry on recommendation from the Small-scale Irrigation Directorate and/or other responsible government body.
IV. The release date of the new version will be notified to all registered users and authorities.

Users are kindly requested to present their concerns, suggestions, recommendations and comments for future updates including any omissions and/or obvious errors by completing the following revisions form and submitting it to the Ministry. The Ministry shall appraise such requests for revision and will determine if an update to the guide is justified and necessary; and when such updates will be published. Revisions may take the form of replacement or additional pages. Upon receipt, revision pages are to be incorporated in the GLs and all superseded pages removed.

Suggested Revisions Request Form (Official Letter or Email)

To: ----------
From: ----------
Date: ----------
Description of suggested updates/changes: Include GL code and title, section title and # (heading/subheading #), and page #.

GL Code and Title	Date	Sections/ Heading/Subheading/ Pages/Table/Figure	Explanation	Comments (proposed change)

Note that be specific and include suggested language if possible and include additional sheets for comments, reference materials, charts or graphics.

GLs Change Action

Suggested Change	Recommended Action	Authorized by	Date

Director for SSI Directorate**: _____Date: _____**

The following table helps to track initial issuance of the guidelines and subsequent Updates/Versions and Revisions (Registration of Amendments/Updates).

Revision Register

Version/Issue/Revision No	Reference/Revised Sections/Pages/topics	Description of revision (Comments)	Authorized by	Date

1 INTRODUCTION

1.1 BACKGROUND

The execution of construction works of small scale irrigation projects goes through three distinct stages. These are: -

Phase 1 - Design and Preparation of Tender Documents
Phase 2 - Tendering up to and including the Award of Contract
Phase 3 - Construction and Supervision

It should be understood that this Construction Supervision guideline covers exclusively Phase 3 mentioned above.

Construction work is the ways and methods of transferring the design and drawing parameters into a concrete physical shape on the ground. Good quality construction bring the desired results and make the structure safe, sound & reliable to carry and sustain the different types of loads, under all varied situations throughout its life and result in providing benefits according to planning. In line with this, well organized and efficient construction supervision service has a paramount importance for successful implementation of irrigation construction project within the contractual time frame; contract price; and in accordance with the specifications, drawings and standards specified in that contract.

Construction supervision in project implementation service come in place to insure that the quality of work specified is maintained, the works conform to the contract documents, to control and manage the costs of construction and to provide proper and consistence as-built records and other project documentation. Hence, CST are responsible to manage the financial, technical and schedule requirements of the project in such a manner as to bring the project on-time, within budget and with a technical quality that meets or exceeds the contractual performance specifications.

Construction supervision service can be delivered either own-force or outsource modalities based on the scope and complexity of the project. For project planning and organization refer *Part I. GL 1: Project Initiation, Planning and Organizations Guideline for SSID.*

1.2 SCOPE OF THE GUIDELINE

The purpose of this guideline is to bring consistency and uniformity in all procedures and actions involving in construction supervision during small scale irrigation project implementation in accordance with the specifications, drawings and standards specified in that contract.

This guideline provides methods and procedures for achieving a standard construction quality work and quality control to be used by construction supervisors mainly engaged on small scale irrigation project implementation.

1.3 SETTING OF THE GUIDELINE

Construction supervision guideline for small scale irrigation development addressed the issues in detail chapter by chapter. There are twelve chapters having the following its own contents: -

Chapter one presents introduction of the guideline and deals with the scope and setting out of the guideline. Chapter two deals with construction supervision task phase by phase in the course of small scale irrigation project implementation.

Chapter three deal with construction supervision personnel and their responsibilities. Chapter four presents construction procedure for preparatory works, excavation and fill works of earthworks, masonry works, concrete works, pipe installation and testing works, pump installation and testing works, and gate fixing works using work flowchart.

Chapter five up to ten deal with quality control for earth works, masonry works, concrete works, pipe works, electro-mechanical works, and hydro-mechanical works respectively. Chapter eleven deal with supervisor contractual duties as part of the contract administration. Finally, construction management software's that are currently applied by the engineers assigned in construction industry are discussed on chapter twelve.

2 CONSTRUCTION SUPERVISION TASKS

Small scale irrigation project implementation passes through three phases namely Pre-Construction Phase, Construction Phase, and Post-Construction Phase.

Pre-Construction Phase covers the period of the signature of the contract up to the commencement of the works. Construction Phase covers the period from the commencement of the works up to completion of the works. Post-Construction Phase it covers the period from project provisional hand over up to final hand over of the project at the end of defect liability period.

Hence, construction supervision services shall be undertaken in to these three phases as discussed here under.

2.1 CONSTRUCTION SUPERVISION TASK DURING PRE-CONSTRUCTION PHASE

After the signature of the consultancy service contract and prior to the commencement of the works, the supervising body shall focus on the following but not limited.

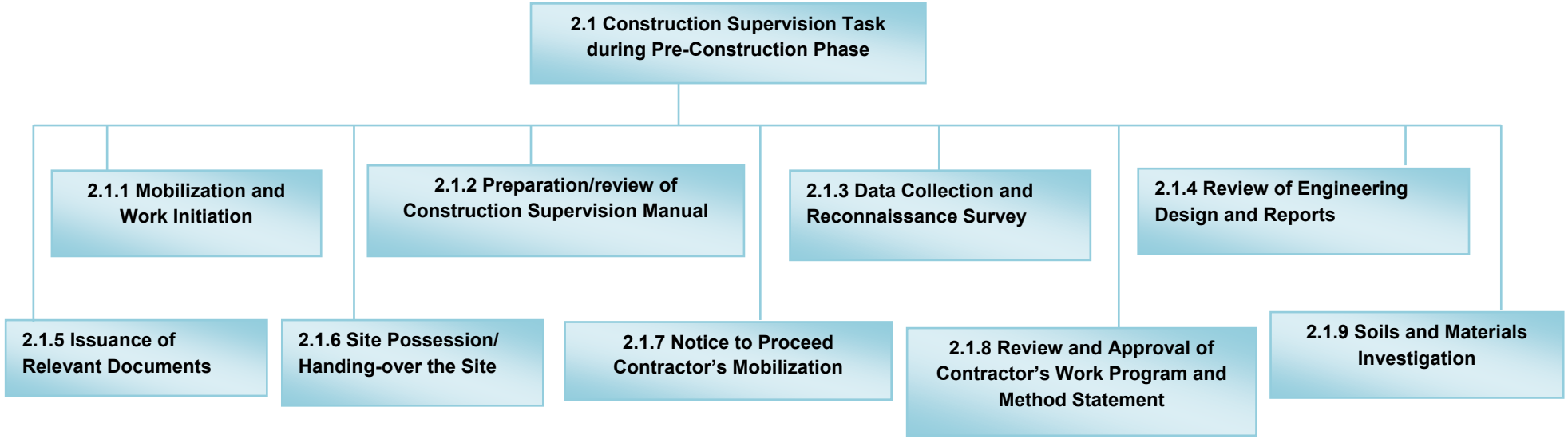


Figure 2-1: List of construction supervision task during pre-construction phase

2.1.1 Mobilization and work initiation

Immediately after the conclusion of the contract agreement signing, the Construction Supervision Team (CST) requires commencing the service by organizing and mobilization of the team of personnel proposed for the work.

2.1.2 Preparation/review of construction supervision manual

The CST shall prepare construction supervision manual tailored for specific project. The construction supervision manual comprises forms/forms for control of quantity, quality, cost and time of the project. The manual shall be basically prepared based on this guideline and past experience in similar construction supervision works and shall be revised from time to time to include areas of interest specific to the project, as the work progresses.

The following Standard Contract Supervision Forms/format shall be prepared but not limited to:

- Form for “Minutes of Meeting”
- Form for “Review of different study & design reports as well as contract documents”
- Form for “Site Possession/Handover”
- Form for “Site Request and approvals”
- Form for “Work Request and approvals”
- Form for “Inspection of Works”
- Form for “Request and Approval of works completed”
- Form for “Request and Issuance of Variation Order ”
- Form for “Measurements of works completed”
- Form for “Interim Payment Certificate”
- Form for “Compensation Event”
- Form for “Submission of Claimed Works”
- Form for “Extension of Intended Completion Date”
- Form for “Defects Liability Certificate Standard Form”
- Form for “Site Takeover”
- Form for “Final Payment Certificate”
- Form for “Final Retention Payment Form”
- Form for “Certificate of Final Completion”

2.1.3 Data collection and reconnaissance survey

The CST should collect and collate all relevant reports, drawings and the Works Contract of the subject project. The data can be collected from the design reports and site observation if required. The data/information of particular relevance may include:

- Topography and Climate (Topographic Maps, Topographic Reference Beacons/Pillars and Climatic Data specially Monthly Rainfall);
- Soil, Materials and Foundations (Availability of Local Materials and Physical Characteristics and Strength, Chemical Properties and Transportation System),
- Water Source and Type, and Rivers /Location, HFL, Bed Characteristics, Foundation Design Parameters/;
- Environment(Special Problems/Erosion, Subsidence, Slope Stability, Flooding/Submergence); and
- Social issues

2.1.4 Review of engineering design and reports

The CST should review and check the adequacy and soundness of the design prepared with the actual site condition and up to date the design parameters. This shall greatly assist the CST in acquainting him/herself with the design and also gives an opportunity for amendments/ changes to entertain conditions that were unforeseen during the design stage. This enables reduction of cost without sacrificing the strength/quality of the works.

All the engineering drawings, plans, technical specifications and design calculations shall be reviewed in reference to the standards adopted for the various designs of the project, the pre-construction survey and outcomes of the assessment of the irrigation project. The review result should be communicated among the three parties and its impact on the contract should be discussed, if any. The review of engineering design and reports shall be undertaken as detailed hereunder.

2.1.4.1 Review engineering surveying report

At the start of commencement of the supervision service, supervisor engineer should identify and verify all the survey ground control stations, beacons and benchmarks previously established during the design phase. In so doing, the supervisor engineer should perform the following activities prior to commencing any construction survey.

- Checking of capability of survey personnel provided by the Contractor,
- Identification and checking of all reference points and bench marks based on the data on the engineering drawings and documents prepared during design stage (phase I),
- Correct, as required, ground control stations based on the outcome of ground control survey,
- Re-establishment of missing stations and benchmarks including placing of concrete posts well fixed into the ground, and
- Checking of the safeguarding of benchmarks and reference points.

One of the major problems encountered at commencement of construction supervision services is the missing of most of the ground control points established at the design stage. This mostly because of a longer time span between completion of the design survey and commencement of the construction works, lack of permanent bench mark establishment and shortage of awareness by the community. In identifying the lost control points, the CST shall make use of the available survey data as well as the details of Permanent Survey Ground Markers (PSGMs).

Having exhaustively tried to identify the PSGMs and if being unable to find these, the CST should adopt to methodological measures to re-establish the lost permanent ground marks. The discrepancies observed during the review of the field survey data and control points shall be brought to the notice of client, as these may lead to variations.

Thereafter, the consultant should handover to the contractor, so that, the Contractor shall proceed with the survey; setting out and ultimately construction of the Works, once all control stations are put in place. Information on all survey data available, already existing or newly established shall be properly filed and maintained for reference by the consultant and contractor until completion of the project and for future references. During reviewing Engineering Surveying Report, the CST shall refer both *GL 4: Topographic and Irrigation Infrastructures Surveying Guideline for SSID and GL 25: Environmental & Social Impact Assessment (ESIA) Guideline for SSID*.

2.1.4.2 Review of Environmental and Social Management Plan (ESMP)

The CST shall review the design documents in regards to Environmental and Social Management Frame (ESMF) and ESMP. Accordingly, various provisions made particularly in regard to methods implemented to safeguard and improve the environmental and social aspects listed in the document shall be reviewed. During reviewing Environmental Management Plan, the CST shall refer *GL 25: Environmental &Social Impact Assessment (ESIA) Guideline for SSID*.

2.1.4.3 Review of technical specifications

Precise and clear technical specifications are a prerequisite for the successful completion of the project. The CST should make a detailed review of the Technical Specifications forming the contract in order to assess the suitability and completeness and suggest, as required, the necessity for additional specifications for the works.

The CST should ensure that the Technical Specifications are consistent with the construction standards of the country, the laid-down performance standards and quantity, quality control criteria and also with the Conditions of Contract. During reviewing Technical Specifications, the CST shall refer the *GL 24: Technical Specifications Guideline for SSID*.

2.1.4.4 Review of drawings

The CST should make a detailed review of all design drawings made for the specific project. Checks should be carried out to ensure that the drawings are consistent with the Technical Specifications and that the method of measurement is clearly recognized in the Bill of Quantities for the respective items of works. In addition, completeness/detail, clarity, and its standard should be part of review. During reviewing drawings, the CST shall refer the *GL 22: Technical Drawings Preparations Guideline for SSID.*

2.1.4.5 Review of bill of quantities

The CST should go on with the review of the Bill of Quantities in reference with the reviewed plans, drawings and technical specifications to check the accuracy and ultimate verification of the one shown in the Works Contract Document. During reviewing, the CST shall refer the *GL 20: Quantity Surveying Guideline for SSID.* The CST should check the following major aspects:

- Ensure all works have a unique item number
- Ensure that the descriptions as given in the BOQ are adequate in regard to the technical specifications including the method of measurement.
- Ensure that all items have unit of measurement and check consistency of the units
- Verification and accuracy of quantities from the design drawings;
- Identification of items, which are provisional and may be subjected to significant changes during execution;
- Ensure that all items have unit price, if not, apply GCC/SCC forming the contract;
- Verify the total cost of each item against its quantity and the corresponding unit rate; and
- Verify the total project cost including VAT with respect to the amount specified on the contract agreement summery.

2.1.4.6 Review of the contract document

CST should thoroughly review the works contract document signed between the client and the contractor so as to investigate any deficiencies associated with contractual matters. Accordingly, the following documents that constitute the Contract Document should be checked and reviewed.

- The Contract Agreement,
- Letter of Acceptance
- Contractor's Bid,
- Conditions of Particular Application,
- General Conditions of Contract,
- Particular Specifications,
- Standard Specification,
- The Drawings,
- Priced Bill of Quantities, and
- Other Documents (Minutes of pre-contract award discussion, etc)

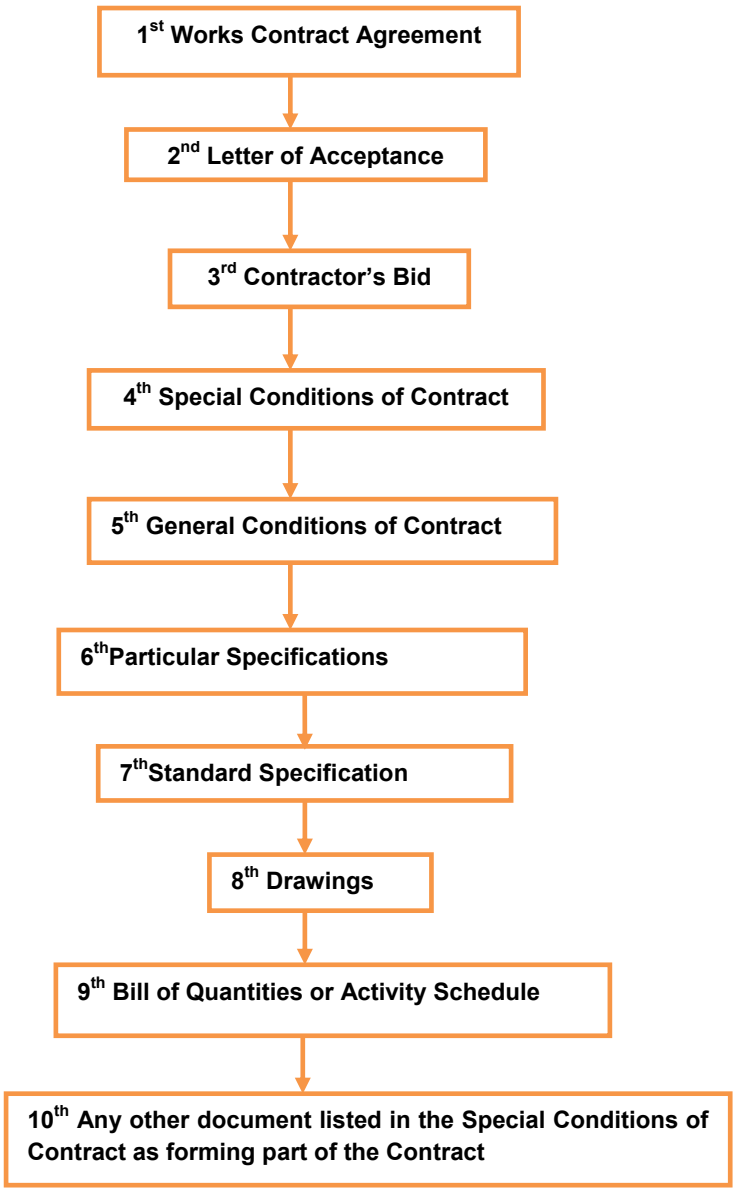


Figure 2-2: Flow Chart for interpretation of works contract documents in order of priority

2.1.5 Issuance and clarification of relevant documents

CST should issue the contractor with all necessary copies of the engineering drawings, technical specifications and contract documents before the site handover. These documents depicting the scope of work are legal documents which form an integral part of the contract and the contractor is required to perform the work in accordance with them.

All other supplementary information requested by the contractor, necessary for him/her to carry out the works, should be provided timely by the supervisor. Consequently, to achieve proper administration of the contract, the transmittal of each document must be handled with circumspection and properly recorded at all stages to avoid unnecessary disputes and claims.

The CST staff should assist the contractor on site in interpretation of the plans, profiles, and detail drawings and specifications, if requested. In addition, the supervisor should clear all technical queries raised by the contractor in the interpretation of the documents. In this respect, each of the CST staff shall be responsible for clarifying all queries raised by the contractor in his field of expertise.

2.1.6 Site Possession/handover the site

Prior to the handing over to the contractor, the supervising body and the client should familiarize themselves with the site conditions by visiting and identifying key features that shall be considered during the site handover event.

The CST, the client, local administrative bodies and the beneficiary community should handover the site to the Contractor. During the site visit, the contractor must be familiarized with the following features:

- Reference marks (Permanent and Temporary Benchmarks);
- Camping site;
- Headwork, canal and major canal related structures locations;
- Gravel, stone, selected material & sand sources possible quarry site locations; and
- Water source to be used by the contractor.

The site handover to the contractor should be accompanied with site possession certificate (*Appendix Part IV/GL 27/H-1 SSI Project Site Handover to Commence Construction Format).*

2.1.7 Notice to proceed contractor's mobilization

The CST should check that all legal conditions have been met and financial guarantees submitted by the Contractor before it is given Notice to Proceed. If all the conditions are in order, the Contractor shall then be given Notice to Proceed in accordance with the time specified in the Works Contract.

Meanwhile, the CST should request the Contractor to produce a detailed mobilization program that includes details of physical, financial, construction materials, plants & equipment and person power deployment schedule.

Finally, the CST shall ensure sufficient labor and equipment is mobilized on site from the contractor side to begin work and obtain listing of contractor's personnel and equipment.

2.1.8 Review and approval of contractor's work program and method statement

2.1.8.1 Contractor's work program

Prior to commencement of construction of the permanent works, the supervisor should request the contractor to produce a realistic Work Program including the deployment of construction equipment, person power and its method statement, supported by charts. It shall be done using format presented as *Appendix Part IV/GL 28/B Planning and Scheduling Format*.

The program shall include all construction stages for individual items of work and identify any critical areas, which could affect the progress of the overall contract. To this effect, the Contractor's program should logically link all activities such that the critical path can be worked out.

The Contractor's program should take into account the time for mobilization, preparatory works, actual physical construction of works, and demobilization of resources. In addition health and safety procedures should be clearly addressed.

The program to be submitted by the Contractor should also include the associated cash flow estimate showing all payments to which it shall be entitled under the Contract.

The program submitted should be thoroughly reviewed using a suitable activity programming technique (MS Project Office, or others latest software's) in relation to the provisions made in the Contract and with respect to the Contractor's technical proposal for allocation of resources.

Accordingly, the review shall be made taking into account the resource analysis against production needs (based on the rate of required for timely completion of the project works) and shall be accepted, improved or rejected based on the outcomes of the analysis. The review shall include:

- Activity schedule,
- Assumption taken for hourly production rate and efficiency of equipment's,
- Number of each type of equipment to be deployed including the time of mobilization (Equipment Schedule),
- Type and quantity of construction materials to be mobilized (Materials Schedule),
- Title and Quantity of Contractor's personnel assigned for undertaking each activity in the project (Person power Schedule),
- Sequencing the construction operations in a logical manner for optimum productivity;
- Contractor's Quality plan, and
- Contractor' health and Site Safety Plans (for project employees and proximity community including HIV/AIDS).

The supervisor should not consent to the program until fully satisfied that the proposed work schedules are achievable within the stipulated period and that the proposed resources (person power, material and machine) are consistent with the Conditions of Contract and Technical Specifications. In case of rejection, the Contractor shall be advised of changes or additional resources required for the submitted program to be realistic and in line with the Contract Documents.

The findings of the CST's review and the suggested modifications, if any, on the proposed Contractor's Work Program and the approved Master Works Schedule, shall be submitted to contractor so as to assist him/her in the follow up of the Project accomplishment.

2.1.8.2 Method statement

A method statement helps to manage the work and ensures that the necessary precautions have been communicated to those involved. The method statement should indicate when, how and by whom a specific construction activities and health and safety measures can be accomplished.

The supervisor should review the method statements (construction methods) proposed by the Contractor to ensure that these are consistent with the stipulations of the Technical Specifications and Conditions of Contract and that the proposed methods do not excessively interfere with the general Eco-system of the route corridor beyond that required for construction of the permanent works. The supervisor should also check the relevance of the construction methods, with reference to the equipment and person power proposed, for achieving the requirements of the specifications within the programmed period.

For so doing, the Contractor should be advised to include his method of working, in respect of each and all construction activities, the details of the person power allocation, the techniques of construction, and the machineries & equipment it is adopting for execution of the works. All the methods proposed should also be checked with respect to quality of workmanship, safety measures to be put in place during execution of each activity and conformity with the accepted practices in the country.

2.1.9 Soils and materials investigation

Besides, the material sources proposed by the Contractor, the CST would investigate exhaustively all construction material sources, existing and new, within the irrigation infrastructure construction site to minimize overhaul, to optimize the use of available construction materials or enhance economy. The construction material sources to be investigated and located are borrow pits for embankment, hard rock quarry sites for production of crushed aggregate for concrete works, natural sand, water and masonry stone. The CST shall refer geology study report for the proposed quarry sites for the required construction materials conducted during project study and design phase.

Factors to be considered while investigating construction materials are suitability of the material, available quantity, ease of production, depth of overburden, hauling distance, accessibility, sufficiency of production area for the construction material and environmental & social impacts of developing the source. Sources visually identified as promising in quantity, quality and hauling distance should be subjected to laboratory testing to approve their compliance to the required Technical Specifications. Due consideration should be given to available test results on all construction and embankment materials prior to conducting new and additional tests. Generally, the identified construction materials sources shall be subjected to the tests scheduled hereunder before they are incorporated into the works.

Borrow material for embankment: Samples from these sources should be tested for Atterberg Limits, CBR, Soil Classification, Shrinkage and Swell

Quarry site for crushed aggregate: Samples recovered from the located site should be tested for Water absorption, Sodium Sulphate, Soundness, Los Angeles Abrasion test, Aggregate Crushing Value (ACV), Coating and Stripping and Specific Gravity. The Flakiness Index should also be tested after commencement of crushing, as this is dependent on the type of crusher used.

Natural sand: Natural sand should be tested for grading, Sodium Sulphate, Soundness, Specific Gravity, clay content, organic impurities and mortar making properties.

Masonry stone: masonry stones that are strong, durable and workable should be located. These sources may also be used for riprap production to be placed on top of the backfill materials.

Water: Samples from the available water sources should be tested for pH Value, Chloride content and Sulphate content.

2.2 CONSTRUCTION SUPERVISION TASK DURING CONSTRUCTION PHASE

During construction phases that cover the period from the commencement up to completion of the works, the supervising body shall focus on the following but not limited.

Figure 2-3: List of construction supervision task during construction phase

2.2.1 Health and safety

The CST should make sure the implementation of health issues reflected in prepared plan during construction time.

The CST shall check that the Contractor follows safe working practices and prevents accident in all his operations. In so doing, the Contractor shall be requested to produce and submit his general safety policy and include in his method statement the safety measures it shall put in place for each operation.

During each construction activity, the Contractor is expected strictly to apply its safety policy and its attention shall be drawn to any instances where the safety policy is not followed. It shall also be directed to carry out all works that are necessary in case of emergency and affecting the safety of personnel, works and adjacent property. In this regard, the supervisor should check the availability of a capable safety officer on the Contractor's side who shall be monitoring that adequate safety measures are put in place at all times accordance to rule and regulation of the country and accidents are satisfactory prevented. Please refer *GL 25: Environmental & Social Impact Assessment (ESIA) Guideline for SSID.*

2.2.2 Quality control

The objective of quality control is to help the construction, achieve high order of quality as laid down in the specifications, in works by controlling various factors responsible for deterioration in quality, investigating reasons and suggesting ways and means for improvements without putting hindrance in the progress of construction work.

The quality control shall be exercised at three stages namely i) Selection of materials, ii) Processing of materials and iii) Execution of works by means of testing; supervision during construction; and compilation, analysis and interpretation of test results.

The Contractor is expected to execute the project works in accordance with sound technical administration, financial and economic practices. In this regard, the CST shall perform all duties associated with such tasks to ensure that only the best construction practice is followed and that the final product is in full compliance with the specification at the most economic costs.

To this effect, the CST shall continuously inspect the Works, both under construction and completed, for compliance to the Specification and the approved method statement submitted by the Contractor. In sufficient time ahead of commencement of every activity, the Contractor is expected to produce his/her proposed working drawing/plans with the associated calculations and method statements. The CST shall examine the submissions and approve or reject the proposals, recommending any changes required.

Quality control of production of construction materials as well as construction of the permanent works is an essential element to have an end product that is up to the standard called for in the Works Contract Document and one that meets the objectives of the project.

The CST shall set up a quality control system meant specifically to the project, which comprises a combination of process control and end product control for the project. The two major aspects to be considered while setting up the Quality Control system are Construction material control and control over workmanship. Construction material control is fully one-half of what construction inspection is all about. The other half is control over workmanship. During quality control use Appendix Part IV/GL 28/G Check List for Work Permit.

2.2.2.1 Quality control of construction materials

Being the basic elements of the permanent works, the contribution of quality of construction materials for the last longing service life as well as quality of the project is vital. Accordingly, the supervisor should establish a quality control system for production, test and handling of construction materials. The system should include testing of samples, visual inspection, or checking manufacturer standard product certificate.

Once the system is in place, the supervisor should carry out all necessary inspection, sampling, testing and analysis for all construction material proposed and to be used by the Contractor, as a control to the quality of the material and checking of compliance with the Technical Specifications. No material shall be used from any pit or quarry without prior testing and approval by the supervisor.

The samples of recommended size shall be collected from the production site as well as after placement (during construction process) to control the quality of material throughout the processes involved in the construction to the final end product. Depending on the test results and the analysis, the material shall be approved or rejected for use into the works. The approval can be as it is or with special recommendation (for example-sand washing, specific usage of stone depending on its type and size).

The Contractor shall be notified that approval of samples from any source shall not be considered as an approval of all materials recovered from the source, and hence, during the production process, samples shall be collected from the approved source from time to time as required and subjected to testing, and it should be rejected if the test results do not meet the required specification set in the contract. The Contractor shall be instructed to halt production of materials from any source immediately, if the characteristics of the material from the source has potentially turned inferior than tested previously, which might indicate the exhaustion of acceptable material from the source.

In case of rejection due to poor quality of material, the Contractor shall be instructed to remove the material from the site with no additional cost and time extension.

i. Materials produced by the contractor

The contractor may produce construction materials such as sand, stone, gravel, soil fill materials; hallow concrete blocks (HCB), and the likes or may purchase them. In the course of the Construction, the Contractor shall identify and locate potential sources of construction material for the various project activities. After satisfying him/herself to the estimated quantity and quality (through testing) of the source, he/she request the supervisor for joint sampling and testing of material from the proposed source.

The source should then be approved or rejected based on its conformity with the Technical Specification. Samples shall be collected randomly from time to time, from the approved sources, to reaffirm the quality of the material in the course of the project period. The Contractor's method of production shall also be inspected on a daily basis by the works inspectors and the material technicians.

ii. Materials procured from manufacturers/producers

Whenever the Contractor proposes to procure construction materials (such as reinforcement steel, cement, gravel, sand, HCB, etc), he/she shall be instructed to deliver manufacturer's/ producer's certificate and sufficient samples of the materials in sufficient time ahead of his/her order for delivery. The manufacturer's/ producer's certificate should include date of production and recent test results based on approved testing standards. The supervisor should then carry out all tests mentioned in the Technical Specification at recommended laboratory. The proposed material may be rejected or approved depending on its conformity to the Technical Specification. If approved, the Contractor shall be allowed to procure the said items and instructed to deliver sample and test results from time to time, as required. Random sampling and testing shall also be carried out to check consistency of quality of the approved material.

Any material proposed by the contractor (produced by him/her or procured), that is of substandard or defective to the provisions of the Technical Specifications of the Works Contract shall be rejected. And then, the Contractor shall be provided with details of the reason for rejection and advised the corrective measures required for future production/delivery. He/she shall then be instructed to remove the defective material/work/ from the site without any additional cost or time extension.

Manufacturer's/Producer's Certificate and all field and laboratory test results on construction materials shall be properly recorded and filed as project references.

iii. Storage of materials

The main construction materials store shall be at the project base camp that is expected to be used for WUA Administrative Office after the completion of construction. If the base camp is substantially far from major structures (mostly headwork, canal and canal structures) temporary storage shall be constructed keeping the recommended standard of storage construction if required).

After approval of the construction materials proposed by the Contractor, the supervisor should check the proper storage of the materials in a manner that insures preservation of their quality and safety as mentioned in the Technical Specifications. Accordingly, the method of storing, stockpiling and protection of materials against the adverse effects of weathering shall be frequently inspected. Materials that are not properly stored or stockpiled shall not be approved for use without retesting.

For example, the supervisor should confirm that cement storage techniques as stated below:

- The walls must be made damp proof
- The roof must be given an appropriate water proofing treatment
- The floor must be raised by at least 80 cm above the ground level to prevent any inflow of water.
- For further protection, cement bags should be stacked at least 10-20 cm clear above the floor by providing wooden battens and planking arrangement. If not, the last cement row should not be used.

- If any windows are provided, these should be few and small and normally kept tightly closed to prevent entry of atmospheric moisture from outside.
- Do not store in a building where walls, roof and floor are not completely weather proof.
- Do not store in a new warehouse until the interior is thoroughly dried out.
- Do not make contact with a badly fitted windows and doors and see that they are kept closed.
- Do not stack against the wall. Always pile on the floor on wooden planks.
- Do not forget to pile bags together.
- Do not pile more than 15 bags high and arrange the bags in header and stretcher fashion.
- Do not take cement from one tier. Step back to three or four tiers.
- Do not keep dead storage. Use first in first out principle.
- Do not keep bags on the grounds for temporary storage at work site.
- Pile on raised dry platform and cover with tarpaulin or Polythene sheets.

2.2.2.2 Quality control of workmanship

To insure quality of workmanship during construction of the Works, the Supervisor Engineer and his/her subordinate staff shall be assigned duties and responsibilities in accordance with their field of expertise. The staff shall be advised to bear in mind that their duty is to inspect quality of workmanship and should not, by any means, interfere with the management of the Work by the Contractor.

Prior to issuance of approval to commence new activity or proceed with following activities, the supervisor should check Contractor's setting out and other preparations for the Works. Frequent quality control tests, as included in the Technical Specification, shall be run on the works to check compliance of the workmanship to the Specification. To assist in this regard, the supervisor should institute a detailed quality control system that ensures adequate supervision and positive control of the works at all times. Accordingly, the qualified personnel assigned for each particular task shall exercise quality control of that specific task.

Any work that is of substandard in respect of quality of material and/or workmanship contrary to the provisions of the Technical Specifications of the works contract shall be rejected. The Contractor shall be instructed to rectify or rework and shall be provided with details of the reason for the same. The inspection made shall be the basis for approval of commencement of following activities and also the interim payment certificates.

Process control of materials while they are worked upon shall be through subjective observations and objective tests. Control of end product, for example compaction would be through objective tests and statistical evaluation.

The three most factors to be closely inspected during quality control of workmanship shall be:

- Conformity with plans
- Capability of Contractor's person power
- Monitoring of Machines, Equipments and Plants

Working drawings, calculations and conformity with plans

As part of the quality control system, the supervisor should inspect Contractor's execution of the Works in accordance with the plans and specifications forming part of the Contract Document. In case of omissions or errors in drawings and specifications, the supervisor should make

appropriate corrections and interpretations required for completeness of the drawings and technical specifications particular to the project.

The supervisor should review the entire Contractor's workings, sketches, shop drawings, erection drawings and the associated calculations in reference to the given plans, and detailed drawings and the accompanying notes. These shall be approved or rejected based on the outcomes of the review. In case of rejection, any changes or modifications required should be pointed out to the Contractor. These shall mainly include:

i. Complete structures drawings including detailed sections and views having all necessary data for approval and field work with summary (schedule) of quantities
ii. The Contractor shall be advised never to commence any construction activities prior to approval of the working drawings and the associated calculations produced by him/her for the same.
iii. In addition to the working drawings, the Contractor shall be requested, as required, to submit for approval construction drawings showing details of the temporary works and the methods of construction he/she proposes to use. These shall include detail description of temporary structures, false works and temporary measures/changes on existing structures.

Capability of person power

The supervisor should check the qualification and experience of the Contractor's key personnel assigned to undertake the construction of each component of the permanent works. The skill of contractor's person power mainly masons, carpenters, bar benders, and others should be practically ensured at the start of their respective assignment and approved by the supervisor. The Contractor shall be instructed to remove from site personnel who are incompetent and may adversely affect the workmanship, and hence the quality of the finished works.

Monitoring of machinery, equipment and plants

The supervisor should also check Contractor's equipment and plants deployed for execution of the project works. In this respect, the following shall be properly noted before commencement of the construction of each component of the permanent works:

- Sufficiency of the size and number of equipment allotted for the specific work,
- Mechanical condition of the equipment and plants,
- Adverse effects due to the use of the equipment/plant,
- Capacity of plants to insure production of sufficient material to meet the needs of each specific work item, to completion, within the time limit, and
- The contractor cost shall be controlled avoiding un efficient machineries from the project site. Hence, the CST shall advice the contractor when the case arises via official letter.

2.2.2.3 Inspection of works and approval

Once the contractor has started to implement the works the supervising body should regularly visit the site to inspect the quality of works and give approvals before the contractor can proceed with certain critical activities. The major responsibility of the Supervising body is to ensure that the contractor's quality of construction materials and workmanship always complies with the technical specifications provided in the contract document. The Supervising body should maintain a daily record of inspected and certified works. For this purpose, sample '**Works Inspection Forms**' need to be developed.

The Supervising body should ensure that the Contractor has a full set of quality control aids on site for checking works during and at the end of each worker's task. During works inspections, the Supervising body must also use these **quality control aids** to check the works.

Inspection of surveying works

At the start of the project works, the Contractor shall be provided with survey information of horizontal and vertical control points such as benchmarks, base line, boundaries and control stations. Thereafter, before commencement of construction of each permanent work, the Contractor is expected to carry out all physical surveying required for the construction purposes. The supervisor, prior to approval of the setting out survey, shall carry out verification survey of Contractor's setting out and satisfy him/herself that there is sufficient survey coverage to accurately define the final setting out of all works.

In so doing, the supervisor should note, but not limited to, the following points:

- Vertical elevation control Bench Marks
- Checking of weir and other main structures axis alignment, centre of reviver bed, position and ground level of the weir body corners,
- Checking of centreline elevation and alignment of canals,
- Accuracy of the pegs, lines, levels and layout of construction works with respect to approved working drawings and prevailing site conditions at the time of execution of the works
- Boundary locations for structures,
- Placement of the works construction limits such as provision of adequate height for backfill, etc
- Tolerance in dimensions of previously constructed layers have been met,

These should ensure that the setting out of vertical and horizontal dimensions is in accordance with the plans and profiles. In addition to these setting out surveys, the supervisor should check out the Contractor's preparation for the Works including, but not limited to, the following:

- Contractor's attachments to the 'Request for Approval' form/to be prepared by the Contractor through discussion with the supervisor/ with respect to compliance of surveying and laboratory test results of previous works;
- Working drawings with their respective method statements;
- Availability and sufficiency of construction equipment with an output ensuring the production of the said amount and quality of work as per the Specification;
- Availability and sufficiency of construction material required for the smooth build up of the works and that is in conformity with the Specification.

Having checked all the aforementioned, the supervisor should give the Contractor approval to go on with construction of the Works. The data relating to setting out and survey work should be recorded in field books and electronic format and submitted to Client as future references, after completion of the works.

The supervisor should inspect the accuracy of finished elevation levels for the structures. The Contractor shall be instructed to rectify sections that fail to meet the tolerance limits in respect of surveying set in the technical specification. The measurements taken before and after a certain volume of work item shall be used as a basis for payment. Refer *GL 4: Topographic and Irrigation Infrastructures Surveying Guideline for SSID*.

Inspection of structures

The supervisor should continuously inspect the irrigation construction Works, both under construction and completed for compliance to the Specification and the approved method statement submitted by the Contractor. In sufficient time ahead of commencement of all activities, the Contractor is expected to produce his proposed working drawing/plans, the associated calculations and method statements for the construction. The supervisor should examine the submissions and approve or reject the proposals, identifying any changes required. Moreover, prior to issuance of approval to commence new activity or proceed with following activities of the construction, the supervisor should check Contractor's setting out of the works and submittals. In this respect, the supervisor should undertake, but not limited to, the following: -

- Check and approve detailed working drawings (and construction drawings, as required) prepared by the Contractor based on the design of the structures;
- Contractor's attachments to the 'Request for Approval' form (to be prepared by the Contractor through discussion with the CST) with respect to compliance of surveying and laboratory test results of previous works;
- Check the setting out of the works, accuracy of the pegs, lines, levels and layout of construction works with respect to the approved working drawings and prevailing site conditions at the time of execution of the works;
- Check availability of adequate equipments (specially machinery, concrete mixers and vibrators) and construction materials required for the smooth build up;
- Check that all safety measures have been put in place;
- Take measurements of the ground before and after excavation for quantifying purposes;
- Check alignment of reinforcement bars in reference to the approved working drawing;
- Checking the dimensions, stability and soundness of formworks;
- Checking box size for measuring of coarse and fine aggregate;
- Collect fresh concrete mix, cure and test for compressive strength;
- Monitor backfilling on abutments and insure these are in accordance with the provisions of the Technical Specification.

Other inspections

During the course of the site inspection, the Supervisory staff shall also conduct the following inspection tasks:

- production of construction materials;
- the site facilities (including storage of materials, workshop for plant, machinery and equipment; health and safety) of the Contractor;
- organization of plants prior to commencement of any permanent works construction;
- construction of temporary works prior to commencement of any permanent works construction;
- Construction materials quality: Cement type of production, expire date information; stone formation, shape and size; quality of sand and source of coarse aggregate.
- Construction relay sequence and procedures;
- excavations and geological formations prior to surfacing works;
- Construction material storage especially cement storage;
- ratios of all aggregates especially mortar and concrete;
- other industrial materials like metal works;
- all engineering set up of the diversion project: headwork (cut off, apron, weir, wing wall), canal system layout: main canal, secondary canal, drops and division box.

To assist in the works inspection, the supervisor should prepare forms and worksheets to be used for the project as follows:

- Data sheets on survey of material sources,
- Sample cards,
- Worksheets for sieve analysis,
- Grain size distribution graphs,
- Soil compaction test data,
- Moisture density graphs,
- Summaries of field test reports,
- Concrete delivery slips,
- Concrete pouring reports,
- Compressive/flexural strength of concrete tests,
- Worksheets for abrasion (Los Angeles) tests,
- Worksheets for concrete design mix, and Others
- On the process of inspection, the CST shall maintain a detailed daily recording of all events.

Quantity surveying

Measurement of each completed activities for both permanent and temporary works should be executed at construction site in continuous basis. Accordingly, based on the agreement made between the Client and the Contractor for the mode of measurement, the quantity surveying shall be made on any construction activities just after approval of works request and the completed work is approved by the engineer. The copy of this form shall be kept with the respective professionals for a record.

Correspondingly, similar procedure and quantity shall be expected from the Contractor that should be compiled in one backup document for the request of interim payment. After making cross-checks with the CST's recorded/computed figures, it shall be sent back to the Contractor's office with correction, if any, for re-submission so that both parties shall reach to an agreement on the interim and final quantities. Joint signature on each work item sheet shall be made as an input for summarized interim payment certificate. For details refer *GL 20: Quantity Surveying Guideline for SSID.*

Design modifications/changes

There are chances for dissimilarity and difference between the actual condition investigated during construction and the study report. During the process of layout and excavation of the foundation of structures a complete knowledge of the topography, foundation materials, distribution along vertical strata, strength, stability, and water tightness will become clear. The design of structures is carried on the basis of the reports and random data collected at set of intervals using different sampling methods.

The design, therefore, has to be adjusted according to the changed parameters. This may vary from minor adjustments to some major modifications. At times the foundation of a structure may have to be taken at lower elevation on account of unstable condition while in some cases it may have to rest at higher elevations due to availability of stable foundation bed. It may need raising or lowering of the height of the structure. Some more adequate measures may be needed for effecting water tightness. At times there may be difficulty in obtaining the desired quantity of materials as well.

Hence, the consultant is expected to conduct design modification/changes within the scope of assignment given to the consultancy firm and communicate the result to the client specially for major changes. Parallel to this job order should be given to the contractor. Design modification/change shall be done according to *Part III: Feasibility Study and Detail Design Guidelines for SSID*.

2.2.3 Schedule control

Supervisor engineer should control construction time and progress by identify and monitoring key dates in the project life Time. S/He should note on the field calendar every date that has special significance on the project, whether it be for test, special inspections, payment request due date, delivery date, or other important milestones. All such data should be obtained either from the specifications (if listed there) or from the contractor's works schedule.

While preparing construction schedule, it is necessary to draw up an optimum time frame keeping in view the following but not limited:

a) Past best experience of similar projects,
b) Location and weather conditions,
c) Time and other constraints lay down by the owner and other stakeholders,
d) Availability of resources such as personnel, funds, construction materials, equipment, etc…
e) Output norms and standards,
f) Time required for proper execution of various activities without compromising quality and safety

When we take project characteristics, SSIPs are infrastructure project by type of work, special short-term projects having less than 1 year completion time (In most case its construction should be complete within 18months), relatively small value projects, and normal pace projects. Hence, construction schedule shall be prepared accordingly.

The consultant should monitor the works progress continually during construction period against the laid down approved schedule. Use Appendix Part IV/GL 28/B Planning and Scheduling Formats while controlling time and progress of the project.

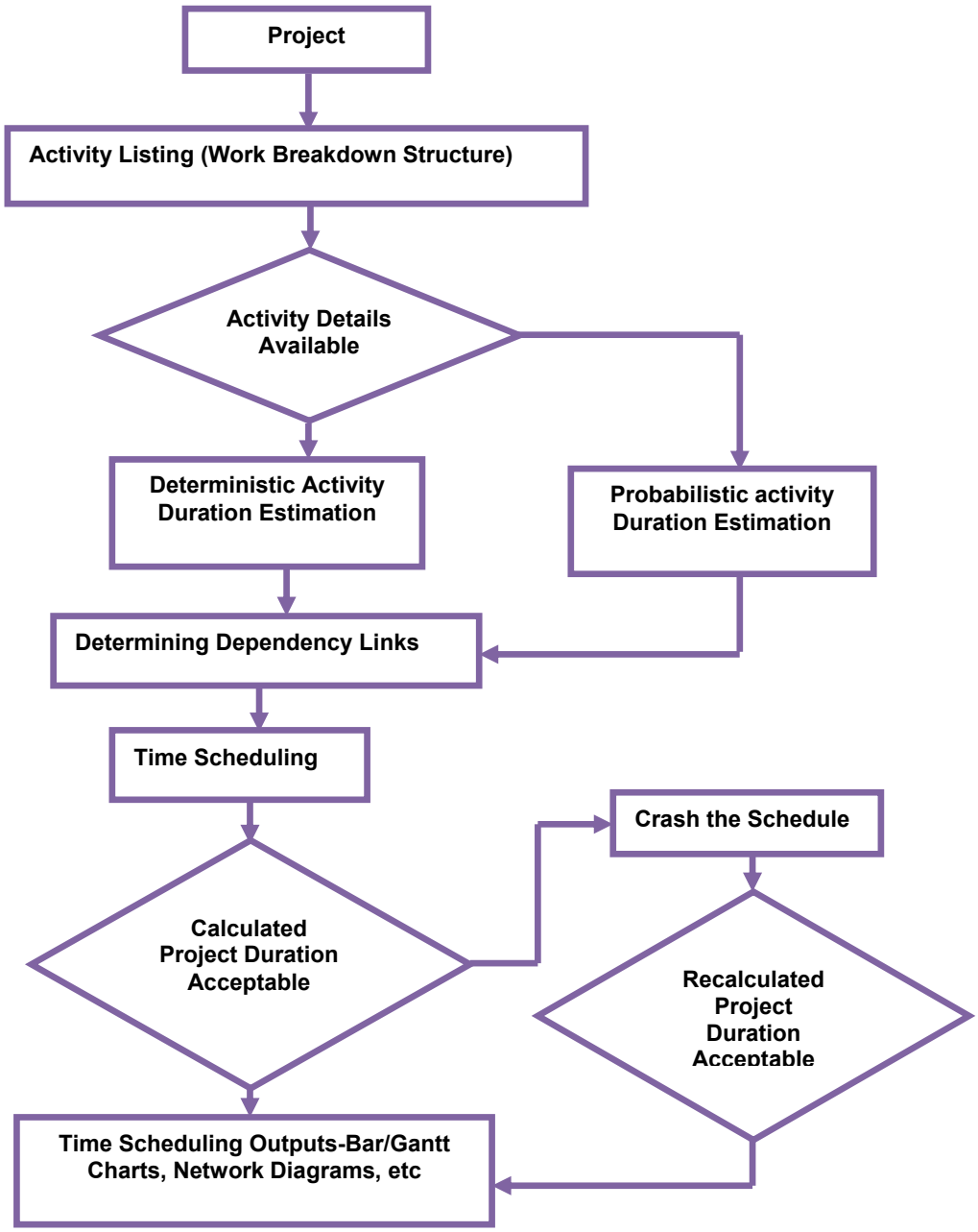


Figure 2-4: Typical time planning/scheduling process

2.2.4 Cost control

Cost is one of the three dimensions of small scale irrigation construction projects that need to be controlled by the supervisor engineer with the following principles:
Conserving the employer's funds,

a. Treating contractor fairly, and
b. Monitoring construction as stipulated in the contract.

In order to discharge this responsibility, the supervisor engineer should determine the amount of work performed by the contractor during a given time period (usually 1 month), advise the employer to the quantity of wok performed, and recommend payment to the contractor in an amount based up on (1) Bill of Quantities- unit rate/price items, (2) reimbursable inventory; and (3) variations to the contract, if any.

In other words, for effective control of cost supervisor engineer must understand the following but not limited to: -

- Both the pricing element and the payment mechanism of the contract,
- The cost of each labour and material component of the project,
- How interim payments are made to the contractor,
- How to correlate any interim payments to the contractor's completion of the project components.

The supervisor engineer principal tool in 'measuring the money' shall be the cost breakdown in the priced bill of Quantities, control procedure and the preliminary cash flow curve of the project. Generally, cost control issues during construction phase are as discussed here under.

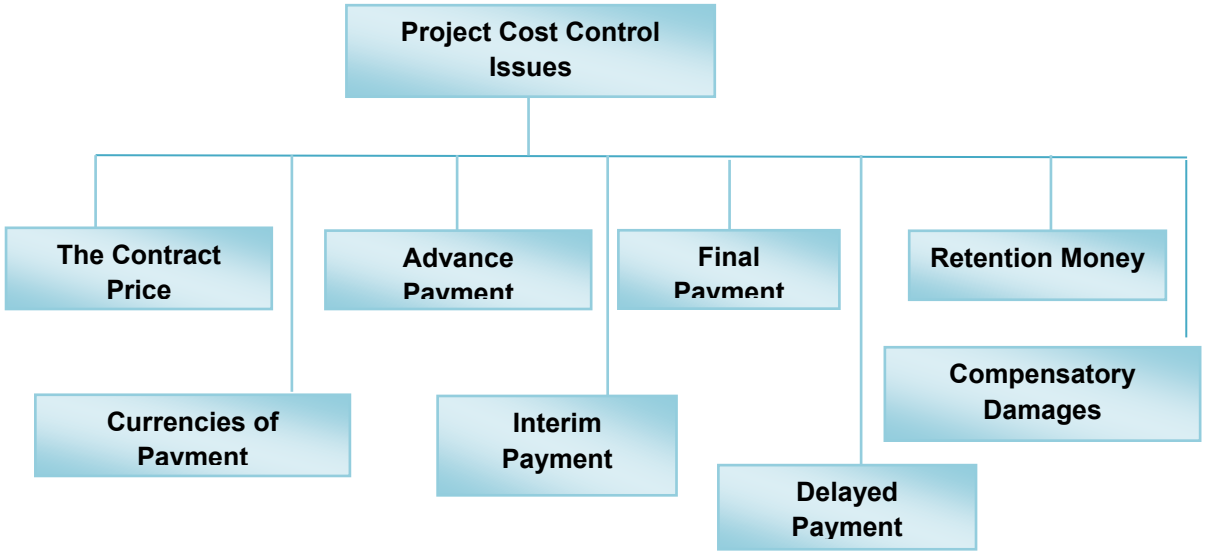


Figure 2-5: List of project cost control issues

The contract price

Contract price is a total price offered by the employer for the execution the whole project activities and accepted by the employee. It is the price obtained during financial evaluation and stated in the contract document.

Currencies of payment

The currencies of payment shall be specified on the special condition of contract forming the contract. Generally, it is Ethiopian Birr (ETB) for both works and consultancy service contract of small scale irrigation development. Every payment should be effect accordingly.

Advance payment

The Employer shall make an advance payment, as an interest-free loan for mobilization, when the Contractor submits a guarantee in accordance with GCC/SCC forming the contract. The total advance payment, the number and timing of instilments (if more than one), and the applicable currencies and proportions, shall be as stated in the Appendix to Tender.

Interim Payment

Interim payments to the contractor usually result from the supervisor engineer's submission to the employer of a document called an "Interim Payment Request". Payment due the contractor for a given period, as set out in the Interim Payment Request, is usually categorized as follows:

a. Work completed on the Bill of Quantities unit rate /price items,
b. Work completed on Lump sum items in the Bill of Quantities, agreed lump sum breakdown items prices,
c. Reimbursable inventory (as verified by the resident engineer's system for inventory control), and
d. Work completed on variation orders issued.

Interim payment bases on the measurement of works completed during work progress, but, sometimes over or under the actual work executed. As the result, it is liable for rectification in proceeding payment.

Delayed payment

If the Contractor does not receive payment in accordance with Clause discussing payment issue in GCC/SCC, the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in GCC/SCC, irrespective of the date on which any Interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the specified in the contract document. The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

Delayed payments negatively affect the cost of future contracts – where delayed payments are a regular feature, suppliers & contractors build in margins to cover anticipated delays in payment or refuse to tender.

Final payment

After the certificate of completion or substantial completion has been field, the contractor shall apply for final payment. It is also called the last progress payment made to the contractor, less retention and should not be made until after execution of notice of completion (Substantial Completion).

It should not be approved for payment until after formal acceptance of the work by the employer as evidenced by the execution of a formal notice of completion (Substantial Completion). When computing the contractor's eligibility for final payment, the following items should be considered for deduction in addition to normal retention. These are: -

a) Any liquidated damages due to the date of notice of completion (Substantial Completion), and
b) Over settlement during interim payments if any.

Retention money

Small scale irrigation construction project, involves some retention of a portion of earned money of the contractor. It is usually 5 percent of the entire project price (or as specified in the particular

conditions of the contract). The purpose of the retention money is to be utilized by the surety to complete the work in the case of uncertified/corrected default by the contractor.

When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. The second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period. Strictly use *Appendix Part IV/GL 28/C Payment Formats* while controlling project cost.

Compensatory damages
It is a sum of money awarded in a civil action by a court to indemnify a person for the particular loss, detriment, or injury suffered as a result of the unlawful conduct of another. It provides a plaintiff with the monetary amount necessary to replace what was lost, nothing more.

2.2.5 Environmental protection monitoring

The CST should ensure all environmental and social impacts mitigation measures set on EMP are in place during construction period. Environmental and social impacts mitigation measures proposed in detail by supervisor should be implemented by the Contractor during execution of the Project Works. During the implementation, the supervisor should monitor the following environmental interventions in accordance with management strategies and actions to minimize adverse impacts as described hereunder.

Minimizing adverse effects on biological environment
The supervisor should monitor that the construction of the project should not unnecessarily affect the plant and animal life in the corridor i.e. vegetation removal should be kept to the minimum in order to protect wildlife habitat. In general, the supervisor should, as much as possible, take care of environmentally sensitive project areas.

Minimizing adverse effects on water, soil and air
In this respect, the supervisor should monitor that the water, soil, and air should not be polluted due to earthworks, crushing operations, and improper handling of hazardous material. The supervisor should also monitor minimization of water and soil pollution through directing of runoff waters into tailing ponds.

Alleviation of noise, vibration and dust
To minimize the effect of noise, the supervisor should advise the Contractor to adjust the time of critical operations in such a way that it should not excessively disturb the community. Accordingly, the Contractor shall be advised to suppress dusting through watering detours, covering crusher conveyor belts, etc. The supervisor should also monitor alleviation of noise and vibration from blasting and rolling operations adjacent to buildings, structures and residential areas.

2.2.6 Social safeguard

Coordination/liaison
The Consultant should maintain close liaison with project client, regional and local administrative bodies, and project beneficiaries throughout the provision of the services.

Communication
The Consultant should establish clear ways and protocols of communication particular to the project and maintain throughout the provision of the services.

Right off way
The CST should pay S/His rule for settlement of right-of-way problems (if any) participating the project client, contractor, local administrative bodies, beneficiaries, and other stakeholders.

Social infrastructure
The CST should closely monitor the implementation and maintenance of social infrastructures related to the specific project. Though it is project specific, some of social infrastructures are water point, washing basin, cattle trough, and crossing structures along foot path.

2.3 CONSTRUCTION SUPERVISION TASK DURING POST CONSTRUCTION PHASE

During post construction phase (period from project provisional hand over up to final hand over of the project at the end of defect liability period), the supervising body shall focus on the following but not limited.

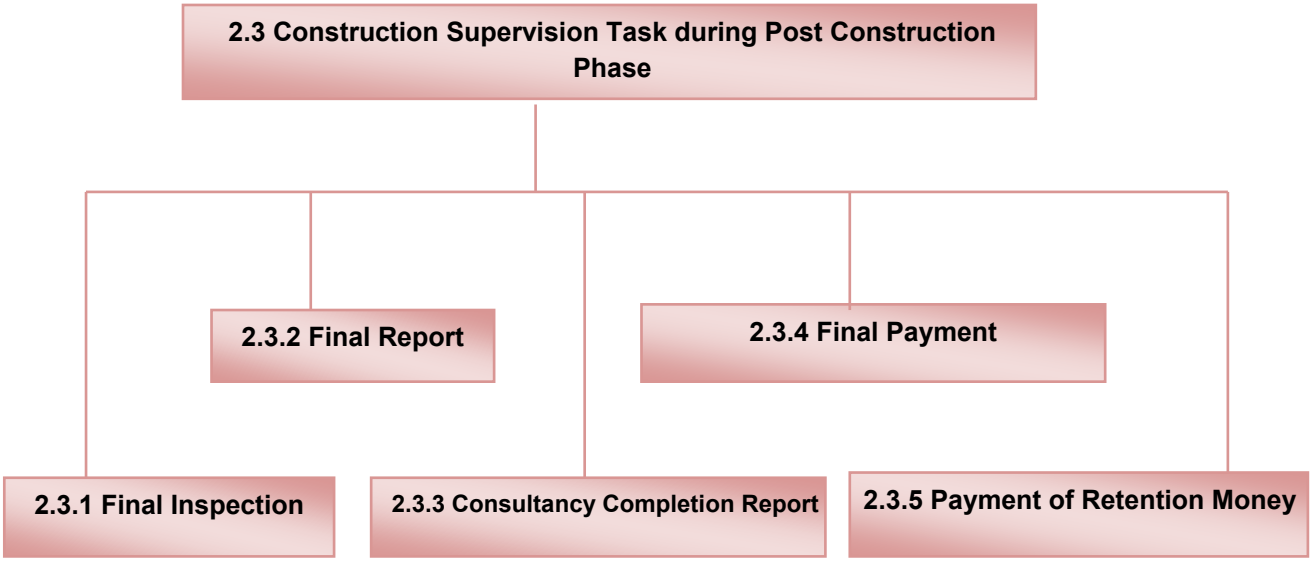


Figure 2-6: List of construction supervision task during post construction phase

2.3.1 Final inspection and testing

The final inspection and testing is carried out as part of the procedures for handing over the completed small scale irrigation project to the beneficiaries and the client. Once the contractor has completed the entire contract, or an agreed part of it, he/she should notify the supervising officer and request for a final inspection. In the final inspection, a number of key measurements are carried out in order to check whether the project has finally been constructed to the specified standards. The results of the final inspection measurements should be compiled in a Final Inspection and Testing Report (Appendix Part IV/GL 28/H-2 Constructed Project Handover Format).

The key measurements carried out during the final inspection of small scale irrigation projects supplied from surface and ground water sources using appropriate water abstraction system and varies irrigation system are the following but, not limited to:

- Small Earthen Dam
  - Visual observations during the first filling of the reservoir with respect to "Initial Filling Plan" as weaknesses in a completed dam often show up at this time. Visual observations of possible distress such as cracking, the appearance of turbid water in downstream toe drainage systems, erosion of riprap, soft wet spots downstream of the abutments or at the downstream toe or on the downstream slope, and other observations are important. Observations of instrumentation also yield valuable data in this respect.
  - Workmanship of diversion weir and auxiliary structures,

  (For more information refer GL 12: Small Dams Design Guideline for SSID)
- *Diversion Weir*
  - Workmanship of diversion weir and auxiliary structures,
  - Structural dimension of diversion weir and auxiliary structures,
  - Level and efficiency of intake and under sluice gates,
  - Wing walls elevations and its completeness up to the natural ground level.
  - Completeness of the entire headwork system with respect to the existing ground condition, and finishing works.

  (For more information refer GL 10: Diversion Weir Design Guideline for SSID)
- *Free River Side Intake*
  - Workmanship of free river side intake and auxiliary structures,
  - Structural dimension of free river side intake and auxiliary structures,
  - Level and efficiency of intake gate,
  - Wing walls elevations and its completeness up to the natural ground level.
  - Completeness of the entire headwork system with respect to the existing ground condition, and finishing works.

  (For more information refer GL 11: Free River Side Intake Design Guideline for SSID)
- *Spring Development*
  - Visual checks of the spring system to ensure that it is in good condition and operating efficiently.
  - Check water quality
  - Check the uphill diversion ditch is adequately diverting surface runoff away from the spring box and is not eroding
  - Check proper functioning of fence
  - Check the spring cover to ensure that it is in place and appears to be watertight.
  - Make sure that water isn't seeping out from the sides or from underneath the spring box, and
  - Check that the screening is in place on the overflow pipe.

  (For more information refer GL 14: Spring Development Study and Design Guideline for SSID)
- *Irrigation Pumps*
  - Visual checks of the system to ensure that it is in good condition and operating efficiently.
  - Check and repair any leakage in piping or through valves
  - Inspect plastic equipment, valves and devices for cracks and other physical damage.
  - Check water meter that describe the discharge at the required head
  - Check pressure gauge reading.
  - Check voltage and current.
  - Check pump and motor bearing temperature.
  - Check vibration and noise.

(For more information refer GL 13: Irrigation Pump Facilities Study and Design Guideline for SSID)

- *Surface Irrigation System*
  - Open Cana system
  - Canal alignments
  - Canal bed level, canal water level, and canal top bank level,
  - Longitudinal slope of the canal,
  - Canal cross sections,
  - Canal dimension,
  - Completeness of the entire canal system with respect to the existing ground condition, and finishing works.

(For more information refer GL 15: Surface Irrigation System Planning & Design Guideline for SSID)

- *Canal Related Structural*
  - Their location,
  - Inlet and outlet elevations for flume, drop, chute, etc,
  - Fitness with respect to the actual ground condition
  - Structural dimension,
  - Bed level, water level, and top bank level,
  - Social structures
  - Completeness of the entire canal related structures with respect to the existing ground condition, and finishing works.

(For more information refer GL 16: Design of Canals and Related Structures Guideline for SSID)

- *Sprinkler Irrigation System*
  - Physical inspection of risers, sprinkler heads and sprinkler nozzles
  - Inspect the system for leakage specially leakage on the main and sub main, laterals, sprinklers and other fittings
  - Check system pressure and system flow
  - Service air valves and hydrants
  - Check sprinklers for wear and replace springs, washers and nozzles where necessary

(For detail refer GL 17: Sprinkler Irrigation System Study and Design Guideline for SSID)

- *Drip Irrigation System*
  - Physical inspection of riser, manifolds, laterals and drippers,
  - Leakage of the main and sub main, laterals and drippers,
  - Uniformity of application and depth of wetting,
  - Operating Pressures at various points on the piping network, preferably at the beginning and at the far end of the main and the submain pipelines,
  - Flow rates/water discharge, and
  - Check, air and pressure control valves proper functioning.

(For detail refer GL 18: Drip Irrigation System Study and Design Guideline for SSID)

- *Headwork gates*
  - Dry test to check the proper functionality (sliding, rotation, opening, closing, etc) of the gates prior to diverting water towards the headwork structure.
  - Wet test to check the proper functionality (sliding, rotation, opening, closing, leakage, withholding water pressure, etc) of the gates after diverting water towards the headwork structure.

2.3.2 Final report

Final report can be called as Contract Completion Report. On the completion months of construction, contract completion report shall be prepared and submitted to Client by the CST that includes, but not limited to the following:

- Executive Summary,
- Mobilization/demobilization details,
- Description of project,
- Project implementation,
- Details of the work executed and of the techniques employed and type, quality, quantities and sources of materials used,
- Financial cost details together with a breakdown of the same, detailing and assessing extra expenditure and cost increases inclusive of the justification for such increases,
- Contract changes and variations, if any,
- Contractor's performance,
- Assessment of any complaints and/or claims by the contractor, if any,
- A critical study of important technical problems which arisen during the construction,
- Comments on Technical Specification and Conditions of Contract,
- Construction records (photo),
- As-built drawings (A1 size reproducible),
- Operation and maintenance manual,
- Conclusions, and
- Details of final account, where possible.

2.3.3 Consultancy completion report

Following submission of the Contract Completion Report, the CST shall prepare a comprehensive report on the Consultancy services throughout the contract period. The report shall describe the aims of the project and the achievements of the construction works. It shall also detail progress on the Final Account, which shall be appended. Finally, it shall give details of the supervisor visits during the maintenance period/defect liability period.

2.3.4 Final payment certificate

As soon as the works are substantially completed and provisional acceptance of the project or upon termination of the Contract (at an earlier stage), the Supervising body and the Contractor must conduct a joint inspection and take final measurements of the completed works based on acceptable guidelines for conducting such Final Inspection. Based on the final measurements and As-Built Drawings a Final Payment Certificate is prepared by the contractor and agreed with the Supervising body.

The Final Payment Certificate shall be computed as the total value of work executed under the contract less any previous payments and all amounts such as Advances, and cost of tools and equipment supplied by the client. The supervising body must also ascertain that all standing labor wages are settled and no other amounts are due to suppliers in the project area. These could include rental charges for site accommodation, food catering charges, charges for use of water sources, gravel sources and rental charges for equipment hired by the contractor.

The supervisor should prepare and issue to a final bill of quantities and final payment certificate for his/her processing. The final payment certificate shall include:

- Outstanding payment of executed and measured works,
- Extra works and any other basis for payment,
- Partial amounts of retention to be released after the provisional acceptance under the provisions of the contract,
- Partial amounts of retention to be retained for defects liability period under the provisions of the contract,
- Corrections and adjustments of all prior estimates and payments, and
- Liquidated project age, if any, due from the Contractor.

The final value of works may also be affected by any unresolved claims. The Claims should, therefore, be settled by negotiation and at the earliest opportunity. By completing the final measurements, both parties shall agree on the quantities related to any claim, thereby assisting in any subsequent evaluation. The supervisor should notify on this matter, evidencing the outstanding situations and reporting all the actions previously taken to solve them within the contractual period.

2.3.5 Payment of retention money

Upon the issue of Certificate of Substantial completion and provisional acceptance of the project, partial amount of the retention money stated in the Works Contract shall be certified by the supervisor for payment to the Contractor.

Upon issuance of Final Taking-Over Certificate and expiration of the Defects Liability Period, the remaining amount of Retention Money shall be certified by the CST for Payment to the Contractor.

3 CONSTRUCTION SUPERVISION PERSONNEL AND THEIR RESPONSIBILITIES

In order to deliver Contract Administration and Construction Supervision service whether outsourced or own-force modalities, assignment of competent supervision crew team members has a paramount importance. The staff composition in a given supervision crew may vary depending to the scale and complexity of the project. A contract administration and construction supervision service project coordination office that comprises the following staff members is recommended for small scale irrigation project.

Table 3-1: Recommended staff composition in a supervision crew

No.	Position	Required Number	Location	Remarks
1	Project Manager	1	Convenient agreed place	For different lots
2	Contract Engineer	1	Convenient agreed place	For different lots
3	Resident Engineer	1	Project Site	For different lots
4	Supervisor Engineer	1	Project Site	Per project
5	Geotechnical/Materials Engineer**	1	Project Site	For different lots
6	Electromechanical Expert	1	Project Site	For different lots
7	Surveyor*	1	Project Site	Per lot/Per project*
8	Laboratory Technician	1	Project Site	For different lots
9	Community Promoter***	1	Project Site	Assigned by client

* Assignment of surveyor may be either per lot or per project based on the scope, complexity and relative location of the projects in the respective lot.

** Material Engineer may be assigned per site in the case of Micro Earth Dam Construction Supervision.

*** Community promoter can be assigned by the client from the government structure.

The staff task assignment for Contract Administration and Construction Supervision Services as presented under but not limited: -

Table 3-2: Task assignment for contract administration and construction supervisory staff

Sr. No	Position	Tasks
1	Project Manager	The Project Manager is responsible for but not limited to: - ➢ The total administration of the project and providing overall management direction. ➢ The full and timely execution of the project in the field. He shall set procedures for job conduct between the contractor and site staff and shall ensure that the requirements of the contract are followed. ➢ Carrying out of frequent reviews of schedule and payment status and shall be kept informed through site staff on performance deficiencies. ➢ Ensuring a suitable job climate for the contractor; rigid lines of contract barriers must be softened and administered in a way to promote cooperation, teamwork and sharing to gain maximum efficiency and best performance. ➢ Review and recommend o Contract Assignments; o Variation Orders; o Rates; o Claims and Dispute Settlements; o Extensions of Time; with or without payment; o Nominated Sub-Contractors and Sub-letting of work; o Engineer's Certificates, including Completion and Final Certificates; o Expenditure of Provisional Sums;

Sr. No	Position	Tasks
		○ Suspension Orders; and ○ Payments ➢
2	Contract Engineer	The Contract Engineer, as specialist adviser to the site staff on contractual matters, shall oversee, review and interpret the documents, and support the contract administration activities of all field staff. The Contract Engineer shall: ➢ Arrange an initial coordination meeting with the contractor, under the chairmanship of the Project Manager, to review the scope of work and conditions and terms of the contract; ensure that all submittals required by the contract (Insurances, Securities, program, etc.) are received in the required time; ➢ In conjunction with the Project Manager and the contractor, establish requirements for conduct and standards of performance, methods of invoicing and payment, administration and lines of authority and communication on the site within the limits set by the contract; ➢ Ensure that all necessary contract documentation is available on site; ➢ Attend periodic meetings with the contractor and other site staff on costs, scheduled progress and contractual and technical problems that may affect the contractor's performance or ability to meet the contract objectives; ➢ Review the contractor's initial and updated construction programs for compliance with contract completion dates and ensure that the updated programs properly reflect actual delays and awarded extensions of time; ➢ Provide controls for the proper authorization of variation orders; ➢ Keep the Project Manager advised of actual and forecast risk, cost and progress of the contract, ➢ Review interim payment applications; ➢ Advise the Project Manager with respect to contractual matters; ➢ Coordinate final inspection and acceptance of the work and prepare Completion Certificates for issue; and ➢ Prior to leaving the site hand over all completion reports, records, files, details of the release of securities and issue of final certificates to the Employer.
3	Resident Engineer	The role of the Resident Engineer is to perform technical supervision of the contractor's work within the areas of their responsibility. He/she should be assisted in this task by supervisor engineers and inspectors. The Resident Engineers shall: ➢ Liaise with the Contract Administration Engineer to ensure that the contractor performs the work in accordance with the requirements of the contract; ➢ Ensure that the Project Manager is kept informed of all issues that may affect the performance of the contract; ➢ Ensure that site engineers and inspectors assigned are properly carrying out their responsibilities and duties; ➢ Review the contractor's construction programs for their areas of responsibility and assessment of physical progress for monthly reporting; and ➢ Be responsible for arranging measurement of the work in their areas of responsibility for payment purposes.
4	Supervision Engineer	Supervision Engineers shall: i. Check Designs, Drawings and related documents including Specifications, Bill of Quantities and Work Programmes prepared by the Contractor; ii. Record quality and quantity of works in progress; iii. Check that proposed process equipment and materials are technically feasible, easy operate and maintain are cost effective; iv. Supervise construction operations;

Sr. No	Position	Tasks
		v. Give instructions to the Contractor and ensure work is carried out satisfactorily; vi. Inspect materials, equipment and plant to be incorporated in the works; vii. Check "as-built" drawings, manuals, operating instructions, etc. supplied and prepared by the Contractor so that Client shall be able to operate and maintain the works; viii. Determine and control quality of all materials and workmanship and accept or reject the same on the basis of their conformity with the relevant Contract and Engineer's instructions;
5	Geotechnical/Materials Engineer	Responsible for: ➢ Ensuring the recommended foundation of structures; ➢ Establishment and management of materials testing laboratories and ensuring that materials and workmanship are in accordance with the specified requirements; and ➢ Geological mapping.
6	Electromechanical Engineer	Responsible for Electro-Mechanical Equipments: ➢ Check Designs, Drawings and related documents including Specifications, Bill of Quantities and Work Programmes prepared by the Contractor; ➢ Record quality and quantity of works in progress; ➢ Check that proposed process equipment and materials are technically feasible, easy operate and maintain are cost effective; ➢ Give instructions to the Contractor and ensure work is carried out satisfactorily; ➢ Inspect materials, equipment and plant to be incorporated in the works; ➢ Check "as-built" drawings, manuals, operating instructions, etc. supplied and prepared by the Contractor so that Client shall be able to operate and maintain the works; ➢ Determine and control quality of all materials and workmanship and accept or reject the same on the basis of their conformity with the relevant Contract and Engineer's instructions;
7	Surveyor	The surveyor is responsible for : - ➢ Checking the original control points for the contract and to confirm their re-installment if they have been dislodged; ➢ Checking the contractor's setting out during the progress of the work as and when required; ➢ Checking other work when specifically requested to do so by a Resident Engineer; and ➢ Undertake all surveying work required for measurement for payment purposes and prepare the associated measurement calculations.
8	Laboratory Technician	Accountable to the Geotechnical/Materials Engineer for: ➢ Testing the materials and work in accordance with the specified test methods. Responsible for the testing carried out by him/her ensuring that: - ➢ The proper test methods are followed; ➢ Only calibrated equipment is used; ➢ Work sheets and report forms are correctly completed; and ▪ All calculations are checked.
9	Community Promoter	▪ Undertake community promotion issues at the project site. It can be assigned either from regional, zonal or Woreda office as convenient to the client.

Project organization for contract administration and construction supervision service

The following project organization for Contract Administration and Construction Supervision Service is recommended for one lot that can comprise three to four projects per lot considering:

- The time allotted for construction of small scale irrigation projects usually is 1 year. Field operation for about 7 months from first December up to end of June,

- Maintaining quality of works as per the specification forming contact through close supervision,
- Job opportunity for professionals that contributes for the successful completion of projects on the specified time, within the budget, and required quality,
- Regular and formal communication would be established between the supervision team and the Employer,
- A quick response system for responding to Contractor's queries and approvals of his submissions would be brought into operation, and
- A channel for communication will be arranged with the experts in the supervision team members at head office for advice on any specialized problems.

Project coordination office shall be established at convenient agreed place for smooth liaison with the project client. At project coordination office the assigned project engineer and contract engineer deliver their responsibilities even for more than one lot. Lot should be established considering Administrative Zones in order to optimize time cost as the result of long travel from one site to the other.

At each project site Supervisor Engineer, Surveyor, and Community Promoter should be permanently assigned as a member of construction supervision team for the case of relatively complex SSIP. For this typical project organization, project site -2 (as shown below onFigure 3-1) is a site located in the center, where the base camp and resident engineer office situated. The Resident Engineer can serve even for three to four projects.

Design Engineer, Geotechnical/Materials Engineer, Electro-Mechanical Engineer, and Quantity Surveyor can serve for three to four projects and sometimes even for more than one Lot considering the work load and the magnitude of impact on time, cost and quality of the project.

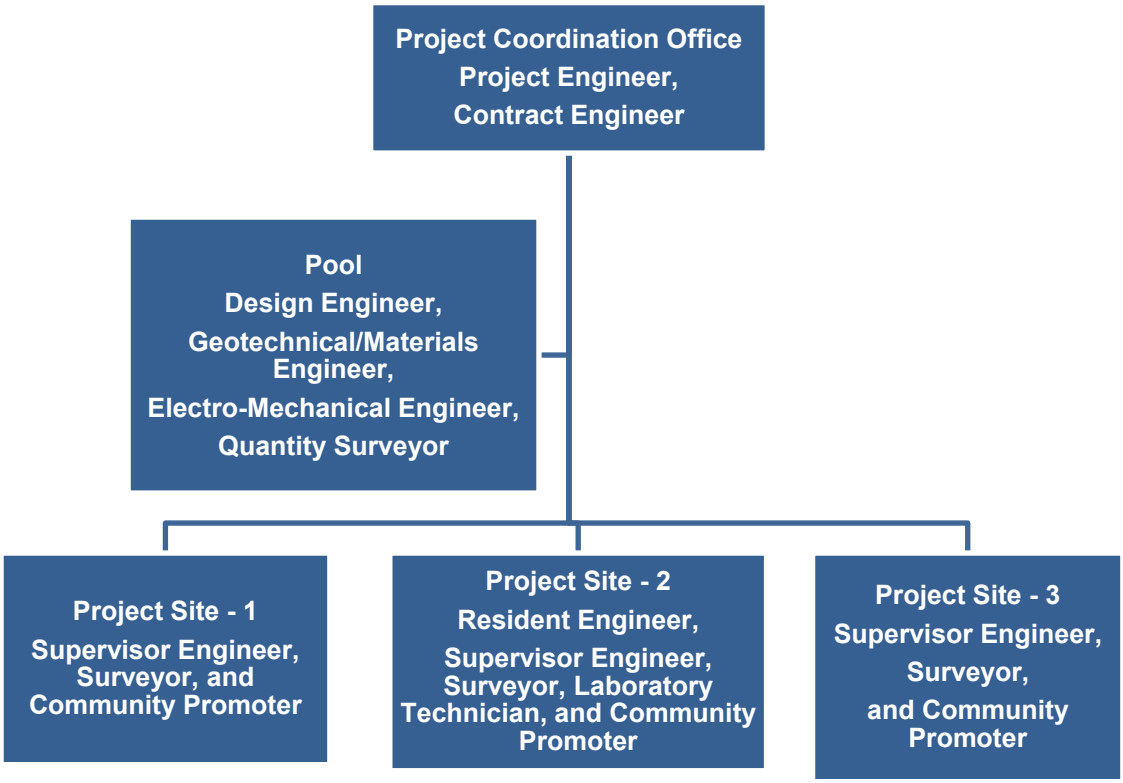


Figure 3-1: Project organization for contract administration and construction supervision service

4 CONSTRUCTION PROCEDURE

The supervisor body should know construction procedure in the construction industry to deliver effective and efficient contract administration and construction service. Construction procedure for preparatory works, excavation and fill works of earthworks, masonry works, concrete works, pipe installation and testing works, pump installation and testing works, and gate fixing works are discussed here separately using work flowchart.

4.1 IMPLEMENTATION PROCEDURE OF PREPARATORY ACTIVITIES

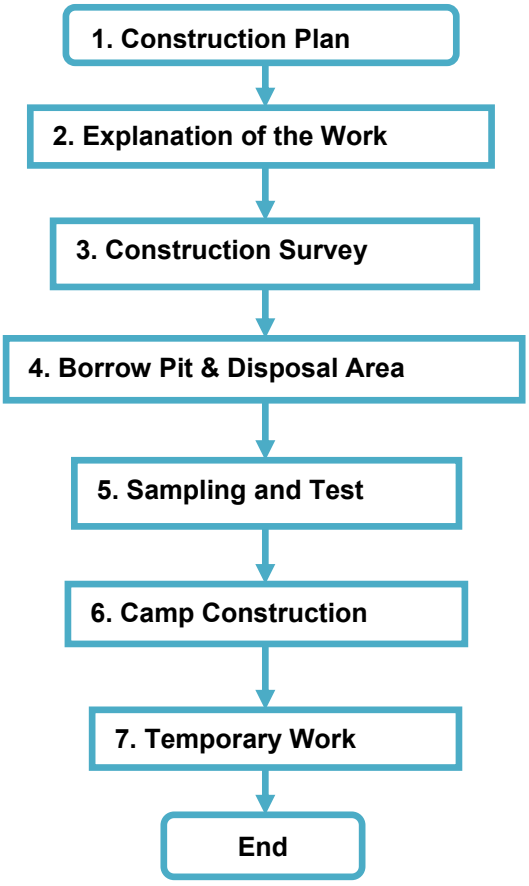


Figure 4-1: Flowchart showing preparation activities implementation procedure

Description of Preparation Activities Implementation Procedure

1) Construction Plan

Construction plan prepared by contractor and approved by the supervisor is the prerequisite to start any construction activities.

2) Explanation of the Work

The supervisory body shall confirm that details of the work and the area to be affected during the construction period clearly described by the contractor and approved by the supervisor body. And also meeting with beneficiary and local authorities should be held to explain the work and get

consent before any commencement of work in the presence of client, supervisor and the contractor delegate.

3) Construction Survey

Setting out shall be prepared for each component of projects and precise data shall be recorded in order to place framework of structures on proposed ground/site step by step jointly by contractor and supervisor surveyors.

4) Borrow Pit & Disposal Area

The contractor should determine with the project supervisor the proposed borrow site (for fill material, masonry stone query site, crushed aggregate query site, natural sand query site) and disposal area during study and design phase. The contractor shall discuss with both local authorities and with land owner farmer about the condition of land after construction (such as elevation, landform, and area) until they reached on consensus on the usage of the considered land. Finally, the volume of material from borrow-pits and disposal area should be measured and firmly used in the project period.

5) Sampling and Test

A sample from the major activities on the earth, concrete and masonry works have to be taken jointly in the presence of contractor and supervisor/client representatives and tested for its compliance with the specification before the realization of the whole works commencement. Test result should be issued and recorded by both parties.

6) Camp Construction

Immediately after required construction materials are secured, camp construction should be executed maintaining the following steps: -

- Clearing and grabbing the camp site,
- Setting out surveying works,
- Foundation excavation,
- Substructure construction,
- Superstructure construction,
- Finishing works, and
- Furnishing the required camp facilities and offices as per agreement.

7) Temporary Work

Temporary works need to be executed as preparatory works of small scale irrigation project implementation are the following but not limited to:

- Access road which is not a part of the project,
- Water source for construction work,
- Dewatering work,
- Cofferdam,
- Safety facilities,
- Power supply, and
- Concrete plant.

4.2 CONSTRUCTION PROCEDURE FOR EARTH WORKS

Earth works can be broadly divided in to two namely excavation, and fill and compaction works. It is discussed in this section separately hereunder.

4.2.1 Construction procedure for excavation works

Excavation works can be also divided in to foundation excavation (for structures like headwork, canal structures), mass excavation (for micro earth dam and night storage reservoir), and trench excavation (for earthen canal system). Furthermore, excavation can be further grouped as normal soil excavation, soft rock excavation, and hard rock excavation.

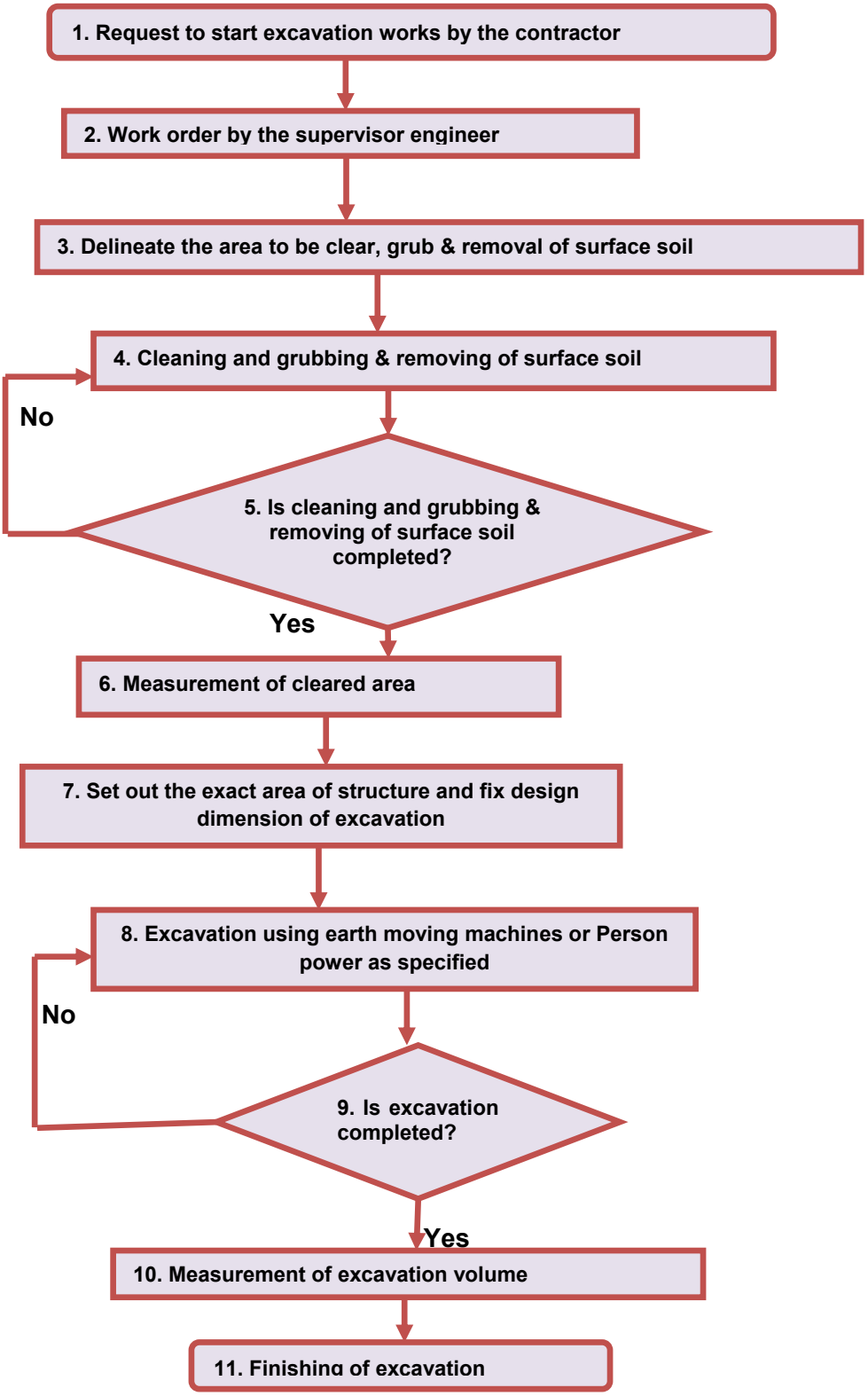


Figure 4-2: Flow chart excavation

Description of excavation works

Step-1: Request to start excavation works by the contractor

The project contractor should submit work requesting letter mentioning his readiness to perform the task.

Step-2: Work order by the supervisor engineer

The supervisor engineer should give job order to the contractor within the specified period checking the fulfillment of logistics to start the task from the contractor side.

Step-3: Delineate the area to be clear, and grub& removal of surface soil

The contractor together with supervisor/client should delineate the area to be clear, and grub & removal of surface soil as specified.

Step-4: Clearing, grubbing and removing of surface soil

Clearing, grubbing and removing of surface soil works should be performed by the contractor either by machine or person power as specified based on scope of the works.

Step-5: Step-5: Is Clearing, grubbing and removing of surface soil completed?

The contractor together with supervisor/client checking the compliance of clearing, and grubbing & removing of surface soil works with the specification. If it is compliant go to Step-6. If not continue clearing, and grubbing & removing of surface soil operation until it becomes compliant to specification (Step-4).

Step-6: Measurement of cleared area

Measure the surface area where cleaning, grubbing & removal of surface soil performed prior to excavation.

Step-7: Set out the exact area of structure and fix design dimensions of excavation

The contractor surveyor should perform set out of the exact area of structure and fix design dimensions of excavation. The final set out should be confirmed by supervisor/client. For headwork and canal structures foundation excavation working space should be considered in addition to the exact design dimensions of structures, whereas, for earthen canal and small canal structures suited on shallow cut depth the exact design dimensions may be dimensions excavation dimensions.

Design dimensions to be considered for structures foundation excavation are width, length and depth; whereas, design dimensions to be considered for canal excavation are width, length, depth and longitudinal.

Step-8: Excavation using earth moving machines or person power as specified

The contractor perform excavation works either by earth moving machines or person power as specified on the technical specification document forming contract documents. For headwork foundation excavation the contractor may use dozer or excavator. In the case of canal and small canal structures suited on shallow cut depth the contractor may use person power for ordinary soil Blasting or Jack Hammer may be used when the cut is hard rock depending on the volume of

works. Besides, local techniques can also be used to deal with rock outcrops, like heating and fast cooling to weaken the rocks and then hitting them with a hammer.

Step-9: Is excavation completed?

The contractor together with supervisor engineer checking the compliance of excavation works with the specification. If it is compliant go to Step-10. If not, continue excavation operation until it becomes compliant to specification (Step-8).

Step-10: Measurement of excavation volume

Excavation for canals drains and open cuts will be measured at the volume in place of excavation actually carried out within the lines of the typical cross-section and below the ground surface before construction starts, but after clearing and grubbing, if any. Structural excavation will be measured as the volume in place actually excavated below the ground level within the vertical plains coincident with the outer sides of the culverts, floors or structure and above the elevation of the foundation as indicated in the drawing or as directed, i.e. the volume will be calculated as a products of the exact length and width of the lowest strip of the foundation according to the drawings and the depth measured vertically; where ground is not level, average depth shall be taken.

Measurement should be done jointly with the supervisor engineer.

Step-11: Finishing of excavation works

The entire excavated canal sections and structures foundation area shall be left in neat and presentable conditions.

4.2.2 Construction procedure for fill and compaction works

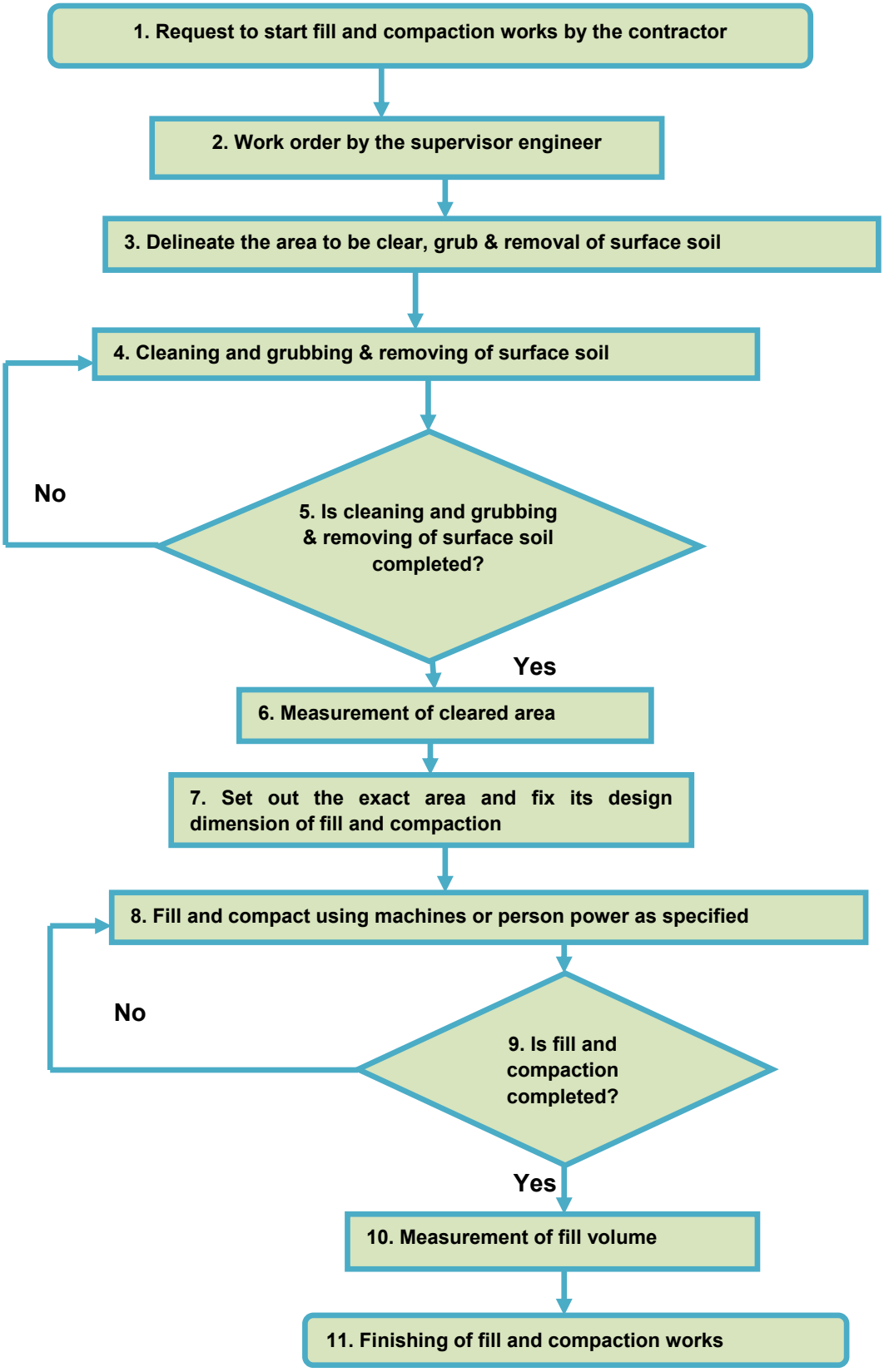


Figure 4-3: Flow chart- fill and compaction works

Description of Fill and Compaction Works

Step-1: Request to start fill and compaction works by the contractor

The project contractor should submit fill and compaction works requesting letter mentioning his readiness to perform the task.

Step-2: Work order by the supervisor engineer

The supervisor engineer should give job order to the contractor within the specified period checking the fulfillment of logistics to start the task from the contractor side. Certificate of fill material test result compliant to the technical specification and works methodology should be submitted and approved by supervisor engineer. Carry suitable soil from the borrow pit to the site.

Step-3: Delineate the area to be clear, and grub& removal of surface soil

The contractor together with supervisor/client should delineate the area to be clear, and grub & removal of surface soil as specified.

Step-4: Clearing, grubbing and removing of surface soil

Clearing and grubbing works should be performed by the contractor either by machine or person power as specified based on scope of the works.

Step-5: Is Clearing, grubbing and removing of surface soil completed?

The contractor together with supervisor/client checking the compliance of clearing, and grubbing & removing of surface soil works with the specification. If it is compliant go to Step-6. If not continue clearing, and grubbing & removing of surface soil operation until it becomes compliant to specification (Step-4).

Step-6: Measurement of cleared area

Measure the surface area where cleaning, grubbing & removal of surface soil performed prior to fill and compaction.

Step-7: Set out the exact area and fix design dimension of fill and compaction

The contractor surveyor should perform set out of fill and compaction area and fix its design dimensions. The final set out should be confirmed by supervisor engineer.

Step-8: Fill and compact using machines or person power as specified

The contractor perform fill and compaction works either by machines or person power as specified on the technical specification document forming contract documents. For micro earthen dam the contractor may use heavy duty compactor. In the case of canal and small canal structures the contractor may use person power and or manual compactor depending on the volume of works.

Spread soil by layer keeping the recommended layer thickness in the specification. Usually the layer thickness ranges 20cm to 30cm. Compact spread soil layer by layer at decided the number of Compaction. Compaction speed shall be optimum (less than walking speed of person). For high grade compaction do the following control.

- Check the number of compaction and compaction speed
- Measure the density of soil by field density test on each layer at the interval on the construction plan and the criteria of construction
- If the test result is out of the criteria, examine the followings check the water content of soil and,
    a. If water content is over allowable range, remove the soil and bank with allowable soil again and adjust water at stock yard for the next work place
    b. If water content is lower than allowable range, spread water and compact at the place again and adjust water at stock yard for the next work place.
    c. If water content is in allowable range, cut the top soil (thin thickness) and compact again and change the thickness of soil spreading to thin from next place.

Step-9: Is fill and compaction completed?

The contractor together with supervisor engineer checking the compliance of fill and compaction works with the specification. If it is compliant go to Step-10. If not continue fill and compaction operation until it becomes compliant to specification (Step-8).

Step-10: Measurement of fill volume

Fill for embankment construction will be measured as volume of embankment within the lines of the typical cross-section or as directed by the Engineer, in its final compacted position after finishing and trimming, and above the ground-surface before embankment construction starts but after clearing and grubbing, if any.

Compacted backfill measurement will be made of the actual number of cubic meter of material placed in the earth fill and approved by the Engineer. Calculation of volume will be made after compaction operation have been completed and within dimensions and elevations shown on the drawing or modified by the resident Engineer so that they represent the existing field condition accepted by the Engineer.

Step-11: Finishing of fill and compaction works

The entire fill and compaction shall be left in neat and presentable conditions.

4.3 CONSTRUCTION PROCEDURE FOR MASONRY WORKS

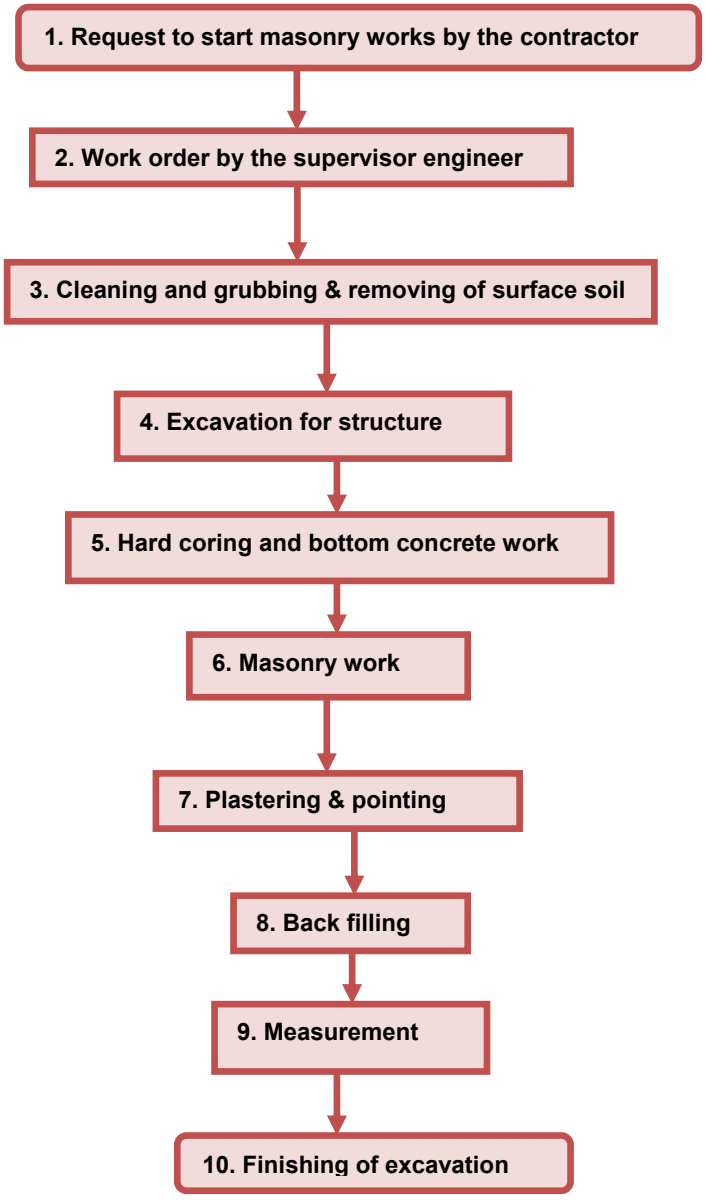


Figure 4-4: Flow chart- masonry works

Description of Masonry Works

Step-1: Request to start masonry works by the contractor

The project contractor should submit work requesting letter mentioning his readiness to perform the task.

Step-2: Work order by the supervisor engineer

The supervisor engineer should give job order to the contractor within the specified period checking the fulfillment of logistics to start the task from the contractor side.

Step-3: Clearing, grubbing and removing of surface soil

The contractor together with supervisor engineer should delineate the area to be clear, and grub & removal of surface soil as specified if any. Clearing, grubbing and removing of surface soil works should be performed by the contractor either by machine or person power as specified based on scope of the works. Measure the surface area where cleaning, grubbing & removal of surface soil performed prior to excavation.

Step-4: Excavation for structure

The Contractor shall set out the working corners and alignment using the data shown on the Drawings or as instructed by the Engineer. The Engineer shall certify his acceptance of the setting out of corners and alignment to the Contractor in writing before commencing masonry works foundation excavation.

Excavation for stone and/or gravel lining shall be accurately trimmed to the specified dimensions. Where over excavation occurs it shall be back filled with gravel as specified below, or such other fill material as the Engineer may order, entirely at the Contractor's expense. Excavation for structures shall be done according to the drawing and specification. Elevation shall be checked using Leveling by contractor and supervisor jointly for its conformity with the drawing and specification. Measurement should be done jointly with the supervisor engineer.

Step-5: Hard coring and bottom concrete work

Stone for hard coring shall be obtained from an approved source. It shall be clean, hard, durable, sound and free from impurities or decomposed rock. Stones shall be set in position with their natural beds as near as possible to the horizontal. The commonly depth of hard coring is 20cm. Measurement of hard core is in m^2.

Bottom concrete work (if any) can be executed mix proportion for plain concrete of material as recommended and stated in the specification. The commonly depth of bottom concrete work is at least 10cm. Measurement of bottom concrete work is in m^3.

Step-6: Masonry work

Stone for masonry shall be obtained from an approved source. It shall be clean, hard, durable, sound and free from impurities or decomposed rock.

Because the masonry walls of headwork retaining walls and canal are required to be as water proof as possible against the hydrostatic pressure of the water inside, particular attention must be paid to the workmanship of the masons. The stones should be lightly taped down into the mortar, and then securely fixed using mortar. Do not leave air voids between stones.

Stone for various masonry works shall be selected and shaped as follows: -

- Stone for facing work shall generally be selected for consistency in grain, colour, and texture throughout the work.
- Stone for below grade work concealed from view shall be chiselled natural stone average size 450mm.
- Stone for rough dressed exposed faces shall be fair chiselled and in average 450mm and individual not less than 380mm length.
- Stone to receive other finish shall be chiselled natural stone in average 450mm and individual not less than 380mm.

Cement mortar is used for stone masonry considering Cement to Sand mix ratio as specified in the technical specification forming the contract. The mortal that results of mixing sand cement and water fill the spaces between the stones and coats them thickly to keep them apart. Approximate width of construction joints for shaped stone masonry lays in the range 1 cm to 2.5 cm.

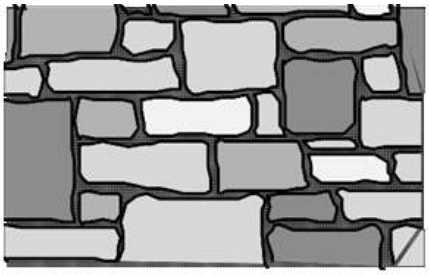


Figure 4-5: Properly constructed masonry structure

Step-7: Plastering & pointing

Provide cement, aggregate, labour, equipment and tools for plaster and pointing as required for the satisfactory installation of the works. Aggregate for plaster and pointing shall be naturally occurring sand or crushed aggregate. The aggregate shall be hard, clean, and free from adhered coatings with tolerable clay content as specified in the specification forming the contract. Or the clay and fine silt content of aggregate shall not exceed 5% by weight. Aggregate shall be free of harmful organic and inorganic material that may affect the setting, strength, durability and appearance of render or undercoat and material in contract with it.

In instances where hand mixing is unavoidable, the cement content shall be increased by 10%. The dry and wet mixes shall be turned over sufficient number of times to produce the respective consistencies as required by batch mixers. Cement mortar shall be used within half hour of adding cement to the mix.

Plaster shall be applied in two coats with the following mix proportion for mortar. The aggregate for mortar to be used shall comply with table 1 of BS (British standard) 1199.

- First coat: 1 Part cement to 2.5 parts aggregate (fine) by volume.
- Second coat: 1 Part of cement to 4 parts of aggregate (fine) by volume.

The first coat shall be wetted and the plumb line for the second coat established after 24 hours. The second coat of plaster shall be applied within 4 hours of the establishment of plumb line on the surfaces.

The second coat shall be applied by trowel to a maximum thickness of 12mm. This coat shall be allowed to cure for days before further finish is applied as per specification.

Measurement will be made for the plain area m^2 of plastering or pointing work acceptable to the level and quality of finishing shown on the drawing or to the satisfaction of the Engineer.

Payment shall be made for the number of m^2 of measured area as provided above at the contract unit price for each plastering and pointing works that shall constitute full compensation of material transportation and mixing mortar together with its cost of application to the required work quality of finishing.

Cement mortar is used for plastering and pointing (finishing a wall by putting mortar or cement between the bricks) considering 1:2 Cement to Sand mix ratio. Generally, the mix design for cement mortal shall be as specified in the technical specification forming the contract.

Step-8: Back filling of structures

Back filling around structures shall be executed spreading and compacting the recommended fill material layer by layer as per the specifications.

Step-9: Measurement of masonry works

Measurement will be made for the number of m^3 of masonry work acceptable placed to the line, Level, grades and cross-section shown on the drawing or established by the engineer.

Payment shall be made for the number of m^3 measured as provided above at the contract unit price for the masonry work shall constitute full compensation for quarrying transporting material to the site ,mixing mortar and all other work related to item.

Step-10: Finishing of masonry works

Masonry works shall be well finished and left in neat and presentable conditions for the satisfaction of the Engineer.

4.4 CONSTRUCTION PROCEDURE FOR CONCRETE WORKS

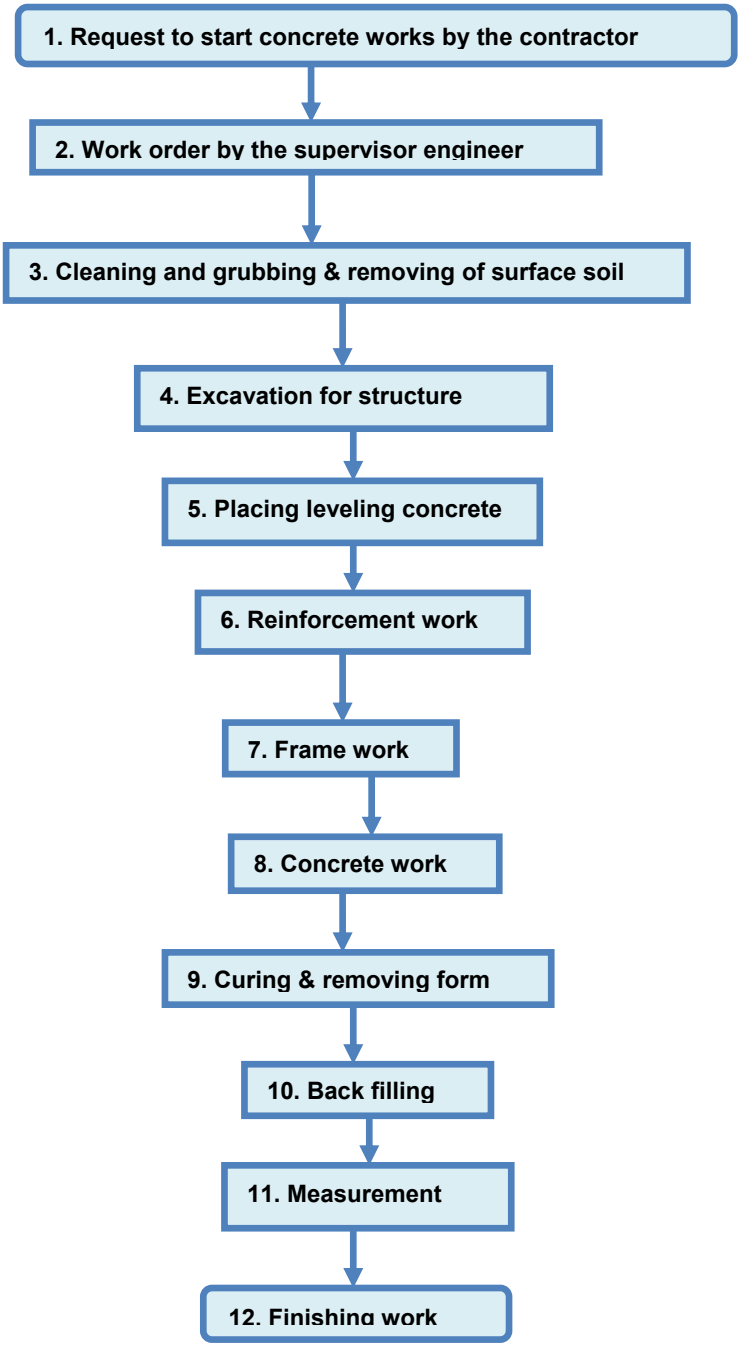


Figure 4-6: Flow chart- concrete works

Description of Concrete Works

Step-1: Request to start concrete works by the contractor

The project contractor should submit work requesting letter mentioning his readiness to perform the task.

Step-2: Work order by the supervisor engineer

The supervisor engineer should give job order to the contractor within the specified period checking the fulfillment of logistics to start the task from the contractor side.

Step-3: Cleaning, grubbing and removing of surface soil

The contractor together with supervisor engineer should delineate the area to be clear, and grub & removal of surface soil as specified if any. Clearing, grubbing and removing of surface soil works should be performed by the contractor either by machine or person power as specified based on scope of the works. Measure the surface area where cleaning, grubbing & removal of surface soil performed prior to excavation.

Step-4: Excavation for structure

The Contractor shall set out the working corners and alignment using the data shown on the Drawings or as instructed by the Engineer. The Engineer shall certify his acceptance of the setting out of corners and alignment to the Contractor in writing before commencing concrete works foundation excavation.

Excavation for stone and/or gravel lining shall be accurately trimmed to the specified dimensions. Where over excavation occurs it shall be back filled with gravel as specified below, or such other fill material as the Engineer may order, entirely at the Contractor's expense. Excavation for structures shall be done according to the drawing and specification. Elevation shall be checked using Leveling by contractor and supervisor jointly for its conformity with the drawing and specification. Measurement should be done jointly with the supervisor engineer.

Step-5: Placing leveling concrete

Mass/plain concrete can be casted to make the weight of structure spread evenly to the ground, and to make reinforcing bars assembled so that reinforcing bars can be placed properly (level or vertically, etc. as indicated in drawings. The commonly depth of level concrete work is 10cm. Measurement of level concrete work is in m^3.

Step-6: Reinforcement work

Steel reinforcement for concrete shall consist of steel bars or welded deformed steel wire fabric except where otherwise shown. Steel bars shall consist of deformed and plain billet-steel bars as specified in ASTM A.615. Steel wire fabric for concrete reinforcement shall be in accordance with the requirements of ASTM A.497.

All deformed and plain steel bars to be used as reinforcement in concrete constructions shall be of Grade 60 and Grade 40 respectively in accordance with the requirements as described in ASTM A.615.

All steel wire fabric shall be delivered in flat sheets.
The Contractor shall prepare test specimens of steel reinforcement to be used in the Works.

Test specimens shall be taken in the presence of the Engineer and shall be of a size sufficient to carry out the tests as described below.

They shall be tested in a nominated laboratory and the certified copies of the results of the tests shall be submitted to the Engineer.

The specimens shall be tested on bending and tensile properties and the steel wire fabric also on weld shear strength. The methods and requirements for testing shall be carried out in accordance with the applicable specifications of A.S.T.M. A.497 and ASTM A.615.

No steel reinforcement shall be used in the Works until the testing results have been approved by the Engineer. If ordered by the Engineer, test procedures shall be repeated at the Contractor's expense for any new supply of reinforcement during the course of the Works.

Storage of reinforcement shall be on racks or supports clear of the ground. Different types and dimensions of the reinforcement shall be kept separate.
Reinforcement processing consisting clean reinforcing bar, cut reinforcing bar by the total length of each bar, and bend reinforcing bar by following processing plan. Please note that *reinforcing bar shall be bent without heating*.

Assembling of the reinforcing bar consisting placing spacer blocks on the leveling concrete to secure the designated clearance between the structure bottom and reinforcement bars, placing the reinforcing bar on the position of structure, binding the reinforcing bars each other by binding wire tightly not to move them by concrete placing, and putting the spacer for keeping space between the reinforcing bars and forms assembly at right position. Payment for reinforcing steel will be made at the price tendered per kilogram or tone for "*reinforcing in place*".

Example-1
What is the unit weight of 10mm diameter bar?

Given
Diameter, d = 10mm

Required
Unit Weight = Weight per unit length of 10mm diameter bar, kg/m
Solution
Unit Weight = Specific Weight of bar * Cross sectional Area of bar
Where,

Specific Weight of bar = 7.85×10^4 N/m^3
Cross sectional Area of bar = $\pi d^2/4$
d = bar diameter = 10mm
π = 3.14
g = specific gravity = 10m/s^2

Unit Weight = 7.85×10^4 N/m^3 * 3.14 * (0.01m) $^2/4$ = 6.165 N/m = 6.165kg.m/s^2/m/10m/s^2 = 0.617kg/m. Therefore, Unit Weight of 10mm diameter bar = **0.617kg/m**.

Example-2
The length of steel, with a diameter of 8mm, required for **X** irrigation scheme is 4,000 meters. How many tons of steel should be ordered for the project?

Given
Diameter, d = 8mm
Length, l = 4000m

Required
Weight of 8mm diameter bar, tons

Solution
Weight of 8mm diameter bar = Unit Weight * length = 0.395kg/m * 4000m = 1580kg = 1.58tons
Therefore, the quantity of 8mm diameter bar to be ordered for project X is **1.58tons**.

Example-3
What is the payment if the 1510m of 12mm diameter bars supplied, cut, bent, and fixed in place as per technical specification and for the satisfaction of supervisor engineer? Consider the tendered price for bar is 45 birr per kilogram.

Given
Diameter, d = 12mm
Executed quantity of bar = 1510m
Tendered price = 45 birr/kg

Required
Payment, birr

Solution
Amount executed, Birr = Executed quantity, kg * tendered price, birr
Executed quantity of bar in terms of bill tendered = 1510m * 0.888kg/m = 1340.88kg
Amount executed = 1340.88kg * 45 birr/kg = 60,339.60 birr

Therefore, payment request for the executed 1510m of 12mm diameter bars tendered price for bar is 45 birr per kilogram worth **60,339.60 birr** only excluding VAT.

Step-7: Form work
Forms shall be true to line and grade with in allowable tolerances for concrete surface, mortar tight and sufficiently rigid or prevent objectionable deformation under load. Care shall be taken to fit the forms over the completed surface so as to obtain accurate alignments of the surface and to prevent leakage of mortar.

Forms for exposed surfaces shall be coated with approved non-straining from oil, which shall be applied shortly before the concrete is placed. All forms shall be so constructed that they can be removed without damaging the concrete.

Formwork shall consist of purpose-made or proprietary timber; metal or plastic boarding; or sheeting; adequate to support the forces during construction of the concrete structure without excessive deflection. It can be reused with the consent of the engineer based on the technical specification forming the contract.

Form shall be sufficient and properly braced. The maximum tolerance is 1cm in width and elevation, and 5cm in length. Generally, dimensional tolerance for formwork shall be as specified in technical specification forming the contract.

Step-8: Concrete work
It is an activity of casting a structure with the specified cement, sand and gravel mix. It may be lean, mass or reinforced cement concrete depending on the quality of works as specified in the technical specification, drawings, and bill of quantity forming contract.

Cast in place concrete is concrete premixed at a batching plant and transported to the work site or concrete whose ingredients are transported to the site and mixed just before casting in place. Provide cement, aggregates, water admixture, labour, equipment and tools for cast in place concrete as required for the satisfactory construction of concrete work.

Mix Proportion

The proportion of concrete ingredients given in the "Standard mixes for ordinary Structural Concrete" of this Specification shown below or proportions obtained by tests shall be used for concrete mixing.

The proportion of ingredients shall be such as to produce a mixture, which will work readily into the corners and angles of the forms and around reinforcement without segregation of the material components. Where the proportion of ingredients given in the Concrete Class Section of the Specification is not applicable, trial batches shall be made and the mix from which the desired strength is established by testing shall be used for the works.

General Formula used to determine the required material in concrete mix design is:

Concrete Mix ratio = 1:2:4

Let Volume of concrete = Z m^3

Then a) Cement = 1/7 x Zm^3 x 1400 kg/m^3 x 1.30 Shrinkage x 1.05 wastage

= 273 kg Z

= 0.19 m^3 Z

b) Sand =2/7 x Zm^3 x 1840kg/m^3 x 1.30 Shrinkage x 1.05 wastage

= 718 kg Z

= 0.39m^3 Z

c) Gravel = 4/7x Zm^3 x 2250 kg/m^3 x 1.30 Shrinkage x 1.05 wastage

= 1755 kg Z

= 0.95 m^3 Z

General assumptions while calculating materials in Concrete Mix are : -

- Shrinkage = 30%
- Wastage = 5%
- Water-cement ratio
- For Machine mix = 0.4 – 0.5
- For Hand mix = 0.4 – 0.65

Note: Hand mix shall only be allowed for class II concrete, and shall not be allowed for concrete of class C-20 and above.

Step-9: Curing & removing form

Curing is the process of supplying water to the concrete after casting. It should be done for at least 7 days in foundation concrete and 28 days in surface concrete by sprinkling water, at least two times in a day by the Construction Engineer. The main functions of curing are (1) to maintain the required chemical action of cement in setting so as to attain the maximum strength of concrete,

and (2) to prevent formation of surface cracks, due to quick loss of water while the concrete is fresh & wet.

Form shall not remove before the expiration of the minimum time indicated below, except as otherwise directed.

Slab = 7 days

Wall = 2 days

Step-10: Back filling

Back filling around structures shall be executed spreading and compacting the recommended fill material layer by layer as per the specifications.

Step-11: Measurement

Measurement will be made of the number of cubic meters of concrete acceptably placed as directed by the engineer.

Payment will be made of the number of cubic meters measured by provided above at the contract unit price per cubic meters.

Step-12: Finishing work

Immediately after removal of forms, all unsightly or lips shall be removed and undesirable local building on the surface to be permanently exposed shall be remedied. All finishing shall be performed immediately after the forms are removed. Care shall be taken to see that all free water which has accumulated at the surface, is removed before making any finish.

4.5 PROCEDURE FOR PIPE SUPPLY, INSTALLATION AND TESTING WORKS

Pipe works may happen in irrigation infrastructure for conveying irrigation water as main canal, secondary canal, and tertiary canal; pressure line in irrigation pump system; and irrigation or drainage culverts.

The common nominal pressure (PN) pipe used for irrigation is 4bar, 6bar, 10bar. The outer diameter of uPVC Pipe currently used are 600mm, 500mm, 450mm, 400mm, 350mm, 300mm, 250mm, 200mm, 150mm, 100mm, 75mm. Aluminum and High density polyethylene (HDPE) having different diameter commonly used for sprinkler and drip irrigation system. For detail refer *GL 17: Sprinkler Irrigation System Study and Design Guideline for SSID and GL 18: Drip Irrigation System Study and Design Guideline for SSID.*

Construction of underground pipelines involves the initial setting out of the trench, the actual trenching, and preparation of the trench bottom, bedding, pipe laying, pipe jointing, back-filling, placing thrust blocks and pressure testing.

Figure 4-7: Flow chart-procedure for pipe supply, installation and testing works

Description of Pipe Installation and Testing Works

Step-1: Request to start pipe works by the contractor

The project contractor should submit pipe works requesting letter mentioning his readiness to perform the task.

Step-2: Work order by the supervisor engineer

The supervisor engineer should give job order to the contractor within the specified period checking the fulfillment of logistics to start the task from the contractor side. Manufacturers

Certificate of pipe that compliant to the technical specification and works methodology should be submitted and approved by supervisor engineer.

Step-3: Delineate the area to be clear, and grub& removal of surface soil
The contractor together with supervisor/client should delineate the area to be clear, and grub & removal of surface soil as specified.

Step-4: Cleaning, grubbing and removing of surface soil
Clearing and grubbing works should be performed by the contractor either by machine or person power as specified based on scope of the works and concluded by taking measurement.

Step-5: Setting out the width and centre line of trenches
Setting out the width and centre line of trenches should be precisely done using benchmarks fixed during study and design phase. The width of the trench at the depth equivalent to the uppermost part of the pipe should be at least 30cm greater than the nominal diameter of the pipe.

Step-6: Trench excavation
Trenching can be quite tedious if the ground is hard and larger diameter pipes are to be used. Trenches are dug using picks, mattocks and shovels, but if rock outcrops are encountered in the process, blasting may be used depending on the severity of the situation. Local techniques can also be used to deal with rock outcrops, like heating and fast cooling to weaken the rocks and then hitting them with a hammer.

To avoid the anticipated load damaging the pipe, it should be covered as specified in the technical specification made for the same. For example, ASAE EP340.2 standards recommend a minimum cover of 75 cm and a maximum of 120 cm when traffic will be passing above the uPVC pipes, whereas, at least 45 cm cover for 63 mm uPVC pipes, and at least 60 cm for larger uPVC pipes.

Measure the excavated volume based on cross-sections and formation levels taken at intervals of specified length and located at the specified Chainage points on the trench centre line. Measurement should be done jointly with the supervisor engineer.

Step-7: Preparation of the trench bottom
The bottom of the trench should be level or of a uniform slope, to accommodate the full length of the pipe.

Step-8: Bedding
Where an uneven trench bottom is encountered, especially in rocky or hard ground, a 10 cm (or at least one third of nominal diameter) fine back-fill or bedding should be provided for during setting out. This layer has to be back-filled, using suitable bedding material such as free-draining coarse sand, gravel, loam or a soil of friable nature, and be leveled.

Step-9: Pipe lying
A pipeline and appurtenances installed to convey water for storage or application, as part of an irrigation water system. Pipes should be laid in accordance to the technical specification forming the contract document. The following points should be considered while installing pipes but not limited to: -

- Completeness of the preceding activities,
- Availability of sufficient quantity in stock for the intended work,
- Capability of plumber,
- Availability of clear method statement,
- Pipe type,
- Nominal diameter of the supplied with respect to the designed pipe diameter,
- Nominal pressure of the supplied with respect to the designed pipe diameter,
- Physical condition of the supplied pipe,
- Rubber seal compatibility, etc

Step-10: Pipe jointing

When pipes have to be joined, they have to be clean of dirt. All the solvent cleaners, adhesives and lubricants used in joining pipes should be those recommended by the manufacturer of the pipe or fitting. It has to be remembered that solvent cleaners and adhesives are highly volatile. For example, in the case of uPVC piping less than 200 mm in diameter, an injection-mould adhesive type of fitting or an integral rubber ring should be used, whereas, for sizes larger than 250 mm diameter, a rubber ring end socket should be used.

Pipes can be cut if shorter pipes are needed, but, if jointing is not done immediately, the pipes have to be temporarily closed in order to avoid the entrance of animals or dirt. It also, is important to ensure that the temporary closures are opened on re-commencement of pipe laying works. Valves and outlets should be closed every day.

Step-11: Back-filling

After checking that the levels of all joints are correctly set out, side filling can then be done in layers that are 75 mm thick, using fine material for the fill. The layers have to be tamped by hand, ensuring that the joints are left exposed. Tamping should be done simultaneously on both sides of the pipe, in order to avoid misalignment. This should continue up to a height of two thirds of the pipe diameter, or up to 10 cm above the crown when the material is spread over the whole length of the pipeline except the joints. Beyond that, the rest of the back-filling can be done in layers of 15-30 cm. The trenches should be over-filled to allow for settlement.

Note that the space between the joints is backfilled after the pipeline has been pressurized and the joints inspected to ensure that there are no leaks. It is necessary to ensure that all pipes are back-filled once they are installed, in order to prevent them from floating due to rainwater or groundwater.

Step-12: Placing thrust blocks

Thrust blocks that helps to transfer the load from a fitting or branch to a wide load-bearing area minimizing the chances of the fitting moving should be placed in a position when the pipeline changes direction, at the end of a pipeline, and when there is a branch such as a tee.

Step-13: Pressure testing and flushing of the system

The purpose of testing pipelines is to ensure that the pipe joints are water-tight and that the permanent concrete thrust blocks are capable of resisting the load.

Normally, at least 7 days should be allowed after constructing the last thrust block before the system is tested. By this time, the last thrust block should be able to withstand the load.

When pressure testing, the pressure should not exceed one and half times the maximum working pressure. It is also important that the valves and all other outlets be opened and closed slowly.

The flushing is intended to remove all the dirt that inevitably gets into the system during pipe laying and it should be done for a couple of hours with the flush valves at the end of the lateral lines open (in the case of pressurized irrigation system). The flushing process should be stopped once clean water starts coming out of the valves.

Step-14: Measurement
Measurements of pipe works will be taken jointly in the presence of contractor and supervisor engineers as in the drawing and itemized in the billed quantity.

Step-15: Finishing of fill and compaction works
The entire pipe works shall be left in neat and presentable conditions.

4.6 PROCEDURE FOR ELECTRO-MECHANICAL EQUIPMENTS SUPPLY, INSTALLATION, TESTING, AND COMMISSIONING WORKS

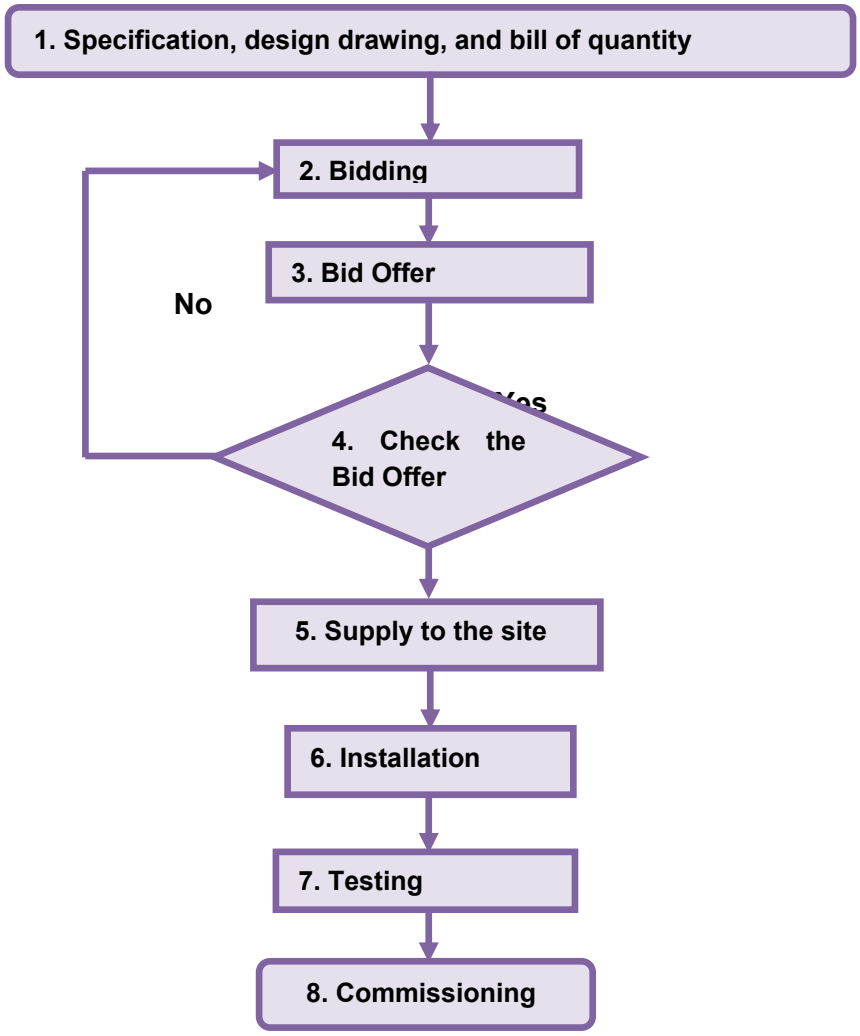


Figure 4-8: Flowchart-procedure for electro-mechanical equipments supply, installation, testing, and commissioning works

The supervisor engineer should control the procedure of electro-mechanical equipments supply, installation testing and commissioning.

Step-1: Specification, design drawing, and bill of quantity
The supervisor engineer should review the specification, design drawing and bill of quantity with respect to the design calculation and update it if required.

Step-2: Bidding
The supervisor engineer should follow weather the contractor entered in to bid process on time or not through formal communication.

Step-3: Bid Offer
The contractor/client should evaluate the technical and financial bid offer with respect to specification, design drawing, and bill of quantity forming the contract. Then, he/she has to submit the technical offer to the supervisor for approval before award.

Step-4: Check the Bid Offer
Up on submission of the contractor for approval, the supervisor engineer should evaluate the technical bid offer with respect to specification, design drawing, and bill of quantity forming the contract. Then, he/she has to give written confirmation whether it is conformance or no-conformance.

Step-5: Supply to the site
Once the contractor gate approval from the supervisor, he/she has to give award for the selected bidder and supply the equipments at site level.

Step-6: Installation
Installation of electro-mechanical equipments shall begin after fulfillments of the following but not limited to: -

- Arrival of the whole electro-mechanical equipments and their accessories. For example,
  - Pumps and accessories
    - Surface pump
    - Submersible pump
    - Riser Pipe
  - Head work fittings
    - Check valve
    - Air release valve
    - Water meter
    - Elbow
  - Equipments for Power sources
    - Generator
    - Transformer
  - Solar System
  - Control Panel
- Pre requisite activities completed and get consent by the supervisor,
- Capability of Contractor's and consultant person power available at site
- Fulfilment of installation equipments and tools arrived at site

The following activities should be done prior to submersible pumps installation:

- *Checking of water level using deep meter through preservation pipe by hydrogeologist;*
- *The hydrogeologist should analysis and draw sound recommendation for the current measured water level with respect to the design input and well completion report made for the same;*
- *If it is recommended by the assigned hydrogeologist, flush the well with the recommended compressor for the recommended time;*
- *If the ground water disagree with the design parameter in any case of the following cases please discuss with the CST to bring solution and proceed or stop the installation activity*
  - *The water level in the production well deeper than the recommended and considered pump position,*
  - *The water level in the production well higher than the recommended and considered pump position but less than the assumed water column above the pump,*

Step-7: Testing

Testing should be done jointly in the presence of qualified contractor and consultant personnel's as per the specified methods and duration set in the specification forming the contract.

Step-8: Commissioning

Commissioning should be done after fulfillment of conditions specified in the contract document.

4.7 PROCEDURE FOR HYDRO-MECHANICAL EQUIPMENTS SUPPLY, INSTALLATION, TESTING AND COMMISSIONING

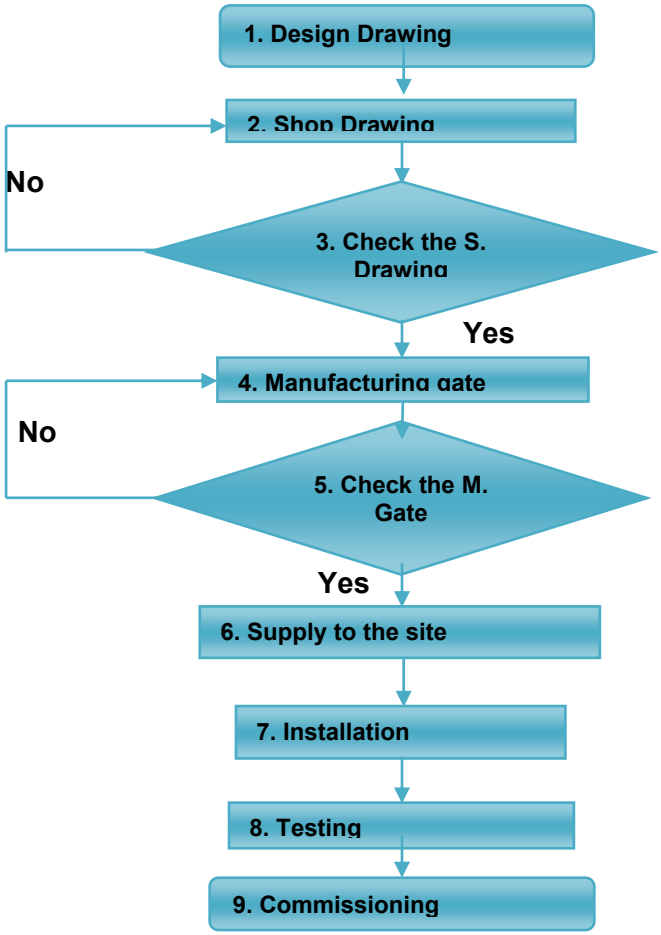


Figure 4-9: Flowchart-procedure for hydro-mechanical equipments supply, installation, testing and commissioning

The supervisor engineer should control the quality of Hydro-Mechanical Equipments such as gates works at each steps of gate manufacturing, supply, installation, testing and commissioning.

Step-1: Design Drawing
The supervisor engineer should review the design drawing with respect to the design calculation and specification made for the same and update it if required.

Step-2: Shop Drawing
Construction engineer should prepared shop drawing (working drawing) based on the specification and design drawing forming the bid and submit to supervisor engineer for approval.

Step-3: Checking the Shop Drawing
The supervisor engineer should check shop drawing (working drawing) prepared and submitted by the construction engineer and give approval if it fit with specification and design drawing prepared for the same. Otherwise, instruct the construction engineer to correct it according to the specification and design drawing forming the bid or modified (if any).

Step-4: Manufacturing
Once the construction engineer get an approval by the supervisor engineer for his shopping drawing (working drawing), he has to proceed the manufacturing of the gate.

Step-5: Check the Manufactured Gate
During this period of manufacturing, the supervisor engineer should inspect the workshop to inspect the process and the final gate manufactured in accordance with the specification, shop drawing and method statement forming the bid. If it is acceptable he can instruct the construction engineer to continue supply at site, if not, give instruction to correct the defect. Here, the supervisor engineer should check the type of material, design dimensions (height, width, length, thickness) with respect to specification and drawing forming the bid.

Step-6: Supply to the site
Immediately after the construction engineer get an approval by the supervisor engineer for the manufactured gate, he has to transport and supply the gate to the site. Supervisor engineer should check and ensure the proper handling during transportation and supply of full set at site level without major damage that may require rectification at workshop level.

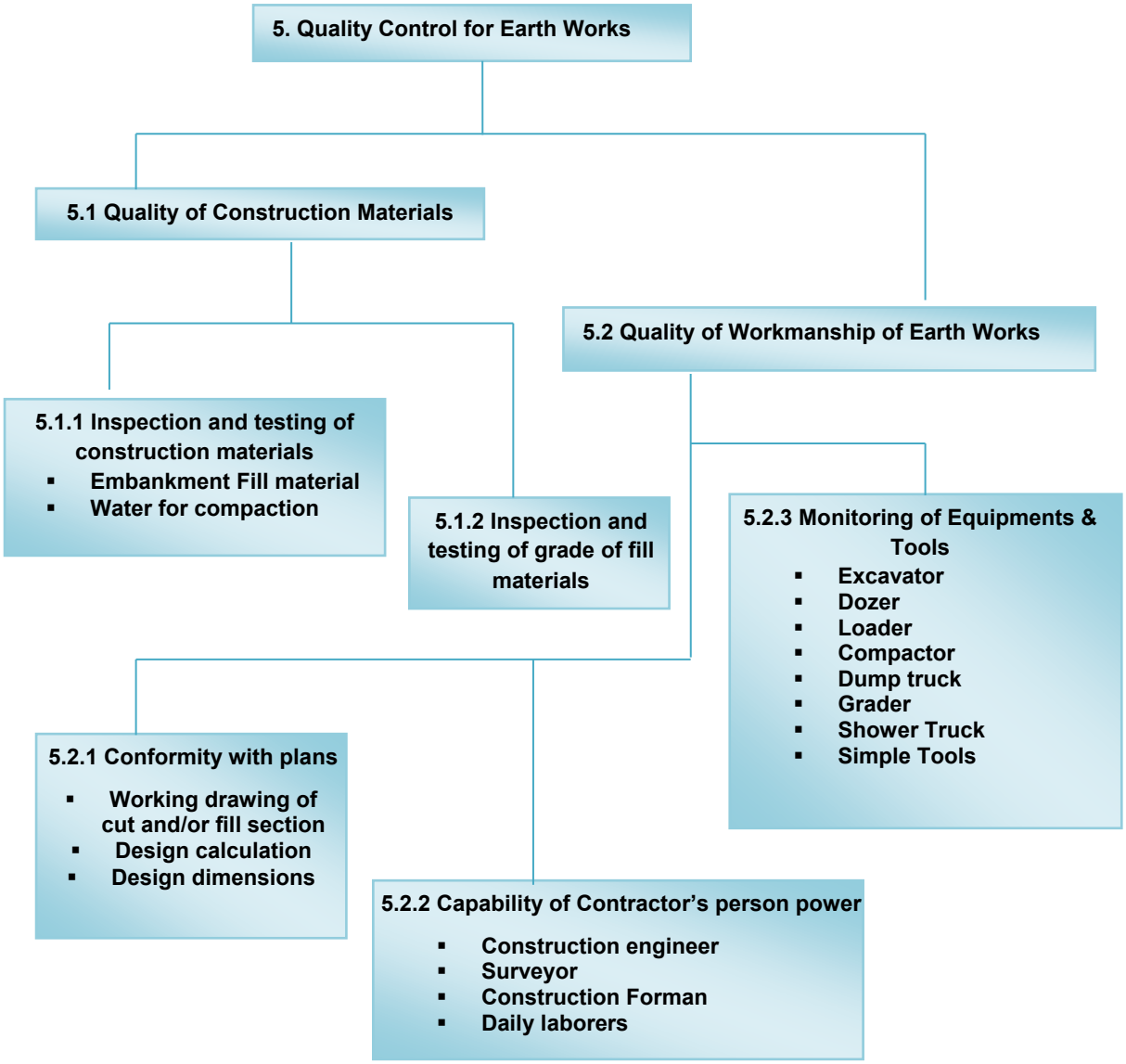
Step-7: Installation
The supervisor engineer can instruct the construction engineer if and only if the following activities are per performed but not limited to:

- Civil structures are completed or ready to be completed,
- Materials required during installation are full filled,
- The required Construction staff for installation and related works are ready and well organized,
- Installation plan and method statement are submitted by construction engineer and approved by supervisor engineer.

Step-8: Testing
After completion of installation operation for the satisfaction of the supervisor engineer, dry and wet test should be taken jointly in the presences of supervisory and contractor civil and electro-mechanical engineers.

Step-9: Commissioning
Finally the work should be finished as recommended by the supervisor engineer. The finishing works may be cleaning, repainting, hammering to rectify minor error, and the like. Commissioning should be done after fulfillment of conditions specified in the contract document.

5 QUALITY CONTROL FOR EARTH WORKS



6 QUALITY CONTROL FOR MASONRY WORKS

Quality of masonry works can be attained by controlling the quality of both construction materials and workmanship in the conformity with the specification forming part of the Contract Document. Supervisor engineer shall refer GL 24: Technical Specifications Preparations Guideline for SSID for general information and the technical specification made for the masonry and act accordingly.

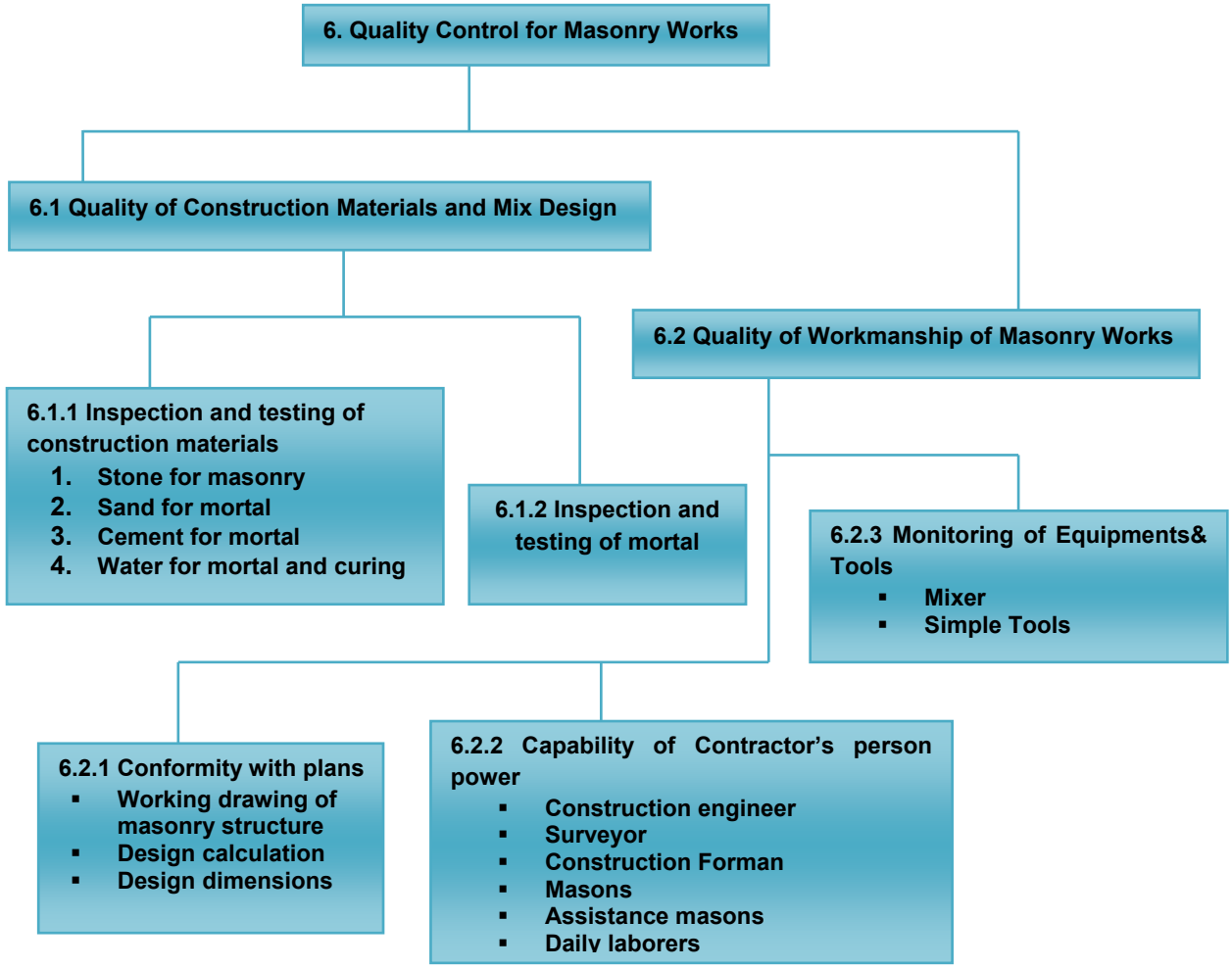


Figure 6-1: List of activities for quality control for masonry works

6.1 QUALITY OF CONSTRUCTION MATERIALS AND MIX DESIGN USED FOR MASONRY WORKS

The following points of construction materials used for masonry works shall be strictly examined and confirmed its conformity with the specification forming part of the Contract Document.

6.1.1 Inspection and testing of construction materials for masonry works

1) Stone for masonry

Hardness, soundness, size and shape, its purity (free from vents, cracks, fissures, discoloration, or other defects that shall adversely affect strength or appearance) of stone for masonry shall be inspected and checked its conformity for the specification forming part of the Contract Document by the engineer before use.

2) Sand for mortal

Sand to be used in the construction of masonry structure shall conform to the specification forming part of the Contract Document and grading limit specified by appropriate standard in masonry works. The supervisor engineer shall maintain the supply of sand from the recommended quarry site unless the material is fully exploited. Before using sand from other quarry, the site shall be confirmed by the engineer and test certificate shall be submitted in advance.

3) Cement for mortal

Check the cement is in accordance to the technical specification forming part of the Contract Document before to use. It includes: -

- The package. Cement shall be furnished in the package as approved by the engineer,
- Storage life of cement. Cement that has remained in store for more than six months shall not be used without special inspection, testing and approval of the engineer. Cement shall be used in approximate in the same chronological order in which it is received from the factory.
- Its freshness and fineness. Transportation units, stores of cement shall be made damp proof and be constructed in such a way that there is no cement left dead.

4) Water for mortar and curing

Water used for mortal and curing purpose shall comply with the specification. Maintain the source from where approved water quality test has been used. Keep the water clean and free from objectionable quantities of silt, organic matter, alkalis, salts, oils, acid, sugar, and other impurities even during handling and mixing process.

6.1.2 Inspection and testing of mortal of specified mix for masonry works

Mortar for irrigation structures is a mixture of cement, sand and water. The mortar binds the stones together. The strength of the bond depends on factors such as:

- The amount of cement used,
- The amount of water used,
- The type and quality of sand, and
- The quality of workmanship.

Always check in the contract specifications for the required mortar grade or mix.

Generally, the mix proportion for mortal in masonry works is to be conducted and decided by laboratory test using sample from the available and recommended sand, cement and water for the specific site as stated in the technical specification forming part of the Contract Document. Sample collection, submission to the agreed laboratory, and collection of mix design certificate shall be done jointly by qualified experts officially assigned from both client/CST and contractor sides.

Tip
The qualified experts expect to have basic construction material qualities and mix design referring the technical specification while collecting representative sample from quarry site and mix design certificate from the laboratory.

No stone should touch another but should be fully laid into mortar having approximate width of joints of 1 cm to 2.5 cm for the commonly used shaped stone masonry.

Quantity of Material for Masonry Works

Material requirements for 1m^3 of finished stone wall can be considers as: -

a) 50cm thick basaltic or equivalent foundation wall bedded in cement mortar 1:4
   1. Stone = 1m^3/m^3
   2. Mortar = 0.4 m^3/m^3
      2.1 Cement = 150 kgs/m^3
      2.2 Sand = 0.42m^3 /m^3

b) 50cm thick roughly dressed super-structure stone wall bedded in cement mortar 1:4
   1. Stone = 1.25 m^3/m^3
   2. Mortar = 0.4m^3/m^3
      2.1 Cement = 150 kgs/m^3
      2.2 Sand = 0.42m^3/m^3

c) 40cm thick dressed super structure stone wall bedded in cement mortar 1:4
   1. Stone = 1.50m^3/m^3
   2. Mortar = 0.40m^3/m^3
      2.1 Cement = 150kgs/m^3
      2.2 Sand = 0.42m^3/m^3

Table 6-1: Quality control for mortar

MORTAR TESTS			
(i) Type of tests: Checks on the suitability of the material for mortar making and the strength of the cured mortar. Unlike most other tests, the client carries out these tests in the laboratory. However, the Site Supervisor has to ensure on site that he/she achieves the required specifications. Continuous control mechanisms and simple site tests ensure good quality work. (ii) Methods used: (see table below) (iii)Rectification measures: Adjustment of batching volumes and mixing water for every major concrete operation.			
Test Item	**Method**	**Location**	**When?**
M.1.)Sand purity and grading	visual	quarry supplier	before procurement
M.3.)Water purity	visual, if req. laboratory	site	always
M.4.)Cement age and condition	production date + visual insp.	at supplier and at site	when buying and using
P.1.) Mixing (batching) place	visual identification	site	before project
P.2.) Identification of mortar type	check specifications	Contract document and drawings	for every masonry job
P.3.) Weather conditions	visual	site	- ditto -
F.1.) Batching volumes	box 40 x 30 x 30cm	site	start of project
F.2.) Mixing	counting batches – mix 3xdry,3x wet	site	always
F.3.) Mixture (consistency and plasticity)	- hand molding - grove “V” test with trowel	site	for every masonry job
F.4.) Usage time limit	set time limits = 30 minutes	site	always
F.5.) Curing	keep wet	site	always for min. 7 days

Legend: M = Material Tests, P = Preparation Tests, F = Fabrication Tests

Source: Contractor’s Handbook for Labour-Based Road Works, Harare, 2004.

6.2 QUALITY OF WORKMANSHIP OF MASONRY WORKS

The following workmanship of masonry works shall be strictly examined and confirmed its conformity with the specification forming part of the Contract Document.

- Check and confirm the assignment of qualified and required number of personnel for each particular task referring the Bid Document forming part of the Contract Document.
- Construction Engineer, Foreman, Masons, Assistance Masons, Daily Laborers, etc.
- Check and confirm review result of the entire Contractor's working drawings, sketches, shop drawings, erection drawings and the associated calculations reveals conformity with the plans, detailed drawings and the accompanying notes forming contract document.
- Check and confirm construction methodology and method statement approved by the engineer.
- Check and confirm Contractor’s equipment and plants deployed for execution of the project works in accordance with the bid offer forming contract document. In this respect, the following shall be properly noted before commencement of the construction of each component of the permanent works:
- Sufficiency of the size and number of equipment allotted for the specific work,
- Mechanical condition of the equipment and plants,
- Adverse effects due to the use of the equipment, and
- Capacity of plants if any to insure production of sufficient material to meet the needs of each specific work item, to completion, within the time limit.

Tip
Equipments used in masonry works may comprise Service Vehicle, Shower Truck, Simple Tools, etc (Refer GL 20: Quantity Surveying Guideline for SSID).

7 QUALITY CONTROL FOR CONCRETE WORKS

Quality of concrete works can be attained by controlling the quality of both construction materials and workmanship in the conformity with the specification forming part of the Contract Document. Supervisor engineer shall refer GL 24: Technical Specifications Guideline for SSID for general information and the technical specification made for the concrete and act accordingly.

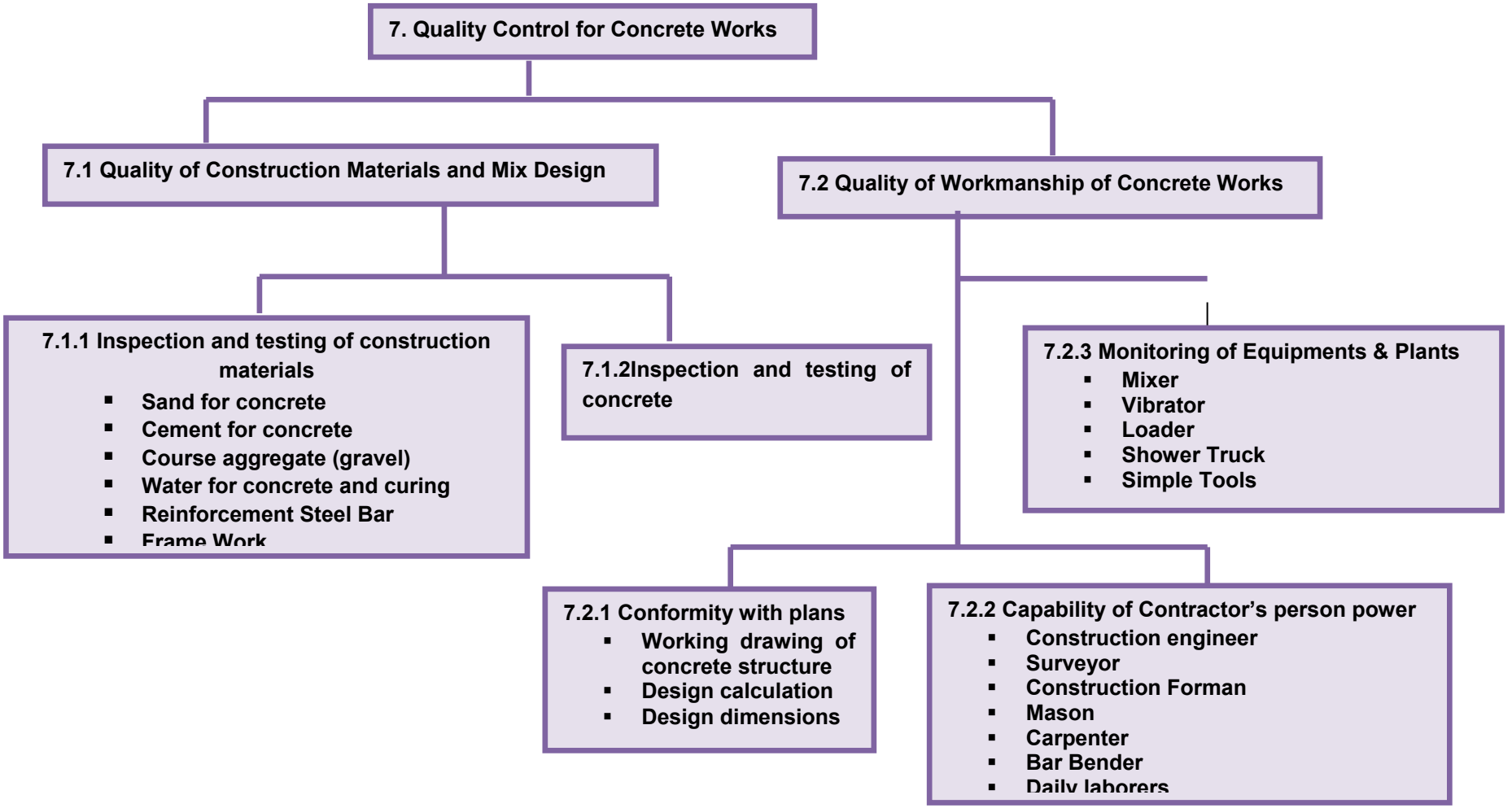


Figure 7-1: List of activities for quality control for concrete works

7.1 QUALITY OF CONSTRUCTION MATERIALS USED FOR CONCRETE WORKS AND MIX DESIGN

7.1.1 Quality of construction materials used for concrete works

The following points of construction materials used for concrete works shall be strictly examined and confirmed its conformity with the specification forming part of the Contract Document.

1) Sand for concrete

Sand to be used in the construction of the structure shall conform to the specification forming part of the Contract Document.

The supervisor engineer shall maintain the supply of sand from the recommended quarry site unless the material is fully exploited. Before using sand from other quarry, the site shall be confirmed by the engineer and test certificate shall be submitted in advance.

Generally unit weight of sand ranges from 1520 - 1680 Kg/m^3. The maximum is compacted unit weight.

2) Cement for concrete

Check the cement is in accordance to the technical specification forming part of the Contract Document before to use. It includes: -

- The package. Cement shall be furnished in the package as approved by the engineer,
- Storage life of cement. Cement that has remained in store for more than six months shall not be used without special inspection, testing and approval of the engineer. Cement shall be used in approximate in the same chronological order in which it is received from the factory.
- Its freshness and fineness. Transportation units, stores of cement shall be made damp proof and be constructed in such a way that there is no cement left dead.

3) Aggregate

The following points should be examined

- size of aggregate
- its purity
- its soundness
- Source of aggregate
- Gradation (particle size distribution) of Aggregate
- Specific Gravity & Unit Weight of Aggregate
- Absorption & Moisture Content

An aggregate for concrete must be clean, sound, hard and strong and durable. Harmful substances which may present in aggregate may be classified as follows.

a) Substance causing an adverse chemical reaction.
   E.g. organic materials such as loam, humus, sugar, etc.
b) Substances which undergo disruptive expansion example, shale, colloidal silica (chert), iron oxide etc …
c) Clay and surface coatings
   Dust increase water requirement and clay prevents good bond between cement paste and Aggregate.
d) Particles having an unduly flat oven elongated shape (offsets workability).
e) Structurally soft or weak particles give lower strength and increase drying, shrinkage, abrasion.
f) Water for concrete and curing

Generally unit weight of sand ranges from 1280 - 1440 Kg/m3. The maximum is compacted unit weight.

TEST ON AGGREGATES (Fine and Course Aggregates)

1) Sieve analysis
2) Unit wt. determinate
3) Specific gravity
4) Absorption test
5) Determination dust or clay content
6) Organic impurities of sand
7) Soundness
8. Abrasion test (Los Angeles abrasion). Abrasion is the resistance to wear.

4) Water

Water used for concrete and curing purpose shall comply with the specification. Maintain the source from where approved water quality test has been used. Keep the water clean and free from objectionable quantities of silt, organic matter, alkalis, salts, oils, acid, sugar, and other impurities even during handling and mixing process.

5) Reinforcement Steel for concrete

American Society for Testing and Materials (ASTM) specifications cover reinforcing steel. The most important properties of reinforcing steel are:

- Modules of elasticity, Es, MPa
- Tensile strength, MPa
- Yield points stress, fs, MPa
- Steel grade designation (yield strength)
- Size or diameter of the bar or wire

The steel for reinforced concrete work shall in conformity to forming part of the Contract Document. Hence, refer the specifications, drawings, and test result reports before making any reinforcing steel works decision.

Checking the quality while reinforcement processing

- Reinforcing bar shall be clean,
- Check the cutting of the total length of each bar in conformity with the drawing and bar schedule forming contract document, and
- Check bending of reinforcement bar in accordance with processing plan without heating.

Checking the assembling of the reinforcing bar

- Checking the placement of reinforcing bar on the position of structure,
- Checking the placement of both main and distribution reinforcing bars in the space in conformity with the drawing and bar schedule forming contract document,
- Place spacer blocks on the levelling concrete to secure the designated clearance between the structure bottom and reinforcement bars.
- Bind the reinforcing bars each other by binding wire tightly not to move them by concrete placing.
- Put the spacer for keeping space between the reinforcing bars and forms assembly at right position. Concrete bar cover shall not less than 5cm.

6) Frame Work

- Forms shall be true to line and grade with in allowable tolerances for concrete surface, mortar tight and sufficiently rigid or prevent objectionable deformation under load.
- Care shall be taken to fit the forms over the completed surface so as to obtain accurate alignments of the surface and to prevent leakage of mortar.
- Forms for exposed surfaces shall be coated with approved non-straining from oil, which shall be applied shortly before the concrete is placed.
- All forms shall be so constructed that they can be removed without damaging the concrete.
- Form shall be sufficient and properly braced. The maximum tolerance is 1cm in width and elevation, and 5cm in length.

7.1.2 Quality of concrete mix design

General Formula used to determine the required material in concrete mix design is: -

Concrete Mix ratio = 1:2:4

Let Volume of concrete = Z m^3

Then a) Cement = 1/7 x Zm^3 x 1400 kg/m^3 x 1.30
Shrinkage x 1.05 wastage
= 273 kg Z
= 0.19 m^3 Z

b) Sand =2/7 x Zm^3 x 1840kg/m^3 x 1.30
Shrinkage x 1.05 wastage
= 718 kg Z
= 0.39m^3 Z

c) Gravel = 4/7x Zm^3 x 2250 kg/m^3 x 1.30
Shrinkage x 1.05 wastage
= 1755 kg Z
= 0.95 m^3 Z

General assumptions while calculating materials in Concrete Mix

- Shrinkage = 30%
- Wastage = 5%
- Water-cement ratio
  - For Machine mix = 0.4 – 0.5
  - For Hand mix = 0.4 – 0.65

Note: Hand mix shall only be allowed for class II concrete, and shall not be allowed for concrete of class C-20 and above. Mixing by hand is labour-intensive, but slow and not effective for larger quantities. Mechanical mixers provide better consistency and quality in the mixing of concrete. They come in all shapes and sizes, from small portable drums with electric motors to those operated by crank, to large petrol-driven machines that can yield up to a cubic meter per batch.

7.2 INSPECTION AND TESTING OF CONCRETE

The design of most of concrete structures is done on the base of 28 days strength. i.e. the design is made such that the design load may be applied after 28 days from the date of casting. It has been observed that even after a month concrete attains strength gradually with age. The strength of concrete is about 130% after three months, about 150% after one year & 155% after 10 years. Thus you find that no appreciable change in strength occurs beyond 1 year.

Hence, supervisor engineer shall ensure that the execution of curing "the process of supplying water to the concrete after casting" by the Construction Engineer for at least 7 days in foundation concrete and 28 days in surface concrete by sprinkling water at least two times in a day for the following purposes.

- to maintain the required chemical action of cement in setting so as to attain the maximum strength of concrete, and
- to prevent formation of surface cracks, due to quick loss of water while the concrete is fresh & wet.

Table 7-1: Quality control for concrete works

CONCRETETESTS

(i) Type of tests:
Check on the suitability of the material for concrete making and the strength of the cured concrete. Unlike most other tests, the client carries out these tests in the laboratory. However, the Site Supervisor has to ensure on site that he/she achieves the required specifications. Continuous control mechanisms and simple site tests ensure good quality work.

(ii) Methods used: (see table below)

(iii) Rectification measures:
Adjustment of batching volumes and mixing water for every major concrete operation.

Test Item	Method	Location	When?
M1.) Sand purity and grading	visual	quarry supplier	before procurement
M2.) Aggregate purity + grading	visual	quarry supplier	before procurement
M3.) Water purity	visual, if req. Lab- test	site	always
M4.) Cement age and condition	production date + visual inspection	at supplier's and at site	when buying and using
P1.) Mixing(batching) place	Visual identification	site	before project
P2.) Identification of concrete type	check specifications	contr. docs. and drawings	for every concrete job
P3.) Weather conditions	visual	site	- ditto -
F1.) Batching volumes	box 40x30x30cm	site	start of project
F2.) Mixing arrangements	counting batches and water	site	always
F3.) Mixing time(3'dry,3' wet)	count	site	always
F4.) Mixture (consistency and plasticity)	Hand moulding, slump test	site	for every concrete job
F5.) Casting time limit	1 hour	site	always
F6.) Compaction(vibration)	- fill layers of max. 30cm height - cement milk passing joints	site	always
F.7.) Curing	keep wet	site	always for min. 15 days

Legend: M = Material Tests, P = Preparation Tests, F = Fabrication Tests

Source: Contractor's Handbook for Labour-Based Road Works, Harare, 2004.

8 QUALITY CONTROL FOR PIPE WORKS

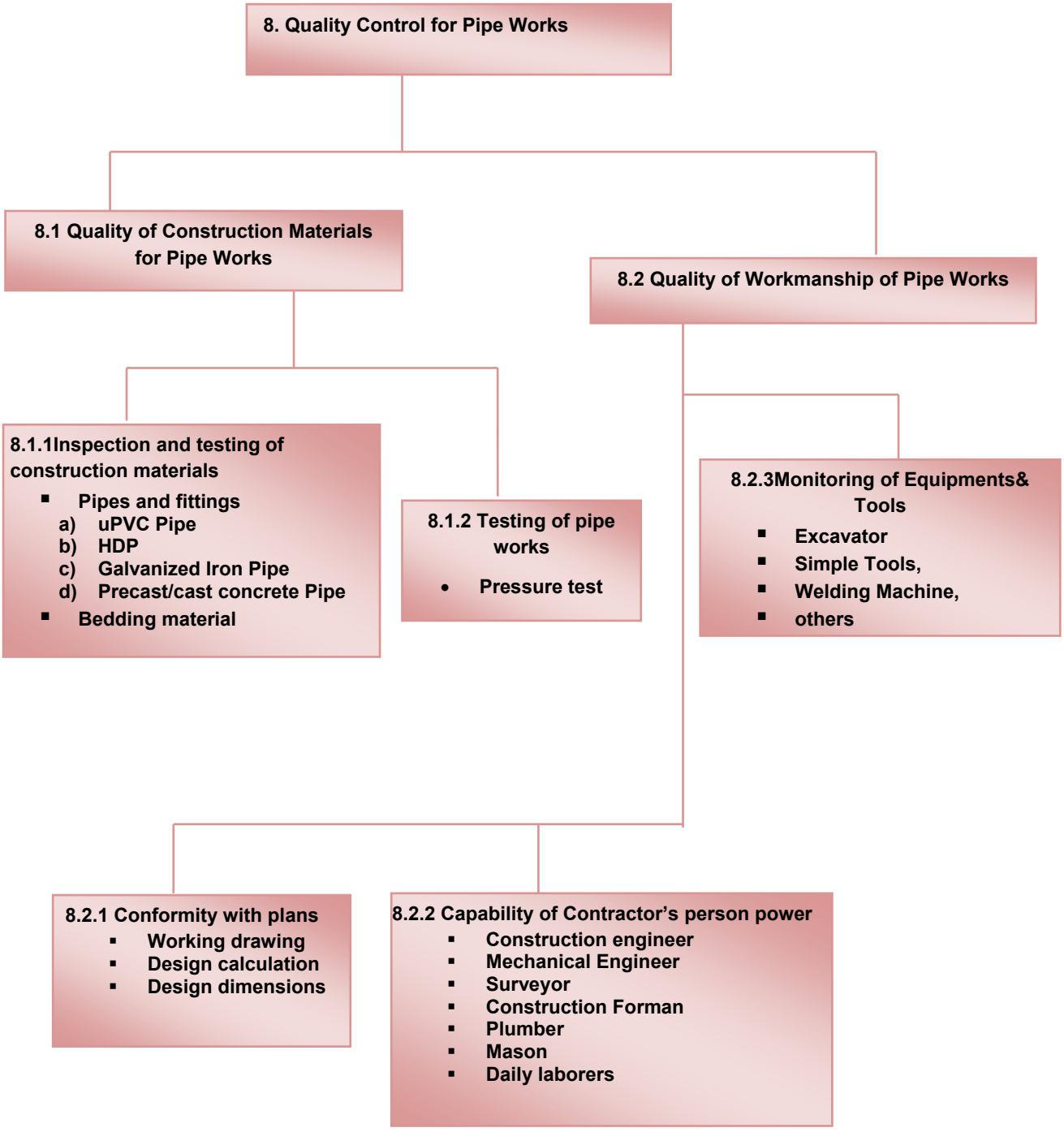


Figure 8-1: List of activities for quality control for pipe works

8.1 QUALITY OF CONSTRUCTION MATERIALS FOR PIPE WORKS

8.1.1 Inspection and testing of materials for pipe works

All pipes and fittings shall be inspected and tested during procurement stage in accordance to the technical specification forming the contract. Generally, the test includes but not limited to:

Physical test: Under this category, three parameters including: *Wall thickness, Bitumen coating thickness, Cement lining thickness in case of DCI* is expected to be conducted.

Mechanical test: The commonly conducted under this category are the *Yield strength, Elongation, and Hardness*. These tests mainly reflect the tensile strength, their allowable limit and requirements of the samples.

Chemical test: The chemical test is mainly related with the chemical compositions of the pipes and fittings that include: *Carbon (C), Silicon (Si) Manganese (Mn), Potassium (P), Sulphur (S), and Magnesium (Mg)* conducted both in the laboratory.

Pressure test: The pressure test is mainly conducted on pipes and fittings to check their resistance against the hydrostatic pressure for a specified duration in accordance to the standard specified in the technical specification forming the contract.

Level, objectives and activities of pipe laying inspection are as tabulated under but not limited to: -

Inspection Level	Inspection Objective	Inspector Activity
Intermittent	Ensure uniform foundation and proper line and grade.	BEFORE contractor begins excavation: Verify pipe layout.
	Verify pipe layout and placement of pipe bedding material and pipe.	BEFORE placement of bedding material: Cross-section (including original ground elevations) areas involving minor structure excavation (sketch and compute minor structure excavation), explore (probe) foundation, check line, grade, termini, source of pipe bedding (local, commercial, etc.).
	Ensure uniform foundation and proper line and grade.	
	Ensure placement and depth of bedding material as outlined in specification.	
	Ensure pipe is of the correct type and size for the application.	Before installing pipe verify type, size, and evidence of inspection.
	Ensure pipe joints installed according to contract.	BEFORE beginning backfill operation: Inspect installed pipe including line & grade, termini, length, joint treatment. Check for pipe damage during placement.
	Ensure pipe joints and fittings are sealed to the degree needed for the type and purpose of the pipe.	
	Ensure proper compacted cover has been achieved Verify backfill operations, suitability of materials, depth of layers, density, and moisture as defined in the specifications.	BEFORE accepting pipe: Check for correct joining and sealing of pipe. Document testing for pipe leakage. BEFORE allowing construction traffic over pipe: Verify proper cover over pipe.

8.1.2 Inspection testing of pipes and fittings

Prior to commissioning each installed pipes and fittings shall be tested as per the specified methods and duration set in the specification forming the contract in the presence of qualified contractor and consultant personnel's.

9 QUALITY CONTROL FOR ELECTRO-MECHANICAL WORKS

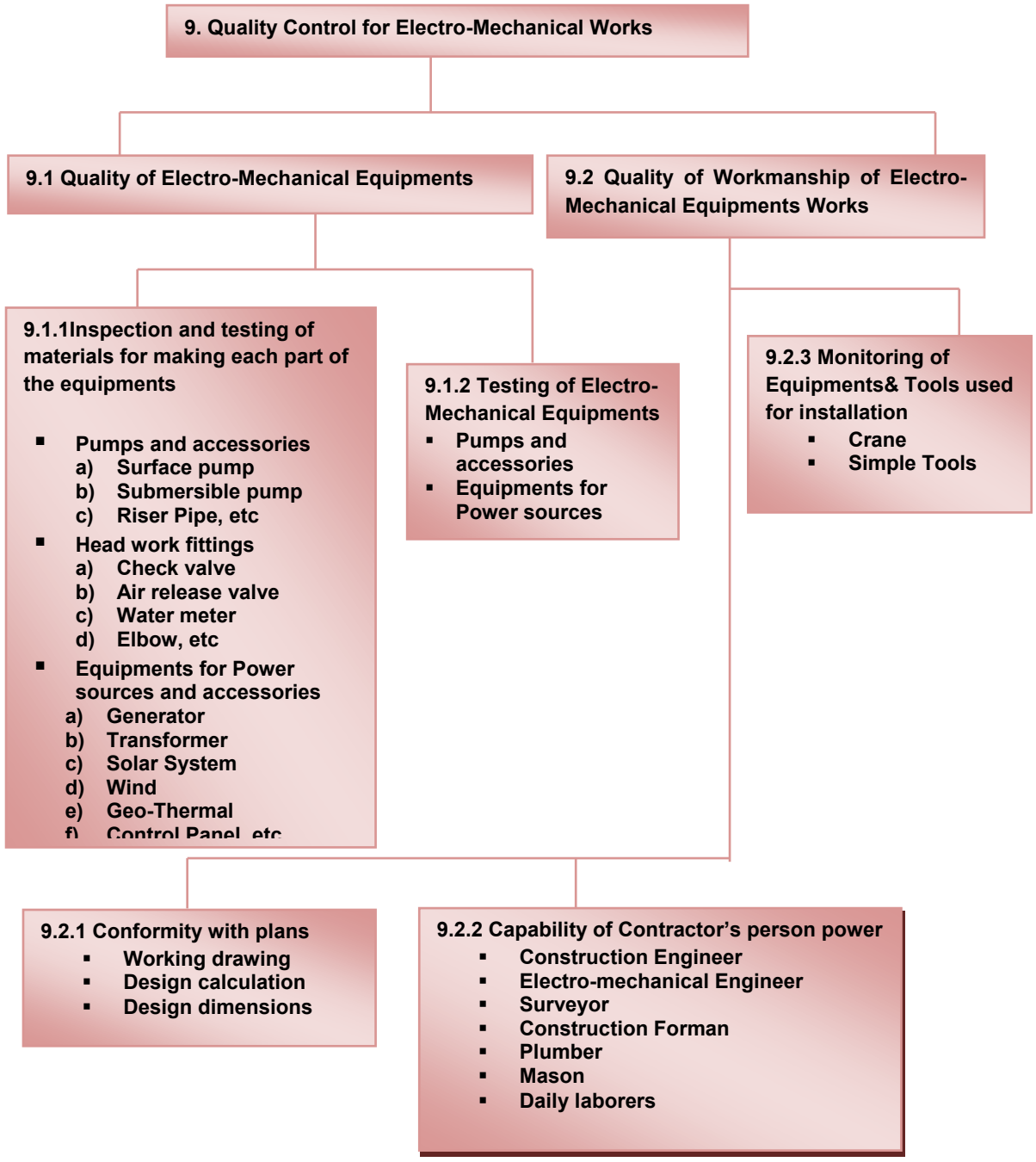


Figure 9-1: List of activities for quality control for electro-mechanical works

9.1 QUALITY OF ELECTRO-MECHANICAL EQUIPMENTS

9.1.1 Inspection and testing of materials for making each part of the equipments

All electro-mechanical equipments shall be inspected and tested during procurement stage in accordance to the technical specification forming the contract. Accordingly, Submersible Pump, Surface Pump, and Generator Set and Its All Accessories shall be inspected in detail using inspection checklist presented as Appendix Part IV/GL 28/G-14 Inspection Check List for Submersible Pump and Its All Accessories, Appendix Part IV/GL 28/G-15 Inspection Check List for Surface Pump and Its All Accessories, and Appendix Part IV/GL 28/G-16 Inspection Check List for Generator Set and Its All Accessories respectively.

9.1.2 Testing of electro-mechanical equipments

Prior to commissioning each installed electro-mechanical equipments shall be tested as per the specified methods and duration set in the specification forming the contract in the presence of qualified contractor and consultant personnel's.

10 QUALITY CONTROL FOR MECHANICAL/GATEWORKS

Different types of Steel Gates are the most commonly used hydro-mechanical equipment used in conjunction with the following flow regulating structures for small scale irrigation projects.

Item No.	Main Structure	Flow regulating structures	Gate	Gate Type
	Headwork Structures			
1	Micro Dam	Intake Structure	Intake Gate	Wheel driven sliding
2	Diversion Weir	Intake Structure	Intake Gate	Wheel driven sliding
		Under sluice Structure	Under sluice Gate	Wheel driven sliding
3	Free Intake	Intake Structure	Free Intake Gate	Wheel driven sliding
4	Pump	Intake Structure	Intake Gate	Wheel driven sliding
5	Night Storage Reservoir	Inlet Structure	Intake Gate	Wheel driven sliding
		Outlet Structure	Under sluice Gate	Wheel driven sliding
	Canal and Canal Structures			
6	Canal	Canal Flushing Structure	Flushing Gate	Sliding and/or stop log
7	Canal Structures	Division Box Structure	Control Gate	Sliding and/or stop log
		Turnout Structure	Turnout Gate	Sliding and/or stop log
		Off take Structure	Off take Gate	Sliding and/or stop log

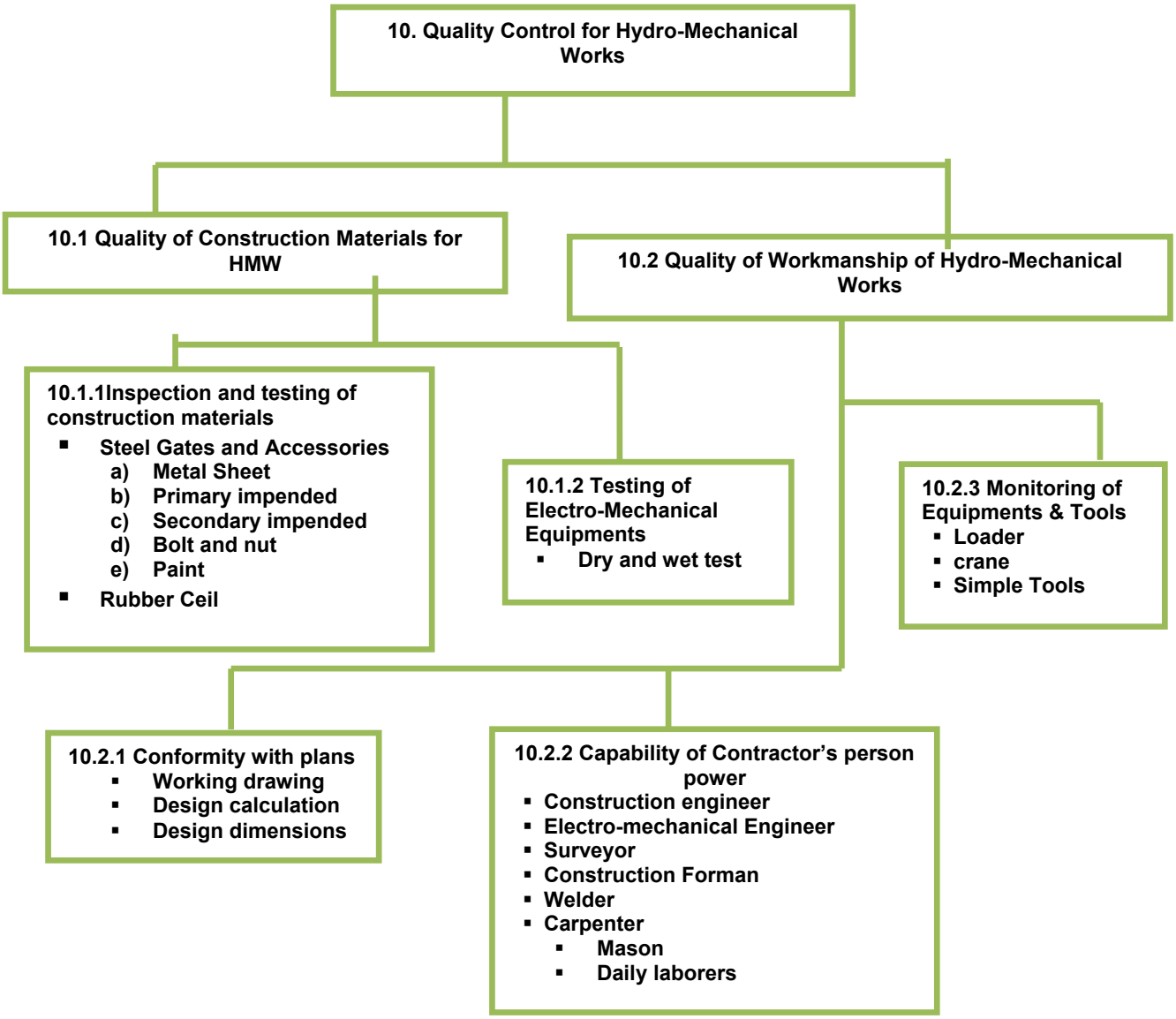


Figure 10-1: List of activities for quality control for hydro-mechanical works

10.1 QUALITY CONTROL FOR HYDRO-MECHANICAL WORKS

10.1.1 Inspection and testing of materials for making each part of the equipments

All materials used to form hydro-mechanical equipments (gates) shall be inspected and tested during procurement stage in accordance to the technical specification forming the contract.

10.1.2 Testing of hydro-mechanical equipments (gates)

Each installed hydro-mechanical equipment (gate), prior to commissioning, shall be tested (dry and wet test), as per the specified methods and duration set in the specification forming the contract in the presence of qualified contractor and consultant personnel's.

11 SUPERVISOR CONTRACTUAL DUTIES

As part of the Contract Administration, the Consultant will undertake the following contractual duties.

11.1 COORDINATION WITH LOCAL AUTHORITIES

The Consultant will establish effective coordination with the local authorities and the community in relation to implementing the biological, physical and social measures including the prevention and control of HIV/AIDS in the project workplaces. Moreover, rock blasting near settlement areas will be properly coordinated with the relevant officers of the Government Authorities to minimize levels of noise pollution and community interference.

11.2 LIAISON WITH EMPLOYER

The Consultant will maintain close liaison with throughout the provision of the services as adequate liaison with the Employer greatly facilitates implementation of the project works. All reports, site meetings, site visits and inspection of the works progress through communication with the Client and the Contractor will be important features of the liaison with.

The Resident Engineer will play a major role in the liaison with. Accordingly, he will liaise with the Client, through the counterpart, in matters related to the following project activities:

1. Making arrangement for monthly progress meetings on site,
2. Discussions on problems encountered, variations, and claims, and
3. Discussions on work progress against the approved program and construction issues, etc.

11.3 LIAISON WITH REGIONAL ADMINISTRATORS

It is also of vital use to ensure close liaison with the Regional Administrators to facilitate any matters requiring interaction with the local society such as assessment and settlement of right-of-way problems in respect of crops and buildings. Moreover, the consultant will assist the Contractor to maintain close co-ordination with all relevant local authorities so that unnecessary small scale irrigation project to services and properties is avoided which will adversely affect the project progress.

11.4 SETTING OUT– VERIFICATION OF QUANTITIES

- In most contracts, the Contractor is responsible for setting out and verifying quantities of the Works;
- The supervisor's surveyor shall check that the Contractor's setting out is correct;
- Before the Contractor starts any aspect of the work, s/he should notify the ER in writing with details of information about setting out and stations;
- The supervisor's surveyor shall check that the reference points are properly established and that it has not been damaged or displaced;
- After completing the setting out, the Contractor shall prepare "As Staked" drawings or templates and "As Staked" quantities;
- The Engineer's staff shall check that the template is prepared according to the standard set out in the specification and design drawings;
- They also check that the quantities. If any variation is anticipated it shall be recorded for further analysis, i.e. to check the variation is within the limit of the Contract.

11.5 RIGHT OF WAY

- The right of way (ROW) is the area required for headwork structure, night storage road for carriageway, canal route, side drainage, plus working area for manoeuvring of machinery;
- Immediately after the Contractor submits the "As Staked" templates, the ER (Resident Engineer) should identify the properties that exist within the limit of the ROW;
- The ER then notifies the Employer in order to remove the properties;
- As a representative of the Employer, he is also required to correspond with the local Administrative Office and other concerned organizations in order to facilitate the timely removal of the properties
- ROW problem is one of the main causes for the Contractor's claim;
- So the ER should give special attention in giving the early solution, and must repeatedly make aware the Employer about the status of the problem and the consequences;
- Utility lines must be checked before the Contractor begins excavation under foundation.

11.6 QUALITY CONTROL

The term quality control in construction can have several meaning. The actual quality of construction depends largely up on the control of the construction materials and the construction itself, that the contractor and supervisor engineer play a line share role.

The task in quality control or quality assurance is construction inspection and testing of materials and workmanship to see that the work meets the requirements of the specifications and drawings.

As the main tasks of quality control supervising firm should perform the following: -
From the very beginning, the Engineer's field staff should always check that materials to be used for the works shall satisfy the requirement of the specification. This is usually confirmed through tests, either test established on project site or at central laboratory with a recognized laboratory centers.

For materials manufactured in factory or brought from outside the project area, the Contractor should submit the certificate specifying the quality of materials; and the engineers hall check that the submitted certificate is for that specific material. If required, further tests need to be done for some materials which may lose their strength over a long period of time.

For materials produced on site, samples are taken jointly by the contractor and the supervisor engineer and make necessary tests if available on Site. For tests to be made at central laboratory, the samples are properly packed, labeled and sent to laboratory for tests. The label should include a minimum of the following information: -

- Project Name:
- Type of material,
- Place of the sample taken with proper description;
- Date sampled,
- Sampled by,
- Other required information.

The supervisor engineer should always check that the materials are brought from the specified and approved sample. Where there is a change for source of material, further tests should be done.

For materials produced in bulk, tests are required at a regular interval specified in the specification.

The supervisory body should establish a good quality control system that:-

- Select what to control,
- Set standards that provide the basis for decision regarding possible corrective action,
- Establish the measurement methods used,
- Compare the actual results to the quality standard,
- Act to bring nonconforming processes and material back to the standard based on the information collected,
- Monitor and calibrate measuring devices, and
- Include detailed documentation for all process.

11.7 CONTRACTOR'S WORK REQUEST AND ENGINEER'S INSTRUCTION

The Contractor is required to submit in advance a request for work filled in agreed format prior to a time specified in the contract. The supervisor engineer shall evaluate the request for work and assign the required personnel to check the preparedness of the Contractor to carry out such activity. If the contractor is not prepared, she/he should notify the Contractor promptly specifying the reason.

For minor matters, or when insufficient time is available to issue a formal letter, authorized staff may issue a Site Instruction to the Contractor following the following procedure.

1. Staff who has the necessary authority will issue instructions to the Contractor as required.
2. Instructions may only be issued for work that is specified in the Contract and not for any new work or any activity that could be construed as a variation or result in an extension of time claim.
3. Instructions must refer to the relevant Specification clause or drawing.
4. A copy is to be filed in a dedicated site file and the Site Instructions Register completed.
5. A copy is to be forwarded to the Project Manager on the day that it is issued.

11.8 MONITOR CONTRACTOR'S PROGRESS OF THE WORKS

The Consultant will continuously monitor the Contractor's progress against the approved program and the associated method of working in all activities. As a contractual obligation, the Contractor is expected to carry out the works as per his program without any significant slippage. To ensure this, the progress of works will be reviewed on a monthly basis and any shortfall observed will be pointed out to the Contractor with directives to take corrective measures. As an efficient way of following up the progress, the Consultant will produce a resource analysis against production needs, required for the timely completion of the project. Critical items, which could affect the progress of works, will be identified from the approved program and will be closely monitored throughout the Contract period with appraisals of changes required for the positive advance of the progress. Based on the observations, the Contractor will be advised when additional resources, revised methods of working or reprogramming of the Works are deemed to be required.

11.8.1 Site and progress meeting

One of the means for controlling the progress of the works will be conducting of progress meetings. Accordingly, weekly and monthly meetings will be held at the project site office. The meeting will focus on the accomplishment of the planned work and the corresponding delay, if any, with the respective resource allocation. Problems encountered and proposed solutions will be highlighted to resolve the problem of delay. These meetings will be minuted and signed for a record.

An agenda will be prepared listing the matters to be raised in the Progress Meetings, which will normally include the following:

- Program and progress,
- Supply of materials,
- Shortage and breakdown of plants and machinery,
- Availability of labor,
- Quality control,
- Weather conditions and effect on the progress of works,
- Actions to recover delays,
- Variations, and
- Claims and recording of facts

The Resident Engineer will chair the monthly meetings and will be responsible for the conduct thereof. S/he will take each item on the agenda and give a brief statement, opening the matter for discussion. It is particularly important that the Contractor's representative has an opportunity to state his views on each subject matter. References will be made to the previous minutes to bring forward matters that have not been resolved since the last meeting. Copies of the agenda will be sent to all those attending the meeting.

Progress on each major item of work will be reported and agreed with the Contractor before comment is made as to whether or not the progress is satisfactory. A member of the Supervision Team will take notes & prepare the minutes and all these records maintained by the Consultant will be submitted to at the end of the Contract. The progress of the planned activities against accomplishments will be prepared in the form of an S-curve and included in the monthly progress reports

11.8.2 Meetings and correspondences

Meetings and correspondences are important contractual means to create mutual understanding between the Contractor and Consultant's site staff for the positive advance of the project works. At the initial stages of the construction, a Line of Communication will be formed that will base an assessment of the task assignment of each of the Contractor and Consultant's key staffs. Site meeting will be made to undertake this task prior to commencement of construction of the permanent works, which will ultimately form an efficient Line of Communication.

In addition to the Line of Communication, the Contractor through discussion with the Consultant will produce Formats for the various activities of the project work. This will include formats and presentations for various laboratory tests, data collection form for surveying works, Request for Approval forms, formats for measurement of finished works, etc.

11.8.3 Variation orders

Variation Orders are issued where extra works significantly affect the contract Sum. These may involve omissions or additions to the Contract Sum. Variation Orders may be approved by the Project Manager within his authority as provided in the Conditions of Contract. However, most Variation Orders must be approved by the Client and accepted by the Contractor. The Contingency Sum or funds saved by rearrangement of bill items may cover the cost of Variation Orders, or extra funding may be requested from the Client. As for Day Works, Approval of the Variation Order must be granted before the extra works may commence. The Project Manager also has power to order any variation that, in his opinion is desirable for the satisfactory completion

and functioning of the works. Such variations include Additions, Omissions, Substitutions, Alterations, Changes in quantity, form, character or kind and Changes in position, dimensions, level or line.

Following the approval of the amendments, the Consultant will prepare and issue Instructions, Variation Orders to the Contractor (including alterations, additions or omissions from the signed contract) complete with the associated measurements, and payment instructions will be advised of such instructions and variation orders together with the associated implications. Depending on the extent and type of variations made, some instructions, which in the opinion of the Consultant do not affect the work significantly and are urgently needed, might not wait for written approval to avoid unnecessary delay. The variations could be in terms of materials, quantities, technical specifications and extra items (not included in the original bill of quantities).
The Consultant will keep records of all change (variations including Day work) and orders issued with respect to the Works. The Engineer's Representative may be delegated powers to issue variations or Day Work under the Contract to a given value. S/he will, of course, discuss the reasons and estimated cost of such variations with the Engineer.

The variation orders (VO) will be issued following a standard format and the Resident Engineer will keep separate measurement with detailed and factual records for each variation. Consultant's recommendation for variation order will include background information with regard to the necessity of the variation, the effect of the variation order on other works and the cost implications of the variations.

Variation orders should include issues such as type of work to be accomplished including the limit of the work; authority under which the instruction has been given; method of measurement; agreed unit rate and method of payment.

Case 1: Managing variation works with no unit rate in priced bill of quantity
Suppose project B is a construction of small scale irrigation project. During bid offer, the selected contractor has not provided /entered in/ rate in the priced bill of quantity (PBOQ) for item (X) plastering Works of diversion weir which is having a quantity of 120m^2. However, during construction the quantity of plastering Works of diversion weir has increased to 530m^2 due to variation as the result of error in quantity surveying.

The engineer with the consent of the employer gave work order for plastering Works of diversion weir to the contractor. After accepting the engineer work order, the contractor claimed an establishment of rate for 530m^2 plastering Works of diversion weir. If you are assigned as Engineer, how do you manage contractor's claim? And what is your final advice for the employer?

Response
Extraction of existing matters with respect to GCC/SCC

1) There is an agreed 120m^2 plastering works of diversion weir as shown on the PBOQ that forms the contract document.
2) The contractor has not provided rate in the priced bill of quantity for plastering works of diversion weir.
3) There is 410m^2 plastering works quantity increment/Variation/ on the same work item.
4) There is work order for the whole plastering works of diversion weir from engineer to the contractor.
5) There is contactor claim to be established rate for the whole plastering works of diversion weir.

- To manage contractor's claim and to give advice for the employer, the following GCC/SCC Clauses should be referred and thoroughly examined: -
  - According to GCC "Payments" Clause, Sub-Clause 4, "Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract."
  - According to GCC "Change in the Bill of Quantities or Activity Schedule" Option 1: "Changes in the Bill of Quantities for Admeasurements Contracts" states:

    1) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 5 percent of the Initial Contract Price, the Engineer shall adjust the rate to allow for the change
    2) The Engineer shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior approval of the Employer.
    3) If requested by the Engineer, the Contractor shall provide the Engineer with a detailed cost breakdown of any rate in the Bill of Quantities.

After examining and understanding the above clauses, the engineer can draw the following advices for the employer: -

- The agreed 120m^2 plastering works of diversion weir shown on the PBOQ that forms the contract document is deemed to be covered by other rates and prices in the Contract as stated above.
- For the remaining 410m^2 plastering works quantity increment/variation/ on the same work item, the engineer can request the contractor to quote new rate attaching detail cost break down.
- The new rate shall be approved by the client via the following procedure: -
  1) Upon receipt of the contractor's price quotation, the supervisor engineer reviews it for conformance with the contract and compares prices to the design engineer estimate.
  2) If the disparity between the contractor offer and engineer's cost estimates seems unreasonable. Supervisor engineer would schedule a meeting with the contractor and the engineer to resolve the matter.
  3) If the contractor's price meets both the terms of the contract and the design engineer estimate, supervisor engineer prepares the paper work necessary to obtain the employers approval and submit to the employer.
  4) On receipt of the employer approval, supervisor engineer submit the documents to the contractor in writing.
- The new rate shall be practicable for the quantity variation only for the excess quantity.

Case 2: Suppose project C is a construction of small scale irrigation project to develop 200 hectare net command area from ground water source using submersible pump. Its construction is practically completed and become ready for provisional taking over. At this stage, the client and engineer generate an idea of using the water resource for multilateral by providing fitting (T) and some additional structures on the completed irrigation system. The design engineer made a new plan particularly for water supply infrastructure for the beneficiary community that comprises pipe system and water points. Finally, the client through supervisor engineer instructs the contractor this additional variation work.

Can a contractor/subcontractor be forced to carry out variation after practical completion?

Response
The contractor is not obliged to carry out variations where the instruction is issued after practical completion unless there is a clause in the contract which gives the

11.9 INSPECTION AND APPROVAL

- The Contractor should obtain approval to commence any aspect of the works and to obtain approval on completion;
- The Engineer's staff must not unnecessarily delay the Contractor as this case give rise to a claim;
- The inspectors must check each stage of the work as it proceeds and must correct any errors as they appear;
- A final inspection should be made when the Contractor says s/he is ready to proceed the next stage;
- The inspector shall forward his/her comments at a time of defect identification while the works are on progress instead of waiting the works are completed by the Contractor;
- Comment should be made as work is being done.

11.10 COST CONTROL AND ADVISE ON ESTIMATED TOTAL COST

In practice, the Bill of Quantities and the bid amount listed in the bid schedule do not govern the final project cost. Payments to the Contractor will be made only for the actual quantities of work items performed in accordance with the plans and specification. In addition to this, due to the nature of construction, some changes in the plans and specifications may be necessary during the course of construction to suit field conditions, which subsequently alter the contract amount.

The Consultant will devise a method for optimization of cost by means of determining the exact volume of work, including amendments, changes and modifications, and will come up with the final estimated cost during the work progress. Variation orders, that include alterations, additions and omissions will be valued at the rates and prices fixed on the contract or if not suitable prices will be fixed. This together with the estimated quantity will enable estimates of the final construction cost to be updated on a monthly basis and help in identifying possible cost over runs or under runs.

An attempt will be made to complete the works specified within the ceiling amount of the contract. Omissions and additions of works will be exercised to make them balanced, where possible. The percentage of increase or decrease of each work item will be computed to check whether these are within the allowable variations stated in the Works Contract. In this respect, routinely and at not more than quarterly intervals, the Consultant will advise the Client on the corresponding paid

sum to the Contractor, volume of remaining work to be done with the estimated total cost to completion of the project. In case of increase/decrease of the estimated initial project cost due to Variation Orders approved by the consultant/client, the reason for the same will be indicated.

11.11 MEASUREMENT AND PAYMENT

Measurement and valuation is clearly a prerequisite to certification and payment of works. Most contracts are of the bill of quantities type (ad measurement contracts) and their measurement and valuation are governed by the conditions of contract. Supervising Consultant must carry out measurements of completed Works. A record of these measurements and derived quantities must be kept by both the contractor and the Supervising Consultant on site to form a basis for preparation of the Interim Payment Certificates.

11.11.1 Monthly interim payments due to the contractor

An agreed and accepted method would be established with the Contractor for carrying out the necessary measurements, calculations and certifications required for interim payments in accordance with guidelines previously agreed with.

At monthly intervals, the contractor must submit to the Supervising Consultant a statement or valuation based on the agreed measurements. The valuation must show the estimated value of the measured works executed up to the end of the previous period as well as the estimated value of work completed during the month in question. The valuation once checked and amended by the Supervising Consultant, where necessary, is used by the Supervising Consultant to prepare the Interim Payment Certificate. When the Contractor will submit his payment applications with all the measurements, costing calculations and supporting documentation to the Consultant, then the Consultant will review, check and verify the application on the basis of the documentation submitted and site inspection records. During the review, the Contractor's statements will be checked in respect of quantities, rates, extensions and additions. Interim Payment Certificates are useful in maintaining liquidity for the contractor. Therefore, the Supervising Consultant must not unnecessarily reject whole sections of works claimed by the Contractor, but make amendments for unsatisfactory works. Liquidated small scale irrigation project, where applicable, will be deducted from the payment in accordance with the procedures set in the Works Contract Document.

Work Items having an agreed unit rate will be processed in accordance with the volume of work executed and the agreed unit rate. For Work items where the method of payment is set on a Lump Sum basis, the payment will be dealt in accordance with the volume of work executed within that payment period measured and estimated as a percentage of the total volume of work described in the Contract document.

The Resident Engineer will ensure that the Contractor submits his proposals for any work under the Variation Order that cannot be ascertained from the priced BOQ. He will examine and amend, should there be a necessity for such actions, the rates and prices proposed by the Contractor to fairly represent the cost of such works. These rates will not necessarily be the rates that will be fixed by the Engineer, but may be termed as Temporary Rates, which could be used for the purpose of interim valuations pending the fixing of rates by the Engineer in consultation with the contractor.

After verifying the sufficiency of the documentation and accuracy of calculations, Interim Payment Certificates will be prepared within seven (7) days of receiving the application and issued to the Client for his processing.

11.11.2 Payments follow up

After submission of Interim Payment to, the Consultant will monitor the payment process and alert the Client when payment delays accrue to the point when:

- Interest charges will become due, and
- The Client will be in default for late payment

11.12 DOCUMENTATION AND SITE RECORDING

Project Records are important instruments to show the detailed Works being undertaken for the project and are clear evidences for justifying or rejecting potential claims that could arise in the course of the construction. One of the prime requirements of construction supervision is to be very much aware of the importance of records. However, the attitude of some is that of put everything down on paper and then to keep this in file is all too tedious, then they have simply missed the message. The Resident Engineer should:

- See to timely preparation of reports,
- See that all parties sign records,
- See to issuing of records, and
- Ensure timely preparation of reports.

Records are meant to fix progress of activities, staff availability, circumstances, agreements with the contractor and other parties and so on and are important for communication with the client, but also for the Consultant, for example, when problems occur after some time. Accordingly, the Consultant will keep and maintain up-to-date and detailed Daily Site Diary and Records that will be available for inspection by Client's representative at any time throughout the contract period, as discussed hereunder.

Site diary and daily log sheets: Records are important and in particular maintaining a system of Daily Records is of paramount importance because it keeps a chronological track of the day to day progress, work conditions, input of Contractor's resources, constraints, delays(if any) and soon. Daily Records represent the only practical means to be able to find out (much) later what happened on any particular day of the execution of the Works. Standard Form needs to be developed for such Daily Record Sheets.

The Site Diary will be maintained at all times and made available anytime, upon request, to the Client staffs and other partners. The Site Log will be used to record including but not limited to the following directives and daily observations of all aspects of the works by proof of signatures recorded in the Log:

- Inception report at the beginning of the assignment;
- Daily; weekly, monthly and quarterly work plan and achievements;
- Safety measures taken and detailed report of any accidents;
- Instructions to the Contractor from the Consultant;
- Requests/comments/recommendations given to the Consultant and contractor by Visitors to the site including Client Engineers and/or other partners (federal, regional, Woreda staffs, and other partners) and actions taken;
- Claims by the Contractor to the Consultant;

- Warnings given by the Supervising Engineer to the Contractor; and
- General observations of the site conditions including weather and rainfall.

Documentation of design drawings, reports, as-built drawings and correspondence: The Consultant shall be responsible for documenting all the design drawings, reports, as-built drawings and correspondence between the Client, the Contractor and the Consultant. The Consultant shall develop an appropriate documentation plan for this purpose. Based on the documentation plan, Consultant shall also carry out the actual documentation and filing of the design drawings, reports, any events, as built drawings and quality monitoring certificates.

Contractual correspondences and data: All contractual correspondences made on site will be properly compiled and recorded. Furthermore, a registration format will be prepared that includes the date, sending authority, receiving authority and the subject for easy reference at any time. Critical correspondences, variations and instructions will also be recorded at the head office level to avoid the risk of unforeseen events on site like fire breakout.

Contractor's equipment: A format will be prepared, and made available for inspection, which will take into consideration the under listed data.

- Date of arrival on or removal from site,
- Date of manufacture,
- Previous hours worked and condition,
- Date commissioned to commence work, and
- Availability and utilization.

Work stoppages and delays: All work stoppages and delays will be recorded. The cause for the stoppage/delay will be investigated, as this is an important factor when dealing with claims and time extensions. In case of work stoppages due to Labor problem, the Consultant will investigate and try to solve the dispute in accordance with the Labor Laws of Ethiopia.

Daily and weekly activities: Consultant's works inspectors and technician will report, on a daily and weekly basis, to the Resident Engineer. This will be properly recorded and used as a basis for the preparation of the monthly progress reports. The Project Supervisor shall maintain documentation of the following items as applicable to the Project on a daily basis: -

- Daily Contractor's activity with its location,
- Daily Contractor's equipment status with coding (working, idle, breakdown …),
- Daily Contractor's personnel on duty,
- Daily Contractor's material usage, and
- Daily weather condition.

Accidents on site: All major accidents on site including bodily injuries, project structures, machinery, equipment and plant will be properly recorded. Advice will be given to avoid or minimize future accidents of similar nature.

Official visitors on site: Name and title of the visitor, date and reason for the visit will be included in the record

Daily weather records: these records will help to forecast convenient and difficult working periods, and plan accordingly for the years ahead.

Activities: Record of activities in progress at any time on site that includes the start and end time and full details of the resources employed per activity will be made.

Media reports: All reports and pictures released on newspapers and electronic media that are of interest for the project will be recorded.

11.13 CONSTRUCTION DELAY

Delay is an event or condition that results in work activity starting, or project completion, later than originally planned, or an interruption or a hindrance to planned progress.

Delays are the most prevalent problem on construction projects that leads delay claim of three categories namely *Non-excusable delay, Excusable delay, and Compensable delay*. The detail is presented under cause of claim in this guideline.

11.13.1 Causes of delay

A variety of factors in an ongoing project can lead to a delay. Typical of delays that might be caused by an owner include the following:

1) Late approval of shop drawings and samples,
2) Late approval of laboratory tests,
3) Delays in answers to field inquires by the contractor,
4) Changes in the contractor's method of doing the work,
5) Variation in estimated quantities,
6) Interference with the contractor during construction,
7) Owner-caused schedule changes,
8) Design changes,
9) Changes in inspection level,
10) Failure to provide for site access,
11) Lack of required rights-of-way, and
12) Interference by other contractor's or owner's forces.

A contractor may jeopardize its claim, however, by being the cause of non-excusable delays of its own. Such delays are frequently the result of any of the following causes:

I. Late submittal of shop drawings,
II. Late procurement of materials or equipments,
III. Insufficient personnel,
IV. Unqualified personnel, and
V. Inadequate coordination of subs or other contractors,
VI. Subcontractor delays,
VII. Late response to owner and supervisor inquires, and
VIII. Construction not conforming to contract requirements, making repeated reworking necessary.

11.13.2 Evaluation of delays in the work

Before it can be determined that a delay in the work was compensable, thereby justifying the issuance of a change order granting both additional time and money to the contractor, the following questions need to be answered:

1) Was the cause of the delay beyond the contractor's control? Did the contractor fail to take normal precautions?
2) Was the contractor ready and able to work?

3) Did the contractor submit a detailed schedule projecting project completion within the allotted time? Was the schedule updated regularly? Did the updated schedule justify a time extension?
4) Did this schedule contain a critical path analysis or an equivalent?
5) Has the contractor maintained sufficient forces in those operations along the critical path where needed to meet target dates?
6) How have causes, other than normal weather, beyond the control and without the fault or negligence of the contractor affected target date along the critical path?
7) Has the contractor proven “unusually severe weather” with such information as climate data, return probability of severe storms, or flood depth data?
8) Did the weather phenomenon actually delay operations along the critical path or in secondary operations?
9) Was the contractor shut down for other reasons?

Use Appendix Part IV/GL 28/G-17Check List for Identifying Cause of Delay while dealing the cause of delay of a particular project.

11.14 COMPENSATION

Based on the cause of delay the compensation may be time, money, or both. If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

11.15 EXTENSIONS OF TIME

An extension of time to a contract period authorized by the client for reasons of adverse weather conditions, an unusual number of variations etc. The reasons for which an extension of time may be granted are usually given in the conditions of contract.

Extensions of time are common in construction contracts and frequently are not responded to expeditiously, resulting in a clime and even a dispute.

It is to be noted that it is not necessary that the Contractor submit a claim before the Project Manager may award an extension of time, but that it generally would be in the Contractor's interest to submit a formal claim.

It is also to be noted that it may be a provision of the Contract that the approval of the Employer be obtained before awarding an extension of time.

In some contracts, the grounds for an extension of time are listed. The Contract must be reviewed to identify these grounds.

There are 3 types of delays:

- Excusable, compensable (delays due to some act or omission of the Employer or Project Manager),
- Excusable, non-compensable (delays which are not the fault of either party), and
- Non-excusable (delays caused by the Contractor).

In order that a delay be excusable in the technical sense, the delay must directly affect the ultimate contract completion date, i.e. it must be on the critical path. A delay that is not immediately seen as being on the critical path may ultimately affect the end completion date as the critical path can change through other events. For this reason, it is necessary that an up to date program, tracking all delays, be maintained.

Generally, a Contractor's claim for time extension must be supported by a schedule analysis. The analysis must identify the cause, responsibility and length of the delay and how it impacts the critical path. Time extensions should only be granted for delays that impact an activity on the critical path. The CE needs to determine if a delay is excusable-non-compensable, excusable-compensable, non-excusable, weather related or concurrent.

11.16 CONTRACT TERMINATION

If there has been a significant breach of contract or one or both parties cannot fulfill their obligation, it may be necessary to terminate a contract before it reaches its natural conclusion. Contracts can only be terminated by the authority that executed the contract. For major contracts this will be the relevant Chairman of the Supply and Tender Board or the Head of State.

Termination of a contract is very serious event. Extreme care must be taken by the Project Manager to ensure that all available measures have been explored, prior to termination proceedings.

11.16.1 Contract termination procedure

The following rules apply in relation to contract terminations:

1) CST is to establish the nature of the significant breach. This will require extensive documented evidence.
2) CST is to discuss the breach with the contractor in an effort to resolve the matter.
3) Employer to seek written legal opinion from the legal advice. This must be sought prior to terminating a contract.
4) Employer to refer the matter to the contracting authority. Prior to the legally delegated body terminating a contract, the technical committee (if any) must meet and decide to terminate the contract.
5) Where the contracting authority is required to terminate the contract, he or she may only do so on written advice from legally delegated body, supported by written advice from the relevant legal advice.
6) The contract authority terminating the contract must immediately write to all stockholders involved in the project implementation to inform them of the termination.

11.16.2 Responsibilities of parties in contract termination

CST is responsible to ensure all measures have been explored before considering termination. S/he must collect evidence and keep the Employer fully informed of proceedings.

Employer is to seek legal advice from State Solicitor. Employer must refer termination proceedings to the relevant contracting authority.

Contracting authority is responsible for the termination of the contract, based on technical and legal advice. Contracting authority must also advice the technical committee (if any) that the contract has been terminated.

11.17 CLAIMS AND DISPUTES

11.17.1 Definition of claim and dispute

Claim can be defined as a written demand or assertion by a contractor seeking adjustment or interpretation of the terms of the contract documents, payment of money, extension of time, or other relief with respect to the contract documents, or determination of other disputes or matters in question between the client and contractor regarding the contract documents or the performance of the work.

In other word, claim can be defined as a request from one contracting party (usually the contractor) to another party (usually the owner) for additional compensation, a time extension, or both.

Dispute can be simply defined as an unsolved claim.

11.17.2 Causes of claim

In general, most claims issues will fall into approximately ten classifications, with numerous variations possible within each category.

1) Owner-caused delays in the work,
2) Owner-ordered scheduling,
3) Constructive changes,
4) Differing site conditions,
5) Unusually severe weather conditions,
6) Acceleration of the work; loss of productivity,
7) Suspension of the work; termination,
8) Failure to agree on change order pricing,
9) Conflicts in plans and specifications, and
10) Miscellaneous problems: - Some of the types of problems that may fall into this category include the following: Damage to works by other prime contractors, breach of contract, cardinal changes, work beyond contract scope, beneficial use of the entire project before completion, partial utilization of the project before completion, owner nondisclosure of site related information, and owner's failure to make payment when due.

11.17.3 Types of claim

Delay claims fall into three categories:

1) *Non-excusable delay claim:* -Non-excusable delay is one that is caused by factors within the contractor's reasonable control. Essentially, this means that the delay is the contractor's fault, so the contractor will be unable to recover additional time or additional compensation.
2) *Excusable delay claim*: -A delay that is caused by factors beyond the contractor's reasonable control, but is not the result of owner's actions or failure to act, is considered excusable. An excusable delay entitles the contractor to an extension of time but to no additional compensation for the cost of the delay.
3) *Compensable delay claim*: -A delay that is considered compensable is one where the owner has failed to meet an obligation stated or implied in the construction contract. In this

cause, the owner must grant a time extension and reimburse the contractor for the increased cost caused by the delay.

It should be stressed that these definitions are general in nature. The parties have great latitude to contractually determine whether or not the contractor will be entitled to additional compensation, an extension of time, or nothing at all.

If a contractor experience concurrent delays where one is compensable and the other is merely excusable, no compensation is allowed. Similarly, on concurrent delays where one is caused by the contractor and the other by owner, the delay is considered neither excusable nor compensable to the extent of the overlap or concurrency.

In most cases delay of activity on critical path may cause an extension of time and compensation for delay related costs.

11.17.4 Sources and causes of time-related disputes

There are many sources and causes of time-related disputes, as indicated in the following list:

Source	Cause
Owner	a. lack of expertise b. Long line of authority in project organization c. Delayed approvals of schedules and change orders d. Slow change order processing e. Failure to obtain permits f. Irrelevant milestone dates in documents
Contract Documents	i. Inadequate scheduling clauses ii. Directing work sequence by owner or supervisor engineer iii. drawings not indicating interfaces iv. Permitting responsibilities vague v. Milestone dates and interface clauses vi. Leverage for enforcement of schedule specification vii. Coordination inadequately specified
Construction Manager	a. Lack of expertise in schedule management by designer b. Implementation of specifications c. Inadequate record keeping d. Inadequate schedule updates and progress monitoring e. On-site coordination f. Job meetings
Contractor	1. Noncompliance with specifications 2. Schedule updates not done 3. Reluctance to cooperate and coordinate 4. Failure to meet milestone dates 5. Not following permit requirement

11.17.5 Preparation and submission of claims

It is most important to comply with the terms of the Contract, as often there are time requirements within which the Contractor is required to submit the details of his “claim” with supporting documentation. The “Claim” cannot be entertained if the time limitations are not observed. The “claim” must be accompanied by complete supporting information and relevant documentation. Such information will include the contractual basis for the claim, details of the “claim” itself, and complete details of costs including the rates.

11.17.6 Management of claims and disputes

In a contractual relationship, disputes can arise as a result of disagreement about issues related to quality, quantity, payment or program of the work. Parties are advised to settle disputes politely.

A contractual dispute occurs when the contractor does not agree with the final decision by the Client and should be resolved in accordance with procedures specified in the Conditions of Contract. The resolution of a contractual dispute may be a costly and time consuming affair for both parties. All efforts should therefore be taken to reach in harmonious settlement. Failing this, a procedure in two steps is normally recommended and specified in the contract before the matter may eventually be brought before the court. For both parties in a contractual dispute it is important to be aware of the formal requirements: Time limits for rejection of decisions and referral of the dispute to a higher level. All communications shall be in writing and with notice to the other party. Failure to comply with these formal requirements will in itself result in a lost case and the decision to be declared “final and binding” on both parties.

The consultant has the opinion that it is the interest of all concerned parties that claims are settled by negotiations at the earliest opportunity. Thorough preparation is the key to a successful negotiation and requires not only detailed knowledge of the claim itself and the collection of all pertinent information, but also knowledge of the strength and weakness of either side. It also requires an attempt to understand the negotiating strategies likely to be pursued by the other side.

Negotiations can occasionally be associated by the selective use of outside experts but the personnel from either side with sufficient authority to settle the matter under discussion should conduct the actual negotiations. Negotiations should be conducted in an atmosphere of “without prejudice”. Conducting the negotiations in such a condition will help to create an atmosphere conducive to frank and open discussion.

11.17.7 Assistance during Arbitration

If a claim cannot be settled by negotiations, the parties can agree to place their respective cases before a conciliator as per the Contract provision. In the event of adjudication or arbitration, the supervisor will provide the necessary personnel and expertise to advise and assist the employer in any such process and will prepare any further analysis of the contractor’s claims submissions as may be necessary to assist the employer in the presentation of his case. The assistance will be continued until such time that the client is through with the case.

12 CONSTRUCTION SUPERVISION SOFTWARE'S

AutoCAD, MS-Project, Primavera Project Planner, and ConMIS Software are construction management software's that currently applied by the engineers assigned in construction industry. The reader should refer *GL 21: Major Application Software's Guideline for SSID* for its detailed presentation and application guidance.

12.1 AUTOCAD

AutoCAD is software program used to made computer-aided design.

12.2 MS-PROJECT

Microsoft Project, the project management software program by Microsoft, is a very handy tool for project managers that help them develop a schedule, assign resources to tasks, track the progress, manage the budget, and analyze workloads for an ongoing project.

12.3 PRIMAVERA PROJECT PLANNER

Primavera Project Planner is used for construction planning & scheduling.

12.4 CONMIS SOFTWARE

ConMIS Software used for bill of quantity calculation, take-off sheet analysis, payment certification and report preparation.

REFERENCE MATERIALS

1. Consultant Construction Administration Manual. Arizona Department of Transportation. Intermodal Transportation Division Construction Group. February 2011.
2. Contract Administration Manual. Government of Papua New Guinea, August 200.
3. Contractor's Handbook for Labour-Based Road Works. Republic of Zambia Ministry of Works and Supply Roads Department Roads Department Training School. Harare, 2004.
4. DID Manual: Volume 10-Contract Administration. Government of Malaysia Department of Irrigation and Drainage, March 2009.
5. FIDIC (1992). Amicable Settlement of Construction Disputes: A Report of FIDIC's Alternative Dispute Resolution Task Committee.
6. Fisk, Edward R. (2000). Construction Project Administration. Ohio, USA.
7. HYDRAULIC DESIGN MANUAL: GUIDELINE FOR ZONE AND WOREDA IADP EXPERTS. Module 6 – Construction Management. SUSTAINABLE WATER HARVESTING AND INSTITUTIONAL STRENGTHENING IN AMHARA (SWHISA). CIDA Project No.: A-030451. 2010 Bahir Dar, Ethiopia.
8. IRRIGATION IMPROVEMENT PROJECT: CONSTRUCTION SUPERVISION MANUAL. REPUBLIC OF YEMEN MINISTRY OF AGRICULTURE AND IRRIGATION. August 2003.
9. Irrigation Manual. Module 13: Construction of Irrigation Schemes. FAO (2001), Harare, Zimbabwe.
10. Japan International Cooperation Agency (JICA) and Oromia Irrigation Development Authority (OIDA): The Project for Capacity Building in Irrigation Development (CBID). Construction Control Manual. May, 2014. Addis Ababa, Ethiopia.
11. Jeremy Glover (2006). UNDERSTANDING THE NEW FIDIC RED BOOK. A Clause-By-Clause Commentary.
12. Saleh Mubarak (2010). Construction Project Scheduling and Control. Second Edition. New Jersey, USA.
13. The Federal Democratic Republic of Ethiopia. Ethiopian Social Rehabilitation and Development Fund (ESRDF). ESRDF's Small Scale Irrigation Project (Gravity) Technical Handbook. Component VII: Manual on Construction Supervision of SSIP. November, 2014. Addis Ababa, Ethiopia.

APPENDICES

APPENDIX I: PART IV/GL 28/A CONTRACT MANAGEMENT FORMAT

Appendix Part IV/GL28/A-1: Procurement Outcome Review Format

Name of the Project: _____

No	Reviewed items	Yes/ No	Remark
1	If missed items exist		
2	Unsound unit cost/rate		
3	Undermined or exaggerated quantity		
4	Undefined specifications		
5			
6			
7			
8			
9			
10			

(Use this place to summarize the findings and discuss with the responsible persons on the review result)

_____

_____

_____

Appendix Part IV/GL28/A-2: Contract Mobilization Checking Format

Mobilisation	Action	When done make a mark (X)	Remark
Document	Distribute contract documents to Contractor/Consultant/Client (Region. Zone, District - Legal section, Relevant departments)		
	Establish Contract file in the name of the project		
Site Handover	Site handover format preparation		
	• Beneficiary and locally area administrative & line office courtesy call		
	• Camp site handover		
	• Headwork and Main structure		
	• Bench Marks		
	• Access road if applicable		
Communication &Relationship	• Establish reporting structure and formats		
	• Contractor contract management personnel acceptance		
	• Establish meeting schedules		
	• Establish communication protocols (diary, memos, letters, email. FAX, telephone calls etc.)		

Appendix Part IV/GL28/A-3: Risk Analysis Format

No	Risk	Category (technical/cost/ managerial)	Degree (High/Medium /Low)	Mitigation Measures
1	Right off way issue			
2	Design modification			
3	Change in client interest			
4	Price escalation			
5	Labour availability			
6	Limitation in construction material			
7	Front loaded			
8				
9				
10				

(Use this place to summarize the risk analysis and mitigation measures after discussing with the responsible persons)

_____

_____

_____

Appendix Part IV/GL28/A-4: Communication Ledger & Follow-Up Format

Date	Ref Number of Letter	Letter issued by	Main Message/Subject	Response from Client/ Contractor/Consultant/Contract Manager

Appendix Part IV/GL28/A-5: Documentation and Record Summary Keeping Format

Name of the Project _____

I. **Cost**						
Initial Contract Price _____ Advance Paid _____ First Amended Contract Price _____ Second Amended Contract Price _____						
Interim	Payments (ETB)	Variations On Each payment		Retention (__ %)	Liquidated damages	Compensation effect
		Amount (ETB)	%			
1						
2						
3						
Fin						

Dispute	(Please write a narrative in the following space when a dispute occurs and how it is resolved – dispute dates / resolved dates and specific issues are important)

Time		
Contract Completion time _____		First Extended Completion Time _____
Second extended Completion time _____	Third extended Completion time _____	Actual Completion time _____

Warnings letter Ref		
Letter RF	date	Subject

Conducted meetings with Contractor		
Venue	date	Subject & minutes

Quality
Use this space if there is quality complain at each interim payment level & where necessary

Appendix Part IV/GL28/A-6: Minutes of Meeting Format

Venue: _____
Date: _____
Time: _____

No	Participants Full Name	Organization	Position
1			
2			
3			
4			
5			
6			

Meeting Agenda:

1. _____
2. _____
3. _____
4. _____

Result of discussion:

1. _____
2. _____
3. _____
4. _____

Signature of participants at the end of the meeting:

Appendix Part IV/GL28/A-7: Contract Monitoring Format

Please use this form for Contract monitoring; *(items can be increased or decreased based on the specific project. Monitoring indicator also can be modified)*

No	Item to be Monitored	Compliance to (Yes/No)							Remark
		Size/Dimension	Specification	Time	Cost	Quality	Shape	Type	
1	Head Work								
1.1	Weir body								
1.2	U/S apron								
1.3	D/S apron								
1.4	Wing walls								
1.5	Gates								
2	Conveyance canal								
3	Main Canal								
4	Secondary Canal								
5	Tertiary Canal								
6	Other canals								
7	Structures								
7.1	Drops								
7.2	Division boxes								
7.3	Turnouts/ Off takes								
7.4	Bed bars								
7.5	Aqueducts								
7.6	Cross drainages								
7.7	Culverts								
7.8	Level crossing								
7.9	Others								

General Comment: (use this space for detail comments of the monitoring result)

Signature of the monitoring team members / individual:

_____

APPENDIX II: Part IV/GL 28/B Planning and Scheduling Format

Appendix Part IV/GL28/B-1: Physical Work Schedule Format

Project Name:_____
Client:_____
_____
Consultant:_____
____
Contractor:_____
Physical Work Schedule in Quantity for the year _____ EFY

Item No.	Description	Unit	Contract quantity	Physical Work Plan in Quantity for the year ____ EFY	Physical Work Schedule for the year _____ EFY Monthly Distribution																							
					July		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June	
					Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%	Qt.	%

Appendix Part IV/GL28/B-2: Financial Schedule Format

Project Name:_____

Client:_____

Consultant:_____

Contractor:_____

Financial Schedule in ETB for the year _____ EFY

Item No.	Description	Unit	Contract Amount, Birr	Financial Plan in Birr for the year ____ EFY	Financial Schedule for the year _____ EFY Monthly Distribution																							
					July		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June	
					Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%	Amt, Birr	%

Appendix Part IV/GL28/B-3: Person power Schedule Format

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____
Person power Schedule in number for the year _____ EFY

Item No.	Description	Unit	Agreed Person power	Person power Plan for the year _____ EFY	Person power Schedule for the year _____ EFY Monthly Distribution											
					July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June

Appendix Part IV/GL28/B-4: Machinery Schedule Format

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____
Machinery Schedule in hours for the year _____ EFY

Item No.	Description	Unit	Agreed Machinery	Machinery Plan for the year ____ EFY	Machinery Schedule in hours for the year _____ EFY Monthly Distribution											
					July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June

Appendix Part IV/GL28/B-5: Construction Material Schedule Format

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____
Construction Material Schedule in Quantity for the year _____ EFY

Item No.	Description	Unit	Agreed Material	Material Plan for the year_____ EFY	Construction Material Schedule in Quantity for the year _____ EFY Monthly Distribution											
					July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June

Appendix Part IV/GL28/B-6: Financial Flow Schedule Format

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____
Financial Flow Schedule in ETB for the year _____ EFY

Item No.	Description	Total Financial Flow Plan (ETB) for the year _____ EFY	Financial Flow Schedule (ETB) Month Distribution											
			July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
1	Material cost													
2	Machinery cost													
3	Person power Cost													
4	Overhead cost													
5	Others													
	Total cost													

APPENDIX III: Part IV/GL 28/C Payment Format

Appendix Part IV/GL28/C-1 Sample Advance Payment Requesting Letter

Contractor Letter Head

Ref. No: _____
Date: _____

To / Name of the organization/

Subject: -Request for Advance Payment

Please allow this letter to serve as our request to receive an advance payment from your organization, /Organization Name/ for a contract our company entered into /Insert contract # ------/ for the Construction/ Consultancy/supply/. The contract amount including VAT is ETB _____ / number & figure/. Hereby we request a /--% / advance payment, in the amount of Birr_____ /number & figure/.

We understand that costs paid for the advance will be dedicated proportionally from the subsequent payment request. Furthermore, the advance will be deducted from the total amount of reimbursement requested.

Here with, we attached the required amount of Advance Security Ref. No _____ dated _____ for the amount of _____ ETB from _____ Bank.

The Company commits itself for full return of the advance payment, in case of any failure to do so and expiration of the security the company will renew the security or will pay back the remaining advance payment in Cash.

If you have any questions or need additional information to process this request, please contact _____ at (_____) _____.

Sincerely, Designated Authorized Representative

(THIS LETTER MUST BE SIGNED BY THE DESIGNATED AUTHORIZED REPRESENTATIVE).

Appendix Part IV/GL28/C-2 Sample Interim Payment Requesting Letter

Contractor Letter Head

Ref. No._____
Date_____

(Insert the Client/Consultant Name)
(Insert the Client Address)

Ref: - Construction of ***(Insert the Project Name)***

Subject: **Request for Approval of Interim Payment No.------**

It is to be recalled that the contract agreement has been signed between your honored office, ***(Insert Client Name)***, and our firm, ***(Insert Contractors Name)*** for the construction of ***(Insert project Name)*** located in ***(Insert Region Name)***, ***(Insert Zone Name)***, ***(Insert District Name),*** and ***(Insert Kebele Name)*** with contract amount ETB ***(Insert Amount in figure)(Insert Amount in Words)*** only including15% VAT.

Accordingly, we have accomplished ***(Put items of works executed)*** that worth ETB ***(Insert Amount in figure)(Insert Amount in Words)*** only including15% VAT.
Hence, according to GCC/SCC ____ we here by request your good office approval and effect Interim Payment No.__ for the work executed this month that worth ***(Insert Amount in figure)(Insert Amount in Words)*** only including15% VAT.
Please find attached herewith _____ pages of summary of work executed for IPC _____ and other supporting documents.

With regards,
Person in Charge
Position

C.C

- ***(Insert Client Name)***
  (Insert the Client Address)
- ***(Insert Name of different internal stockholders)***
-
-

  (Insert the Contractor Name)
  (Insert the Contractor Address)

(THIS LETTER MUST BE SIGNED BY THE DESIGNATED AUTHORIZED REPRESENTATIVE).

Appendix Part IV/GL28/C-3 Summary of Checked Amount Format

SUMMARY OF **CHECKED PAYMENT**

CERTIFICATE OF PAYMENT No.___					
Project Client Consultant Contractor		Location			
1. Original Contract Amount					
2. Supplementary Contract					
3. Variation					
Revised Contract Amount					
Value Added Tax (VAT)					
TOTAL					
			Executed B.O.Q Amount (Birr)		
Item No	Type of Work	Contract Amount	Total Executed Amount	Previous Amount	Current Amount
a	Total				
b	Add VAT = (15% *a)				
c	Grand Total = (a+b)				
	DEDUCTION				
	Retention = (5%*a)				
	Advanced payment = (30% *c)				
d	Total Deduction = (5%*a + 30%*c)				
	Total due to certificate after deduction including 15% VAT= (c-d)				
	Advance Payment				
	1.Advance Paid to the Contractor				
	2.Advance repaid by the Contractor				
	Outstanding Advance Payment				

Consultant's Representative
Name _____
Signature _____
Date _____

Client's Representative
Name _____
Signature _____
Date _____

APPENDIX IV: Part IV/GL 28/D Reporting Format

Appendix Part IV/GL28/D-1 Monthly Project Information Format

Project Name: _____
Client: _____
Consultant: _____
Contractor: _____

1. General Information
    1.1 Location: _____
    1.2Altitude: _____
    1.3 Weather Condition: _____
    1.4 Working Hours: _____

2. Short and descriptive comparison of work progress against schedule:
_____
_____.

3. Current project status:
_____
_____.

4. Problem encountered:
_____
_____.

5. Measures taken:
_____
_____.

6. Pending issues that needs attention:
_____
_____.

7. Net amount of payment certified during previous time:
_____
_____.

8. Estimated amount of work accomplished during this month:
_____
_____.

9. Others:
_____
_____.

Appendix Part IV/GL28/D-2 Monthly Work Progress Format (Quantity)

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____

Plan Period : _____ Contract Time: _____

Fiscal Year: _____ Utilized time: _____

Commencement date : _____ Remaining contract time: _____

Completion Date: _____ Percentage completion to date: _____

Bill Item No	Activity	Unit	Unit Price' Birr	Tender Quantity	Previously completed quantity	Accomplished Quantity				To - Date Certified	Difference	Remark
						This month		To - Date		Quantity	Accomp-Certified	
						Planned	Executed	Planned	Executed		Quantity	

Remarks: _____.

Prepared by

Name: _____
Signature _____
Date _____

Approved by

Name: _____
Signature _____
Date _____

Appendix Part IV/GL28/D-3 Monthly Work Progress Format (Amount)

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____
Plan Period : _____ Contract Time: _____
Fiscal Year: _____ Utilized time: _____
Commencement date : _____ Remaining contract time: _____
Completion Date: _____ Percentage completion to date: _____

Bill Item No	Activity	Unit	Unit Price' Birr	Tender Amount, Birr	Previously Amount, Birr	Accomplished Amount, Birr				To - Date Certified	Difference (Accomp-Certified)	Remark
						This month		To - Date Amount, Birr		Amount, Birr	Amount, Birr	
						Planned	Executed	Planned	Executed			

Remarks: _____.

Prepared by
Name: _____
Signature _____
Date _____

Approved by
Name: _____
Signature _____
Date _____

Appendix Part IV/GL28/D-4 Person power Mobilized to the Site during the Month

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____

Plan Period : _____ Contract Time: _____

Fiscal Year: _____ Utilized time: _____

Commencement date : _____ Remaining contract time: _____

Completion Date: _____ Percentage completion to date: _____

S/No	Description	Unit	Month, Year		
			Plan	Mobilized	%

Remarks: _____.

Prepared by

Name: _____
Signature _____
Date _____

Approved by

Name: _____
Signature _____
Date _____

Appendix Part IV/GL28/D-5 Machinery/Equipment Utilization during the Month

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____

Item No.	Type Of Machinery/Equipment	Plate No.	Capacity	Name of Operator	Total			Operation Hours		Remark
					Available Hrs	Idle Time	Down Time	Bill Item No.	Total	

Remarks: _____.

Prepared by

Name: _____
Signature _____
Date _____

Approved by

Name: _____
Signature _____
Date _____

Appendix Part IV/GL28/D-6 Construction Materials Used during the Month

Project Name:_____
Client:_____
Consultant:_____
Contractor:_____

Item No.	Description	Unit	Total Quantity	Total Cost		Bill Item Number			Remark
							Cost		
				Birr	Cents	Qty.	Birr	Cents	

Remarks: _____.

Prepared by
Name: _____
Signature _____
Date _____

Approved by
Name: _____
Signature _____
Date _____

APPENDIX V: PART IV/GL 28/E WORKREQUEST FORMAT

Request for permission to proceed_____

Employer _____	Approval No. _____
Consultant _____	Request No. _____
Contractor_____	
APPROVAL REQUEST	
Date _____	Date _____
Time _____	Time _____
Requested by _____	Received by _____
Please you are requested to check the following works for approval	
Item of Work : _____	
_____	
Location of Work : _____	
Time of checking : _____	
Next stage of work : _____	
For Engineer's use only	
Surveying executed by :_____	
For the contractor _____Date_____hour_____	
For the consultant_____ Date_____hour_____	
REMARK	
Approved ☐	Not approved ☐
Supervising Engineer _____	Construction Engineer
Time _____	Time _____
Date _____	Date _____

Note:

The contents of approve does not relieve the contractor from any of his obligation toward the work as per the drawing and specification of the contract and as per clause --------- of the general condition of contract

N.B.:-Next stage of work shall be commenced after getting approval from the consultant.

Contractor Resident Engineer

APPENDIX VI: PART IV/GL 28/G CHECK LIST FOR WORK PERMIT

Appendix Part IV/GL28/G-1 Check List for Work Permit of Temporary Activities & Others

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Temporary Activities & Others( )	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Provision of general plan of temporary works for approval;	☐	☐	☐
• All physical obstructions are to be considered by the contractor;	☐	☐	☐
• Location of temporary blocks and structure are to be agreed both by the contractor and the Engineer;	☐	☐	☐
• The Contractor is expected to facilitate the Setting Out tools and materials within the Mobilization Period;	☐	☐	☐
• Position of Crushers and Batching Plants should be with the approval/ consent of the Client and others	☐	☐	☐
• Set up Mixers, and Material's dumping place shall be with the approval of the Engineer;			
○ Equipments	☐	☐	☐
○ Materials	☐	☐	☐
○ House Services	☐	☐	☐
• The Contractor shall immediately submit his Master Schedule to the Consultant, and his Work Methodology of subsequent activities to the Engineer for approval	☐	☐	☐
• The Contractor shall separately submit his method of Site Protection from flood;	☐	☐	☐
• Quality of supervisor office and other facilities	☐	☐	☐
• The Contractor should avail her/himself of pre construction materials testing during the mobilization period;	☐	☐	☐
• Provision of General Items	☐	☐	☐

Additional Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled* ,the ☐ Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this ☐ activity ☐ shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-2 Check List for Work Permit of Site Clearance

Project: _____			
Employer: _____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill: _____			
Site Clearance	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Materials test requisition & results;	☐	☐	☐
• Preparation of estimated measurement	☐	☐	☐
• Distance of setting out board from the edge of building and stabilization means of the setting out erections	☐	☐	☐
• Elevation, Levelness, angle and alignment of the profile board and strings	☐	☐	☐
• Accuracy of transferred Bench Mark	☐	☐	☐
• Remedy given for physical obstruction	☐	☐	☐
• Means of taking the existing Ground Elevation	☐	☐	☐
• Grid Points considered	☐	☐	☐
• Conformity of the readings with the drawings	☐	☐	☐
• Methodology of removal	☐	☐	☐
• Site protection	☐	☐	☐

Additional Remarks _____

For the above items are *fulfilled* ☐ /not ☐ *fulfilled*, the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name: _____
Signature: _____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-3 Check List for Work Permit of Trench Excavation

Project: _____			
Employer: _____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill: _____			
Trench Excavation	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Necessity of Masonry Foundation along the stated axes	☐	☐	☐
• Availability of materials for subsequent work	☐	☐	☐
• Submittal of work methodology	☐	☐	☐
• Qualification of work men/ operators	☐	☐	☐
• Equipment for excavation	☐	☐	☐
• Submittal of pre excavation elevation readings	☐	☐	☐
• Readiness to protect trench wall from falling in	☐	☐	☐

Additional Remarks _____

For the above items are *fulfilled* ☐ /not ☐ *fulfilled*, the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name: _____
Signature: _____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-4 Check List for Work Permit of Bulk Excavation

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Bulk Excavation	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Submittal of work methodology	☐	☐	☐
• Preparation of estimated measurement	☐	☐	☐
• Investigation of underground physical obstruction by the Contractor	☐	☐	☐
• Qualification of Personnel	☐	☐	☐
• Submittal of pre excavation readings on same Grid Points	☐	☐	☐
• Approval of top soil materials disposal	☐	☐	☐
• Machineries to be applied	☐	☐	☐
• Requisition of Back filling materials test	☐	☐	☐

Any other Remarks _____

For the ☐ ☐ ☐ ☐ above items are *fulfilled* /not *fulfilled* ,the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-5 Check List for Work Permit of Backfilling

Project: _____			
Employer: _____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill: _____			
Backfilling	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Backfill material (borrowed/from site)	☐	☐	☐
• Submittal of the Backfill material test result	☐	☐	☐
• Conformity of readings of the reduced level with the first reading	☐	☐	☐
• Cut surface (reduced ground) compaction before Backfilling begin	☐	☐	☐
• Method of sprinkling of water and its sufficiency	☐	☐	☐
• Method of spreading the fill material	☐	☐	☐
• Moisture content of the area to be filled	☐	☐	☐
• Thickness of backfilling layer	☐	☐	☐
• Method of blending for mixed material	☐	☐	☐
• Decision on No of Test points for Compaction	☐	☐	☐
• Anti Termite solutions (if applicable)	☐	☐	☐
• Surface cleanliness of the area to be filled	☐	☐	☐

Any other Remarks _____

For the ☐ ☐ ☐ above ☐ items are *fulfilled* /not *fulfilled* ,the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name: _____
Signature: _____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-6 Check List for Work Permit of Hard Coring

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Hard Coring	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Fulfillment of Quality of Test Results of the Compaction	☐	☐	☐
• Confirmation of estimated quality against the documents	☐	☐	☐
• Time elapsed after compaction completion	☐	☐	☐
• Surface condition of the area to be covered	☐	☐	☐
• Quality of hard core material	☐	☐	☐
• Availability of well-graded materials for Blinding	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not ☐ *fulfilled*, the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-7 Check List for Work Permit of Stone Masonry Foundation

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Stone Masonry Foundation	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Submittal of work methodology	☐	☐	☐
• Distance of excavated material from the brim of the Trench	☐	☐	☐
• Conducted materials test	☐	☐	☐
• Protection of Trench wall from falling in	☐	☐	☐
• Type & size of Masonry (Uniformly thick/battered)	☐	☐	☐
• Size of Stone masonry	☐	☐	☐
• Qualification of Mason	☐	☐	☐
• Bedding material	☐	☐	☐
• Uniformity of color, texture, etc of the stone	☐	☐	☐
• Proportion of height to length of the stone	☐	☐	☐
• Mix ratio of mortar & box size	☐	☐	☐
• Reliability of the Mixer	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled*, ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-8 Check List for Work Permit of Cement Screed

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Cement Screed	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Completion of preceding works/ceiling/plastering	☐	☐	☐
• Leveling state of floor to be screed	☐	☐	☐
• Surface nature of floor chiseled/Washed	☐	☐	☐
• Mix proportion of screed material	☐	☐	☐
• Quality of fine aggregate, water etc.	☐	☐	☐
• Method of mixing of mortar	☐	☐	☐
• Thickness of designed screed	☐	☐	☐
• Smooth nature of finished level	☐	☐	☐
• Curing period of screed surface	☐	☐	☐
• Protection measure of finished surface form damage	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled*, ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:

Name: _____
Signature: _____
Date: _____

For the Contractor

Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-9 Check List for Work Permit of Formwork

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Formwork	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Submittal of formwork design and method of construction	☐	☐	☐
• Type & quality of material to be used for formwork /metal or wood	☐	☐	☐
• Provision of Lean concrete	☐	☐	☐
• Clearing /Disposal/ of excavated material away from the pit	☐	☐	☐
• Provision of means for draining underground water if there is any	☐	☐	☐
• Availability of enough spacer for concrete cover	☐	☐	☐
• Readiness for preparation of required reinforcement to be placed on that specific formwork	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled*, ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-10 Check List for Work Permit of Placing of Reinforcement

Project: _____			
Employer: _____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill: _____			
Placing of Reinforcement bar	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of skilled and semi-skilled person power	☐	☐	☐
• Fulfillment of quality test	☐	☐	☐
• Checked for the right dimension, level & straightness of formwork	☐	☐	☐
• Method used to keep the formwork in position /clamp, bolt or anchors/	☐	☐	☐
• Rigidity, wrapping & opening of formwork joints due to shrinkage of timber	☐	☐	☐
• Coated with release agent for the inside surface of formwork	☐	☐	☐
• Submittal of shop drawing/bar schedule/	☐	☐	☐
• Handling & storage of reinforcement /raised from ground, protected from weather effect and appropriate location not to hinder progress of work/	☐	☐	☐
• Availability of reinforcement free from dirt, oil, paint, rust & other foreign substance	☐	☐	☐
• Readiness to place the reinforcement as per the drawing	☐	☐	☐
• Availability of spacer for concrete cover /shape, dimension & type of spacer/	☐	☐	☐
• Proposed method the prevent displacement of reinforcement from tolerance	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled*, ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name: _____
Signature: _____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-11 Check List for Work Permit of Placing of Concrete

Project: _____			
Employer: _____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill: _____			
Placing of Concrete	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of Skilled and semi-skilled person power	☐	☐	☐
• Fulfillment of quality test	☐	☐	☐
• Submittal of mix proportion for the mix design	☐	☐	☐
• Rechecking the rigidity of the scaffolding & shuttering formwork from displacement of the fixed position.	☐	☐	☐
• Conformity of proper dimension for the finished surface	☐	☐	☐
• Cleanliness of all reinforcement bar (free from dirt, paint, oil, rust and other foreign sunstones	☐	☐	☐
• Submittal of mix proportion for the mix design	☐	☐	☐
• Method used for pouring concrete to avoid segregation/Chute, down pipe, trunking, or any other/	☐	☐	☐
• Conformity for right dimension, vertical alignment & level of finished element	☐	☐	☐
• Sufficiency for different size of aggregates piled separately	☐	☐	☐
• Type, quantity, quality, age of cement	☐	☐	☐
• Size of gauging box for measuring aggregates	☐	☐	☐
• Water	☐	☐	☐
• Workability of concrete for ensuring proper handling and placing of concrete without segregation/low, medium, high/	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled*, ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name: _____
Signature: _____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-12 Check List for Work Permit of Plastering

Project: _____			
Employer:_____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill:_____			
Plastering	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of plasterer	☐	☐	☐
• Quality of fine aggregate, water, lime etc..	☐	☐	☐
• Design of mixing of mortar	☐	☐	☐
• Method of mixing of mortar	☐	☐	☐
• Max. allowable thickness of coats of plaster(1^{st} coat, 2^{nd} coat, 3^{rd} coat)	☐	☐	☐
• Duration between 1^{st} and 2^{nd} coat	☐	☐	☐
• Allowable duration time of mortar between mixing and placing	☐	☐	☐
• Smooth nature of last coated surface	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled,* ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant:
Name: _____
Signature: _____
Date: _____

For the Contractor
Name:_____
Signature:_____
Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-13 Check List for Work Permit of Electro-Mechanical Works

Project: _____			
Employer: _____			
Contractor: _____			
Consultant: _____			
Location: _____			
Document Referred: _____			
Bill: _____			
Electro-Mechanical Works	**Make a (√)**		
	C	**NC**	**NA**
• Qualification of Professional	☐	☐	☐
• Capacity of item (Discharge, Cutter rating, Voltage, Head etc...).	☐	☐	☐
• Applicability of product data with given design	☐	☐	☐
• Suitability for intended purpose as per offer	☐	☐	☐
• Submission of shop drawing	☐	☐	☐
• Presentation of methodology	☐	☐	☐
• Location of item	☐	☐	☐
• Positioning of item	☐	☐	☐
• Other	☐	☐	☐

Any other Remarks _____

For the above items are *fulfilled* ☐ /not *fulfilled,* ☐ the Contractor is hereby allowed/refused to proceed Clearing the Site. The take-off sheet of this activity shall immediately be signed upon completion.

For the Consultant: For the Contractor

Name: _____ Name: _____
Signature: _____ Signature: _____
Date: _____ Date: _____

C = Conformed NC = Not conformed NA= Not applicable

Appendix Part IV/GL28/G-14 Inspection Check List for Submersible Pump and Its All Accessories

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
1	**Pump portion**				
1.1	Manufacturer				
1.2	Country of origin				
1.3	Model designation				
1.4	Pump Serial No				
1.5	Rated flow (m^3/hr ,l/s)				
1.6	Rated head (m)				
1.7	Efficiency at duty point (%)				
1.8	Power absorbed at duty point (KW)				
1.9	Pump out let size (mm)				
1.10	Pump outlet Type (Threaded or Flanged)				
1.11	Borehole casing diameter (mm)				
1.12	Pump diameter including cable (mm)				
1.13	Pipe clamp thickness (mm)				
1.14	Operating Temperature				
2	**Motor Portion**				
2.1	Manufacturer				
2.2	Country of origin				
2.3	Model				
2.4	Motor serial No.				
2.5	Motor Starter type				
2.6	rewind able or non rewind able type				
2.7	Actual speed at full load (RPM)				
2.8	Rated Power (KW)				
2.9	Supply voltage (V)				
2.10	No load current (A)				
2.11	Full load current (A)				
2.12	Efficiency at full load (%)				
2.13	Working temperature				
2.14	Motor winding temperature sensor type				
2.15	Maximum Motor Diameter (mm)				
3	**Control Panel**				
3.1	Manufacturer				
3.2	Country of Origin				
3.3	Switch board name/family				
3.4	Serial no				
3.5	Starting system				
3.6	Voltage Rating (V)				
3.7	Main circuit breaker type				
3.8	Main circuit breaker ratings in Ampere				
3.9	Volt meter with seven/three position selector switch or Multipurpose digital display				
3.10	Ammeter with three position selector switch or Multipurpose digital display				
3.11	Under Voltage relay				
3.12	Over voltage relay				
3.13	Phase sequence and phase failure protection relay				

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
3.14	Run hour meter				
3.15	Protection Index (IP)				
3.16	Dry run protection				
3.17	Contactors types				
3.18	Contactor Ratings : Voltage Rating (V) Current Rating (A) Coil voltage (V)				
3.19	Adjustable over load protection relay Current range				
3.20	Control fuse and main power fuse				
3.21	Adjustable time relay Time range (sec.)				
3.22	Indicator lights : Power Supply indicator Motor RUNNING indicator Motor FAULT indicator				
4	**Power Cable**				
4.1	Cable type (flat type or round)				
4.2	Manufacturer				
4.3	Name				
4.4	Number or core				
4.5	Cable diameter (mm^2)				
4.6	Cable length (m)				
5	**Riser Pipe**				
5.1	Class (Type)				
5.2	Connection (threaded or flanged)				
5.3	Size(inch)				
5.4	Length of a single pipe				
5.5	Total riser pipe length supply(m)				
5.6	Total riser pipe length installed(m)				
6	**Coupler Type**				
7	**Water Meter**				
7.1	Type of water meter				
7.2	Size/diameter (inch/mm)				
7.3	Nominal pressure (bar)				
7.4	Connection (flanged/threaded)				
8	**Check Valve**				
8.1	Type of check valve				
8.2	Size/diameter (inch/mm)				
8.3	Nominal pressure (bar)				
8.4	Connection (flanged/threaded)				
9	**Gate Valve**				
9.1	Type of gate valve				
9.2	Size/diameter (inch/mm)				
9.3	Nominal pressure (bar)				
9.4	Connection (flanged/threaded)				
10	**Air Release Valve**				
10.1	Type of air release valve				
10.2	Size/diameter (inch/mm)				

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
10.3	Nominal pressure (bar)				
10.4	Connection (flanged/threaded)				
11	**Accessories**				
11.1	Cable clamp quantity/length				
11.2	Vulcanization Kit quantity (Set) availability				
11.3	Water Level control electrode quantity				
11.4	Water Level sensor cable length and diameter				
11.5	Pressure gage type and size in bar				

Over all decision of Inspection committee on pump and related equipments:

Accepted _____
Rejected _____
Write clearly the reasons for rejection ----------

Incomplete supply _____
Write clearly the incomplete items ----------

Name of Committee	Signature	Date
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____

Appendix Part IV/GL28/G-15 Inspection Check List for Surface Pump and Its All Accessories

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
1	**Pump portion**				
1.1	Manufacturer				
1.2	Country of origin				
1.3	Model designation				
1.4	Pump Serial No				
1.5	Discharge min & max(m3/s , l/s)				
1.6	Head min & max (m)				
1.7	Efficiency at duty point (%)				
1.8	Power absorbed at duty point (KW)				
1.9	Type of pumps(in line or end suction)				
1.10	Pump in late & out let size (mm)				
1.11	Pump in late & out let Type (Threaded or Flanged)				
1.12	Operating Temperature				
2	**Electric Motor**				
2.1	Manufacturer				
2.2	Country of origin				
2.3	Model				
2.4	Motor serial No.				
2.5	Motor Starter type				
2.6	Actual speed at full load (RPM)				
2.7	Rated Power (KW)				
2.8	Supply voltage (V)				
2.9	No load current (A)				
2.10	Full load current (A)				
2.11	Efficiency at full load (%)				
2.12	Working temperature				
2.13	Motor winding temperature sensor type				
3	**Control Panel**				
3.1	Manufacturer				
3.2	Country of Origin				
3.3	Switch board name/family				
3.4	Serial no				
3.5	Starting system				
3.6	Voltage Rating (V)				
3.7	Main circuit breaker type				
3.8	Main circuit breaker ratings in Ampere				
3.9	Volt meter with seven/three position selector switch or Multipurpose digital display				
3.10	Ammeter with three position selector switch or Multipurpose digital display				
3.11	Under Voltage relay				
3.12	Over voltage relay				
3.13	Phase sequence and phase failure protection relay				
3.14	Run hour meter				
3.15	Protection Index (IP)				
3.16	Dry run protection				

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
3.17	Contactors types				
3.18	Contactor Ratings Voltage Rating (V) Current Rating (A) Coil voltage (V)				
3.19	Adjustable over load protection relay Current range				
3.20	Control fuse and main power fuse				
3.21	Adjustable time relay Time range (sec.)				
3.22	Indicator lights : Power Supply indicator Motor RUNNING indicator Motor FAULT indicator				
4	**Power Cable**				
4.1	Cable type (flat type or round)				
4.2	Manufacturer				
4.3	Name				
4.4	Number or core				
4.5	Cable diameter (mm2)				
4.6	Cable length (m)				
5	**Riser Pipe**				
5.1	Class (Type)				
5.2	Connection (threaded or flanged)				
5.3	Size (mm/inch)				
5.4	Length of a single pipe				
5.5	Total riser pipe length supply (m)				
5.6	Total riser pipe length installed (m)				
6	**Coupler Type**				
7	**Water Meter**				
7.1	Type of water meter				
7.2	Size/diameter(inch/mm)				
7.3	Nominal pressure (bar)				
7.4	Connection (flanged/threaded)				
8	**Check Valve**				
8.1	Type of check valve				
8.2	Size/diameter(inch/mm)				
8.3	Nominal pressure (bar)				
8.4	Connection(flanged/threaded)				
9	**Gate Valve**				
9.1	Type of gate valve				
9.2	Size/diameter(inch/mm)				
9.3	Nominal pressure (bar)				
9.4	Connection(flanged/threaded)				
10	**Air Release Valve**				
10.1	Type of air release valve				
10.2	Size/diameter(inch/mm)				
10.3	Nominal pressure (bar)				
10.4	Connection(flanged/threaded)				
11	**Accessories**				

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
11.1	Cable clamp quantity/length				
11.2	Vulcanization Kit quantity (Set) availability				
11.3	Water level control electrode quantity				
11.4	Water level sensor cable length and diameter				
11.5	Pressure gage type and size in bar				

Over all decision of Inspection committee on pump and related equipments:

Accepted _____
Rejected _____

Write clearly the reasons for rejection ----------

Incomplete supply _____
Write clearly the incomplete items ----------

Name of Committee	Signature	Date
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____

Appendix Part IV/GL28/G-16 Inspection Check List for Generator Set and It's All Accessories

S.N.	Description	Technical Requirements	Supplier Offer	Practically Supplied	Remark
1	**Engine**				
1.1	Engine type				
1.2	Model				
1.3	Country of origin				
1.4	Year of manufacturing				
1.5	Engine Serial No.				
1.6	Engine power				
1.7	Engine efficiency				
1.8	Engine Aspirating system (natural or turbo charged)				
1.9	Availability of exhaust manifold (short/extended)				
1.10	No of cylinder				
1.11	Fuel injection system (direct or indirect)				
1.12	Engine cooling system				
1.13	Fuel governing system (mechanical or automatic)				
1.14	Fuel pump/feed pump system(mechanical or electrical) or without feed pump				
1.15	Engine starting voltage (12v or 24v)				
2	**Alternator**				
2.1	Type				
2.2	Model				
2.3	Serial no				
2.4	Country of origin				
2.5	Year of manufacturing				
2.6	AVR-type				
2.7	standby Output power (KVA) at full load				
2.8	Prime output power (KVA) at full load				
3	**Control panel**				
3.1	Type (digital /analogue)				
3.2	Availability of self stand structure				
3.3	Availability of measurements and indicators				
3.4	Fuel level				
3.5	Battery charging system indicator				
3.6	Temperature sensor				
3.7	Oil pressure indicator				
3.8	Volt meter				
3.9	Ammeter in each phase				
3.10	Frequency meter				
3.11	Phase selection switch				
3.12	Availability of 3 phase and single phase supply				
3.13	Availability of automatic breaker				
3.14	Cranking mechanism(key, pushbutton or remote)				
3.15	Hour meter				
3.16	Emergency stopping switch				
3.17	Generator running indicator				
3.18	Availability of standard operating, maintenance and installation manuals for(engine, alternator and control panel/switch board)				

Over all decision of Inspection committee on pump and related equipments:

Accepted _____
Rejected _____

Write clearly the reasons for rejection ----------

Incomplete supply _____
Write clearly the incomplete items ----------

Name of Committee	Signature	Date
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____

Appendix Part IV/GL 28/G-17 Check List for Identifying Cause of Delay

Project Name:_____

Client:_____

Contractor:_____

Sir. No.	Day/month/ year	Item of work delayed	Shortage of Material	Shortage of Equipment	Shortage of Machinery	Labor required	working dwg required due to modification	Social problem	Others	Delayed time, hr/day/weak /month/	Remark

Contractor

Name_____

Sign_____

Date_____

Consultant

Name _____

Sign _____

Date _____

APPENDIX VII: PART IV/GL 28/H PROJECT HANDING OVER FORMAT

Appendix Part IV/GL2/H-1 SSI Project Site Handover to Commence Construction Format

1. General Aspect of the Project
   - Project Name:
   - Administrative Location:
     - Region:
     - Zone:
     - District:
     - PA:
     - Specific Site:
   - Distance from Towns:
     - District Capital (---) = -------km
     - Zone Capital () = ----------km
     - Country Capital (Addis Ababa) = ------km
   - Geographic Coordinate of
     - Headwork Site
       - Longitude/East (UTM): ----------
       - Latitude/North (UTM): ----------
       - Altitude (masl): ----------
     - Command Area
       - Longitude/East (UTM): From ---------- to ----------
       - Latitude/North (UTM): From ---------- to ----------
       - Altitude (masl): From ---------- to ----------
   - Client: ----------
   - Contractor: ----------
   - Consultant: ----------
   - Month and year of project startup: ----------
   - Command Area: ----------hectare
   - Total Number of Beneficiaries: ----------HH

2. Checking and handing over of detail design drawings at site level
   a) Checking and handing over of Bench Marks at Headwork and Command area ----------.
   b) Checking and handing over of headwork site topographic map and water abstraction system ----------.
   c) Checking and handing over of command area system layout ----------.
   d) Checking and handing over of location orientation and dimension of canal system ----------.
   e) Checking and handing over of location and dimension canal and social structures ----------.

3. Checking and Handing Over of Major Components of the Project at Site Level

Item No.	Description of project major components	Detail of the Structures							Remark
		Shape	Type	Specification	Length (m)	Width (m)	Depth (m)	Elevation (masl)	
1	Head Work								
1.1	Weir body								
1.2	U/S apron								
1.3	D/S apron								
1.4	Wing walls								
1.5	Gates								
2	Conveyance canal								
3	Main Canal								
4	Secondary Canal								
5	Tertiary Canal								
6	Other canals								
7	Structures								
7.1	Drops								
7.2	Division boxes								
7.3	Turnouts								
7.4	Off takes								
7.5	Bed bars								
7.6	Aqueducts								
7.7	Measuring structures								
7.8	Cross drainages								
7.9	Culverts								
7.10	Bridges								
7.11	Level crossing								
7.12	Others								

Narrative Remarks: ----------

---.

4. Conclusion

   ---.

This SSI Project Site Handover to Commence Construction effected on: _____.

In the presence of:

On behave of Project Client

Name_____ Signature_____ Date_____

On behave of Project Consultant/Contractor

Name_____ Signature_____ Date_____

Witness and Signature

1.
2.
3.
4.
5.
6.

Appendix Part IV/GL28/H-2 Constructed Project Handover Format

1. General Aspect of the Project
   - Project Name:
   - Administrative Location:
     - Region:
     - Zone:
     - District:
     - PA:
     - Specific Site:
   - Distance from Towns:
     - District Capital (---) = -------km
     - Zone Capital () = ----------km
     - Country Capital (Addis Ababa) = ------km
   - Geographic Coordinate of
     - Headwork Site
       - Longitude/East (UTM): ----------
       - Latitude/North (UTM): ----------
       - Altitude (masl): ----------
     - Command Area
       - Longitude/East (UTM): From ---------- to ----------
       - Latitude/North (UTM): From ---------- to ----------
       - Altitude (masl): From ---------- to ----------
   - Client: ----------
   - Contractor: ----------
   - Consultant: ----------
   - Month and year of project startup: ----------
   - Command Area: ----------hectare
   - Total Number of Beneficiaries: ----------HH
   - Total Investment cost: ETB ----------

2. Project handover status
   ----------.
3. Current status of the project
   ----------.

4. Inspection and testing during project handover process

Item No.	Project major components Description	Unit	Contract Quantity	Result of inspection and testing				Remarks
				Length (m)	Width (m)	Depth (m)	Elevation (masl)	
I	**Civil Structures**							
1	Headwork							
2	Canal							
3	Canal Structures							
4	Others							
II	**Electro-Mechanical Equipments**			**Inspected Quantity**	**Supplied**	**Installed**	**Test**	
1	Pump							
2	Generator							
3	Pipe							
4	Others							

Narrative Remarks: ----------

---.

5. Conclusion

   ----------.

This project ---------- hand over effected on: _____

In the presence of:

On behave of Project Client

Name_____ Signature_____ Date_____

On behave of Project Contractor

Name_____ Signature_____ Date_____

On behave of Project Consultant

Name_____ Signature_____ Date_____

Witness and Signature

1.
2.
3.
4.
5.

Appendix Part IV/GL28/H-3 Format for Irrigation Project/Scheme Transferring to the Beneficiary

1. General Aspect of the Project
   - Project Name:
   - Administrative Location:
     - Region:
     - Zone:
     - District:
     - PA:
     - Specific Site:
   - Distance from Towns:
     - District Capital (---) = -------km
     - Zone Capital () = ----------km
     - Country Capital (Addis Ababa) = ------km
   - Geographic Coordinate of
     - Headwork Site
       - Longitude/East (UTM): ----------
       - Latitude/North (UTM): ----------
       - Altitude (masl): ----------
     - Command Area
       - Longitude/East (UTM): From ---------- to ----------
       - Latitude/North (UTM): From ---------- to ----------
       - Altitude (masl): From ---------- to ----------
   - Client: ----------
   - Contractor: ----------
   - Consultant: ----------
   - Project commencement date: ----------
   - Project completion date: ----------
   - Command Area: ----------hectare
   - Total Number of Beneficiaries: ----------HH
     - Male Headed----------
     - Female Headed.....
     -
   - Source of Fund
   - Total Investment cost: ETB ----------
     - Share of Funding Agent: ETB ----------
     - Share of Beneficiary: ETB ----------

2. Statement of consensus about the project with the beneficiary
   - Land use (present land occupation) ----------.
   - Existing Water Users Association ----------.
   - Existing cooperative organization ----------.
   - Works well be improved and scale up in the future ----------.

3. Substantially or totally completed components of the project

Item No.	Project major components Description	Unit	Quantity	Result of inspection and testing				Remarks
				Length (m)	Width (m)	Depth (m)	Elevation (masl)	
I	**Civil Structures**							
1	Headwork							
2	Canal							
3	Canal Structures							
4	Others							
II	**Electro-Mechanical Equipments**			**Inspected Quantity**	**Supplied**	**Installed**	**Test**	
1	Pump							
2	Generator							
3	Pipe							
4	Others							

Narrative Remarks: ----------

---.

4. As built documents transferred to the beneficiary
   - Design document

   - As built drawings

   - Operation and maintenance manual (s)

     ---
5. Execution of training for operators

   ---.
6. Conclusion

   ---.

This scheme transfer to the beneficiary effected on: _____

In the presence of:

On behave of Project Client

Name_____ Signature_____ Date_____

On behave of Project Beneficiary

Name_____ Signature_____ Date_____

On behave of Project Contractor

Name_____ Signature_____ Date_____

On behave of Project Consultant

Name_____ Signature_____ Date_____

Witness and Signature

1.
2.
3.
4.

SSIGL 28

Prepared by

GIRDC