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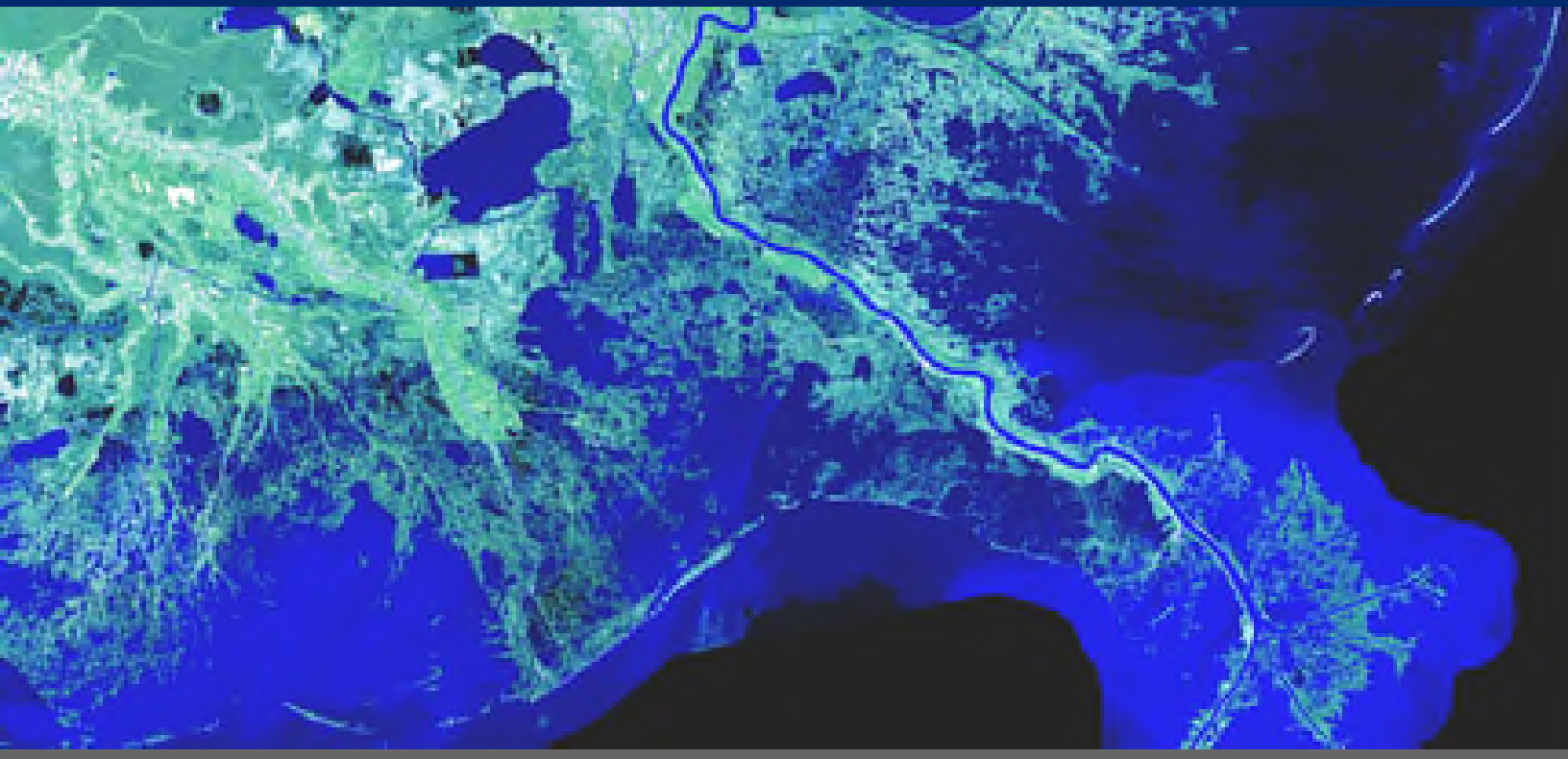
REFERENCE FOR CONSTRUCTION MANAGEMENT AND CONTRACTING PROCESSES: AN ECCM TRAINING DOCUMENT



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Reference for Construction Management and Contracting Processes: An ECCM Training Document

FOREWORD

Core Engineering and Construction Contracting Management (ECCM) training program resources have been made available as helpful resource documents for planning, preparing solicitations, and implementing and managing construction projects.

ECCM TRAINING COURSES

The ECCM 201 course was initiated through a task order awarded under the Bureau for Economic Growth, Education, and Environment's (E3's) Architectural and Engineering (A&E) Global IQC and transferred to M/OAA/PDT to complete course development and management. Subsequent to the task order transfer ECCM 211 - Local Systems (LS) was created. ECCM curricula were produced based on adult learning principles and are available for all USAID staff. The program is designed primarily to improve USAID's Acquisition Workforce (AWF)[1] contractual knowledge about and access to A&E and construction services, best practices, lessons learned, and reference materials when undertaking construction projects in the development context. The ECCM training program will assist the USAID AWF to achieve the ultimate objective of a successful construction project - completion according to specifications, within budget, while meeting industry quality standards, notwithstanding all construction challenges. Missions may desire, as appropriate, request technical engineering support services from the E3, Office of Energy and Infrastructure Programs (E&I) or USAID regional missions.

ECCM curricula are intended to emphasize U.S. Government rules and regulations, and USAID operational guidance and policies when implementing construction projects in partner countries. ECCM curricula combine lecture-style presentations with interactive discussions and group activities to provide participants immediate operational skills and knowledge. Course materials include presentation slides, group exercises and discussions, checklists, and many short videos and supporting reference and resource materials.

M/OAA/PDT and E3 sponsored training classes for over 300 USAID AWF members primarily through the two courses -- ECCM 201 and ECCM 211 - LS. All interested USAID staff are strongly encouraged to enroll in ECCM courses through USAID University. Below are brief descriptions of the ECCM 201 and ECCM 211-LS and a list of additional "Supplementary Training Resource Documents":

ECCM 201

The overall goal of ECCM 201 is to provide the USAID AWF with basic operational skills and competencies related to procurement and management of construction projects. This course covers many ECCM contracting subject matter areas including alternative procurement instruments and financing options, the construction program life cycle and its phases, and sequencing relationships including planning, design, procurement, construction, oversight, post construction, operation and maintenance (O&M), and sustainability.

[1] Acquisition Workforce in defined as Contracting/Assistance Specialists, Contracting/Assistance Officer Representatives, Purchasing Series staff, Executive Officers Foreign National Procurement Staff and Personal Services Contractors employed as procurement staff.

ECCM 211- LS

The ECCM 211- LS course curriculum was designed as a follow-on course to ECCM 201. The overall goal is to provide USAID AWF with additional and higher-level knowledge, skills, and competencies for complex construction project situations, choice of implementation instruments and financing options when using direct contract, assistance, host country contracting (HCC), and government-to-government (G2G) instruments. ECCM 211-LS makes extensive use of example documents as learning guides to provide the USAID AWF "real-time" exposure to common procurement, implementation, and management issues.

ECCM SUPPLEMENTARY TRAINING DOCUMENTS

Supplementary training documents were drafted by former senior USAID engineers and funded by M/OAA for the ECCM training program and include updated USAID guidelines and procedures. These training documents have been tailored to support the AWF's understanding of selected ECCM processes. We anticipate that USAID's AWF and other staff will find these documents useful and are welcome to read and download them as needed from the M/OAA/PDT web page. The ECCM supplementary training documents completed to date include:

1. Reference for Construction Management and Contracting Processes: An ECCM Training Document prepared by Fred Zobrist, 2017

2. Construction Management, Contracting, and Oversight Principles: An ECCM Training Document prepared by Moenes Youannis, 2017

3. Construction Tendering And Contracting Guidelines: An ECCM Training Document prepared by Michael Gould, 2017

4. A Basic Reference for Architectural and Engineering (A-E) Contracting: An ECCM Training Document prepared by Michael Gould, 2017

5. Use of Government to Government (G2G) Fixed Amount Reimbursement (FAR) in Construction Projects: An ECCM Training Document prepared by Moenes Youannis, 2017

6. Use of Host Country Contracting in Construction Projects: An ECCM Training Document prepared by Moenes, 2017

With my compliments,

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ACRONYMS

A-E	Architect-Engineer Firm
AIDAR	USAID's Acquisition Regulations
ADS	Automated Directive System of USAID
AO	Agreement Officer
AOR	Agreement Officer Representative
ASCE	American Society of Civil Engineers
BoD	Basis of Design
BOQ	Bill of Quantities
CBD	Commerce Business Daily
CDCS	Country Development Cooperation Strategy
CM	Construction Manager
CMC	Construction Management Contractor
CO	Contracting Officer
COR	Contracting Officer Representative
CPFF	Cost Plus Fixed Fee
CPM	Critical Path Method
DAC	Development Assistance Committee
FAA	Foreign Assistance Act
FAR	Federal Acquisition Regulations
FIDIC	Federation Internationale des Ingenieurs-Conseils (International Federation of Consulting Engineers)
HGIU	Host Government Implementing Unit
IDI	Indefinite Delivery Indefinite Quantity Contract
IEE	Initial Environmental Examination
IFB	Invitation for Bids
IGCE	Independent Government Cost Estimate
O&M	Operations and Maintenance
PAD	Project Assessment Document
PD	Preliminary Design
PDP	Project Design Plan
QA	Quality Assurance
QC	Quality Control
RFP	Request for Proposals
RFQ	Request for Qualifications
SOW	Statement of Work
USG	US Government
USAID	United States Agency for International Development

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EXECUTIVE SUMMARY

This supplementary training document covers the basic steps in the process of planning, designing, and contracting for engineering expertise and infrastructure construction projects funded by the U.S. Agency for International Development (USAID). It is intended for training and guidance of USAID engineers and other development staff responsible for planning, engineering design, managing and oversight of construction projects awarded with a direct contract using the Federal Acquisition Regulations, ADS, and AIDAR policies and guidance. This supplementary training document may also act as a useful reference when implementing any infrastructure project where engineering and construction are important components.

The starting point for undertaking successful construction projects discussed in this supplementary training document, begins with a construction project or program that has been identified in the Mission Strategic Plan, and for which the preliminary environmental, gender, feasibility, and costs studies have been completed during internal and preliminary USAID planning and design activities. Often, before funds can be obligated for the actual construction phase, more technical and cost detail will need to be completed during an engineering design phase. In addition, reliable construction cost estimates must be obtained prior to solicitation for a construction award in order to meet the requirements of FAA Section 611a through e.

An example construction project is utilized in this supplementary training document to illustrate the typical steps and phases project managers may face during the engineering design and implementation of construction projects. The example project includes references to a number of environmental, social, and engineering issues which could be encountered in USAID cooperating countries.

The first step during the engineering design phases will be to make sure the project is clearly defined, and to review the limits and restrictions that must be addressed. Conditions precedent of the financing or assistance agreement must be met if a Host Country Contracting (HCC), Government to Government (G2G), or Public International Organization (PIO) procurement approach will be used. This step includes deciding what set of engineering standards should be used - US, international, and/or local. Local laws, customs, policies, and other parameters affecting completion of the construction project should also be addressed at this time.

To define a construction project's objectives more clearly, it may be necessary to complete, or add more information to a number of background studies completed during the USAID planning phase. These Basis of Design (BoD) activities include but are not limited to: examinations of alternative approaches for providing infrastructure services; special engineering issues; more detailed environmental impact assessment with further mitigation measures; community and stakeholder outreach and participation programs; and detailed cost estimates needed to meet the mandatory requirement of FAA Section 611. USAID technical staff can often address primary aspects of many of the BoD activities during its planning phase. However, for complex projects, it may be necessary to procure the services of specialist

consultants easily accessible by an Architecture and Engineer (A-E) firm.

Next, the supplementary training document discusses the steps necessary to procure the A-E consultant for work that has been divided into several independent activities in three sub-phases. Sub-phase 1 includes: (1) the BoD report; (2) completing the preliminary design; and (3) completing the final design (to be used for the tendering process to hire the construction contractor). Phase 2 includes possible A-E technical support assistance with the tendering (award of the construction contract) process. Phase 3 includes A-E construction oversight and administrative and management technical support assistance. These Phases can be approved together in the A-E contract, or approved as independent sets of activities within the three Phases. Example tasks and deliverables are presented and discussed for each Phase, as well as the procurement process in this supplementary training document.

Once the BoD study phase has been completed and approved, the A-E would be directed to undertake the remaining two sub-phases in the engineering design phase - each of which will require USAID review and approval.

The USAID planning Phase is usually completed prior to the A-E led engineering design Phase. Procurement of the A-E contractor occurs prior to procuring the services of a construction contractor, because the construction contractor will want to know what services the facility to be built is supposed to provide, the engineering and material specifications, and all other information.

The tendering Phase involves discussion of and selecting the appropriate construction contractor bidding or proposal evaluation process. Other key issues include selection of the construction contract model, and approaches to be used for quality assurance and quality control. The bidding or proposal process discussion addresses pre-qualification, the documents and process needed for the invitation for bids, bid evaluation, and the pre-construction conference.

The A-E contract responsibilities during the construction phase is divided into two parts. The first part covers contract administration and the second covers contract oversight. Contract administration involves general project requirements such as paper flow and records, quality control and review of payment requests, which are the responsibility of the participating parties to prepare and approve. Construction oversight provides and ensures overall quality assurance.

The last Phase is post-construction – the Operation and Maintenance (O&M) Phase. Activities will typically include, but are not limited to startup of the facility, training activities, preparation of operating manuals, and warranty follow-up. USAID has often supported the procurement of follow-on contracts for O&M technical support by either the A-E, or construction contractor. One contentious area that must be addressed during the O&M phase will be the settlement of any residual claims by the construction contractor (or by USAID). Claims are regarded as a common occurrence during construction contracts and should be anticipated by USAID with an understanding of its legal responsibilities and the claims process.

USAID project managers/engineers – including the Contracting Officer (CO) or Agreement Officer (AO), the Contracting Officer Representative (COR) or Agreement Officer Representative (AOR), and the Activity Manager (if appropriate) - have the responsibility to assure that the process of contracting for engineering and construction and management of these activities are carried out professionally and in accordance with USAID regulations and guidelines. Other USAID staff will have authority for selected actions including financing and, legal issues, and other approvals. However, the project manager/engineer has overall responsibility for

the completion of the construction project and that required actions are completed in a timely and cost-effective manner. This requires that the project manager should have a broad understanding of engineering and construction contracting processes, the constraints and issues normally encountered when working on construction projects in developing countries, and USG and USAID procedures and regulations pertaining to construction projects.

1. OVERVIEW

This supplementary training document has been prepared to introduce engineering and development professionals to the basics of engineering design and construction contract management. It describes the basic approaches to managing U.S. Agency for International Development (USAID) engineering and construction contracts, and outlines the steps needed to meet the Agency's goals for long-term meaningful results and development impacts. USAID's engineering and project officers have been given responsibility for managing its construction and engineering contracts. Other USAID construction supplementary training documents address engineering design and construction contracting management subject matter in more detail and are referenced during the following discussion.

1.1 CONSTRUCTION PROJECTS AND CAPACITY BUILDING

USAID construction projects can be as small as a one-room rural health clinic or pit latrine. They can also be quite large, costing over $100 million for a new sewage treatment plant or for reconstruction of a major road. Regardless of project funding level or size, it is USAID's responsibility to ensure that the construction project is built properly and meets design specifications, uses good construction management methods, functions as designed to provide services, and is sustainable for years into the future with proper maintenance and operation.

Thus, USAID's responsibility is to develop contractual and assistance mechanisms and procurement approaches that clearly address the design, plans, specifications and responsibilities of all parties involved. A construction project's sustainable success requires operational and management knowledge, skills experience, and technical abilities on the part of those implementing and managing the construction activity.

However, many professionals in the developing world have not yet internalized the core infrastructure, construction, technical, and management, skills and other competencies which are often taken for granted in more advanced economies. For this reason, USAID should always consider incorporating infrastructure sector capacity building activities into many of its construction projects. These construction projects usually require follow-on contracts for operations and maintenance support that include an emphasis on broad training requirements. As a result, USAID also has the development responsibility to ensure that the final Owner of the project will have many, if not most, of the primary skills needed to successfully construct, operate and maintain similar construction projects in the future.

1.2 THE ACTORS IN CONTRACT MANAGEMENT

There are a number of team members involved in the implementation of USAID-financed construction projects. It is important to clearly define the role of each team member at the beginning of the project to ensure there is little opportunity for confusion about responsibilities later. Some of the primary team members and their roles and responsibilities are identified in this section.

1.2.1 U.S. Agency for International Development

USAID is usually the sponsor and provides funding for the infrastructure construction project, and in these situations will contract directly with A-E and construction companies for project implementation. USAID also uses other procurement approaches to implement construction projects such as HCC, G2G, and cooperative agreements, where its role is primarily that of the financier.

Typically USAID construction related contracts will be direct and to a lesser extent HCC. Both will require major involvement by project managers and engineers during implementation. Other contracting approaches such as G2G and Cooperative Agreements will involve limited input by project managers and engineers as responsibilities have been transferred to the implementing agency. Monitoring would normally require routine inspections during construction and closeout. The most common construction G2G contracting method is the Fixed Amount Reimbursable (ADS 220, 317, 630). The supplementary training document "Use of Government to Government (G2G) Fixed Amount Reimbursement (FAR) in Construction Projects: An ECCM Training Document" outlines the Fixed Amount Reimbursable Agreement process (FARA). HCCs also transfer implementing responsibilities but require selected USG regulations and conditions of a direct contract be used. In this case project management and engineering efforts shift from an action role to more of a mentoring and oversight role. The lack of skills and experience of the implementing agency can result in time management requirements exceeding the direct contracting process for the Project Manager.

The USAID construction project team includes the following professionals.

Project Manager. A USAID engineer or project officer with similar experience usually fills this role, although an experienced engineering manager is generally required as a best practice for larger construction projects. The project manager is responsible for making sure that other members of the team are participating and providing management assistance when needed, interfacing with cooperating country officials, communities, and stakeholders, and managing the A-E and construction contractors. The project manager will work closely with the contracting officer (CO) and serve as his representative on contractual matters. In this role he will be the Contracting Officers Representative (COR). Project Manager and COR are terms used to identify the same individual in the supplementary training document and are used interchangeably.

Another part of the project manager's job is to ensure that the project is completed on time, assist with any change orders, provide assurance that construction is in accordance with technical engineering and materials specifications, and is completed within the expected budget. The project manager is also responsible for reporting, processing and approving payment documents; drafting and processing documents that require approval from a higher authority; tracking progress; making site visits; drafting responses to Congressional inquiries; and anticipating and resolving problems and possible contract disputes before they evolve into claims or other major management issues. With HCC and G2G contracting, most of these actions are transferred to the Host Government.

Project engineer. This role is filled by a professional engineer, who has a background, technical skills, and operational experience that are relevant to the project. For example, electrical and power engineers would be assigned to a power plant and a civil engineer to a road project. Multidisciplinary engineers are classified as general engineers and can work on different types of

projects. A project engineer often may jointly serve in the role as the project manager/COR.

Project engineers can often work on several construction projects at the same time, while a project manager would be assigned to one or two projects, depending on their size. A project engineer's role becomes much more important if the project manager does not have an engineering background because of the additional requirement of providing assistance with engineering issues.

Comptroller. The comptroller is the project's financial representative and is an important team member. The comptroller has the responsibility of assuring that sufficient funds are available and payments are timely and correct. Construction contractors can face major financial problems and possible insolvency if payments are not timely or are incorrect.

Legal advisor. It is important to keep the legal advisor informed of a project's progress, especially if legal problems appear to become substantial issues. The legal advisor has the responsibilities of assuring the project team that legal and contractual documents are correct, and providing legal assistance when claims or contract issues such as defaults need to be resolved.

Contracting officer. The CO has the final authority over all contracting issues. This individual will ask for, as well as rely primarily on the project manager's, legal officer's, and engineer's advice when making decisions. With HCC's the CO's role is minimized and legal officer's increased.

Environmental officer. The environmental officer is responsible for ensuring that the environmental requirements and mitigating measures under 22 CFR 216 for the project have been met. It is common for construction projects to require an initial environmental examination (IEE) and a more detailed environmental impact assessment (EIA). The background studies required for a construction project may have determined that several initial environmental issues needed mitigation. The engineering design process and additional or supplemental geotechnical or site evaluation studies may also identify environmental concerns that trigger additional analysis and mitigation measures.

Mission director. The Mission Director has the final authority over all Mission projects, including a construction project, and should be kept informed of its progress and of all significant potential problems. The Mission Director must sign the approval memorandum for the Project Assessment Document (PAD), and also approve funding and its release for the construction project. The PAD approval memorandum provides approval to proceed with the engineering design of the construction activities for which certain minimum planning criteria have been satisfied (ADS 201.3.3.8 and 13).

1.2.2 Beneficiaries

The beneficiaries of a project are usually represented by a senior member of the particular entity of the cooperating country government. The representative would be responsible for accepting the assistance for community representatives, stakeholders, and other individuals representing groups designated as beneficiaries. The cooperating country representative will usually be a Minister, but could also be a representative of a city, province, or a government agency such as a utility. The cooperative country entity taking ownership of the facility must bear ultimate responsibility for approving, operating and maintaining the project. The beneficiary usually shares the cost of the construction project with either cash or in-kind services.

1.2.3 Engineering Design Professional

The engineering design professional is usually an A-E firm (A-E) contracted under the FAR. When alternative procurement is made for an A-E firm through HCC, G2G, and cooperative agreements,

International Federation of Consulting Engineers (FIDIC) or FIDIC based contracting arrangements are often used. When this occurs, the A-E is referred to as the Engineer, using the FIDIC based terminology. The Engineer usually has more extensive and different responsibilities than those provided by FAR contracting procedures.

The A-E, will frequently use subcontractors to provide specialty expertise such as surveying, materials testing, and soils surveys. Larger A-E firms generally will have broader in-house capabilities and may have direct access to their own in-house specialists. A-E can be contracted for a range of work, including feasibility studies, project design, tendering, various aspects of construction oversight, and post-construction training, and operation and maintenance (O&M) support.

1.3 INTERNATIONAL POLICY AND LAW

The construction project management team needs to be aware of all USG and USAID legal requirements, regulations, and policies, especially international rules and regulations. The legal officer can clarify any questions or concerns as to the appropriateness of using international documents. Both the legal officer and the contracting officer can clarify and provide advice for any necessary incorporation of USAID mandatory clauses within international documents.

With USAID direct contracting, the Federal Acquisition Regulations (FAR) and USAID's acquisition regulations (the ADS and AIDAR) provide the controlling requirements and policy guidance. International A-E firms and construction contractors are generally more familiar with the FIDIC-based contract conditions. These contract conditions need to be amended by the entity involved, if necessary, to meet certain FAR and AIDAR requirements.

Most countries have building codes and construction standards, but generally accept international and US standards which are usually more complete and have more specific quality specifications. USAID contractors generally follow U.S. building standards, but international and local standards are acceptable if they are amended to include any mandatory USAID conditions.

USAID project managers must ensure that USG and Agency policy guidance, regulations, and legal requirements and considerations have been fully addressed when implementing construction projects:

- That financing agreement conditions precedent are met
- Engineering design plans and specifications are compatible with local conditions, the capabilities of local construction firms, the recipient entity, and the skills of the operations and maintenance work force
- Local laws, customs, and requirements are fully considered and incorporated into the final engineering design

In addition, construction project managers are responsible for the timely and professional implementation of a project and should use the following tools:

- Maintaining a project schedule for use by all players
- Holding routine meetings with the team members and the contractors to assure that progress remains on schedule

For projects using local construction contractors, international and US standards may be unfamiliar and must be adjusted to be user-friendly – sometimes with waivers. For example, working with U.S. weights and measures will be problematic for a construction contractor who is only familiar with the metric system. Also, the policy of specifying building materials and equipment to be imported from the US should be adjusted to meet local materials and equipment

capabilities. Supplying imported equipment when parts are unavailable or equipment cannot be properly maintained should be avoided.

1.4 MAJOR MILESTONES

Construction project managers have the responsibility of ensuring that the project stays on schedule. However, problems and delays will occur and these situations must be anticipated. It is important to maintain a checklist of all potential and actual problems and delays and keep channels of communication open with all those involved. Providing a construction contractor's schedule, including major milestones and the critical path activities to all key players is an important management tool. The construction schedule should be updated routinely and whenever changes occur. Examples of major milestones for implementing a construction project include:

- Development of a detailed description of the project and required steps to complete it
- Completion of any supplementary and special background and technical studies
- Procurement of a final engineering design
- Approval of the preliminary and final design cost estimates
- Approval of the preliminary and final designs
- Prequalification of possible construction contractors
- Dates for A-E and construction contractor issuance of solicitations
- Dates for invitations for bids or requests for proposals delivery
- Planned dates for the A-E and construction contract awards
- Dates for the construction project completion and dedication

1.5 SUPPLEMENTARY TRAINING DOCUMENT EXAMPLE

This supplementary training document uses a construction project example to demonstrate

The hypothetical example used in this report is a neighborhood located in a developing country that has experienced flooding similar to that caused by Hurricane Katrina, which struck New Orleans in 2005.

This neighborhood lies in an isolated drainage basin, with hills on three sides that prevent any flooding from those directions. The fourth side is approximately 1,000 feet wide at its narrowest point and is open to the sea and threatened by major storms.

A floodwall is being considered to be built on this open side. There are a dozen homes located in the basin and they have been there for a number of years. The area is also experiencing some subsidence, resulting in increased flooding problems. A natural sand dune provides some protection to the area from storms and sea flooding. It has an average height of about 10 feet above mean sea level, but is intersected by a natural drainage channel from the area. All of the houses have floor elevations near sea level. A storm event similar to Katrina would have flooded all the homes to about the rooflines. If another flood were to occur, the villagers would expect that there would be at least 15 feet of water at the point where a floodwall might be constructed.

various approaches and steps required to successfully implement construction projects.

The example also assumes that the USAID project manager is an experienced international development officer with demonstrated experience managing infrastructure construction projects. It is also assumed that this project management officer is supported by a professional civil engineer (or is a professional engineer with a civil engineering background/training).

2. USAID PLANNING ACTIVITIES

Certain administrative actions are required for any USAID project. This section first describes the mandatory planning requirements for the example project. These are referenced in ADS 201. It then walks through a series of other activities needed prior to preparation of the project's final engineering design.

2.1 MANDATORY REQUIREMENTS

The example project would normally be expected to have been included as one of activities in Mission Objectives in the approved CDCS before being considered for construction funding. The responsible USAID team would have already addressed issues related to the project's Statement of Work (SOW) and general feasibility when it developed the Mission's Assistance Agreement with the cooperating country. Several mandatory requirements would have included an Initial Environmental Examination (IEE) and a gender analysis.

The project's IEE concluded that an Environmental Impact Assessment (EIA) statement would be required because a historic ruin lies on the proposed building site and potentially endangered wildlife inhabit the area of a possible flood wall alignment.

Also, the construction project costs will probably exceed the statutory pre-obligation requirements allowed by the Foreign Assistance Act (FAA) Section 611a. FAA Section 611a applies to obligations in excess of $500,000. This mandatory clause requires that substantive technical, engineering, and financial planning be completed prior to project authorization, which would require detailed engineering studies. This requirement must be completed before the PAD approval memorandum is signed and the project funding is obligated.

2.2 PLANNING STEPS

ADS 201 guidance for planning construction projects requires seven sets of activities during the Project Design Plan (PDP) and the Project Assessment Document (PAD) process before the project would enter the engineering design phase.

1	Develop a clear statement of the services
2	Identify alternative construction solutions
3	Evaluate the alternative construction solutions
4	Evaluate possible construction issues and risks
5	Evaluate the construction technical complexity
6	Evaluate soft consequences of the project
7	Prepare an Independent Government Cost Estimate (IGCE) for the preferred solution

2.2.1 Develop a Clear Problem Statement

In response, the project manager and project engineer working with the project team developed this statement of the problem: "To be able to

sustain a 100-year flood, taking into consideration the effects of unexpected weather events, storms, climate change, and ground subsidence, with no injury to the residents and with minimal damage to the environment and personal property."

2.2.2 Identify Alternative Solutions

Alternative solutions that may meet the requirements of this problem statement include:

- Evacuation of the flood plain
- Raising or relocating the existing structures to an elevation higher than the anticipated flood elevation, plus the additional elevation attributable to more severe storms, possible sea level rise, or climate change, plus a safety factor
- Construct a floodwall with a top elevation higher than the estimated 100-year flood elevation plus an allowance for anticipated ground subsidence, plus a safety factor

2.2.3 Define Alternative Solutions and Estimate Their Costs

The project planning team developed several preliminary cost estimates and evaluated the issues associated with each of the three alternatives.

Evacuation. The cost to relocate the 12 families was estimated to be $150,000 each for a total cost of $1,800,000. The planning team assumed that the existing homes would be demolished and new homes would be provided near existing support utilities.

Elevation. Elevating the existing homes by either raising the foundation or relocating the home to a higher location was estimated to cost $50,000 for each home. The total project cost would then be $600,000.

Floodwall. The cost of a 1, 000-foot floodwall was estimated to be $1,000 per foot, for a total of $2,000,000.

2.2.4 Identify Possible Construction Issues and Risks

The risks associated with each alternative include:

Evacuation:

Resistance by the residents to relocation

- Lack of suitable land for resident relocation
- Inability to ensure that no new homes would be built in the exposed flood plain in the future

Elevation:

- Difficulty in making elevated/relocated homes attractive for continued residence
- Difficulty in accessing homes during a flood event
- Infrastructure serving the home may be damaged during a flood event
- Resistance by residents to the increased elevation of their homes
- Temporary relocation of residents during flood events may be required
- Maintaining security during a flood and its aftermath
- Ability to ensure that no new homes would be built in the exposed area below the design flood elevation in the future

Floodwall:

- The floodwall would affect the views of the water/marsh, etc.
- Poor ability of marshy soils to support the floodwall
- Ability to close floodgates quickly during a flood event
- A pump station may be needed, including standby power, at additional cost
- Lack of available land

- Monitoring and testing would be required
- Might attract more homes to the flood plain
- Possibility of exceeding the 100-year flood event
- Funding of operating and maintenance costs

2.2.5 Evaluate Technical Complexity

At this stage of their studies, the project team concluded that it did not have enough information or expertise to decide which is best alternative and that a more detailed engineering analysis would be required by an A-E firm during an engineering design phase. This analysis would include, for example:

- Detailed supplementary engineering studies
- The refinement of the initial cost estimates to assure that 611a requirements were being met
- A more detailed assessment of the possible construction "issues and risks" identified and the formation of a risk register

The technical assessment would include a number of specific additional technical and background studies including:

- Undertaking geo-technical soil tests in order to determine the feasibility and technical complexity of constructing a floodwall on marshy soils
- Determining a final design elevation for the floodwall based on a 100-year typhoon considering subsidence, possible sea level rise, or climate change
- Completing the required environmental impact statement, mitigating measures, and evaluation of any other environmental issues
- Cultural, economic, financial, and other socioeconomic issues affecting degree of beneficiary acceptance and ownership
- Sustainability analysis (FAA 611.e)

2.2.6 Evaluate Soft Consequences

Soft consequences result from human behavior, which can be difficult to predict without careful study. In the example project, these consequences included citizen resistance to the project, security issues, inability to connect homes to utilities, and people moving into a vulnerable area after being attracted to the amenities brought by the project.

For this reason, all projects should have a community outreach component that would explain the project to local residents and involve them in the planning, design, and decision processes. It is expected that the A-E firm would obtain a subcontractor to conduct a full set of participation activities with the local residents and other stakeholders.

3. ENGAGEMENT OF THE ARCHITECT-ENGINEER

The A-E firm selected to provide technical support assistance for the project can performs several integral functions. This section describes the role of and typical responsibilities for an A-E, the selection process, and the variety of requirements the A-E can perform during the entire construction process.

3.1 A-E REQUIREMENTS

In the example project, the USAID project management team found the evaluation of the construction alternatives to be complex, requiring additional technical engineering expertise and experience before proceeding with a final project design. The A-E - acting as USAID's technical consultant - would provide additional or supplementary background studies to help evaluate each of the project alternatives, solicit community input to determine what alternatives would be acceptable and supported, and estimate the alternatives' costs in more detail. For the purposes of this discussion, all these requirements have been combined into a single contract with an A-E. The A-E would prepare final design plans and specifications once a preliminary design alternative has been agreed upon. The A-E would be tasked with providing tendering support assistance, construction oversight, administrative, and management services during construction, and operation and management service training services.

It is usually much more efficient to combine these four sets of activities, responsibilities, and deliverables into one contract. This will usually result in management time and other cost savings, and more importantly, one contract will be much easier for the project management team to manage rather than having to award and manage several contracts while keeping to an overall construction schedule.

3.2 A-E SELECTION

There are two options for selecting an A-E. The first would be to use an existing USAID A-E Indefinite Delivery Indefinite Quantity (IDIQ) mechanism to provide engineering services through a task order.

The second is to competitively procure a U.S., small business, or local A-E through a full and open competitive solicitation. This would start by first advertising in the *Commerce Business Daily* (CBD), where the kinds of services required would be described. In this case, a Request for Qualifications (RFQ) would be issued. The Brooks Act and AIDAR 736.6 govern the engagement of an A-E firm as the design professional by USAID although the certification requirement can be waived by the CO (FAR 36.906-4). The AIDAR 736.6 selection process includes advertising, ranking, selecting, and negotiating contracts in a two-stage process. Simply put, the Brooks Act and AIDAR 736.6 state that demonstrated technical capacity is to be the first stage basis for selection, and then a second stage cost negotiation can be conducted with the highest ranked firm. Best value or cost alone will not be the primary basis of selection.

Although using an IDIQ is often a preferred approach, there may be many circumstances where the Mission may want to conduct its own competition to award a U.S. small business, or

well-qualified local A-E firm. In both situations, management oversight of the A-E firm is the combined responsibility of the project management team led by the CO and COR. More details about the A-E selection and management process can be found in the USAID supplementary training document, "A Basic Reference for Architectural and Engineering (A-E) Contracting: An ECCM Training Document."

The example project used a local RFQ approach to procure an A-E firm. This will require a CBD advertisement to procure an A-E firm to undertake several initial activities. These may include completion of supplementary and any needed alternative or technical studies to prepare a Basis of Design report, a preliminary design and cost estimation, and community outreach and participation activities and studies. Once these are satisfactorily completed, follow-on technical support assistance requirements (e.g., preparation of a final design, tendering support assistance, construction oversight, administrative, and management support, and operation and maintenance training) can be implemented depending on the results of the Basis of Design and preliminary design activities.

Figure on page 13 illustrates the sequencing and the phases involved in an engineering and construction project. That is from planning to preliminary design, design, tendering, construction and construction oversight, O&M, and the overall sustainability of the project.

Table below also summarizes these phases. Each phase has been described and the requirements laid out in the following sections of this supplementary training documents.

3.3 A-E STATEMENT OF WORK

In the hypothetical example, the SOW is divided into five phases:

Phase I Basis of Design Studies	Phase I covers the completion of the alternatives evaluation, supplemental and additional socioeconomic and technical studies and outreach and participation consultations with the local communities and other stakeholders
Phase 2 Preliminary and Final Designs	Phase 2 is for completion of the project's preliminary and final design and cost estimates, which will depend on the outcome of Phase I
Phase 3: Construction Tendering	Phase 3 is the first sub-phase of the construction process and includes preparation of documents and other information that will be of assistance during the tendering (evaluation and award) of the construction contractor
Phase 4 Actual Construction	Phase 4 is the second sub-phase of construction and is when the facility project is built. During this phase, the A-E provides construction oversight, administrative assistance, and overall management support to the USAID project team, and if requested, provides assistance with the construction closeout activity.
Phase 5: Operation and Maintenance	Phase 5 is final phase of construction and is when the facility becomes operational, is turned over to the Owner, and continued operation and maintenance is required for its continued provision (sustainability) of services.

The general set of requirements and responsibilities that follow are illustrative and should be tailored, as appropriate, to each construction project.

3.3.1 Basis of Design Phase

Some examples of items to include in the SOW include:

- Brief statement of the infrastructure services problem and description of the alternative solutions under consideration
- Review each possible alternative for feasibility, and refine design concepts, costs, other issues and construction risks
- Consider additional construction alternatives only after receiving approval from the CO and project manager
- Undertake preliminary geo-technical assessments of the marshy soils with regard to the construction requirements for a floodwall or similar structure
- Investigate and estimate the annual rate of reported subsidence with geo-technical studies
- Prepare an environmental impact assessment (EIA) on the local ruin for cultural heritage issues, tourism, and the nesting areas of endangered species (turtles in this example)
- Complete drafts of EIAs for recommended alternatives
- Review construction methods and materials, and recommend appropriate technologies for the construction alternatives
- Present results to the community, other stakeholders, and the appropriate cooperating country government officials, and obtain their input and preferences, as appropriate
- Recommend the best construction alternative for this project based on costs, risk, technical feasibility and community preferences
- Present progress reports bi-weekly

3.3.2 Preliminary Design Phase

The preliminary design phase will require a major review by the project team and will present all the preliminary design components of the proposed construction project, an outline of the technical and material specifications, and a more reliable estimate of the project costs. This information will allow the project team to redirect or correct the A-E contractor if additional design features are required or additional beneficiary concerns need to be addressed.

The preliminary design phase generally reflects about 30% of the design effort (e.g., the "30 percent" design).

Examples of requirements to be included in the SOW for this phase include:

- Details of the recommended alternative(s) to be constructed
- Design standards to be used (usually U.S. or international, but may include host county standards where local standards and practice are equivalent to international standards)
- Criteria for reliable cost estimates
- Consideration of alternative construction procedures and materials with an emphasis on local business and supplier involvement
- Incorporation of aesthetic and cultural considerations as appropriate
- Emphasis on a design that minimizes or suits local capabilities for construction technology, and minimizes the complexity and costs of operations and maintenance activities
- Incorporates environmental issues and concerns into the preliminary design as appropriate

- Contract specifications and documents (usually U.S. or FIDIC standards)
- Type of construction contract (usually Fixed Price) and preferred payment/reimbursement option
- Operation and maintenance cost, revenue, and training factors
- Assurance that the engineering design results in a sustainable project that can and will be easily operated and sustainably maintained by the cooperating country government entity

3.3.3 Final Design Phase

After approval of the preliminary documents the A-E will finalize all the documents required to proceed with tendering. Depending on the complexity of the design a further review may be required at the 90% stage. Also issues may arise requiring project team action.

Elements of the Final Design

- Detailed Engineering
- Detailed Plans and Specifications
- Integration of changes and mitigating factors resulting from Preliminary Design, EIA, SIA and VE reviews
- Firm Cost Estimate – will be used as Government estimate in the bidding process
- Final Design Reports
- Construction Schedule
- Constructability Review

Final Design Deliverables

- Final Design Drawings
- Final General and Technical Specifications
- Proposed Cost Estimate
    - Treated as confidential
    - Must be accurate to +/- 15%
- Final Design Reports
- Quality Control Program for Managing Construction

3.3.4 Construction - Tendering the Construction Contractor

Following are the key steps required prior to the initiation of construction. Although the A-E will be available to assist with these items most will require the participation of the contracting officer and the project team.

Items to consider

- Contract Form
- Advertisement
- Bid Process
- Prequalification
- Invitation for Bid
- Pre-Bid Conference
- Receiving Bids
- Bid Evaluation
- Award
- Pre-Construction Conference

3.3.5 Construction - Actual Construction

The A-E represents the project team in assuring that construction is conducted and completed in accordance with the plans and specifications prepared during the final design. However it imperative that the project team closely observe and understand the progress of the construction. This responsibility falls primarily on the project engineer and/or the project officer.

The A-E assistance support responsibilities during the actual construction typically includes, but is not limited to:

- Preparing schedules and briefings
- Approving shop drawings
- Inspecting the site
- Maintaining a record of all construction-related activities
- Completing progress reports

- Verifying the correctness of billings
- Accepting and approving warranty, guarantees, and other submissions required of the construction contractor
- Reviewing the construction contractor submittal of value engineering proposals
- Preparing punch lists and turnovers during the project completion and close out
- Preparing as-built drawings
- Assisting with disputes and claims resolution
- Preparing project startup and training activities such as developing files and documents needed for O&M and operator training
- Maintaining good relations with local communities and stakeholders

3.3.6 Post Construction Phase

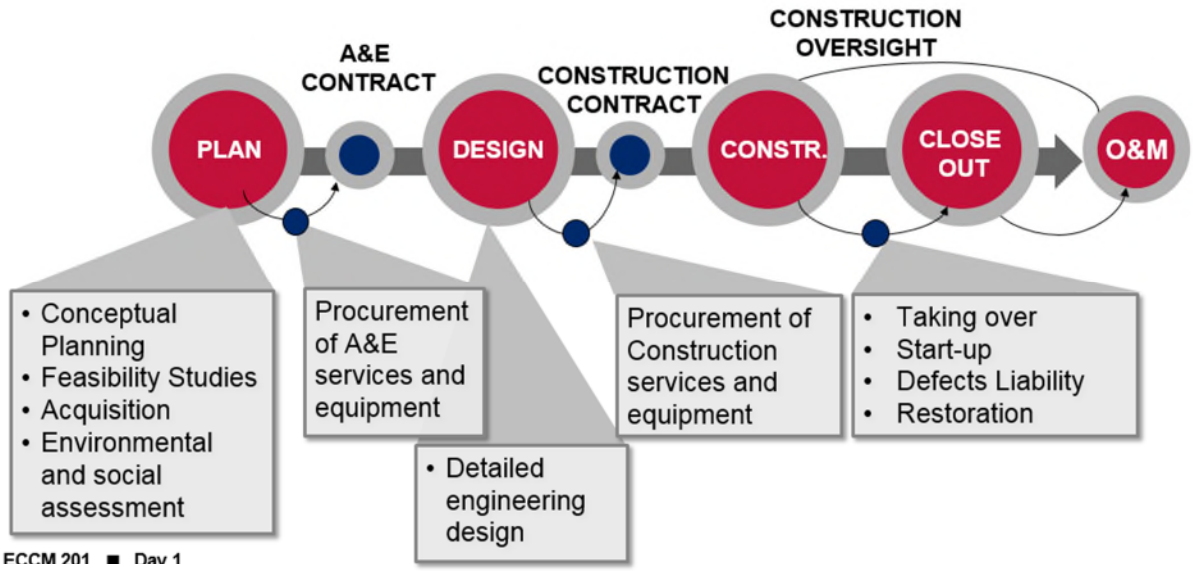
The end of construction and transfer of the facility to the beneficiary does not mean the project team can celebrate and move on to new ventures. Many project failures start with this approach. Many contractual details will remain. The new owners usually require training and assistance in order to assure project sustainability. Potential ongoing requirements and activities are listed as follows.

Construction Contractor

- Warranty and Guarantee problems
- Repair of newly identified defects
- Punch lists items remaining
- Training and equipment startup support
- Operation and Maintenance manuals

A-E Services

- Monitor Construction Contractor requirements noted above
- Transfer of relevant documents such as as-built drawings
- Assisting with startup and training
- Resolving payment, disputes and claims issues
- Assisting with media outreach support
- Assisting with beneficiary issues and complaints



4. REQUEST FOR QUALIFICATIONS AND CONTRACT AWARD

Interested U.S., international, or local A-E firms will respond to the request for qualifications announcement published in the CBD. In the example project, there is a special need for community outreach, an evaluation of the marshy soils, verification of the 100-year flood levels, and investigation of the reported subsidence. These tasks will require special expertise that may not be directly available from many A-E firms. Bidders would be expected to subcontract with other firms that could provide such expertise and skills. The key steps to contracting for a contractor include the following:

Step 1	Receive responses to RFQ
Step 2	Evaluate responses using pre-determined evaluation criteria
Step 3	Stage I: Score, approve, and select the top bidder
Step 4	Stage II: Top bidder submits cost proposal
Step 5	Negotiate contract
Step 6	Issue notice to proceed

4.1 INFORMATION REQUIRED BY THE RFQ

A-E firms that are interested in bidding to provide engineering and design services on the project would generally be required to provide at least the following information using form SF330 Part 1:

- Statement of qualifications, including those of subcontractors
- Identification of personnel to be assigned to the work and relevant experience of the personnel to be assigned
- Suggested schedule for work, including mobilization (if appropriate) and for completion of the various phases
- List of completed relevant projects
- Relevant references for past performance contracts with government agencies and private industry in terms of cost control, quality of work and compliance with performance schedules
- Any other project specific information requested or deemed useful by the construction contractor

4.2 EVALUATION CRITERIA

These criteria are established in the solicitation and are used evaluate the proposals received. Also, because they inform potential bidders on how they will be judged, they should also be published in the CBD, or another appropriate public forum.

The development of appropriate selection criteria is important to the success of the process of selecting and awarding the A-E contract, and must reflect the technical expertise and experience

needs of the specific project to be awarded. These criteria must be chosen and worded carefully. If a bidder were to challenge the award, it is likely to be on the basis of the appropriateness of the evaluation criteria and how they were applied during the award process.

For the example project, some of the factors on which the criteria would be based could include, but are not limited to:

- The extent of demonstrated experience the A-E team has in conducting feasibility studies, community outreach, environmental impact assessment, design of related works, providing tendering assistance, construction oversight and management, and providing operations and maintenance training
- The design team should have specific technical expertise and design experience with shoreline based flood control structures, i.e., design of structures exposed to wave action
- General team experience should include working in this or a similar developing country and region under similar conditions and on similar flood control projects
- The administrative, logistics, and management experience of the team leader with the bidder and designation of the responsibilities of key personnel is critical. A bidder may list excellent qualifications as an international expert in all of the SOW areas. However, if the assigned field personnel have never worked outside the U.S. or do not have experience with similar projects, this may lead to failure. Lack of developing country experience does not necessarily mean that the individual cannot do a good job. For timely implementation, the team leader, at a minimum, should have a certain level of developing country experience and the appropriate technical skills to be able to supervise key and other project personnel

Some Evaluation Criteria for the Example Project	
Experience of the A-E Team	
Planning/feasibility/outreach	10
Flood control design	10
Construction management	10
Experience of the Key Personnel	
Team leader	15
Outreach leader	5
Soils expert	5
Hydraulics/hydrology expert	5
Design team leader	10
Construction Oversight Manager	10
Environmental specialist	5
Timely completion of work	5
References	10
Total	100

4.3 EVALUATION BOARD

The project officer, in cooperation with the CO, would establish a panel of a minimum of three qualified members to review the submittals and select the top-three qualified A-E bidders. The evaluation board, also referred to as the selection panel, should include at least one qualified engineer, and also include members qualified to address the demonstrated experience and other important qualifications of each bidder.

Each evaluation board member would independently review and score each submittal using a format similar to the foregoing example, or a format prescribed by the CO. The evaluators' scores are then averaged, the top-three firms ranked and a technical evaluation memorandum is then prepared presented to the CO by the evaluation board. The CO then submits this ranked list for approval by the Mission Director in order to proceed with finalizing a contract by negotiating a price with the top ranked Offeror (AIDAR 736.6).

The board may feel that it is necessary to make further background checks of proposed key personnel and to check the firm's references. To assure that a record of the selection process is complete, the evaluation board chairman must document the results of the selection process immediately after the process is completed in the technical memorandum submitted to the CO.

4.4 CONTRACT NEGOTIATION

Contract negotiation is the exclusive responsibility of the CO. The CO will start price negotiations with the highest-ranked firm and if unsuccessful, move to the second-highest bidder and so on. Most of the time, negotiations will be successfully concluded with the highest-ranked firm.

The CO may not request the technical evaluation board's assistance during this process. However, the USAID project team is responsible for preparing an Independent Government Cost Estimate (IGCE) for the A-E work and providing it to the Mission Director with the PAD approval memorandum for approval before the CO issues the A-E contract solicitation.

The IGCE is prepared based on an analysis of the required work for a technical services contractor For the example project, only the cost for the Basis of Design (BoD) "studies" portion can be specifically negotiated at this point because the costs of the follow-on phases will depend on the results of the BoD study. However, since the overall contract will be awarded for all the technical assistance support that the A-E firm will be responsible for providing, estimated costs for the remaining activities can be "notionally" negotiated with the expectation that the A-E contract may be modified later. In most circumstances, the A-E contract will be incrementally funded on a yearly basis after the construction contract is awarded and funded.

4.5 NOTICE TO PROCEED

Once the contract has been signed, the financial officer has assured that funds are available to be obligated, and congressional notification is completed, the CO will issue a notice for the A-E to proceed. This means that the project team can begin working with the A-E contractor.

4.6 PROJECT RESPONSIBILITIES

The project manager will be responsible for assisting the CO in managing the Request for Qualifications and Award of Contract processes. Within these processes, the CO will have sole responsibility for the actual contract negotiation, award and notice to proceed. It is incumbent on the project manager to support the CO as needed to assure that the procurement, evaluation, and award processes are completed in a timely manner.

5. BASIS OF DESIGN STUDIES

As noted earlier, A-E contracts should include a Basis of Design (BoD) phase before proceeding to the preliminary and final engineering design and construction management phases. The BoD phase includes, but is not limited to planning additional or supplementary technical, feasibility, and other studies, environmental assessment, various community and stakeholder participation, and coordination activities. These background studies are typically multi-disciplinary and involve many technical specialists, the communities involved, and other stakeholders. They also address the "soft" issues, such as community outreach and information sharing. Obtaining village cooperation for the proposed floodwall project would be one of the "soft" issues that would likely be assigned to the A-E firm.

Some of the studies typically required for an engineering or construction project include:

Technical	Soil assessment Subsidence evaluation Hydraulics
Environmental	An Environmental Impact Assessment (EIA) on threatened or endangered species or water sources
Social	Community Impacts, Fees and Revenue Collection, Sustainability
Cultural Heritage	Impacts on important architectural, religious, and other sites

A significant portion of the BoD phase is taken up by data collection. Soil cores will be required to determine the soil conditions along the general proposed alignment of the floodwall. These are critical for the design of the structure, as soils will control where pilings may be needed, and where an earth levee will suffice versus a concrete wall. The soils tests are also a critical factor in determining the floodwall's alignment. The general alignment was established in the planning phase. However, because of the nature of the marshy soils, a more complete soil survey is needed.

Surveys will be also required to establish both vertical and horizontal construction parameters. They will also be needed to establish property lines and the location of existing structures and archeological and environmental features that may need special protection from construction activities. Elevations will be especially important in establishing the most economical alignment for the floodwall and in locating a pump station within the approved general alignment.

A hydraulic analysis will be needed to determine the capacity of the storm water pumping station. Other factors such as environmental issues and villager concerns need to be considered in the design. The preliminary environmental impact assessment will also need to be finalized.

The BoD results should be summarized in one or more reports, often called design memorandums. Preliminary plans will represent the proposed concept and as needed, show alternative design

concepts as appropriate. Outline specifications should also be a part of the preliminary submittal to the project team.

Of great importance is the inclusion of an updated cost estimate, because funding adjustments may require time to arrange or may not even be possible.

The building codes and standards proposed to be used should meet the standards of the local country and local area standards. These generally will be based on appropriate international standards. U.S. standards are typically used on USAID projects, especially when using U.S. A-E firms and construction contractors.

5.1 TEAM MEMBERS STATEMENT OF WORK

Section 3 included a suggested SOW for the BoD phase. This SOW would reflect a proposed floodwall project to protect the village located at the example project site. The level of effort (LOE) for the A-E firm is expected to be relatively small for this phase of the example, and studies would likely be completed within three months.

5.1.1 Hydrologist/Hydraulics Specialist

The hydrologist/hydraulics specialist would need to visit the site to become familiarized with the local conditions, and collect topographic data and local storm records to assess the surge that could be expected from a 100-year storm. Historical information obtained from the villagers from their formal or informal records will be important.

5.1.2 Soils Expert

The soils expert will be required to make a preliminary site visit to access local soils and determine soil characteristic options for constructing a floodwall. This expert would be tasked with investigating the reported subsidence problem. More detailed geo-technical studies of the soils, including borings, will have to be taken during the BoD phase in order to refine the preliminary engineering design and expected construction costs.

5.1.3 Environmental Specialist or Team

This individual or team would be included in the initial site visit team in order to assess the reported archeological ruin and endangered bird nesting areas. The environmental specialist or team would also assess the impact of the floodwall and its associated floodgate for other environmental issues, and would participate in discussions with the villagers about feasible mitigation measures depending on these findings.

5.1.4 A-E Team Leader/Chief of Party

The project team leader/Chief of Party should be present during the BoD stage and work closely with each of the technical specialists involved, coordinate all of the information gathering activities, and work with the village and other stakeholders to monitor beneficiary issues and concerns. The A-E team leader/Chief of Party (COP) will be responsible for example, timely submissions, quality control, monitoring costs and finalizing the BoD study reports.

The project team leader/Chief of Party and the engineering design staff should visit the proposed project site while the BoD specialists are present. This is an ideal time to exchange ideas, feasibility issues, and design options with the BoD staff while new information is being discovered.

5.2 EXAMPLE NEXT STEPS

For the purpose of laying out the sequence of actions in the engineering design phases of the A-E contract, the example project's BoD studies and reports have recommended that a floodwall is the best feasible alternative, which is also the conclusion of residents in the project area.

The conclusions are:

- The soils are acceptable for construction of the floodwall. However, a special design of the footing and foundation, including support piling, will be necessary
- The hydraulics specialist has determined that preliminary estimate for the flood wall height could be reduced by 2 feet based on the predicted 100-year storm, but notes that 1 additional foot in height must be added because of the expected impact of possible climate change on sea level
- The soils specialist reports that a foot should be added to the floodwall over the 50-year project life to allow for subsidence based on an estimate of 1 inch every 5 years. This expert also notes that locally available subsidence records are sketchy and that this is his best estimate. Thus, the original floodwall height estimate will not be changed
- The draft EIA was found to be acceptable and will be finalized during the final engineering design activity
- The proposed alignment of the floodwall optimizes expected costs, avoids the area around the ruins, does not encroach on the nesting area of endangered species, and is acceptable to project area residents

The design discussion in Section 6 is based on these conclusions, which were approved by the USAID project team, and then approved by the Mission Director.

5.3 PROJECT RESPONSIBILITIES

The project manager's role during the predesign phase of a project is basically to monitor progress and expedite any approval process. This individual will also approve or clear such routine matters as payment requests and status reports, and route them to relevant members of the team.

Site visits and meetings with the A-E to view condition and progress should be included. The project manager should be alert for signs that the A-E is not performing as planned or assigned staff are not qualified for the intended work.

6. ENGINEERING DESIGN

The next engineering design phases are focused on preparation of the preliminary and final construction plans, specifications, and the final estimated cost. In the example project, the A-E has completed all of the supporting background studies and has reviewed the feasibility of each of the possible alternative approaches to meet the flood protection objectives. This required a preliminary review of the marshy soils to determine their adequacy for the construction of protective structures, verification of the estimated flood levels, an environmental impact assessment, and working with villages in the project area to gain approval of a "best" feasible solution approach. These background studies also provide a basis for firming up an estimate of the expected project costs for each of the alternatives evaluated for feasibility. The BoD result was for the proposed selection of the floodwall alternative.

To complete the engineering design phase, the A-E project manager/COP has asked the CO to amend the Cost Plus Fixed Fee (CPFF) contract to include revised estimates of the A-E costs and level of effort requirements, and a revised schedule to complete the deliverables and meet the contract requirements for the preliminary and final engineering design phases. When this contract modification has been completed, the CO will issue the A-E a Notice to Proceed with the engineering design work.

Preliminary Design	Incorporate Geo-Technical And all other technical and socio-economic analyses and studies Conduct additional studies or surveys if needed Finalize preliminary specifications Update cost estimates Prepare draft construction drawings Incorporate Environmental Impact Assessment
Detailed Design	Detailed project engineering Construction drawings/plans Detailed technical specifications General project specifications Construction schedule Firm cost estimate Quality control program Outline of bid document package Land acquisition requirements Draft bid documents

6.1 PRELIMINARY DESIGN

The following section describes in detail aspects relevant to the preliminary design of a project.

6.1.1 Data Collection and Analysis

This involves undertaking necessary surveys and studies and incorporating the results of the BOD studies to evaluate options to meet the requirements of the project. Cost, constructability, and sustainability need to be assured at this stage. Depending on the nature and type of project, work identified in the BOD is often conducted or supplemented during the Preliminary Design Phase.

6.1.2 Deliverables

Specific preliminary design deliverables should include:

- Preliminary construction drawings
- Outline specifications
- Basis of Design reports
- Cost estimates
- Finalized Environmental Impact Assessment

6.1.3 Project Responsibilities

The A-E project manager/COP will be responsible for the review and completion of these documents. The A-E project manager/COP should use the engineering and related team member skills available, being especially mindful of environmental issues, project costs, the appropriateness of the recommended technology, sustainability issues, operations and maintenance concerns, and other local community and stakeholder concerns and issues.

The project manager/Chief of Party should provide time for review comments from the A-E team, either as corrections or to be considered for inclusion in the detailed design. The A-E project manager/COP also needs to work with USAID to ensure that the USAID project team's reviews are timely and meet the project schedule.

6.2 DETAILED DESIGN

Once the USAID project management team has completed its review and the A-E team has been given approval by the CO to start preparing the detailed design, virtually all of the major project design decisions will have been made. The A-E project manager/COP's focus should be on monitoring the A-E team's progress and anticipating and resolving problems. The A-E team will provide progress reports as required by the contract. However, regular project meetings with the USAID CO and COR are still a valuable monitoring tool.

6.2.1 Deliverables

Specific final design deliverables should include:

- Construction drawings (plans) to an acceptable standard showing in detail the proposed construction
- Technical and materials specifications
- General specifications for the project
- Proposed construction schedule
- Firm cost estimate for the proposed construction
- Development of a quality control program for managing the construction
- Progress reports and minutes of meetings
- Outline of bid document package with drafts of the cover letter, etc.

6.2.2 Project Responsibilities

The A-E project manager/COP needs to make sure that the necessary land use and rights-of-way have been specified for the floodwall, pump station, borrow pits, disposal sites and work areas in the final design documents. Providing the necessary permits and access to the necessary land use is usually the responsibility of the local government, but it is also incumbent on the construction contractor to ensure that all agreements are in place before undertaking work. The A-E team should delineate who should be

responsible for what, the proposed time line for obtaining land use, environmental, and other permits, and access rights for the construction project prior to issuance of any solicitation documents for the construction contractor.

The A-E project manager/COP should be prepared to provide any needed support to ensure that the construction documents are reviewed and approved by the USAID project management team, and Host Country government officials in a timely manner.

6.2.3 Bid Documents

Once the A-E team has made their final changes or corrections to the final engineering design, the final review and approvals will be made by the USAID project management team. The Host Government entity involved in the construction project may also be asked to review and approve the documents. Once all reviews have been completed and cleared the CO will then release the tendering package documents to prequalified construction contractors for preparation of bids or proposals.

7. PRE-CONSTRUCTION PHASE – TENDERING

The tendering phase of a construction project is the first phase of the construction process and entails selecting, hopefully, the most qualified and reliable construction contractor. This process involves identifying responsible contractors and providing them with the plans, specification and contract documents for the intended project so that they may offer a tender. Those invited to offer a tender will have been prequalified. During this process CO's will make a Responsibility Determination required by the FAR. The responsibility determination is a critical element needed to maximize the probability (and minimize the risk) that the facility will be completed on time, as specified, and in accordance with the cooperating country's agreements. This is more important when prequalification is not used as the prequalification process is also designed to ensure these same results.

7.1 PREQUALIFICATION

Prequalification is the process of reviewing potential construction contractors' technical, and operational capacity, experience, and financial qualifications in advance of seeking bids or proposals. The purpose of a prequalification activity is to assure USAID that only qualified contractors are permitted to bid or submit proposals, in order to minimize possible construction problems and risks during the construction phase.

The prequalification factors, which should be considered, could include:

- Experience with similar projects
- Size of projects completed
- Value of past work completed
- Availability and experience of key staff
- Access to equipment
- Work backlog

Construction projects can be solicited without a prequalification process under certain circumstances. This is dangerous practice and not recommend. If used the CO should place the Mission Director's and other senior official's approvals in the file to validate this decision.

7.2 CONSTRUCTION CONTRACT PAYMENT AND REIMBURSEMENT OPTIONS

The common payment and reimbursement options for construction contracts include:

7.2.1 Lump Sum

These contracts are frequently used for construction where materials and labor are easily quantified and construction risks are low for the intended facility.

7.2.2 Unit Price

Unit price construction is used when the construction contractor is paid a certain amount per unit of production. For a pipeline, for example, this can be for each foot of pipe or further broken down to include other components such as excavation, bedding, and backfill. These

contracts are typically used where quantities are not easy to estimate accurately in advance.

7.2.3 Cost Plus Fixed Fee (CPFF)

CPFF construction contracts are more appropriate for special situations where the extent of estimated costs for the project are not easily measureable in advance. CPFF contracts are also used in special emergency post- conflict and natural disaster situations when detailed surveys and design are not possible before the construction begins.

7.2.4 Fixed Amount Reimbursement Agreements (FARA)[2]

FARA reimbursement agreements are used when USAID is financing the facility under a HCC or a Government-to-Government (G2G) arrangement. In these situations, the Host Country Implementing Unit (HCIU) entity or the Partner Government Implementing Entity (PGIE) awards the construction contract. USAID usually awards the A-E contract when HCC arrangements are in place, but the PGIE usually awards the A-E contract when G2G arrangements are in place.

When HCC arrangements are in place, USAID has specific oversight responsibilities governing various aspects of the construction award process and oversight of the construction contract. However, only the HCIU has the ability to issue instructions to the construction contractor because USAID is not a legal party to the contract.

When HCC FARA arrangements are in place, USAID reimburses the host county construction companies up to a certain percentage of the estimated construction costs for meeting pre-specified completion and quality goals or milestones and the HCIU entity assumes the financial risk for any cost overruns. Details of these agreements can be found in ADS 305 and the USAID supplementary training documents describing HCC and FARA procurement and implementation. When using HCC, USAID serves as the financier while the HCIU entity - as the Owner - has the responsibility for completion of all the construction activities. USAID's role as the financing agency is limited to assuring that projects being financed meet the terms of the required bilateral agreements. This contracting approach was common in the past, but is now superseded by G2G contracting arrangements. However, in some instances, without proper oversight, HCC resulted in situations where the facilities under construction did not meet required standards and agreed upon construction schedules. Also, without proper management by the HCIU entity, this approach often resulted in cost overruns and contractor disputes. For more details on Host Country Contracting procedures refer to the USAID supplementary training document, "Use of Host Country Contracting in Construction Projects: An ECCM Training Document."

All of the contract types noted are considered to be Fixed Price contracts, except for CPFF, which is a cost reimbursement contract. Other contract types that are applicable to USAID work include incentive contracts, indefinite delivery quantity-indefinite (IDIQ) task orders that are usually based on CPFF principles and FAR 16.505 guidance. For the example village flood protection project, a unit price contract is most suitable. Quantities of materials such as earth fill, excavation, concrete, and piling cannot be accurately estimated in advance and will be measured as construction progresses for

[2] Please note that although the guidance on FARA terminology has changed to Fixed Amount Reimbursement (FAR), the Author utilizes the term FARA throughout this document in order to avoid confusion between the Federal Acquisition Regulations (FAR) and Fixed Amount Reimbursement (FAR).

reimbursement. This contract approach is the standard and known as Design and Build or Design-Bid-Build (DBB).

Other contract lump sum options include Project Management (PM), Design-Build (DB). DB and DBB's are typically Fixed Price while the PM's work on cost or at a fixed cost ceiling known as "at risk". A Fixed Price construction contractor assumes the risk concerning unknowns such as quantities and underground conditions. These potential costs will be factored into his Fixed Price and if they do not materialize still must be paid. However, he is motivated to be efficient since time and waste are costs to him. The PM approach can be styled to be all inclusive or to be divided into units such as design, construction management and construction either on a cost basis or a Fixed Price. The disadvantage of working on cost basis is that the construction contractor has little incentive to consider savings or efficiency. He has little risk and profit is usually a percentage of his total costs. One tool COs use is to cap his profit fee so that overruns and add-ons are without profit. Of course these factors do not apply if the contactor is at risk. Using the DB approach works best where the designer and builder both have extensive experience with the type of construction project and the construction site conditions. Another advantage is that the construction team works closely with the design team resulting in a more efficient construction process resulting in savings. ASCE reports that studies show that DB contracts, also known as 'turn-key', are generally less costly and faster to implement than DBB or PM contacts. PM's are best suited for large and complex projects where specialized experience and management skills are required. Another key factor in choosing a construction approach is the time required to complete a project. Typically the standard design and bid approach requires the most time while the DB is the quickest. Risk to USAID, also remains the highest with the DBB approach. For PM, this risk is transferred in part to the A-E manager. Risk for DB is transferred primarily to the contractor. Each approach has advantages which must be evaluated against the project type, urgency, construction site and the management capacity. Each requires obtaining A-E's and construction contractors with the proper experience and skills.

The USAID approach, based on staffing and experience working in unknown and high risk areas is best suited to the design and build standard. However other approaches should always be considered as occasions will occur when they are more appropriate.

7.3 INVITATION FOR BIDS

The Invitation for Bids (IFB) solicitation is issued by the CO for a construction contract once tender documents have been completed and approved. In addition to asking firms to compete for USAID work, it includes the completed facility plans and specifications that become the basis for the contract's SOW. The IFB also establishes the evaluation criteria against which all bidders will be evaluated on an equal basis.

An IFB that is not precise will lead to problems requiring corrections and modifications of the solicitation. The end result is generally a delay in the construction contract award. The IFB usually includes the following sections:

Cover letter inviting bids
Instructions to bidders
Form of tender
Bill of quantities
Forms of bid, performance, and payment bonds or guarantees
Form of agreement
Conditions of contract (two parts)
Technical specifications and drawings

7.3.1 Cover Letter

The cover letter is sent to each of the invited firms. It identifies the IFB number and lists the parts of the IFB attached.

7.3.2 Instructions to Bidders

The instructions include the following, as appropriate:

Some Elements of the Instructions to Bidders
Invitation number
Name and address of contracting agency
Date of issuance
Date, hour and place of opening
A brief description of the proposed construction
Permission, if any, to submit bids by electronic means
Permission, if any, to submit alternate bids, including alternative materials or designs
A statement that bids will be rejected if they do not conform to the minimum period for acceptance stipulated in the IFB
The name and address of the person to whom questions should be directed
The method of issuing addenda to the IFB
Bid bond or guarantee requirements
Arrangements for inspecting the site and data, which may affect the performance of work
A statement concerning any limitations on subcontractor work
Information on the prebid conference
A statement that the bid price is the sum of all dollar and local currency amounts, and the exchange rate to be used in arriving at the total bid price

Some Elements of the Instructions to Bidders
A statement of how the dollar and local currency portions of the contract will be paid
A list of documents to be included in the bid
A statement concerning modifications to bids
If prequalification was not used, the procedure for determining whether bidders are qualified
If factors other than bid prices are to be considered in the evaluation, the formula by which the monetary value of each such factor will be computed
A statement warning against grossly unbalanced bids
A statement that the contract will be awarded to the lowest responsive, responsible bidder and the agency's right to reject all bids
A statement that requests for clarification of the IFB and explanations of the award should be addressed to CO

7.3.3 Form of Tender

The required tender form should be included in the IFB to assure all bidders accept the same obligations in submitting their bids. This makes it easier to compare bids. The U.S. GOV form of tender for Direct Contraction is "Standard Form 1442, Solicitation, Offer and Award."

7.3.4 Bill of Quantities

The bill of quantities (BOQ) lists the component parts of the contract work and provides for the pricing of quantities for each of these materials and other elements. The BOQ is the basis for the technical specifications components of the work, and is one of the deliverables in the final design package. The quantities the A-E firm has estimated for each material item will be included as appropriate in the tender form. The bidder fills in the unit price for the item, and the total

expected cost amount (i.e., quantity times the unit price).

The BOQ may include "provisional items" that may or may not be required for the work. These provisional line items are useful when internal cost adjustments and flexibility are needed and when funding is fixed.

7.3.5 Forms of Bid, Performance, and Payment Bonds or Guarantees

The requirements for bid, performance, and payment bonds and the amounts for these bonds must be specified in detail. Special formats can be required, although in most cases it is sufficient to indicate that the format for bid, performance and payment bonds will be in accordance with standard U.S. commercial practice and FAR 28 requirements.

A bank guarantee is often allowed by the IFB solicitation at the direction of the CO in lieu of a bond when local construction companies are awarded contracts. If a bank guarantee is used, the amount of the guarantee must be stated.

7.3.6 Form of Agreement

The form of contract agreement is usually a brief statement, signed by the USAID CO and the successful bidder, listing the documents forming part of the contract. It obligates the contractor to perform in accordance with the listed documents. USAID would be responsible to make payments to the contractor in accordance with the provisions contained in the conditions of the construction contract.

7.3.7 Conditions of the Contract

These are standard or model documents that are generally in two parts and must be amended to meet the needs of each specific project. For example, Part 1 is titled General Conditions and Part 2 is titled Special Conditions or Conditions of Particular Application. Part 2 is designed to adapt the General Conditions to a particular project.

Organizations such as the Engineering Joint Council and American Institute of Architects have developed model documents that receive wide usage. For international work, a popular standard is Federation International des Ingenierurs (FIDIC), which usually serves as the primary basis for host country documents.

Part 2 has been adapted by USAID to modify Part 1 for construction projects and is assumed to be the appropriate document for the example flood control project. USAID has mandatory legislative and policy requirements that must be included in any contract. These, for example, include but are not limited to:

- Legal effect of USAID approvals and decisions
- Nationality, source and cargo preference
- Required contractor invoice and contract abstract
- Air travel and other transportation
- Worker's compensation insurance
- Marking equipment supplies with the USAID logo
- Host country taxes
- Dispute settlement
- Disposition of personal property in the cooperating country
- Equal employment opportunity
- Audit and records
- Corrupt practices
- Auditing and contract closeout provisions

The conditions of the contract must be carefully adapted to the conditions under which the construction contractor will perform the work, precisely identify the rights and obligations of all the contractual parties, and include provisions for payment, inspection, and release of bonds or guarantees. Further, the conditions of the contract generally contain all provisions to define the working and legal relationships of the parties.

7.3.8 Technical Specifications and Drawings

The technical specifications and drawings are the construction contractor's road map for completing the project. These documents represent the primary products of the final design phase.

7.4 BID PROCESS

Prequalified construction contractors will usually have a number of questions after receiving and reviewing the tender documents. These will be addressed to the USAID CO, who in turn will depend on the COR (USAID project manager/engineer) (and the A-E firm if tendering assistance is a contract requirement) for many of the technical and business aspect responses. The CO will combine all the questions from the prospective bidders and answers from the technical staff (and A-E) and provide a simultaneous joint response to all recipients of the bid documents.

Pre-bidding conferences (see below) are also a time for contractors to raise questions. Those questions and clarifications requiring further input before answering will be recorded and answered in a joint response to the bidders from the CO. Pre-bidding conferences are also used to explain many details of the construction project, which are not always easily conveyed in the technical plans and specifications. More importantly, bidding conferences can highlight construction contractor financial, scheduling, and other operational concerns that could cause a higher bid price due to risk factors if not clarified. Pre-bidding conferences should also include a site visit. With international projects this is not always convenient or possible, but a site visit is important. Many construction contractors prefer to make site visits without other contractors present, believing they can gain an advantage if they visit on their own.

The process of opening bids is very important and must be documented carefully and accurately. The timing for receipt of the bids will be published in the tender documents. Late documents must be rejected and returned to the bidder unopened. Any moment in time after the prescribed deadline is considered to be late for a bid document. Bids can be received by mail or by hand delivery at a particular location, and the time of receipt needs to be recorded.

Opening the bids is generally done in a public setting where bidders can be present. Each bid is opened and the critical price information is announced. At that time, it will also be made clear that the documents will be reviewed in detail and the apparent winner announced later.

7.5 BID EVALUATION

The bid documents need to be carefully reviewed by the CO to ensure that all of the required supporting documentation is included. The CO will usually expect the project manager/engineer to assure that the documents meet the necessary requirements. For example, have the required bid bonds been included? Have exceptions been made? Are all required signatures included? Are there errors in the bid price extensions? Such problems should be discussed by the legal counsel and the CO, because many issues have the potential to void the tender (the failure to provide the information requested and exceptions may cause the bid to be rejected, or otherwise void the tender).

Once the lowest responsible bidder has been determined and approved by the CO and cleared by the project team, the contractor is to be notified, as well as the unsuccessful proposers. At this time the successful bidder will have additional submissions to make before receiving a Notice to Proceed from the CO.

7.6 PRE-CONSTRUCTION CONFERENCE

The purpose of the pre-construction conference is to update all the legally responsible parties in the construction process and clarify any questions about the roles and responsibilities of each party. In addition, the pre-construction conference can help clarify the working relationships among the parties and allow them to state their expectations, concerns, and preferences.

The conference should be hosted by the USAID project management team and could be chaired by the USAID project manager, or the CO. The Mission Director should be invited to open the meeting.

Alternatively, USAID could assign the hosting of the pre-construction conference to the A-E firm, but USAID staff should remain major participants. Delegation of the Pre-construction Conference is usual for larger projects involving many sub-contractors, all of which are under the management of a prime construction contractor.

The selected construction contractor will also be a key participant, presenting its construction approach and a draft work plan, as well as any additional clarifications or concerns it may have. The details of the construction contractor's planned schedule will be especially important, and the A-E firm and the USAID project management team should take time to work through the construction schedule so that details and timing are well understood.

At this point, the A-E firm, assuming this responsibility is a contract requirement, can begin to provide construction management assistance support to USAID for construction oversight and other responsibilities, including validating the Quality Control approach by the construction contractor and the A-E's responsibility for Quality Assurance. If possible, representation of the cooperating country government (the HCIU or PGIE) as well as stakeholders from affected communities should be invited. Subcontractors and suppliers that are expected to provide services to the project could also be invited to the pre-construction conference depending on whether the construction contractor is fully supportive.

In general, the pre-construction meeting should be used to acquaint all the participants, establish roles and responsibilities of key players and lines of authority, with the objective of doing everything possible to get a successful start for the construction project.

Minutes of the conference should be recorded by USAID and/or the A-E firm and copies made available to all the participants.

7.7 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Quality Assurance (QA) is described by the American Society of Civil Engineers (ASCE) as the "planned and systematic actions to help assume that project components are being designed and constructed in accordance with applicable standards and contract documents." Simply stated, QA is a plan of how quality is to be achieved at each step of the construction process.

ASCE describes quality control (QC) as "the review of project services, construction work, management, and documentation for compliance with contractual and regulatory obligations and accepted industry practices." QC is simply the implementation of the QA plan. A QC program would include inspections, testing, training, and maintenance of detailed records (logs, written reports and photos, etc.) for the construction project.

The A-E , when required as part of its contract as the construction management contractor (CMC), will be responsible for assuring that the quality of the work is in accordance with the plans and

specifications, as well as the building standards contained in the tendering package. The A-E/CMC may rely on independent testing firms for concrete, soils and other materials testing to validate the construction contactor's QC program. If independent testing firms are not available, the A-E/CMC must be prepared to provide equipment and trained personnel to undertake this work. Or USAID may provide a contract requirement that the A-E/CMC firm provide training, materials, and equipment to build the necessary independent construction testing capacity typically used by the construction sector.

Safety monitoring and training needs to be a requirement of both the construction contractor and the A-E/CMC. The A-E/CMC should also be responsible for assuring that the contractor's safety program is adequate and being implemented as one of its contract construction oversight requirements.

For further reference, a more detailed USAID supplementary training document is available titled "Construction Tendering And Contracting Guidelines: An ECCM Training Document."

8. CONSTRUCTION PHASE CONTRACT ADMINISTRATION

Construction contract administration provides the necessary support and oversight to assure that the construction project is completed in a timely manner, within budget, and with minimal operational problems.

The key elements of contract administration include:

Flow of the construction work (schedule)
Paperwork flow
Quality control
Progress payments

8.1 PROJECT SCHEDULE

The construction schedule is probably the most important management tool available to the USAID project team for assuring that the facility is completed in an orderly and timely fashion. The construction schedule, developed by the construction contractor, shows and provides assurance that the flow of work can progress efficiently and that various types of technical and other labor, materials and equipment arrive in a timely manner. Thus, the construction schedule must be viewed as a critical management tool and used by all of the USAID staff, stakeholders, communities, the cooperating country government, and sub-contractors involved in the project.

All the parties involved should expect that the construction schedule will and should be modified when unexpected problems arise that will require changes to the construction project for a wide variety of reasons. Weather is often a problem that will causes delays. In the event of inclement weather, materials supply disruptions and similar events, the construction schedule may have to be adjusted as needed to assure that the workflow can continue efficiently and with a minimal amount of disruption. It is also possible that the construction schedule provided by the construction contractor has already provided enough "work" time to account for these situations.

The construction schedule's implementation usually requires routine weekly or bi-weekly meetings of the COR, CO, A-E, and the construction contractor to review implementation issues. Depending on the nature of the project, these meetings may be held on a daily, or as-needed basis during temporary and unforeseen construction situations. Bilateral and internal meetings should also be held with and within each primary participant with project administration responsibilities. The most important participants will be the USAID project team, the construction contractor management team, and the A-E team. Meetings between the construction contractor and the A-E team acting as the CMC are also critical. Meetings at this level should be on a scheduled basis supplemented by ad-hoc meetings in

emergencies and other similar types of situations. The COR will usually meet with the construction contractor and/or CMC on a regular basis, but more complex or high-visibility projects may also require meetings on a more frequently scheduled basis. At the working level, safety and environmental issue meetings should always be held on a scheduled basis.

In any construction project there is one sequence of scheduled activities that will take the longest amount of time to complete by the construction contractor. This is called the "critical path." The critical path shows where work cannot be allowed to take more time to complete, or the entire construction project will be delayed. The construction schedule will also show where other construction activities are not time sensitive and can be delayed without affecting the completion date. Several computer programs are available to assist contractors with project scheduling. Contractors can be expected to use a system with which they are familiar.

The Critical Path in the Example Project

The final plans for the example project's compacted earth levee will take 200 days to complete, according to the construction contractor's proposed schedule. Completing the concrete floodgate structure is estimated to take 90 days and the storm water-pumping station should take 100 days. Thus, the earthworks portion of the project is on the critical path because it will take the longest amount of time to construct.

The contractor plans to accomplish this work schedule with two crews. One crew will be responsible for the levee construction, while the other crew can complete the pumping station and floodgate portions of the project. This crew would ideally focus on the pumping station first, allowing time for the mechanical crew to install pumps, electrical wiring and controls.

8.2 PAPERWORK FLOW

Three parties are responsible for record keeping:

- The A-E/CMC firm, acting as the ***on-site construction manager,*** will have primary responsibility for keeping a detailed record of construction progress. The A-E/CMC team will keep a daily record of the work performed, the weather conditions, what equipment the contractor has on the job and its condition, and other information (for example, safety issues)

- The A-E/CMC will also keep track of how the work is progressing relative to the schedule's activity completion dates and associated milestones. This information is very important for determining any construction contractor requests for time extensions and resolving claims. For the example project, weather conditions can be a basis for a time extension request since the earthwork is on the critical path. The construction manager should also complete a weekly progress report for the COR and CO

- The COR must maintain adequate records in order to be able to readily produce reports on the project's status, problems, and successes to inform the CO and/or the USAID project team. The COR's records will rely primarily on the A-E/CMC's reports, contractor billings, and the Controller's reports on funding status. It is important that the A-E/CMC makes routine site visits and records progress observations and notes other issues concerning problem areas. Photographs and site inspection notes are important and should be part of the A-E/CMC's files

The ***construction contractor*** will maintain its own set of records. Most important among these

will be billing files and copies of official submittals such as shop drawings, warranties, equipment manuals, and other product information. The construction contractor will generally accept, review, and maintain the original contractor submittals until construction has been completed and closeout procedures have been finalized. The construction contractor can also be expected to maintain detailed records on the progress of work, delays and their causes, safety issues, and other items that may be important to a claims process, if one is initiated. Many records will be in the form of test reports, inspection reports, shop drawings, or equipment manuals, for example. These will be collected and maintained by the construction contractor until the end of the project, when they will be turned over to USAID and the Host Country O&M team.

8.3 QUALITY CONTROL

Quality control is the responsibility of both the construction contractor and the A-E/CMC firm. The CMC's role is to assure that the construction contractor is providing the quality control required in the contract documents and procedures expected from standard operating construction practices. If properly prepared, the project's QC documents will reflect the expectations of the beneficiaries and USAID, and will be implemented by the construction contractor to meet these expectations. The COR should be aware of the quality assurance plan, the quality control procedures being implemented by the construction contractor, and make review of this process a regular site visit activity.

8.4 PROGRESS PAYMENTS

On a unit price contract, progress payments are typically made monthly to the construction contractor. USAID regulations allow a certain time to process these requests unless they are in error, and this will be specified in the construction contract.

On a lump sum, performance based contract, the work is typically broken into a BOQ. The monthly payment request by the construction contractor is usually based on the percentage completed of the items set forth in the BOQ. Typically, a lump sum performance based construction contract will withhold 10% of the value of the work that has been completed, which normally will be paid upon final project acceptance by the CO.

As previously discussed, unit price and lump sum contracts are variations of Fixed Price contracts. Other variations include Fixed Price plus an economic adjustment. This is commonly used when oil or material prices are unstable, for example. An incentive can also be used for fixed prices, for example, early completion of work. Other examples include Cost Reimbursement Contracts where a contractor is paid his actual costs plus a fixed fee. Variations include cost plus award fee or cost plus fixed fee. The award or incentive is usually based on timely and satisfactory completion of work within the budget. For each of these contract types the payment process is similar and based on actual work completed with a retained percentage of 10%. The award and incentive fee is usually retained and made with the final payment.

Contracts provide for a time lag between the time a contractor's payment request is submitted and when payment is to be made. This allows for a monetary cushion between the amount paid to the contractor and the amount of work completed. It is important to never pay the contractor an amount more than the value of the work in place. This allows USAID to be able to complete the work with another firm if the contractor fails to perform work as specified, possibly at little additional cost.

8.5 PROJECT MANAGER RESPONSIBILITIES

The USAID Project Manager must maintain a project file that includes all important reports and actions concerning the project. A photographic record is also advised. This individual will be the primary source of information on the project within USAID. The Project Manager would be expected to make project briefings covering status, finances, problems, and accidents, for example, on a moment's notice. The project manager will be tasked with drafting responses to A-E and construction contractor's correspondence and issues that may range from a Congressional inquiry to a concern by the USAID Inspector General. As the COR, he/she would also be expected to review and process requests from the construction contractor and the A-E/CMC relating to change orders requiring approval by the CO.

For HCC and G2G projects the Project Officer/COR responsibilities will be shifted since contractual relations with the A-E and construction contractor will be with the Host Government. However involvement with the HGIU will be increased.

Progress Payments in the Example Project

In the example project, unit cost payments on the earthwork levee may be based on the number of cubic yards of material to be incorporated into the planned construction. The floodgate structure may be a lump-sum payment item. However, the floodgate itself may be fabricated off site, delivered, and stored on the site until it is needed. Alternatively, the contractor's payment request may be based on a combination of the number of cubic yards of select fill that have been incorporated into the levee, the estimated completion milestones percentage of the floodgate structure, and payment for the uninstalled floodgate stored on site. However, if the roof of the pumping station was not installed in accordance with the specifications, the CMC should not authorize payment for this lump-sum line item when it reviews the billing voucher until the issue is resolved.

9. CONSTRUCTION PHASE OVERSIGHT

Oversight of the actual construction is necessary to provide independent assurance to USAID and Host Country beneficiaries that the construction contractor is performing the work in accordance with the requirements specified in the construction contract documents. The level of construction oversight can vary from a cursory review to a detailed review depending on the complexity of the construction project and financial and other risk issues.

The technical skills and operational experience required for construction oversight depend on the complexity of the specific project and could include architects, civil, mechanical and electrical engineers, surveyors, geotechnical engineers, GIS specialists, and administrative support staff. The assigned field personnel from the A-E/CMC and its subcontractors responsible for oversight is dependent on their integrity and attention to detail. Some of the construction oversight is best provided by experienced mid - or senior - level professionals. They may be supported by local professionals and technicians, who often will require some level of additional training. A training component could be an A-E/CMC contract requirement in support of USAID's Local Systems capacity building goals for the construction sector.

9.1 CONSTRUCTION MANAGER CONTRACTOR RESPONSIBILITIES

Construction oversight is typically the primary responsibility of an A-E firm acting as the CMC. It is common to have the design professionals, who developed the final design documents and specifications also involved with the construction management roles and responsibilities. Section 4 ("Request for Qualifications Contract Award") presents a discussion of this approach as well as an outline of duties expected by a CMC:

Construction Manager Responsibilities
Scheduling and briefings
Shop drawing approvals
Site inspections
A record of all construction-related activities
Correspondence record
Verification of correctness and approval of billings
Acceptance and approval of warrantees, guarantees, and other required contractor submissions
Punch lists and turnover preparations
As-built drawings
Assistance with disputes and claims resolution
Project startup and training activities
Project dedication
Media outreach support

9.1.1 Scheduling and Briefings

The CMC is usually the primary coordinator and interface between the USAID project team and the construction contractor, local communities, and cooperating country representatives. The

CMC is also usually responsible for ensuring that all parties are informed of activities related to the construction that may concern them.

9.1.2 Shop Drawing Approvals

The construction contractor will provide any required shop or related drawings to the CMC for review and approval as specified in both contracts.

9.1.3 Site Inspections

Monitoring the quality and the progress of the work is a continuous activity for the CMC. Inspections must be made before work on the facility is covered or embedded, and at critical stages of construction.

9.1.4 A Record of All Construction-Related Activities

Daily and other logs are common tools used for recordkeeping as well as written reports by the CMC. Keeping a record of the daily progress is critical background information, which is referenced when resolving disputes and claims that may arise.

9.1.5 Correspondence Record

A detailed record of incoming and outgoing correspondence and shipments of materials, machinery, and equipment is required by the CMC. These records are most useful when resolving cases of misplaced lost documents.

9.1.6 Verification of Correctness and Approval of Billings

The CMC is in the best position to verify the correctness of the construction contractor's billings and must verify their correctness before they are forwarded to the USAID for payment.

9.1.7 Acceptance of Warrantees, Guarantees, and Other Required Subcontract Submissions

The CMC must verify the adequacy of required contract submittals.

9.1.8 Punch Lists and Turnover Preparation

As the facility nears completion, the CMC is usually contractually required to complete a detailed list of corrections and outstanding items yet to be completed for the COR and CO. The facility transfer process may require training of the beneficiary staff, collecting and organizing O&M manuals, and planning an official dedication ceremony with USAID and other officials and stakeholders requiring planning and organizational activities, and media coverage.

9.1.9 As-Built Drawings

The A-E/CMC is responsible for completing or verifying the as-built drawings shortly after the construction is complete. This activity should be an on-going process, with as-built drawings completed for each segment of the project as it is finished.

9.1.10 Assistance with Claims and Disputes

Claims and disputes are common in construction contracts. The A-E/CMC should analyze each case and be ready to provide support assistance to the CO and COR to help resolve the dispute or claim. Situations involving additional funding or that are in violation of policy or regulations must be quickly referred to the CO for a decision on how to proceed.

9.1.11 Project Startup and Training Activities

Training may be required prior to the beneficiary transfer and startup to assure that the local staff is ready to operate and sustainably maintain the facility. Training activities may be shared between the construction contractor and the A-E/CMC. For example, mechanical equipment suppliers the construction contractor would typically be required to provide instruction on how to operate and repair their equipment and machinery. The A-E/CMC may be required to provide training for

staffing requirements and general operation of the facility.

9.1.12 Project Dedication

The CM may be asked to arrange for a dedication ceremony when the facility is completed. This would require arranging for a venue to hold the ceremony, preferably at the project site. Seating, refreshments, decorations and draft speeches are usually provided by the A-E/CMC, and media arrangements need to be made. Transportation of participants and guests may be required. A tour of the facility with signage should be considered. Major dignitaries to consider are the US Ambassador, Mission Director, host/partner county representatives, and village representatives. The construction contractor should be recognized in some manner by USAID as well as other key participants.

9.1.13 Media/Outreach Support

On a typical USAID construction project, the A-E/CMC may be asked to provide support for working with members of the public, who may or may not be beneficiaries to the project. This may include media releases on the project. Such releases may require USAID approval and should be cleared through the CO and COR.

For the example project, the CMC has been tasked to work closely with the village in order to keep them informed of the progress of the construction, what their obligations are, and the timing of key milestones. The CMC also is expected to keep USAID fully informed of construction progress and of any problems that arise as part of its contractual requirements.

10. POST-CONSTRUCTION OPERATION AND MAINTENANCE

Once construction is complete, work on the construction project is not over. Warranty issues, punch lists remaining items, claims are examples. Claim issues can take years to resolve, often over issues that could have been resolved during the construction. Also the construction contractor and/or A-E/CMC together with the USAID project team will often continue working to provide operation and maintenance assistance with the provision of expatriate technical support. This last section details possible responsibilities of the construction contractor, A-E/CMC, and USAID once the facility has been certified as having been constructed successfully. It is also noted that it has been the USAID experience that host governments struggle with maintaining highly technical projects. Often this results simply from the lack of funds but more often from the lack of skills or access to spare parts. Skills training sometimes results in the trainee leaving for a better paid job, leaving an untrained replacement. Spare parts issues are resolved by providing backup spares as requirement of the construction contract. Even when adequate spares are provided, failure has occurred when inadequate storage and security are provided. Losses from theft and damage are common. This section is included primarily to ensure that engineers and project officers are aware of this development problem and that they address this matter while in the planning and design phases of a project. Following are options for ensuring sustainable projects.

10.1 CONTRACTOR RESPONSIBILITIES

The construction contractor and/or the A-E/CMC firm's contract requirements and responsibilities should provide the flexibility to ensure startup operational issues are included in their scopes of work. This may include, for example, extended facility startup support, extended warranties and guarantees on equipment, and extra stocking of critical and hard to obtain parts. A training program for operators and maintenance staff needs to be considered beyond the startup phase. The A-E and construction teams could, as needed, be tasked with these issues during the startup period and follow on for up two or three years.

In the past, USAID has provided extended post-construction operations support for facilities requiring complex operating procedures, such as a wastewater treatment plant. This has been up to a period of five years with both finance and a team of experts serving as counterparts to key local employees. In many instances, this financial support was in the form of a declining pre-

specified share of the expected O&M costs over a specified period of time.

10.1.1 Project Team Responsibilities

O&M issues need to be addressed during the design phase of a project. Detailed studies of the host government capacities and capabilities are required. This will require an engineering analysis as well as financial and management/administration study of the receiving organization. Secondly, the design team needs to address the local country capacity to provide labor, supplies and materials. The projects final design must maximize the use of local materials and labor. Often this will result in using technology not common in U.S. engineering practice or the latest trends in the field. The most important consideration is that it must work.

Off course local engineers and managers tend to resist this concept as they often want the latest and most expensive product available.

10.2 MANUALS

Two types of manuals are essential for the O&M of the project. These include the O&M manuals and equally important a Safety Manual(s). The existing A-E contract should also provide the appropriate training needed by operations and maintenance staff. Training should include all key employees. A contingency plan for follow up training should be considered if needed. Manuals need to be fully understandable and written in the local language. Standard supplier lingo may require translation.

For the example village flood control project, the construction contractor is responsible for the initial startup and testing of the equipment post-construction. (Normally, this would have been completed during the construction phase, but in this case, there was insufficient rainfall at the project site, and the floodgate could not be adequately tested.)

The village is located behind the gate and would be subject to flooding with a heavy rainfall event, if the pumps failed to operate. The construction contractor was required to have a representative present during the first heavy rainfall to assure the pumps operate properly. This includes verifying that the pumps will start automatically, and a test to assure that the standby generator would automatically respond when cutting the pumps from the main power source.

At the completion of construction, the contractor had delivered the appropriate operating manuals to the village and trained both a village resident as the "operator" and a backup operator. A representative from the cooperating country entity (as the Owner) presence was required for the initial set of tests.

The tests would also show if the operating manuals were adequate and that the village based operator and backup operator needed further training.

10.2.1 Operation and Maintenance Manual(s)

O&M manuals are typically completed during the construction phase so they can be available for the facility's start up. These manuals will depend heavily on the manufacturer's machinery and equipment documentation. Constructed and fabricated components may require special documentation and specialized training.

O&M manuals are also required for training the operations staff prior to or at turnover. The O&M manuals should be updated and supplemented during operations as procedural changes occur. It is important that the related as-built drawings are included with the manuals so that if facility repairs are needed they can made efficiently and with a minimal disturbance. The training process should instill the fact that Manuals are to be used and updated as changes are made.

10.2.2 Safety Manual

A manual on safe operating procedures and practices needs to be prepared for the project.

This manual would emphasize specific equipment and components that may be hazardous and would also serve as a basis for safety training of the O&M staff. Projects that use hazardous materials are especially in need of such guidance. Water treatment facilities using chlorine are an example. The A-E/CMC contractor is usually selected as being best qualified to ensure that a safety manual is prepared and included with the other operating and maintenance manuals and associated training plans.

10.3 AS BUILT DRAWINGS

Construction 'As Built' drawings are provided by the A-E at the completion of construction. These should be retained by a responsible employee such as a Chief Engineer. Drawings related to specific facilities that are critical to operation and maintenance should be copied and included with the O&M manuals. Secure storage of these documents is also important as they will be a critical resource in the event of a disaster or when planning any changes or additions to the project.

10.4 SPARE PARTS

Assurance of a secure storage facility for the spare parts provided is important. Past experience is that they tend to disappear or become unusable because of pests and weather if not stored properly. It is important for the project team to inspect any proposed storage for this important USAID investment.

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This Author's experience with USAID infrastructure projects spans 40 years as a Foreign Service Officer, Engineering Consultant and Chief of Party involving projects and programs in over 100 countries. The Author believes that USAID is an evolving Agency. Regulations and Guidelines continue to change. Therefore references provided in this document can be expected to be updated with time. One last note from the Author, "USAID engineers' project review and advice should not be ignored at the same time engineers should work within the development space and do their best to provide alternative solutions when needed."

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