EXPRO National Manual for Projects Management

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Project Submission Standards and Requirements

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1.0 PURPOSE

The purpose of this document is to define for the Entity the design requirements with respect to the field investigations, Computer Aided Design (CAD) Standards, Building Information Modeling (BIM) considerations, design phase requirements, engineering support to the construction tender evaluation and during construction phase. The Entity shall include in the Architect & Engineer (A/E)'s scope of work the applicable requirements of this chapter for all projects. This chapter is to be read in conjunction with the Engineering requirements (definitions, references, codes, procedures, design guidelines, etc.) defined in the other chapters of National Manual for Project Management (NMPM), Volume 6 on Engineering.

1.1 Definitions

Items	Description
3D	Three dimensional
A/E	Architect & Engineer
BEDD	Basic Engineering Design Data
BIM	Building Information Modeling
CAD	Computer Aided Design
DBR	Design Basis Report
ENTITY	A Saudi Government organization which is responsible for the delivery of government funded infrastructure construction projects.
GCS	General Commission for Survey
NMPM	National Manual for Project Management
O&M	Operations & Maintenance
PEM	Project Engineering Manager
TCDD	Typical Construction Details Drawings
VE	Value Engineering

1.2 References

1. EPM-KE0-PR-000008: CAD Standards Procedure
2. EPM-KE0-GL-000018: Standard Drawing Template Guide
3. EPM-KE0-GL-000020: Project Automation Requirements & Deliverables Guideline
4. EPM-EN0-PL-000001: Technical Standardization Plan
5. EPM-KE0-GL-000010: Engineering Introduction
6. EPM-KSS-PR-000019: Project Demolition Procedure
7. EPM-KE0-GL-000001: Environmental Guideline
8. EPM-KE0-GL-000016: General Design Guidelines
9. EPM-KE0-TP-000013: Project Basic Engineering Design Data Template
10. EPM-KE0-PR-000006: Development of Service Requisition - Procedure
11. EPM-KE0-PR-000009: Design Change Notice Procedure
12. EPM-KE0-GL-000002: Geotechnical Guideline
13. EPM-KEC-GL-000005: Surveying Guidelines
14. EPM-KCE-PR-000002: Project Construction Technical Query Procedure

2.0 CAD STANDARDS

The CAD Standards Procedure (EPM-KE0-PR-000008) and Standard Drawing Template Guide (EPM-KE0-GL-000018) define the CAD requirements and CAD Templates for use by the Entity on all its projects.
They also provide the instructions for creating, sharing, reusing, and managing CAD/BIM files for Entity's projects and providing a base for documenting future change. The Entity shall include in the A/E's scope of work to follow the requirements defined in these two documents. The Entity is responsible for ensuring these standards are implemented by all A/E's and their subs.

3.0 BUILDING INFORMATION MODELING (BIM)

BIM (Building Information Modeling) is an intelligent digital 3D (three dimensional) model-based process that gives design teams and construction professionals a collaborative system to more efficiently deliver built assets. It also allows the building owner to utilize the model in the operation of the facility throughout its life. BIM is a way of working; a process of information modeling and information management in a shared graphical environment where all stakeholders work to the same standards and methods. BIM creates value from the combined efforts of people, process and technology by improving collaboration in real time together with the ability to create 3D simulations and visualizations, drawing extractions, clash detection and quantities reporting and other practices.

BIM is a process used to realize all manner of projects in design, construction and operation such as in:

· Architecture and building design
· Civil and structural engineering
· Energy and utilities
· Highway and road engineering
· Landscape and land surveying
· Offshore and marine architecture
· Rail and metro transportation engineering
· Tunneling and subway architecture
· Urban master-planning and smart city design

The BIM is developed iteratively and collaboratively across multiple disciplines and departments. As the project progresses, the complexity of the model and its information increases. The BIM enables those who interact with the building to improve their decision making, optimize their actions thereby maximizing the whole life value of the asset from concept to demolition. While software is key to BIM by enabling the 3D Modeling and information management, the work process lies at the heart of BIM. The software together with workflows and practices enable expanding opportunities through the typical practices mentioned in this document but also by enabling development of completely new process and procedures that will benefit the Entity

Refer to the Document No: EPM-KE0-GL-000020: Project Automation Requirements & Deliverables Guideline which is a guide describing the Entity's automation requirements and deliverables of the A/E including BIM requirements. This also acts as a guideline for the A/E to develop their own project automation and BIM execution plan for the project. Entities deploying BIM on their projects shall develop the BIM set-up to suit the CAD procedure/ templates as defined in this chapter.

4.0 GEOGRAPHIC INFORMATION SYSTEM (GIS)

GIS is a system designed to collect, edit and provide the spatial data for an area, region or country that allow users to create interactive queries and analyze the information. The results can be used for spatial planning, transport/logistics, telecommunications, projects engineering, etc. as well as included in Operations and Maintenance (O&M) of existing assets. GIS technologies use digital information, for which various digitized data creation methods are used. The most common method of data creation is digitization, where a hard copy map or survey plan is transferred into a digital medium through the use of a CAD program, and geo-referencing capabilities.

General Commission of Survey (GCS) is mandated to establish the National GIS Standards which will define the requirements for all Government Entities with respect to generating the spatial digital information for their areas/ assets/ projects to be made available nationally through GCS.

GCS is soon expected to issue GIS Standards. Once these Standards are issued, Entities are to follow and comply with the GCS requirements and provide up-to-date data at the appropriate level and compatible with GCS to allow for proper data integration and sharing.

5.0 SUBMISSION REQUIREMENTS

The Entity shall define the submission requirements by the A/E for all the phases of each project - the initial planning, preliminary studies, site investigation, value engineering, design, and during construction. The A/E shall identify any deviations or exceptions to the Entity's submission requirements and obtain approval before proceeding with the A/E scope of work. Refer to Document No. EPM-KE0-GL-000010 (Chapter 1 of NMPM, Volume 6: Engineering Introduction) for the due considerations, as good engineering practice, to be given to various aspects of a project such as material availability, energy and water conservation, standardized components, etc. in developing the project requirements.

5.1 Preliminary Studies

If required, the Entity shall conduct preliminary studies to validate the Project scope and budget. The intention is to generate high-level information that will be the foundation for detailed design development for the Project. These studies may include, but are not limited to the following:

a. Feasibility studies / reports
b. Master planning
c. Programming, space planning
d. Traffic and other site analyses
e. Concept design
f. Cost estimate / validation
g. Code Analysis
h. Water Usage Projections

5.2 Specialty Consultants

The Entity may choose to hire specialty consultants to perform or review the basic and/ or detail design of special systems including but not limited to Fire & Life Safety Systems, Acoustics, Water Systems, Building Maintenance System, etc. Such specialty consultants may be hired directly by the Entity or through the A/E.

5.3 Value Engineering (VE)

In a normal design process, the early intensive collaboration between the Entity (and O&M team if required) and the project design teams carried out as design progresses can lead to the optimized project value (life cycle cost, schedule, performance and safety). The project optimum value should be ingrained in to the Project Scope, Design Basis, Specifications, Plot Plans, Scheme Drawings, etc.

However, the need for value engineering (VE) studies may still arise due to the identification of items that contribute cost without contributing to the functions, requirement of studying total cost of owning, operating and maintaining facility, meeting client's specific objectives, etc. The benefits of VE studies diminish with the progress of design. The optimum benefits of VE studies are achieved if carried out before or immediately after the 30% design review stage. On a given project any team member can identify areas of VE studies but areas to be studied using VE techniques is at the discretion of the Entity. The VE Study, wherever required, should be conducted without pre-determined end-results. The Entity will have the overall responsibility for the cost-effective use of VE efforts.

Value Engineering studies, whenever performed, are usually to be undertaken by the on-project team personnel who are familiar with the work process and project scope and who can complete much of the pre-study requirements by working one-on-one with key project team members. The Project Engineering Manager (PEM) will identify a leader and members and develop the study scope/ objectives for each study in details to assure study direction, define estimated saving target and a realistic study cost. The PEM will continue to monitor the progress of any recommendations through to completion. If any Value Engineering study requires specific specialist skills/ facilitator not available within the organization, an external help can be engaged for the support. The Value Engineering Strategy should be defined in the Execution Plan of every Project.

In summary, the Value Engineering studies need not be performed as a matter of routine on every project but should be done on as need basis.

6.0 FIELD INVESTIGATION AND EXISTING CONDITIONS

This section provides the guideline for the performance of existing site survey and geotechnical/ environmental studies and existing data investigation.

6.1 Surveying

Surveying Guidelines are included in the NMPM, Volume 6, Chapter 7, Section 2 – Civil (EPM-KEC-GL-000005). The surveying guidelines provide the procedure for collating hydrographic data, Digital Terrane Modeling and the use of different survey techniques.

6.2 Geotechnical Investigation

Geotechnical Investigation Guidelines are included in the NMPM Volume 6, Chapter 7, Section 11 – Geotechnical Guidelines (EPM-KE0-GL-000002). The Part B of this document covers details on Investigation Using Borings, Groundwater Assessment, Geotechnical Equipment, In-Situ Testing, Geophysical Testing, Laboratory Testing, Offshore Geotechnical Investigations, and the Geotechnical Data Report.

6.3 Deconstruction, Demolition and Removal

The Entity shall define the requirements related to the demolition and site removal of its existing structures/ facilities/ services in accordance with the conditions specified in the Project Environmental Approvals/ Permits. The demolition plans shall be advised to the A/E during initial design phase as such requirements may have impact on the design of the Project, hook up with utilities, construction sequencing, etc.

The procedure for the demolition of existing structures/ services is defined in the Document No. EPM-KSS-PR-000019: Project Demolition Procedure (NMPM, Volume 11).

6.4 Environmental Condition Report

The existing environmental conditions report, if available, to be collected and summarized from the previous site investigations. This data will serve as the basis for design of environmental aspects of the project.

The report shall include a summary of tangible data to be used for project design. The report shall contain summaries of previous reports such as Environmental Site Assessment, geo-environmental investigations, marine investigations and other site activities in which data was recorded and/or a report was generated. The Existing Environmental Condition Report shall include, but not limited to, the following:

- Executive Summary – summary of the key information of the report.
- Introduction/Site Background - purpose of the investigation; general site description; and list the parties involved in the investigation and reporting
- Methodology - describe the methodology and sources used for obtaining existing reports, including a summary of the activities and their findings and conclusions
- Details of any historic and archeological studies conducted for the site.

Refer to NMPM, Volume 6, Chapter 7, Section 10 – Environmental Guideline (EPM-KE0-GL-000001) for the requirements of conducting environmental investigations and reporting for the proposed project site.

7.0 DESIGN PHASE REQUIREMENTS

The Entity shall define the A/E's scope for each of its projects including the data and deliverables to be issued by the A/E. Refer to Document No. EPM-KE0-GL-000016: General Design Guideline regarding the

identification of design deliverables and data (Deliverable lists) for each engineering disciplines to be developed and issued by the A/E on the Entity's project. Design Basis Report (DBR), Basic Engineering Design Data (BEDD), Design Criteria and Specifications are the key documents which define the basis of detail design of a project. The details of these key documents are presented in this section.

In general, any information provided in one engineering document such as Specification can be cross referenced but not reproduced in any other engineering documents such as Scope of Work of Construction Contractor.

7.1 Design Basis Report (DBR)

The Design Basis Report is a key project specific document which along with the Basic Engineering Design Data (BEDD), Design Criteria, Specifications and Standard Details forms the scope and the basis of the design of the Entity's projects. The DBR is developed by the A/E to convey the background, the detailed breakdown of the scope of the project clarifying how the A/E will achieve the intent of the scope, the references and the precedents used to design each operational system and infrastructure component of the Project. The DBR shall be completed within the first three months of the design phase and submitted for Entity's approval. A/E shall update the DBR with any scope changes throughout the project and obtain Entity's approval at each revision before proceeding with the change.

The Project DBR describes the detailed scope of the project (location, access, existing facilities, list of buildings/ types/ foot prints, external works, utilities, tie-up, assumptions, etc.) and how the design meets the Entities' scope of work, the technical, performance, and functional requirements as well as design constraints. The DBR shall apply to all applicable disciplines.

The DBR is an item included in the A/E's Scope of Work document as a deliverable from the A/E. Refer to Development of Service Requisition – Procedure (EPM-KE0-PR-000006) for the guide on the development of the Scope of Services for A/E and/or Engineering, Procurement and Construction (EPC) contracts.

7.1.1 DBR Contents

Each DBR shall contain the following descriptive items for each project:

7.1.1.1 INTRODUCTION

- Project overview (background, purpose, related and adjacent work)
- Supporting documents

7.1.1.2 Detailed Project Scope

The Entity to define in detail the facilities/ services to be designed for its project. It shall include any required demolitions and assumptions made which need verification by the Entity/ A/E. The information on project scope of work shall include, but not limited to, the following:

- Site location and access (existing and proposed)
- List/ type/ foot prints of buildings with required support facilities
- Site works (grading, roads, drains, etc.)
- Concrete and Steel works (foundations, structures, etc.)
- Utilities (Potable Water, Sewage, Fire Water, irrigation, Electrical) – existing, max/ min demand and tie-ups
- Low Voltage Systems (Telecommunications, Voice & Data, Security, Fire Alarm, etc.)

7.1.1.3 Appendices, Acronyms, and Definitions as needed

7.1.1.4 Any modifications of, exemptions to, or deviation from the requirements specified by the Entity

As a minimum, the DBR along with Design Criteria (Section 7.3 below) shall demonstrate that the A/E has:

a. Familiarized with Project site conditions
b. Analyzed and defined all functional requirements.
c. Analyzed and defined the performance targets.
d. Considered the integration of all systems, sub-systems, and components and fully identified and defined all interfaces.
e. Identified and mitigated risks and constructability issues related to the design.
f. Developed all relevant preliminary design drawings (e.g.: general arrangements, location plans, schematics, single line diagrams, etc.).
g. Performed and recorded any studies required to support and/or validate the design basis.

7.2 Basic Engineering Design Data (BEDD)

The BEDD is a project specific document which shall contain meteorological, seismic, existing site condition report, etc. required for the design of the Project. The BEDD shall also be completed within the first three months of the design phase and submitted for Entity's approval. Refer to the Document No. EPM-KE0-TP-000013 (Project Basic Engineering Design Data Template), referred to in the NMPM, Volume 6, Chapter 7-General Design Guidelines.

7.3 Design Criteria

Design Criterion provide the technical basis to be used for the design of the project such as selection of codes, material/ equipment/ technology selection, design margins, types of foundations, installation requirements, battery limits, etc. Design Criteria shall be developed by the A/E for each discipline within first three months of the design phase and submitted to the Entity for review/ approval before proceeding with the design.

Refer to Document No. EPM-EN0-PL-000001, Technical Standardization Plan for the details on the development of Design Criteria. This plan provides the reference to the Discipline Design Guidelines which define the purpose of its use by the Entity/ A/E.

7.4 Specifications

The Entity is to identify the list of Technical Specifications required for its projects and include its development in A/E's scope of services. Refer to Document No. EPM-EN0-PL-000001, Technical Standardization Plan for the details on the development of Technical Specifications.

7.5 Typical Construction Detail Drawings (TCDD)

TCDD, also referred to as Standard Details, define various installation details such as slab joints, component mounting, skirting, pipe/ tray supports, etc. which can be applied across the project(s) to bring about uniformity in design, ease of material take-offs, reduced engineering efforts, etc.

Refer to Document No. EPM-EN0-PL-000001, Technical Standardization Plan for the details on the development of TCDD. This plan provides the reference to the Discipline Design Guidelines which define the purpose of its use by the Entity/ A/E.

8.0 ENGINEERING SUPPORT DURING CONSTRUCTION TENDER PHASE

The Entity will need the A/E's support during the tender phase of construction packages by responding to the technical queries from bidders, technical bid evaluation, and in the development of conformed Scope of Work for awarding the construction contracts. Refer to the Document No. EPM-KE0-GL-000010: Engineering Introduction for the details of the A/E services required during Construction tender phase.

9.0 CONSTRUCTION PHASE REQUIREMENTS

This section provides guidelines to the Entity to define the scope of work required from the A/E during the construction phase of the Project. The Entity should involve the A/E that designs a Project in the construction phase of the project to provide technical support to Construction. The extent of the A/E support during construction will vary depending upon the complexity of the construction. The A/E team should be stationed at the construction site for faster resolution of site technical issues/queries. During the construction phase the A/E will work under the Entity's Construction Manager.

The main engineering tasks during construction are described in this section.

9.1 Technical Queries (TQ):

Respond to all design related queries raised by the construction contractor or equipment/ material supplier. Refer to Project Construction Technical Query Procedure (EPM-KCE-PR-000002).

9.2 Design Change Notice

After the design has been issued for construction (IFC), subsequent changes are managed through Design Change Notice. Refer to Document No. EPM-KE0-PR-000009: Design Change Notice Procedure for the procedure on identification and implementation design changes after the documents are issued for construction.

9.3 Review and Approval of Design Submittals by the Construction Contractors

Technical submittals such as Factory Acceptance Test reports, supplier document submittals, O&M manual reviews, field test results, installation test reports, etc. are to be reviewed by the Entity which may be included in the A/E scope of services for efficient reviews and approvals. The Entity may want to include in the A/E scope of work to witness and verify construction inspections if the project complexity warrants. Refer to Document No. EPM-KE0-PR-000006: Development of Service Requisition -Procedure regarding document and data submittals requirements.

9.4 Miscellaneous Site Engineering tasks

The Entity may require miscellaneous engineering support at the site such as design of temporary construction facilities for which A/E services may be considered if that is the best option for its project.