MALAWI INFRASTRUCTURE DELIVERY MANAGEMENT STANDARDS

Infrastructure Technical Audit System

Subsystem No. 7

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INTRODUCTION

The Malawi Infrastructure Management System (IDMS) guidelines have been authored and written as a guide to all Construction Industry players in implementation of quality infrastructure. The guidelines have been developed to respond to poor project planning and management which often results in poor quality infrastructure in the Construction Industry. The Council regulates the Construction Industry to ensure quality infrastructure in the country, however, there has been a gap between the Industry players and the Client organizations. Based on observations by the Council, a good number of client organizations do not fully understand the processes of Construction Project Management lifecycle. The IDMS addresses the gap that exists in the Construction Industry and provides the user with rich knowledge on how infrastructure projects are supposed to be conceived, planned, designed, procured, implemented and maintained.

The guidelines have seven subsystems namely; Infrastructure planning system, infrastructure gateway system, infrastructure procurement system, project management system, operation and maintenance system, supply chain management and infrastructure technical audit system. These subsystems are very useful in quality infrastructure delivery in the country.

The IDMS is an informative resource because it outlines simplified steps which can be followed for the management of life cycle of infrastructure. The guidelines have been written in a simplified manner for easy understanding and use by every player in the Construction Industry. The IDMS will contribute greatly to delivery of quality infrastructure in the country when put to the right use.

The guidelines have seven subsystems namely; 1-Infrastructure planning system, 2-infrastructure gateway system, 3-infrastructure procurement system, 4-project management system, 5-operation and maintenance system,

6-supply chain management, 7-infrastructure technical audit system

INFRASTRUCTURE PROJECTS TECHNICAL AUDIT (IPTA)

SCOPE

This subsystem requires that IPTA are incorporated and done in all infrastructure projects to ensure adherence to compliance to contract and project requirements as well as provide an opportunity for continuous improvement through implementation of corrective measures as well as the documented lessons.

Article I.

PREAMBLE

Section 1.01 General

1.1 Infrastructure Project Technical Audit is an evaluation of various aspects of a construction project by the Consultant, especially the quality, cost and contractual aspects, to ensure that they align with what was stipulated in the contract. Further, the IPTA also compares project management processes and schedule controls with industry best practices.

1.2 The purpose of technical audits is to enhance the quality of the infrastructure in the Construction industry. The team to conduct Technical Audits should be comprised of:

(i) Team leader who shall be registered as:

(a) a Professional Architect registered in terms of the BOAQS Act,

(b) a Professional Engineer in terms of MEI Act;

(c) Professional Quantity Surveyor in terms of the BOAQS Act.

(ii) 2 Key experts who shall be registered as:

(a) a Professional Architect registered in terms of the BOAQS Act,

(b) a Professional Engineer in terms of MEI Act;

(c) a Professional Quantity Surveyor in terms of the BOAQS Act.

1.3 The Team Leader – shall have at least 10 years' experience post professional registration of experience covering among other things, design and construction and contract management.

1.4 The key experts who shall have at least 10 years of experience in their respective fields.

1.5 Where applicable, a minimum of 1 accountant with a public practice certificate and any other professionals as may be required

1.6 Construction audits can be initiated by the construction firm, client, project stakeholders or government officials on public projects

1.7 All Technical Audits shall be carried out in a professional and objective manner. The Technical Auditor shall audit activities of the three main players:

- Client/Owner
- Consultant (Architect, Engineer etc.)
- Contractor

Article II.
ROLE AND RESPONSIBILITIES OF THE TECHNICAL AUDITOR

Section 2.01 General

1.1 The Technical Audit for a typical construction project should be carried out in three stages as presented in flowchart in Figure 1. These stages are spaced through the duration of construction of a project in order to build in an early warning system.

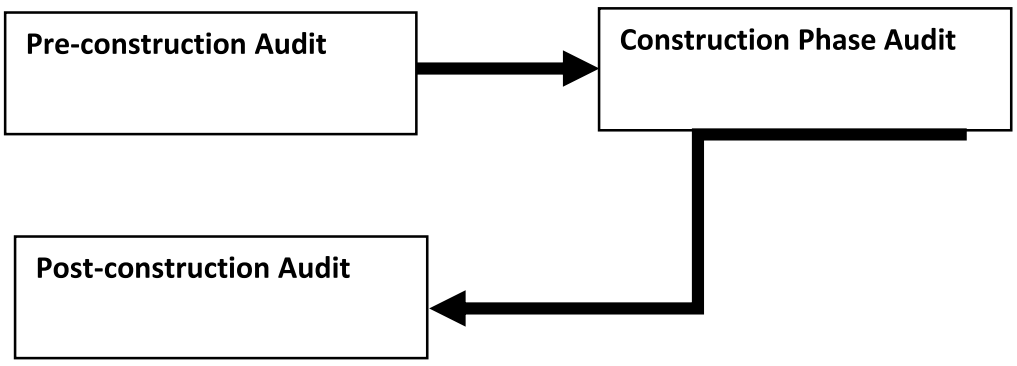

Figure 1: Auditing stages flowchart

1.2 The Technical Auditor should be appointed as early as possible after appointment of the Supervising Consultant and immediately (preferably) before the start of the tender process and appointment of the Contractor. This would allow the Auditor the opportunity to assess the following:

- evolution of the project to its current stage.
- Gross deficiencies in design
- Bills of Quantities or tender documents that have shortfalls identified by the Auditor and reported to the Client, may necessitate revisions.

1.3 The Technical Auditor may, in addition to his specified duties, be called on to act as an advisor to the Client on matters pertaining to the project.

1.4 At the conclusion of each phase of an audit, the Auditor should present his findings in a report to the Client in an agreed format. The Auditor shall conduct a debriefing session with the project management team to highlight significant findings.

1.5 The Auditor shall notify the Client on immediate risks identified during the Audit process (e.g., the use of inappropriate materials, absence of supervising consultant) for early intervention. The notification to the client shall be in a defined format**.**

1.6 The Auditor shall recommend for a post construction technical audit where construction requirements have not been fully fulfilled during the project.

1.7 The Auditor shall present the findings in a prescribed manner such as an exit conference to discuss the conclusions of the Technical Audit. The following parties should attend:

- the Client
- Auditor
- Contractor

- Consultant
- other relevant parties invited by the Client.
- the Auditor shall be responsible to document proceedings of the exit conference.

1.8 The Technical Auditor shall be accountable for his duties to the Client, and must fulfil all the obligations specified in the Terms of Reference for his appointment.

Article III.
RELATIONSHIP OF THE AUDITOR WITH THE CLIENT, CONSULTANT AND CONTRACTOR

Section 3.01 General

1.1 The Technical Auditor shall be appointed by the Client; to whom he shall report directly. The Technical Auditor shall not advise or issue instructions to the Contractor or Supervising Consultant.

1.2 Communication shall be focussed on seeking clarification or information regarding the project. The Technical Auditor shall avoid any interference with smooth implementation of the project.

1.3 The Consultant, Contractor and Client shall make available to the Auditor any document, as and when required by auditor as stipulated in the relevant clauses in the tender documentation and/or letters of appointment.

1.4 The relationship between the Auditor and the Client shall be documented in his agreement with the Client.

1.5 The Auditor shall review actions of the Client during the project and any deficiencies or lack of performance shall be included in the report. This shall make the process transparent, improve on internal practices and avoid problematic projects

Article IV.
PRE-CONSTRUCTION AUDITS

Section 4.01 General

1.1 The Auditor shall clearly understand the scope and complexities of the project by reviewing the following:

- all contract documentation including drawings, Quality Assurance, Quality Control
- specifications
- materials reports
- conditions of contract.
- price submitted by the Contractor
- the tender evaluation report
- all correspondence between parties such as minutes, letters, Instructions

1.2 All the above documents shall be carefully studied and related to the Contractors proposed programme as well as his resources. This shall probably require consultation between the Auditor and the Client.

1.3 This shall be carried out immediately after the Auditor has been appointed and within two weeks of award of the construction contract.

1.4 The Auditor shall visit the project site during this phase to acquaint himself with the ground conditions.

1.5 A report shall be submitted to the Client highlighting the outcome of this phase in order to clarify details before the works proceed.

Article V.
CONSTRUCTION PHASE AUDITS

Section 5.01 Initial Audit

1.1 This phase shall be carried out as soon as the contractor is properly established but within the first three months or 20 per cent of the contract period, whichever comes first.

1.2 This phase shall be carried out after construction has commenced so that all of the correct procedures can be established from the beginning of the project.

1.3 In the first on-site audit attention should focus on project management issues and construction methodologies. This will incorporate:

- A review of the Consultants proactivity, control and approval procedures;
- Adequacy of the materials laboratory;
- Qualifications of staff;
- Site communications;
- Knowledge of the contract;
- Construction quality of work completed; •
- General attitude towards the project.

1.4 The Auditor shall also ensure/verify that the assessment of the Contractor has been done satisfactorily by the Consultant, regarding the following issues and aspects:

- Quality and appropriateness of the plant and equipment;
- Methods of working;
- Materials supply;
- Site organization and site management;
- Quality and detail of the construction programme;
- Site safety;
- Adherence to cost control
- Quality assurance procedures;
- Quality control procedures;
- The Contractors project management processes and procedures.
- And general contract administration

1.5 The format and content of Monthly Progress Reports and Monthly Meeting Minutes shall be reviewed to ensure that all the important matters are raised and reported.

1.6 Proceedings of technical meetings should be assessed to ensure that no serious issues are being suppressed from public scrutiny.

1.7 At the end of this stage; the Auditor shall submit a report in a prescribed format and the report shall include the following:

- facts on any deviations from the stipulated contract.
- auditor's opinion on the construction supervision and the ability of the contractor to deliver on time and to meet all of his obligations.
- recommendations to the client on any actions that are considered necessary and should include all issues assessed and not only the critical ones.

Section 5.02 Intermediate Audit

2.1 The Auditor shall carry out an Intermediate Audit that concentrates on conformance with the specification and matters of effectiveness and ensures that the procedures set up initially are running correctly.

2.2 The Auditor shall carry out the intermediate Audit approximately halfway through the project.

2.3 On large projects it shall be necessary to carry out more than one Intermediate Audit and the timing and frequency of these should be specified in the Terms of Reference for appointment of the Technical Auditor.

2.4 The following shall be addressed during the Intermediate Audit/Audits:

(a) Initial Audit

Review the Initial Audit and the subsequent actions

(b) Specification

i Review of as-built records, relevant correspondence and minutes of meetings;

ii Inspect and check both the completed work and work in progress. Completed work should conform to the typical plans;

iii Assess the Consultant's quality assurance procedures,

iv Assess the laboratory equipment, test methods and general procedures;

v Assess the construction methods and the care and diligence employed by the contractor.

(c) Progress

Review progress against the programme and review the history of programme changes (reasons and responsibility for delays shall also be assessed).

(d) Cost

i Check the current estimate against the tendered price using both the Consultant and the Contractors management systems

ii Check measurement records and the latest payment certificates

iii ascertain whether disputes and claims are being dealt with in terms of the contract;

iv Check materials on site by sampling and testing and inspection of materials and records;

v Check that all payments to the Contractor are as per the contract conditions.

vi Assess the variations to the contract and cost implications

2.5 The above assessments/information shall be presented to the Client as a Summary Report highlighting any actions necessary to ensure successful completion of the project.

Section 5.03 Final Audit

3.1 This shall commence at least four weeks before issuance of the substantial completion certificate and shall be completed before the site staff is completely demobilised from site.

3.2 If an earlier starting time for the Final Audit is possible without causing disruptions to the project, then it should be encouraged. The purpose of the Final Audit is to

determine conformance with all aspects of the Contract. The principal sources of information will be:

- as-built drawings
- test records
- measurement and payment data
- site correspondence and minutes.

3.3 Both the actions of the Consultant and the Contractor shall be assessed. A principal output of the Final Audit shall be a recommendation for any further testing that is required to assess the quality of the works (Post Construction Audit).

3.4 The required field and laboratory investigation identified in Section 6 would follow this immediately and shall be concluded within the defects liability period. This is necessary so that deficiencies identified by the Post-construction Audit can be taken up with the Contractor prior to expiry of the defects liability period.

3.5 A full report on the project shall be presented to the Client summarising any further testing considered necessary and indicating any contractual obligations or any other outstanding matters that have not been fulfilled by either the Consultant or the Contractor.

Article VI.
POST CONSTRUCTION AUDIT

Section 6.01 Data Requirements

1.1 The Post construction audit can be carried out even where there has been no pre-construction and construction phase audit.

1.2 The three phases of a Technical Audit as discussed above shall define the extent of any possible Post-Construction Technical Audit, following the Final Audit

1.3 The Technical Auditor shall collect all available information for evaluation.

1.4 A full post construction phase Technical Audit may require laboratory and fieldwork. The input in the three phases (Pre-construction, Construction audit and Final) comprises predominantly a performance review and discussions with limited time spent on site. This would include visits to the site offices and a brief visual evaluation of the project in progress.

Section 6.02 Project Familiarization

2.1 The Technical Auditor shall obtain all information from the project preconstruction phase of a technical audit, regarding the design and progress of the project. This shall include:

- Consultant's design and drawings;
- Materials reports;
- Tender documentation including Tender Evaluation report;
- Bills of quantities;
- Ownership of plant;
- Contractors resources, program and cash flow

Section 6.03 Consultant's Design and Drawings

3.1 The Technical Auditor shall assess all the drawings and design documents pertaining to the project.

3.2 The Technical Auditor may determine whether the design is appropriate for the specific situation. The appropriateness of the project includes diverse considerations such as:

- Planning;
- Political;
- Social;
- Environmental;
- Cost-benefit prioritisation issues

3.3 However, the appropriateness of the project would normally have been assessed in-house by the Technical team prior to tender and it can be assumed that they were considered to be appropriate.

3.4 The Technical Auditor shall, however, familiarise himself fully with the background to the project, qualities and quantities (from materials reports) and specific issues relevant to the project.

Section 6.04 Tender Documentation

4.1 The Technical Auditor shall assess tender documentation and unusually high or low unit rates shall be noted. Specific note shall be made of any alternatives proposed and whether these were accepted.

4.2 The Technical Auditor shall take note of the Special conditions of contract particularly as they apply to quality control/assurance testing.

4.3 The Technical Auditor may evaluate the Tender prices or process, and aspects that might influence project management or quality of construction shall be highlighted during assessment of the tender documentation. Any examples of apparent negligence should also be noted.

4.4 The Technical Auditor shall take note of the proposals to use unconventional construction plant or techniques. Special conditions such as the use of proof rolling should also be identified to ensure that the results of compaction trials are obtained, assessed and properly recorded.

Section 6.05 Bills of Quantities

5.1 The Technical Auditor shall assess the Bills of Quantities to identify unusual quantities, spurious prices and to generally familiarise himself with the pricing of the project and aspects likely to result in claims should be noted.

Section 6.06 Initial Audit

6.1 The TA shall visit the site where establishment and methodology issues are generally audited. During this visit the following aspects should be assessed through observation and discussions with site staff:

- Management issues (e.g., work schedule, documentation, construction programme, etc);
- Construction methodologies;
- Site laboratories;
- Plant;
- Key personnel;
- Safety;
- Quality assurance;
- Site instructions
- Environmental protection

6.2 The TA shall evaluate the availability and quality of documentation (e.g., work programme, laboratory methods, control and approval procedures, etc) and communication among the respective parties.

Section 6.07 Intermediate Audit

7.1 The TA shall identify inconsistencies and deviations from conformance with the specifications. It is essential that the following data be obtained, through the Client. It shall be specified in the Tender documentation that all information will be made available to the Auditor for Auditing purposes.

- Laboratory test results;
- Daily/weekly/monthly construction records;
- Quality assurance data;
- Site correspondence, site instructions and minutes of meetings, engineer's orders, etc.;
- Variation orders and contractor's claims;
- Measurement and payment certificates;
- Project management issues;

- Efficiency of contractor's plant and machinery.

7.2 In addition, any other documentation originating from the project shall be reviewed.

Section 6.08 Laboratory Test Results

8.1 The TA shall inspect routine laboratory test results to ensure that the correct materials are being utilised, the materials are generally within specification and the laboratory testing is of the expected frequency and quality.

8.2 The TA shall inspect the laboratory equipment for calibration and check test procedures methodology for compliance with the project specifications.

Section 6.09 Construction Records

9.1 The TA shall inspect Daily/weekly/monthly construction progress records to identify problems resulting in slow progress as well as periods with greater than expected progress.

9.2 Unless additional resources were employed, very rapid progress may be indicative of short cuts being taken. Material quantities, stabiliser application rates, bituminous spray rates and quantities and water usage shall all be assessed in terms of the completed works for road project.

Section 6.10 Quality Assurance

10.1 The TA shall inspect quality control/assurance measurements to ensure that the correct quality was achieved. Calibration and control records of nuclear density testing equipment shall be inspected.

10.2 The TA shall take samples or carry out testing to check construction quality if so dictated by his assessment.

Section 6.11 Site Correspondence

11.1 The TA shall assess all relevant site correspondence, Instructions, variation orders and minutes of monthly meetings. Construction problems will usually be identified at these

meetings, and disputes between the Client, Consultant and the Contractor shall often be indicative of potential problems.

11.2 Delays due to material shortages, compaction problems or other construction issues could all lead to potential "shortcuts" that are not easily identified when construction is complete.

11.3 The TA shall review all correspondence associated with progress of the project to identify how smoothly the project is progressing. A full set of site instructions shall be obtained.

11.4 A high degree of rejection of work by the consultant could indicate that the Contractor experienced difficulties meeting the specification giving warning of potential problems.

Section 6.12 Variation Orders and Contractors Claims

12.1 The TA shall assess variation orders against the original design, the effect on cost, time and whether they were implemented correctly. Variation orders are almost always associated with claims.

Section 6.13 Measurement and Payment Certificates

- Measurement and payment certificates should be compared with the tendered bills of quantities for confirmation of work done;
- It is essential to ensure that all of the specified layers are properly accounted for, especially when stabilisation of materials is involved incase of a road project;
- Sample payment certificates shall be checked and related to the supporting documentation;
- Calculations for rain and other unforeseen delays and contract price adjustment should be in accordance with the conditions of contract. The rates used to calculate amounts must be either the tendered rates or agreed rates with supporting documentation;
- Payments for extensions of time and unforeseen conditions must agree with the Approval given by the Consultant;

- Payments for day works should be according to the certificates signed by the Contractor and the Consultant. The need for day-works can also be evaluated;
- All quantities shall be measured in accordance with the pay items. Each certificate should be cross-referenced with the Consultant's and the Contractor's measurements;
- Dimensions from typical plans shall be checked;
- Measurements based on the Consulatnt's judgement, such as for excavation of hard, intermediate or soft material and other ground conditions shall be carefully assessed to establish the parameters used;
- Where a current certificate is evaluated, the materials on site shall be verified. Spot measurement checks may also be required.

Section 6.14 Project Management Problems and Issues

14.1 The TA shall assess the application of good project management principles can be assessed in a number of areas. The Contractor's programme is a key project management tool.

14.2 The TA shall assess the quality and detail of the programme, and progress according to the programme. Consistency between planned activities and those actually undertaken shall be noted as well as resources and time spent.

14.3 The on-site labour force and plant resources shall be pertinent to current activities and adequate for meeting project deadlines.

14.4 The TA shall question any excessive delays due to adverse weather. Conformance with the requirements of the General Conditions of Contract as to submission and response dates, certificates of insurance, compliance with statutory submissions for labour, etc. shall be reviewed and compliance verified.

14.5 Both the Contractor and the Consultant shall have suitably qualified site personnel to ensure that the project is properly managed.

Section 6.15 Final Audit

15.1 The TA shall make use of the final audit carried out when construction was nearing completion use, all the information collected during the earlier phases to justify and identify the need for additional investigations.

15.2 Problems identified and rectified during the Initial and Intermediate Audits shall minimise problems likely to be revealed in the Final Audit. In addition to the information already available from the earlier Audits, it shall be necessary that the following also be evaluated:

- Consultant's construction/completion report;
- Performance of the structure to date;
- Safety of the structure

15.3 The completion report is usually not available immediately after completion of construction. Attempts should, however, be made to have it submitted as soon as possible.

Section 6.16 Construction/Completion Report

16.1 The TA shall evaluate the Consultant full completion report This should contain all the relevant information regarding progress of the project including all quality control records and test results. There should be a particular focus on the frequency of testing and completeness of test results, i.e. no areas with missing data.

16.2 The Client can engage the auditor on every stage of the project or on specific stages of the project. The duration of the Audit at every construction stage shall not exceed 10days. However, the duration for Post contract audit shall be not less than 3 months

APPENDIX - FORMAT OF THE AUDIT REPORT

EXECUTIVE SUMMARY

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