

**King Fahd University of Petroleum and Minerals
College of Environmental Design
Department of Construction Engineering and Management**

CEM 510

CONSTRUCTION PLANNING AND SCHEDULING

**Planning & Scheduling Techniques
Used By
Elseif Engineering Contracting Company**

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TABLE OF CONTENT

Abstract	3
Introduction	4
Contractor's Organization	5
Contractor's Major Projects	7
Project Management Techniques	8
Purpose & Scope	9
Key Activities and Output	9
Project Realization	13
Project Management Responsibilities	16
Why Use PQP?	23
Effectiveness of ESEC Project Management Technique	24
Conclusion	26
Appendix	27

Abstract

In the field of building construction industry, there is no ideal construction method to be used, as numerous methods are being used. The mean or criteria based on which a contractor defines his construction method is affected by alternative issues relative to the surrounding environment, plus other criteria. In this study, it highlights or direct the spot at one of the major main contractors in Saudi market; **ElSeif Engineering Contracting Company ESEC**. Who have played a major role in construction industry & built alternative project that are structure and became land mark & affected the architectural contexture and composition in Saudi Arabia.

As this study explain the method used in their construction & it's positive effects that lead to their success plus it's negative side.

Introduction

There are numerous methods being used to plan projects, many of which are old in origin. Most persons are acquainted with the type of schedule which is prepared by management and consists basically of a list of dates on which certain items are to take place or to be completed. Most are familiar with the Gantt chart which supplies additional information by showing the beginning and ending of each portion of the work as well as the total scope of the project. The decision concerning the method to be used for the planning of a project rests with the project manager, or planner, and the supporting staff. Success or failure depends in large part upon the knowledge of available procedures and the ability to choose the method which will be of maximum benefit to the company. Whatever choice is made for planning the project the decision will involve gathering as much information as possible on the following items: materials, equipments, manpower, money, and time.

This study highlights the planning and scheduling techniques used by a construction contractor performing projects locally (within Saudi Arabia). The targeted contractor is **ElSeif Engineering Contracting Company ESEC** which is considered to be one of the major contractor company in Saudi Arabia.

The technical, management procedure followed by ESEC led ESEC to be one of successful contractor on Saudi Arabia, Gulf Countries, and Lebanon as well.

Noting that ESEC uses its own system and new techniques to make sure that they achieve the ultimate goals in construction industry.

An interview was conducted with the General Manager, Operation Manager, Tender Department Manager, and Procurement Manager to discuss the following subjects:

- The projects the contractor has built; their type, size, cost, and location.
- Management techniques used for planning, scheduling, and control.

The purpose of the interview was to come up with an answer to the main important question which this study has been done for; “ How does the contractor manage his project? What technique does he use? Why?, and how efficient is it? “

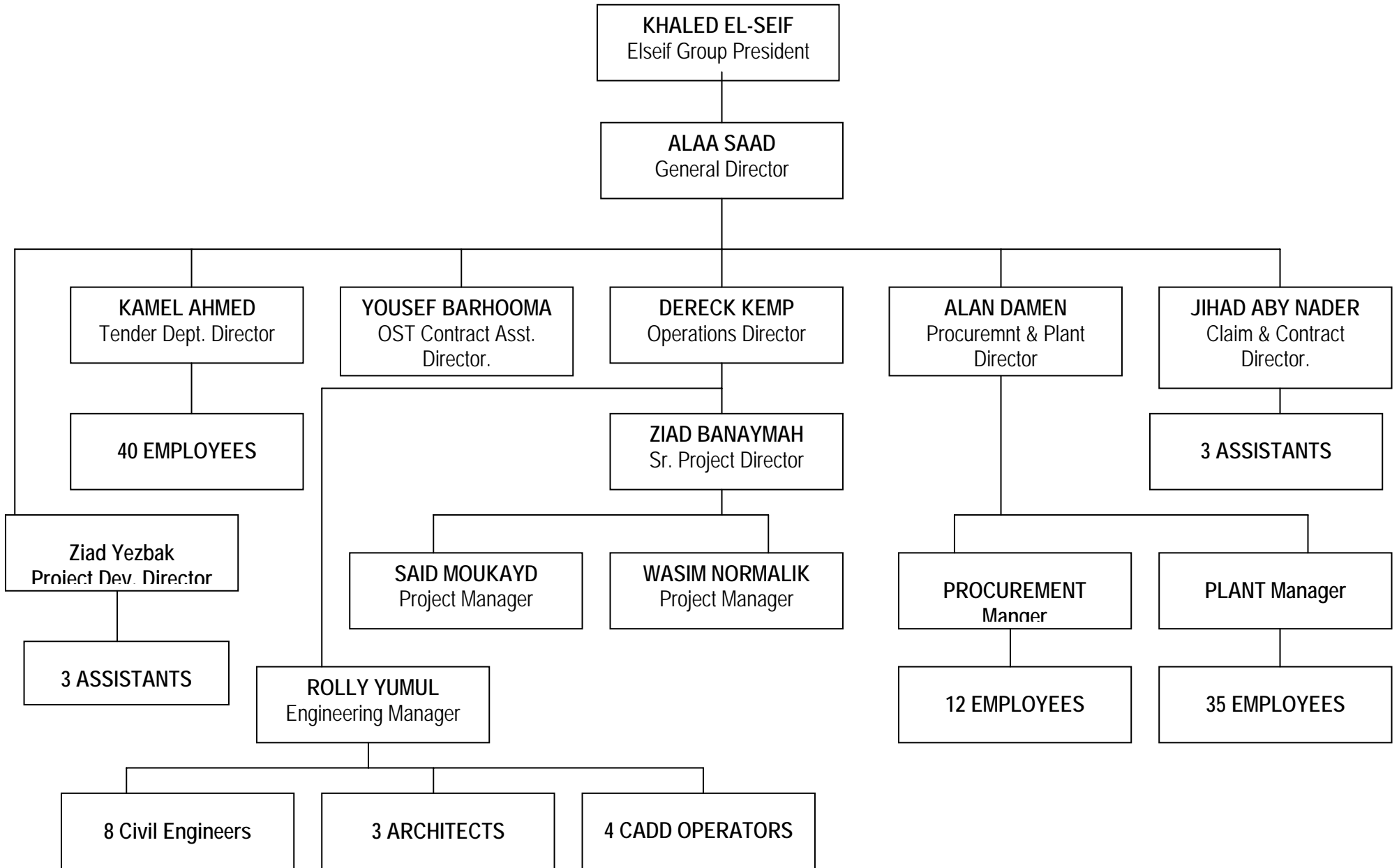
Contractor's Organization

ESEC is headed by ElSeif Group President (Mr. Khaled ElSeif). He is responsible for all company projects performed within the Kingdom of Saudi Arabia. A QA/QC manager, a safety & environmental engineering manager, and a Deputy Projects Director (Site Manager) report directly to the Project Director, plus project development manager.

The general director plays the role of managing the heads of the company's departments & interferes in supervising, checking the ongoing projects or bidding, and report directly to Mr. Khaled ElSeif (President) as the rest of the department heads each are role to run his department professionally and reporting to Mr. Alaa (General Director).

In the scale of each project, the project manager utilizes the Security Manager, Subcontracting Administration Manager, Logistics Manager, Commissioning Manager, Training Manager, Project' Material Coordinator, Personnel Manager, Site Control Manager, Site Administration Manager, and the Field Engineering Manager to ensure that all required resources (Material, Equipment, Labors, Subcontracting, Purchasing....) are available for the Construction Managers to complete their projects with minimum cost and duration.

The Construction Manager employs Site Superintendents from different disciplines to manage the daily construction activities. (Refer to appendix for a schematic organization chart). He coordinates daily with the Site Control Manager to update him about the daily progress and to forecast upcoming activities. They also, identify any problem areas which may require corrective action or higher management involvement.



Contractor's Major Projects

ElSeif Contracting Engineering Company (ESEC) has accomplished many projects within the local area since it has been established under different contractual agreements (Lump Sump Turn Key, Lump Sum, and Unit Rate Cost plus; classified, etc). Alternative project types in alternative sites have been built and vary between residential, commercial, and industrial. Projects' values range from SR 150,000,000 to SR 942,000,000 and more (A list of the major projects is attached in the Appendix.)

Lately ESEC has been involved in big value project in Saudi Arabia which are well known by most of the people not only who are in the construction industry. Those projects previously mentioned are; Kingdom Hospital in Riyadh (SR 220,000,000), Kingdom Center in Riyadh (SR 942,000,000), and AlTaamer Shopping Center-Riyadh (SR 45,000,000). The major projects ESEC is currently working on are Qatar Government Hospital in Doha (SR 600,000,000) and Transportation project in Iraq. In addition to those projects, ESEC was the general contractor for Lebanese Government Hospital in Lebanon. From above it can be recognized that ESEC has the experience in construction under alternative specialty.

Project Management Techniques

A project is usually one time effort. Although similar work may have been done previously, every project has its own features and therefore is of non-repetitive nature. In order to complete the project tasks efficiently, the project manager must plan and schedule largely on the basis of his experience with similar projects. During the course of the project, he will have to re-plan and schedule due to unexpected progress, delay or technical conditions. Project manager has to assure that project completion is within the budget and on time to satisfy the owner's requirements. This involves the use of modern technology, plant and equipment and scientific methods of exercising control on all activities of the project. Main features of this are:

- Proper planning, design and site investigations.
- Use of scientific and mathematical instruments for quality control.
- Training of skilled and supervisory field staff for specific jobs.
- Use of CPM, PERT, and bar charts or even developing their own way to ensure timely execution of different elements of the construction project.
- Use of works diaries for recording day-to-day progress and outputs.
- Use of log books to record consumption and outputs so plant, equipment, machinery and vehicles.
- Introduction of usage rates for purpose of debiting the project in respect of the usage/hire of plants, equipment, and machinery.
- Cost control study to check the performance of the position of expenditure with reference to budget allotment and administrative approval.
- Arrange periodical audit of the expenditure incurred head wise (store, machines, labor, and supervising staff).

To ensure all of previously mentioned, ESEC developed their own way of project scheduling and planning technique which is basically using Critical Path Method known as C.P.M. but concentrating on the quality manner since the company is well-known in the local market and have built their history to be specialized in high rise building and professionally occupied building such as hospitals where big effort in quality management is required in this kind of projects.

This technique is called **Project Quality Plan (PQP)**

1.0 Purpose & Scope

The purpose of this quality plan is to define specific key requirements related to quality performance and ensures a thorough understanding of such by all project parties concerned.

Through PQP awareness and implementation the performance of the engineering, procurement construction and support functions may effectively and efficiently achieve their objectives and provide the Client with a project that fulfills their quality requirements and expectations.

The PQP is supplemental to the ESEC Quality Management System (QMS) and provides the mechanism to link specific requirements of the Client / project to those of the ESEC quality system.

In summary the PQP details the activities and responsibilities related to

- Mobilization
- Design and Engineering
- Procurement and Material Management
- Planning
- Execution
- Coordination for Major Subcontractors and Specialists
- Quality Control
- Contracts Administration/Cost Control
- Document Control
- Warehousing
- Quality Assurance
- Site Administration

And ensuring that these related activities are planned, implemented and controlled and their progress and effectiveness is monitored.

The above summarized and referenced key activities are further expanded upon within the following PQP Section 2.0.

2.0 Key Activities and Output

Necessary project planning and controls shall be established as part of the developed ESEC Quality Management System and as appropriate the quality plan refers to this documentation under the key activity headings within this section.

2.1 Mobilization

Mobilization is defined as the period starting from contract award and continuing until all Construction Support facilities and infrastructure /

accommodation is complete. Key activities and controls to be established are:

- Programs – design / procurement / construction.
- Plant and equipment approved budget
- Organization and staff resources
- Document control system.
- Issue of commercial reporting formats
- Authority limits
- Procurement tracking system
- Project Quality Plan (including method statement scheduling)
- Project Safety Plan
- Setting up of site offices, accommodation, temporary works.
- Initiation of early temporary or permanent work materials procurement
- Labor histogram and mobilization plan

2.2 Design and Engineering

Review of contract drawings, specifications obtain / provide clarifications, coordinate among all related disciplines and produce shop drawings within performance parameters. Key activities and controls to be established are listed below:

- Design review and approval process/procedures
- Design and engineering production program
- Design and engineering procedure for external/internal reporting
- Organization of design and engineering personnel
- Engineering drawing production
- Identification, notification and implementation of changes
- Drawing submittal

2.3 Procurement and Material Management

To prepare technical / commercial packages comparisons for permanent materials and to secure competent and reliable sources for procurement. Key activities and controls to be established are:

- Procurement program
- Preparation of material submittal for Client approval in accordance with the terms of contract agreement, contract scope of work, approved drawings and specifications
- Approved material deliveries to the project warehouse
- Procurement tracking report on suppliers

2.4 Planning

To develop planning schedules, monitor, accommodate changes and report progress. Key activities and controls to be established are:

- Mobilization program covering all aspects of mobilization, design, procurement and early construction activities

- Detailed construction program
- Program review
- Work package program for subcontractors
- Program Monitoring and control

2.5 Execution

Execute the construction program within the set performance parameters defined by approved shop drawings, approved material submittals and approved quality controls.

Key activities and controls to be established are:

- Short term programs to direct and control the works
- Weekly productivity reporting/Planned vs. Actual Progress
- Weekly procurement reporting
- Formal pre-qualification of subcontractors and suppliers
- Weekly design progress reporting
- Method statement schedule and update as necessary
- Inspection and test planning (Process Control Sheets)
- Monthly quality performance reporting
- Monthly safety performance reporting
- Monthly update of the contract program

2.6 Coordination of Major Subcontractors and Specialists

Coordination of technical matters, material procurement deliveries to site and site progress. Key activities and controls to be established are:

- Monitor material and drawing submittals and timely processing of such with client for approval.
- Coordination with internal/ external parties to ensure potential problems is high-lighted and reported.
- Monitor and report on progress and performance at scheduled weekly progress meetings

2.7 Quality Control

To carry out the QC activities required for achieving compliance with defined plans and specifications through the organization of respective works on site and monitoring quality activities. Key activities and controls to be established are:

- Coordination of the review of subcontractors / supplier quality related documentation and QA/QC resources
- Preparation and monitoring of defined process control documentation ,inspection and test planning and associated work execution
- Establishing coordinated inspections and tests and associated records
- Recording of observations /non-conformance and corrective / preventive actions

2.8 Contract Administration / Cost Control

Monitor, administer and protect the Company's contractual and financial relationship with client, consultant, subcontractors and suppliers. Key activities and controls to be established are:

- Construction budget development, monitoring and reporting
- Monthly Cost Value Reconciliation (CVR) preparation and issue
- Settlement of the final account and final cost.
- Monthly Interim Application for payment.
- Identification, recording and notification of changes which maybe identified through any of the following:
 - Variations arising during the preparation of shop drawings.
 - Changes in the scope suppliers / subcontractors / specialist work.
 - Request for clarification.
 - Meetings with the client.
 - Corrective actions identifying errors or omissions in the contract documents.
 - Formal notification from the employer.
- Comprehensive file of each subcontractor / supplier / specialist shall be maintained including signed copies of the subcontract / supplier / specialist, progress and approved payment vouchers.

2.9 Document Control

ESEC Corporate Information Technology and Documentation Department and associated processes and procedures will as appropriate be utilized to develop and implement the following controls:

- Receiving and Distribution of Documents
- Generating Documents
- Document Security, Retrieval and Disposal
- Generating Internal Document
- Information Technology Help Desk

2.10 Warehousing

Receive, store, protect and distribute materials as required by construction. Key activities and controls to be established are:

- Ensure permanent materials are acceptable prior to release for site use
- Status recording and reporting of materials arrival and notification to concerned construction team
- Upon delivery of material at site the following initial verification will be carried out:
 - Inspection of delivery documentation against the Purchase Order
 - Checked for quantities under, over and obvious damage
 - Notification to site QC for inspection
 - Computer data entry in store receiving system
- The issuance of material shall be made on request and warehouse records and computer data base updated accordingly
 - Stores receiving voucher (SRV)

- Site request to stores
- Store Issue Voucher (SIV)
- Materials / services acceptance
- Weekly permanent materials report
- Reconciliation of as-built quantities and material wastage

2.11 Quality Assurance

To carry out the quality assurance activities required for achieving compliance with defined plans, manuals, processes, procedures, and method statements. Key activities and controls to be established are:

- Provision and maintenance of a documented QMS
- Internal audits of documented QMS
- As applicable external assessments of subcontractors and suppliers
- Provision of in-house training on the QMS to project personnel
- Performance reporting for Management Review

2.12 Site Administration

To provide a wide variety of administrative services to the project, including the maintenance of personnel files, handling and storage of consumable materials related to administrative services. Key activities and controls to be established are:

- Transfer of employees between projects
- Transfer of employees within the same projects
- Personnel evaluations in liaison with HO Human Resources Department

3.0 Project Realization

3.1 Introduction

When the process of achieving results is planned, designed and managed effectively, the quality of the end result becomes predictable. To achieve this project goal, assigned key project team members shall plan and develop processes and associated supporting documentation that will encompass a systems management approach. The organization shall implement defined methodologies and monitor their effectiveness and efficiency in order to provide control of the quality of project activities undertaken as summarized in Section 2.0 of this document.

3.2 Design and Development Control

A project management coordination role shall be established by the Engineering Department and key responsibilities, authorities and interfaces (including those with the Client, Sub-contractors and/or Suppliers) shall be clearly defined.

Verification reviews shall be planned and coordinated to ensure that the design results meet with the requirement of national / international specification and

intended usage, which is they are verified and validated with standard construction and civil engineering criteria.

From the approved design the production of shop drawings to complete the work shall be made under the direct control of the Company Engineering function at Head Office.

3.3 Purchasing Control

The Company aims to establish sound supplier and subcontractor relations in order to develop a mutually beneficial relationship that improves the ability of all parties to create value to a project.

Assessment and recording of new and existing suppliers/ subcontractor's capabilities and performance shall be implemented by the Company Procurement and Material Delivery (PMD) Department at Head Office in liaison with project management.

Effective controls shall be implemented to ensure that the interfaces between suppliers/ subcontractors, project management and the Client are clearly defined whilst delivering products or services to the project that meet with the specification requirements.

3.4 Construction

These activities relate to a wide cross section of resources, including a wide base of personnel, skills, plant and equipment.

The Company shall ensure by careful planning the provision of proper project controls during work execution, and satisfactory resourcing for the projects. Such controls will be defined within the following quality system documents:

- Project Quality Plan (PQP)
- Department manuals/ programs
- Processes
- Procedures /method statements
- Records (forms/ formats)

For specific elements of production that are difficult or impossible to immediately validate, (e.g. concreting, painting, welding, etc.) work procedures and/or method statements shall be established for approval prior to the commencement of the work process to ensure that the correct result can be achieved.

3.5 Identification and traceability

Appropriate methods shall be established by both ESEC (HO) and on site for identifying and recording the identification, and traceability status of materials,

products, services throughout all stages of the project as defined in the respective processes for Procurement and Quality Management.

3.6 Preservation

Throughout construction operations, appropriate methods of identification, handling, packaging, storage and protection shall be employed to ensure that all goods, materials, product and site provisions are properly protected from damage, deterioration and loss.

This is also important with regards to property belonging to the Client, which may include intellectual property (e.g. designs, drawings) and project site itself.

3.7 Monitoring and measurement devices

The Company shall determine the extent of monitoring and measurements to be carried out on a project-to-project basis. Suitable measurement and monitoring devices shall then be selected and used to provide evidence of product conformity.

Systems shall be established to evaluate the validity of measurements taken should the relevant measurement by the said equipment be out of calibration.

Effective controls shall be established for Company laboratory and survey equipment, determined as requiring periodic calibration, where consistent verification measurements on product conformity are essential.

Similarly, subcontractors monitoring and measurement devices shall be identified, reviewed and confirmation of their calibration status made.

3.8 Measurement, Analysis and Improvement

This element of project control shall be planned in order to provide a clear organization-wide approach to continual improvement of the project performance of key project activities (i.e. Key performance Indicators) and shall be regarded as permanent Company objective.

Elements of control shall focus on four (4) areas of the Company activities:

- 1) Product conformity - by monitoring and measuring the product (QC)
- 2) Quality management system conformity - by internal and intrinsic audit (QA)
- 3) Continual improvement of the effectiveness of the quality management system by:
 - a) Internal audit (QA)
 - b) Monitoring and measurement of the processes (KPI's)
- 4) Evaluation of appointed Suppliers and Subcontractors.

The documented Company procedures established to define the controls needed in relation to the above can be provided upon request these are as follows:

- | | |
|----------------------|--|
| • QAM-DPR-001 | Internal audits |
| • QAM-DPR-002 | External audits and assessments |
| • QAM-DPR-003 | Improvement and suggestions |
| • QAM-DPR-004 | Inspections and tests plans |
| • QAM-DPR-005 | Permanent material verification |

- **QAM-DPR-006** **Inspection and verification of construction and installation works**
- **QAM-DPR-008** **Non conformance reporting**
- **QAM-DPR-013** **Management review**
- **QAM-DPR-015** **Evaluation and monitoring of subcontractors**

The analysis of data in relation to the results from the above elements of control shall be collected and reviewed in order for management to evaluate where best to deploy appropriate improvement action plans and resources.

3.9 Corrective action

The Company has developed and established a procedure that details and records the corrective actions taken to eliminate the cause of non-conformities in order to prevent their recurrence. Corrective action implemented will be appropriate to the impact of the problem encountered.

3.10 Preventive action

The Company has developed and established a procedure that details and records the preventive actions taken to eliminate the cause of potential non-conformity in order to prevent their occurrence.

Preventive action implemented will be appropriate to the impact of the potential problem encountered.

4.0 Project Management Responsibilities

The goals set by ESEC executive management relevant to the success of any awarded Project shall be effectively communicated throughout the organization and such responsibilities, authorities etc shall be defined and performance monitored on an ongoing basis.

Appropriate communication channels shall be established within the project organization including interfaces with external parties.

A summary of the responsibilities for key project functions is given in within this Section, in line with those specific project responsibilities defined with the relevant ESEC manuals, processes, procedures, method statements etc to be implemented on the project.

4.1 Project Management

Project Manager

- Comprehensive review of all contract documents, and the further development of project planning in line with Company and contractual requirements.
- Provide necessary leadership and resources to Construction for the effective and efficient execution of all project works.

- Ensure engineering controls are effectively established for planning, production and approval of drawings in line with approved project schedules.
- Establish material management controls for the approval, purchase and delivery of permanent materials.
- Review, approval and presentation of progress reporting to the Client.
- Oversee the establishment and reporting on the implementation of Safety and Quality Management programs.
- Promote continuous performance improvement for all project functions to enhance Client satisfaction.
- Detailed performance reporting to the Director of Operations, on time, cost, quality and safety related issues.

4.2 Design and Engineering

Site Engineering Coordinator

- Familiarization and awareness of project design drawings and specifications requirements
- Production of the project shop drawings through assigned drafting personnel
- Coordinate with other disciplines in the Project Engineering function to ensure compatibility of project works
- Maintain continuous coordination with construction team to ensure understanding of project's design and specification details.
- Participate in meetings with other Project disciplines, subcontractors etc and as required resolve civil engineering queries or issues raised.
- Collaborate in producing project progress reporting, forecasts, and as required special engineering reports.
- Coordinate / liaise with other engineering trades.
- Perform other essential project engineering / associated duties agreed and assigned by project management.

Structural Engineer (s)

- Review project structural drawings and specifications.
- Develop the structural shop drawings in accordance with the specifications, designs, and in coordination with all other specializations (i.e architectural, civil, electrical and mechanical).
- Review structure design for modification or change as and when required.
- Collaborate in preparing project studies, reports, forecasts and special engineering reports as and when requested.
- Perform other essential project structural engineering / associated duties agreed and assigned by management.

Architect

- Study the project design drawings and specifications.
- Prepare building material review interface with Project Management.
- Guide and lead Auto CAD Draftsmen in the production of professionally enhanced and well presented drawings.
- Check all drawings to ensure proper coordination among all specializations.

- Arrange the preparation of construction drawing presentations and Architectural models.
- Collaborate in producing reports and clarifications.
- Perform other essential architectural / associated duties agreed and assigned by management.

Drafting Personnel

- Suitably qualified and experienced assigned personnel shall as applicable prepare CAD shop drawings for set architectural / mechanical / electrical / structural work assignments.
- Produce drawings in varying degrees of detail utilizing CAD files and maintaining uniform and professional standard of presentation utilizing approved software.
- Incorporate input given by the Architects / Engineers into the relevant drawings.
- Perform back-up procedures as per defined Company instruction.
- Record and prepare as built drawings from various project sources
- Perform all duties (related to the nature of the job) assigned by his immediate supervisor.

4.3 Procurement and Material Delivery Management

Material Engineer

- Perform detailed reviews of pre / post tender project documentation / quotations, budget details, drawings, bills of quantities and pre-tender quotations.
- Examine contract documents to identify material and subcontract requirements for the project.
- Review project construction schedules prepared by Planning Department.
- Formalize listings of potential suppliers for the different material items and subcontracted scope of works.
- Review received quotations to verify they are in accordance with project specifications, shop drawings, bill of quantities and delivery schedule meets with the project construction schedule.
- Contact suppliers / subcontractors for clarifications concerning their offers
- Prepare a comparison sheet to summarize the contents of received quotations.
- Issue “Permanent Material Approval (PMA)” which is to be reviewed and signed according to relevant Company Process.
- Maintain the Project Material Specification Record (data base)
- Prepare submittals to the client for approval of material, subcontractors and suppliers.
- Provide assistance in the follow-up of material delivery to site.

4.4 Planning

Site Planner (s)

- Study contract documents and obtain complete information necessary to develop detailed construction programs.
- Prepare detailed programs / coding structure to the level of details agreed with the Project Manager.

- Monitor at agreed intervals actual site progress of the works and update the master program logic to reflect any variance, VO issues, changes in sequence / method, etc.
- Participate in the preparation of the necessary programs as required(Weekly, Short-term / periodic etc)
- Prepare various reporting and statistics as requested by the Project Manager.
- Ensure traceability of planning records / programs, progress reporting is maintained and complete backed filing and indexing.
- Perform all duties (related to the nature of the job) assigned by the Project Manager.

4.5 Execution

Construction Manager

- Study contract documentation / specifications and obtain complete information to as necessary assist in the development of detailed construction programs and method statements.
- Examine contract documents to identify material, subcontract and supplier requirements for the project execution / specification compliance.
- Participate in meetings with other Project disciplines, subcontractors etc and as required provide input into the resolving queries / issues raised.
- Collate as-built information necessary for issue for the preparation of as-built record drawings
- Review and evaluate work methodology and sequencing and liaise with the project Manager / Planner regarding suggested work improvements
- Prepare detailed safety planning with the assigned Safety Officer and implement, monitor and manage the overall safety program / training
- Coordinate with assigned subcontractors work packages ensuring ESEC / Client contract requirements are met (i.e. on quality, safety, program and budget).
- Hold daily internal construction coordination meetings and attend scheduled progress meetings, reporting on work performance, coordination issues, time, quality, safety, cost issues against defined / approved programs.
- Organize project work execution utilizing suitably skilled / trained personnel to carry out specific tasks in accordance with approved procedures and specification requirements, including Site Survey works.
- Ensure that Supervisory personnel are provided with the latest revisions of approved project documentation and familiar with documented process control requirements and Request For Inspection system, associated reporting
- Maintain close communication with the Materials Engineer / Warehouse regarding material submittals / approvals, ETA on site and stores receipt and clearance.

Superintendent/Foreman

- Supervise crews of laborers in their performance of assigned work.
- Review drawings and clearly communicate technical issues to the various trades.
- Apply schedules, procedures and related work rules, that meet productivity, quality and safety requirements.
- Report to Site Superintendent on any problems related to the absence of manpower, materials or equipment that relate to time, cost , quality, safety etc

- Assist Site Superintendent in the preparation of construction methods, schedules and manning charts.
- Perform general functions inherent to all supervisory jobs on site operations.

4.6 Quality Control

QA/QC Engineer (s)

- Primarily responsible for the development and implementation of project quality planning throughout all project operations.
- Oversee project inspection and test planning, development and implementation.
- Scheduling and execution of project quality system assessments and audits.
- Liaison with the Clients representative on quality related topics.
- Establish QA/QC records control and retrieval system.
- Implement quality control procedures and related activities in compliance with defined requirements.
- Overall monitoring of site construction activities and QC personnel reporting on inspection and test requirements.
- Site monitoring and surveillance of subcontractors / suppliers against detailed schedules for compliance with defined standards and specifications.
- Monitoring and surveillance of the operations undertaken by the Site Laboratory, including work methods and test reporting.
- As applicable conduct off site inspections for project associated work carried out at subcontractors / suppliers, verification of associated submittals and preparation for client submittal.
- Evaluation of the Observation / Non Conformance reporting systems and as applicable associated corrective / preventive action implementation.

Quality Control Inspector (s)

- Carry out surveillance and monitoring inspections during construction works in accordance with defined inspection and test planning, standards / specifications and approved construction drawings.
- Assessment of potential / actual non-compliances and as applicable issue of Observation/ Non Conformance reporting for management evaluation.
- Completes applicable inspection and verification checklists/ reports to confirm when conformance to specification/ standard has been achieved.
- Liaison with the Clients appointed representative to undertake arranged joint inspections on materials or phase completion of project works.
 - As applicable liaison with the QC Laboratory on test result status.

Laboratory Technician (s)

- Implement system of obtaining random samples of material from suppliers and site.
- Apply and execute the suitable analytical test methods on different material samples obtained / tabulation of results and present reports.
- Prepare and carry scheduled tests and advise appropriate parties accordingly
- Ensure that all laboratory testing and analysis executed in accordance with established quality and safety standards and procedures.

- Revise the stock records of laboratory chemicals and equipment, raise purchase requisitions to the superior for approval.
- Perform routine maintenance on equipment and as applicable periodic calibration of laboratory instruments and devices. Ensure that all laboratory equipment is properly operated, maintained and stored.

4.7 Contracts Administration

Contracts Administrator

- Perform detailed studies of contract and subcontract agreements and documents in view of highlighting the contractual obligation of all parties in the performance of the contract.
- Provide support to the Project Manager in contract / subcontract matters.
- Administer the preparation / review of monthly certificates of payments in coordination with client's representatives to ensure that it captures the total work executed for the period.
- Administer the preparation / review of the subcontractors estimate vouchers for the period.
- Prepare invoices to the client for extra work executed beyond the contract scope of work requirements.
- Prepare invoices for back charges allocated to subcontractors and suppliers and notify HO Finance Department accordingly.
- Prepare and document claims for additional works and time delays and provide support to the Project Manager to secure acceptance from the client.
- Maintain a complete and sufficient record of evidence in relation to every change, obstacles / hindrances or additional work ordered by the client for reference in claim preparation and follow-up.
- Examine historical project correspondence and drawings records to determine the sufficiency of any contractual claims which may be advanced to compensate for additional costs incurred.
- Monitor and evaluate the costs and time implications of the consultant's remarks on submittals for materials or drawing approvals.
- Communicate to project management changes in contractual obligations and implications to the different areas of responsibilities.
- Attend project management progress meetings and meetings with client representatives or subcontractors to address contractual issues when required.

Quantity Surveyor (s)

- Valuation of change orders, pricing of claims and assessment of Subcontractors / Suppliers variation orders and claims.
- Maintain all records / correspondence pertaining to change orders, loss of expenses and delays.
- Assist Contract Administrator in preparation of reports on change orders / claims for Senior Management.
- Participate in negotiation with Client / Consultant / Subcontractor for settlement of final accounts and variation orders.

- Ensure that all executed works and materials on site are correctly valued in monthly payment applications.
- Liaise with Consultant / Supervising Engineer for timely certification of payment.
- Certify Subcontractors / Suppliers interim payments and make adjustment to the amount due to be paid by add / omit default costs arising from breaches and recover ESEC costs as defined in subcontract agreement.
- Prepare statement of account of subcontractors / suppliers.
- Check the quantities measured by Quantity Surveyors prior to forwarding to Procurement Department.
- Submit to accounts department on monthly basis the forecast of revenue and expenditure.
- Preparation of cost reports in coordination with the Project Manager / Construction Manager produced reporting on reconciliation of quantities.
- Prepare final account of main contract and subcontract.

4.8 Site Support / Administration: Site Administrator

- Establish coordination with the project support / HR and Administration Departments at Company Head Office and implement the procedures governing the transfer of employees to and from the project site and the provision of life support services consistent with site conditions and Company policies and procedures.
- Maintain and supervise on site necessary personnel records and files.
- Coordinate with the Administration Department in the Head Office the exchange of work permits and passports etc for necessary government formalities.
- Coordinate the referral of site employees to the Company's physician for medical treatment.
- Act upon reports to Head Office any incidents or accidents resulting in injury, in accordance to local regulations and Company's policies and procedures.
- Ensure the provision of efficient office services to support the project.
- Ensure that office equipment is maintained in proper working conditions and that office furniture is provided and accounted for.
- Ensure that all utility services are provided in support of the project.
- Ensure that a proper and efficient document control and filing system is installed and adhered to in the project management office.
- Guide the transfer of office files to the Central Archive in the head office upon project completion.
- Maintain control of site cash floats available in accordance with Company policies and procedures.
- Prepare site cash reimbursement claims to be approved by the Project Manager and dispatch to the Head Office Finance Department in a timely manner.
- Maintain the workload of purchasers on the project site and ensure that cash invoices and supporting documents are in order according to Company's policies and procedures.

- Ensure that the receipt of consumable materials related to project administration services, its proper storage in site stockroom and its proper issuance are all done in accordance with Company policies and procedures.
- Supervise the work of Camp Boss in the provision of general services for the staff and labor housing in the area of the project and particularly ensures the maintenance of clean and hygienic environment.
- Review payroll timesheets prior to Project Manager approval.
- Review and dispatch all monthly labor and staff timesheets to HO in timely manner.
- Provide assistance in the disbursement of payroll.
- Prepare periodical reports as required by the Project Manager.
- Perform any other duty (related to the nature of the job) assigned by the Project Manager.

4.9 Safety

Safety Officer (s)

- Contribute to the development and implementation of the Project Safety Plan, rules, regulations and safety training programs.
- Ensure that all safety measures are fully implemented with regards to storage and usage of materials and equipment at the various work areas.
- Investigate and report on incidents / accidents on site.
- Maintain records of safety audits, incidents / accidents, trend analysis, and make reports and recommendations.
- Accompany Client's safety inspectors on their periodic safety inspections of the site.
- Provide guidance to maintain site cleanliness and tidiness standards.
- Monitor on-site equipment usage (tower / mobile cranes, heavy plant etc.) and ensure its safe and proper handling.
- Perform any other duty (related to the nature of the job) to be assigned by the Head of the Safety Section.

Why use PQP?

The well-known techniques are; WBS, CPM, PERT. WBS is preferred because it keeps performance measurements at a reasonable technical data information level using common sense. Moreover, WBS is often the source for project Gantt charts, which are used to establish a work schedule. While CPM is used because;

- It logically determines activities that should be adjusted (time and logic) to complete the project on time.
- It pinpoints trouble spots before they occur
- It provides selectivity of important activities to control

The PQP is supplemental to the ESEC Quality Management System (QMS) and provides the mechanism to link specific requirements of the Client / project to those of the ESEC quality system.

Effectiveness of ESEC Project Management Techniques

The success of any construction contractor depends mainly on its ability to plan, schedule, and control the projects on hand. This study shows that ESEC is implementing a project quality plan system which routinely collects and records the information from the start of the project

It has been generally seen that although considerable progress has been made in the design of engineering projects, the progress in the planning or execution of the projects, has been far from satisfactory. In a majority of major projects the period of completion and the estimated cost change considerably. This type of shortcoming can only be overcome by ensuring that each and every activity that forms part of a project is considered logically, And in the correct sequence. Likely bottlenecks should be foreseen well ahead and remedial action taken. The required control on the progress of the various activities can only be exercised by the CPM network system of analysis. Since the CPM has the following advantages;

- The activities of the work are integrated into the time-schedule and hence calendar-wise schedule of commencement and completion of each activity, manpower, machinery, and resources can be drawn.
- Inter-relationship and sequence of performance of various activities/items of work are clear from the network.
- Builder and executive responsible for the conduct of the project can determine the time when various resources (men, material, machines, and equipments) are needed and procurement action can be taken accordingly.
- From the schedule of procurement thus prepared, difficulties can be visualized well in time and timely action for removing them can be taken.
- In the event of the program getting upset due to some unforeseen reason, a revised CPM chart can be prepared to avoid further loss of resources.

- Realistic time to complete the project can be ascertained by going into the details of time required and sequence of each activity.
- During the execution of the project, the output constants for various tasks can be revised in the light of the output experience gained during the execution of the project.
- The network scheduling ensures optimum use of the men, machine, and materials.
- The executive gets a reliable and valuable aid to assess progress of the work and exercise the required control.

Thus the network analysis helps in locating trouble spots and bottlenecks and adverse situations can be avoided by proper planning. Any delay in the period of completion adds considerably to cost and by CPM networks analysis such expenditure can largely be avoided if not altogether eliminated.

Conclusion

ESEC is a very well establish international construction contractor who has implemented project quality plan for project management techniques. All the projects completed for local market throughout the past were within schedule, and within budget or less. Except in few projects due to project owner interference.

Review of the scheduling technique used by ESEC showed that they have a strong system in-place. It is capable of breaking any project into small manageable activities, scheduling those activities in a logical order, and monitoring and controlling the actual progress of those activities.

APPENDIX

List of the major projects:

Project Name	Location	Amount/Value	Remarks
Kingdom hospital	Riyadh	220,000,000	
AlMarai CPP2	Kharj	165,000,000	Design & Built
Kingdom Tower	Riyadh	942,000,000	
AlTaamer Shopping Center	Riyadh	450,000,000	
Zahla Hospital	Zahla-Lebanon	80,000,000	
Qatar Hospital	Doha-Qatar	600,000,000	Ongoing Project