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BASIC ENGINEERING AND CONSTRUCTION MANAGEMENT: A PRIMER

DRAFT FINAL REPORT

December 2010

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EPIQ II

MAKING POLICIES WORK FOR PEOPLE

EXECUTIVE SUMMARY

This manual covers the basic steps in the process of planning and contracting for engineering and infrastructure projects funded by the US Agency for International Development. It is intended for training USAID engineers and other development staff on engineering construction and management. It is also a handy reference for use when implementing any project where engineering is a factor.

The starting point for undertaking successful construction projects in this manual is a project that has been identified in the Mission Strategic Plan and for which the preliminary environmental, gender, feasibility, and costs studies have been completed. Often, before funds can be obligated, more detail will be needed and more reliable cost estimates must be obtained to meet the requirements of FAA Section 611a.

A hypothetical project is used in this manual to illustrate the typical steps project managers can anticipate needing to take during all phases of an engineering and construction project. The example includes environmental, social, and engineering issues.

The first step will be to clearly define the project, and review the limits and restrictions that must be addressed, such as, have the conditions precedent of the grant agreement been met? This step also encompasses asking, for example, what standards will be used, US or international. And what local restrictions must be addressed?

To define a project's scope more clearly, it may be necessary to complete additional studies. These pre-design activities include such studies as examinations of alternatives, special engineering problems, the need for an environmental impact assessment, a community outreach program, and detailed cost estimates needed to meet the mandatory requirement of Section 611a. USAID technical staff generally complete the pre-design activities, although for complex projects, it may be necessary to procure the services of specialist consultants.

Next, the manual discusses the steps necessary to procure the architect/engineering consultant for work that has been divided into three phases (study, design, and construction management), each of which must be approved independently. Example tasks are presented for each phase as well as the procurement process. Once the study phase has been completed and approved, the A/E will be directed to undertake the design phase. This will be divided into preliminary and final design work, each of which will require USAID review and approval. Again, typical scopes of work for the example project are included.

The pre-construction phase is initiated concurrent with the design phase; it focuses on procuring the services of a construction contractor. In addition to discussing the bidding process, other key concerns addressed are construction contract types and quality assurance/quality control. The bidding process discussion addresses pre-qualification, the documents and process needed

for the invitation for bids, bid evaluation, and the pre-construction conference.

The construction phase is divided into two sections. The first covers contract administration and the second contract oversight. Administration involves general project requirements such as paper flow and records, quality control and payments, which are the responsibility of the participating parties. Oversight is provided by the construction manager (generally, the A/E firm).

Last is the post-construction phase. Typical activities here include startup, training, manuals, and warrantee follow-up. USAID has often supported follow-on contracts for operations and maintenance support. This support is often provided by the construction contractor, or in some cases, the construction manager. One contentious area that must be resolved during this phase will be the settlement of claims, which are common and should be accompanied by plans for resolution.

USAID project managers/engineers have the responsibility to assure that the process of contracting for engineering and construction is carried out professionally and in accordance with USAID regulations and guidelines. Other USAID players will have authority for selected actions, such as contracting, finances, and approvals. The project manager/engineer has overall responsibility for the project and must ensure that required actions are completed in a timely and cost-effective manner. This requires that the project manager have a broad understanding of engineering and contracting processes, the constraints of working in developing countries, and USAID procedures and regulations.

ACRONYMS

A/E	architect/engineer
AIDAR	USAID's acquisition regulations
ADS	Automated Directive System of USAID
ASCE	American Society of Civil Engineers
BOQ	bill of quantities
CBD	*Commerce Business Daily*
CM	construction manager
CMC	construction management contractor
FAA	Foreign Assistance Act
FAR	Federal Acquisition Regulations
FIDIC	Federation Internationale des Ingenieurs-Conseils (International Federation of Consulting Engineers)
IFB	invitation for bids
IQC	indefinite quantity contract
O&M	operations and maintenance
QA/QC	quality assurance/quality control
RFQ	request for qualifications
SOW	scope of work
USAID	United States Agency for International Development

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1. OVERVIEW

This primer introduces engineering and development professionals to basic engineering and construction contract management. It describes the basic approaches to managing US Agency for International Development (USAID) engineering and construction contracts, and outlines the steps needed to meet the Agency's goals for long-term results and development impacts. USAID's engineering and project officers have been given responsibility for overseeing its construction and engineering contracts.

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 sewage treatment plant or major road. Regardless of their size, it is USAID's responsibility to ensure that the project is built properly, uses good construction management methods, and functions as designed for years into the future. Thus, it puts in place contracts that clearly lay out the design, plans, specifications and responsibilities of all parties.

A project's success over the longer term requires knowledge, skills and abilities on the part of those implementing and managing it. However, many professionals in the developing world have not yet internalized the core competencies that those in more advanced economies take for granted. For this reason, USAID incorporates capacity building activities into many of its engineering projects. These projects generally also require follow-on contracts for operations and maintenance support that include an emphasis on training. As a result, the owner of the project will have the skills needed to successfully construct, operate and maintain similar projects in the future.

THE ACTORS IN CONTRACT MANAGEMENT

There are a number of players involved in the implementation of USAID-financed engineering and construction projects. It is important to clearly define the role of each party at the beginning of the project to ensure there is little opportunity for confusion later on. Some of the main actors and their roles are identified in this section.

US Agency for International Development

USAID is usually the sponsor of the infrastructure project, and in most cases today, it contracts directly with engineering and construction companies to implement it. In the past, USAID primarily used host county contracts, under which it played the role of financier.

Host country contracting requires monitoring efforts by USAID project officers and engineers, who must also play an active role in assuring that construction standards and project goals are met. The USAID construction project team includes the following professionals.

Project manager. This role is filled by a USAID engineer or project officer, although an engineering manager is generally required for larger construction projects. Like the captain of a

ship, the project manager is responsible for seeing that other members of the team are participating when needed. Another part of the project manager's job is to see that the project is completed on time, to technical specifications, and within budget. He or she 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; and drafting responses to Congressional inquiries, to name a few. Last, the project manager needs to anticipate and resolve problems and disputes.

Project engineer. This role is filled by a professional engineer, who generally has background skills that are relevant to the project's needs. For example, an electrical engineer should 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 either type of project.

Project engineers are often able to work on several projects at the same time, while the 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 is not an engineer, because he or she must also step in and assist with engineering issues.

Comptroller. The project's financial representative is an important team member as this person assures that funds are available and payments are timely and correct. Contractors can create major problems 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 problems are looming. This individual has the routine role of assuring that legal and contractual documents are correct, but will be especially needed when resolving claims or contract issues such as defaults.

Contracting officer. The contracting officer has the final authority over all contacting issues. This individual will ask for, as well as rely on, legal and engineering advice when making decisions.

Environmental officer. The environmental officer is responsible for ensuring that the environmental requirements for the project have been met. It is common for capital projects to require an environmental assessment or the more detailed environmental impact statement. The type of study required for a project may have may have been determined when USAID was developing strategic objectives for the project, or later pre-engineering studies may have identified concerns that trigger additional analysis.

Mission director. The mission director has the final authority over the project and must be kept informed of its progress and all potential problems. Any project amendments or major changes will require his or her approval. This individual will also sign all key correspondence regarding the construction, unless he or she has delegated this responsibility to another staff member.

Beneficiaries

The beneficiaries of a project are usually represented by a senior member of the particular arm of the host government accepting the assistance. Usually this will be a minister, but it could also be a representative of a city, province, or a government agency such as a utility. The beneficiary must bear ultimate responsibility for approving, operating and maintaining the project. The beneficiary also must make a contribution to the project. This can be either in cash or in-kind services.

Design Professional

The design professional is usually a consulting engineering firm for general construction or an architectural firm for building construction. In

USAID terminology, they are jointly called A/E firms.

The design professional will frequently have subcontractors to do specialty work such as surveying, materials testing, and soils surveys. Larger firms generally will have broader in-house capabilities and may thus supply their own specialists. Many consultants working with USAID have a fairly broad range of in-house capabilities. A/Es are typically used for a range of work, including pre-design and feasibility studies, project design, construction management, and post-construction training and operations and maintenance (O&M) support.

INTERNATIONAL POLICY AND LAW

The project management team needs to be aware of all USAID legal requirements and policies, especially those on the use of international rules and regulations. The legal officer will clarify any questions or concerns as to the appropriateness of using international documents, as well the contracting officer regarding the incorporation of USAID mandatory clause within international documents.

With USAID direct and host country contracting, the Federal Acquisition Regulations (FAR) and USAID's acquisition regulations (the AIDAR) provide the controlling standards. International contractors are generally more familiar with the FIDIC contract conditions, which are often used by USAID and amended, if necessary, to meet the FAR and AIDAR requirements.[1] Most countries have building codes and construction standards, but generally accept international and US standards of they are equal or better. USAID work generally follows US standards, but equal international and local standards are acceptable if they are amended to include the mandatory USAID conditions.

For projects using local contractors, international and US standards may be unfamiliar to them and just be adjusted to be user-friendly. For example, US weights and measures will be a problem to someone who is only familiar with the metric system. Also, the policy of specifying materials and equipment from the US should be adjusted to meet local capabilities. Supply equipment where parts are unavailable or cannot be properly maintained should be avoided. Waivers are possible if they are needed.

Project managers must ensure that the following international policy and legal considerations have been addressed when implementing engineering and construction projects:

- That grant agreement conditions precedent are met
- Plans and specifications are compatible with local conditions, the capabilities of targeted construction firms, and the skills of the operations and maintenance force
- Local laws and requirements are considered
- USAID mandatory requirements are met.

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

- Maintaining a project schedule for use by all players
- Holding routine meetings with the team members to assure that progress remains on schedule
- Issuing routine status reports, including actoin items and completion dates
- Anticipating problems and being prepared for their resolution.

[1] Federation Internationale des Ingenieurs-Conseils (International Federation of Consulting Engineers).

MAJOR MILESTONES

Project managers have the responsibility of ensuring that the project stays on schedule. However, problems and delays will occur and must be anticipated. It is thus important to maintain a checklist and keep channels of communication open with all players. Providing a schedule, including major milestones, to all key players is an important tool. It should be updated routinely as well as when changes occur. Examples of major milestones for implementing a construction project include:

- Develop a detailed description of the project and required steps to complete it
- Complete pre-engineering and special studies
- Procure a design professional/construction manager
- Approve preliminary design/firm cost estimates
- Approve final design
- Prequalify construction contractors
- Request bids
- Construction contract award
- Construction completion/project dedication.

PRIMER EXAMPLE

This report uses a hypothetical example to demonstrate various approaches and steps required to successfully implement engineering and construction contracts.

The example also assumes that the USAID project officer is an experienced project development officer with skills in managing infrastructure projects. He or she will be supported by a professional civil engineer. Together, they make up the project management team, bringing in other USAID professionals.

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 might be constructed 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 the sea. 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 roof lines. There would be at least 15 feet of water at the point where a flood wall might be constructed.

2. PRE-DESIGN ACTIVITIES

Certain actions, such as conducting an environmental analysis, are required for any USAID project. This section first describes the mandatory requirements for the example project. It then walks through the series of other activities needed in preface to the project's design.

MANDATORY REQUIREMENTS

The example project would have been included as one of the approved Mission Assistance Objectives before being considered for construction funding. The USAID Assistance Objective Team would have already addressed issues related to the project's scope and general feasibility when it developed the USAID Mission's Assistance Agreement. Mandatory requirements that would have been completed were an environmental analysis and a gender analysis.

The project's environmental analysis concluded that an environmental impact statement would be required because a historic ruin lies on the site and potentially endangered wildlife inhabit the area of a possible flood wall alignment.

Also, the 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 and financial planning be completed, which would require detailed engineering studies for the project. This requirement must be completed before the Grant Agreement is signed and the project funding is obligated.

PRE-DESIGN STEPS

Engineering and construction projects require six sets of activities before the project can enter the design phase.

1	Develop a clear statement of the problem
2	Identify alternative solutions
3	Evaluate the alternative solutions
4	Evaluate possible issues and risks
5	Evaluate technical complexity
6	Evaluate soft consequences

Develop a Clear Problem Statement

The project manager and project engineer developed this statement of the problem: "To be able to sustain a 100-year flood, taking into consideration the effects of global warming and ground subsidence, with no injury to the residents and with minimal damage to the environment and personal property."

Identify Alternative Solutions

Solutions that may meet the requirements of this problem statement include:

- Evacuate the flood plain
- Raise or relocate the existing structures to an elevation higher than the anticipated flood elevation, plus the additional elevation attributable to global warming, plus a safety factor
- Construct a floodwall so that the top elevation will be higher than the estimated 100-year flood elevation plus an allowance for anticipated ground subsidence, plus a safety factor.

Define Alternative Solutions and Estimate Their Costs

The project manager and engineer team developed preliminary costs 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 team assumed that the existing homes would be demolished and new homes would be provided near existing supporting 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.

Identify Possible Issues and Risks

The risks associated with each alternative include:

Evacuation:

- Resistance by the residents to relocation
- Lack of suitable land for the 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
- Difficulty in accessing homes during a flood event
- Infrastructure serving the home may be damaged during a flood event
- Resistance by residents to the 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 will 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
- Will attract more homes to the flood plain
- Possibility of exceeding the 100-year event
- Funding of operating costs.

Evaluate Technical Complexity

At this stage of their studies, the project team concluded that they did not have enough information to decide which was the better alternative and that a more detailed analysis would be required by an A/E firm. This analysis would include, for example,

- Engineering studies
- The refinement of the initial cost estimates to assure that 611a requirements were being met
- A more detailed assessment of the "issues and risks" identified.

The technical assessment could include a number of specific activities, such as:

- Undertaking soil tests in order to determine the "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 and climate change
- Completing the required environmental impact statement.

Evaluate Soft Consequences

Soft consequences are basically those that 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 decision process at an early point. It is expected that the A/E firm would obtain a subcontractor to assist in undertaking this important work.

3. ENGAGEMENT OF THE ARCHITECT/ENGINEER

The architect/engineer contracted for the project performs several integral functions. This section describes the need for an A/E, how they can be selected for the project, and the variety of tasks the A/E can perform in each major phase of a project.

A/E REQIREMENTS

In the example project, the USAID project management team found the evaluation of the alternatives to be complex, requiring outside expertise before proceeding with the design of the project. The outside experts would provide studies of the project alternatives available, solicit community input in order determine what alternatives would be acceptable to them, and estimate the alternatives' costs in more detail. For the purposes of this discussion, these tasks have been combined into a single contract with an A/E firm. (Depending on circumstances outside the scope of this paper, the method of implementation could also be through a cooperative agreement or a grant, as explained in ADS Chapter 304.)

An A/E would also be needed to complete the design of the project and prepare plans and specifications once an alternative has been agreed upon. Last, the A/E would be needed to provide construction management services if the favored alternative includes construction.

It is much more efficient to combine these three components into one contract. This will usually result in cost savings, and more importantly, will be much easier for the contracting officer and project management team to manage.

A/E SELECTION

There are two options for selecting an A/E. The first would be to use an existing USAID Indefinite Quantity Contract (IQC) to provide engineering services on a work order basis. The second is to procure a new contractor 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 governs the engagement of a design professional (professional engineering or architectural firm) by the Federal Government or when using federal funds. This process includes advertising, ranking, selecting, and negotiating contracts. Simply put, the Act states that cost is not to be the basis of selection.

Although using an IQC is often the preferred approach, the example project uses the RFQ approach to procure an A/E firm. This will require a CBD advertisement to procure a consultant to undertake the three components. In this case, the A/E is given authority to proceed only with the completion of alternative studies, cost estimation, and community outreach studies. Once these are satisfactorily completed, the follow-on components (design and construction management) can be implemented depending on the results of the studies phase.

A/E SCOPE OF WORK

In the hypothetical example, the scope of work is divided into three phases:

Phase 1 Studies	This phase covers the completion of the alternatives evaluation and outreach program to the local community
Phase 2 Design	This phase is for the project's design, which will depend on the outcome of the studies phase
Phase 3 Construction	The project is built during this phase; it also depends on the results of the studies phase.

The general components of each phase are to be included in each phase of the A/E's Scope of Work (SOW). The lists of components that follow are illustrative and should be tailored to each project undertaken.

Studies Phase

Some examples of items to include in the SOW are:

- Briefly state the problem and describe the alterative solutions under consideration
- Review each alternative and refine concepts, costs, issues and risks
- Consider additional alternatives only after receiving approval from the contracting officer
- Undertake a preliminary assessment of the marshy soils in regard to the requirements for a floodwall or similar structure
- Investigate the reported subsidence and estimate the annual rate
- Investigate the impact on a local ruin and the nesting areas of endangered species (turtles in this example)
- Complete a draft of the environmental impact statement for the recommended alternative
- Review construction methods and materials, and recommend appropriate technologies for the area
- Present results to the community and obtain their input and approvals as appropriate
- Recommend the best alternative for this project based on costs, risk, technical feasibility and community preferences
- Present progress reports bi-weekly.

Design Phase

This phase is divided into a preliminary design phase and a detailed or final design phase. The preliminary design phase will be a point of major review by the project team and will present all the components of the construction project, an outline of the specifications, and a firm estimate of the project costs. This will allow the project team to redirect or correct the A/E contractor if needed.

The preliminary design phase generally necessitates about 30% of the design effort. Examples of items to be included in the scope of work for this phase are:

- Details of the recommended alternative to be constructed
- Design standards (usually US or international, but may include host county standards where local standards and practice are equivalent to international standards)
- Requirements for costs estimates
- Consideration of alternative options for components and materials with an emphasis local business and suppliers
- Incorporation of aesthetic considerations as appropriate
- Emphasis on a design that minimizes or suits local capabilities for operations and maintenance
- Incorporates environmental concerns into the design as appropriate
- Contract specifications and documents (usually US or FIDIC standards)

- Type of construction contract (usually fixed price)
- Operation and maintenance factors.

Construction Phase

The A/E represents the project team in assuring that construction is completed in accordance with the plans and specifications prepared during the design phase. These include:

- 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 warrantees, guarantees, and other submissions required of the contractor
- Reviewing contractor value engineering proposals
- Preparing punch lists and turnovers
- Preparing as-built drawings
- Assisting with disputes and claims resolution
- Preparing project startup and training activities
- Maintaining good relations with local villages.

PROJECT RESPONSIBILITIES

Overseeing the activities of the A/E is the sole responsibility of the project manager team.

4. REQUEST FOR QUALIFICATIONS AND CONTRACT AWARD

Interested 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 available in many engineering firms. Proposers would be expected to subcontract with other firms that could provide such skills.

Step 1	Receive responses to RFQ
Step 2	Evaluate responses using pre-determined evaluation criteria
Step 3	Score and select the top bidder
Step 4	Negotiate contract
Step 5	Issue notice to proceed

INFORMATION REQUIRED BY THE RFQ

Consulting and A/E firms that are interested in bidding to provide services on the project would generally be required to provide at least the following information:

- 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.

EVALUATION CRITERIA

These criteria are used evaluate the proposals received. Also, because they inform potential bidders on how they will be judged, they should 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 contract, and must reflect the needs of the specific project to be awarded. These criteria must be chosen and worded carefully: if someone were to challenge the award, it is likely to be on the basis of the appropriateness of the criteria and how they are applied during the award process.

For the example project, some of the factors on which the criteria would be based would include:

- The A/E team must have experience in planning and feasibility studies, community outreach, environmental impact assessment,

design of related works, and construction management.

- The design team should be well versed in flood control structures.
- General team experience should include working in a developing country under similar conditions and on similar projects.
- The experience of the team leader and key personnel is critical. A firm may show excellent qualifications as an international expert in all of the SOW areas; however, if the assigned field personnel have never worked outside the US 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. However, for timely implementation, the team leader, at a minimum, should have this experience and the appropriate technical skills.

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 manager	10
Environmental specialist	
Timely completion of work	5
References	10
Total	100

EVALUATION BOARD

The project officer, in cooperation with the contracting officer, would establish a panel of a minimum of three qualified members to review the submittals and select the top-three qualified A/E teams. The evaluation board, also referred to as the selection panel, should be chaired by an engineer, and include a member qualified to address the outreach qualifications.

Each member would independently review and score each submittal using a format similar to the forgoing example. The evaluators' scores are then averaged and the top-three firms ranked and presented to the contracting officer to proceed with finalizing a contract.

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. The chairman should also keep minutes of each board meeting.

CONTRACT NEGOTIATION

Contract negotiation is the responsibility of the contracting officer. This individual will start negotiations with the highest-ranked firm and if unsuccessful, move to the second-highest and so on. Generally, negotiations will be concluded with the highest-ranked firm.

The contracting officer may not usually seek the evaluation board's or project officer's assistance during this process. However, the project officer is responsible for preparing an official government estimate of the cost of the services and providing it to the contracting officer before negotiations begin. This is required for each proposed contract or contract modification expected to exceed $100,000.

The cost estimate is prepared on the basis of a detailed analysis of the required work, as though the government were submitting the proposal. For the example project, which has three phases of work, only the "studies" portion can be negotiated at this stage. This is because the costs of the

follow-on phases depend on the results of the study.

NOTICE TO PROCEED

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

PROJECT RESPONSIBILITIES

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

5. STUDIES

As noted earlier, A/E contracts often include a pre-design phase before proceeding to the engineering design and construction management phases. Pre-design includes such activities as planning assignments, feasibility studies, environmental assessments and impact statements, and stakeholder coordination. Such studies are typically multi-disciplinary and involve many stakeholders. They also address the "soft" issues such as community outreach. Village cooperation in the example project is indicative of a "soft" issue.

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

Technical	Soil assessment Subsidence evaluation Hydraulics
Environmental	Environmental assessment Impacts on threatened or endangered species
Social	Community impacts
Heritage	Impacts on important architectural, religious, and other sites

SCOPE OF WORK BY TEAM MEMBER

Section 3 included a suggested scope for the studies phase. This scope reflects the needs of a project to protect the village located at the example project site. The level of effort is relatively small for this phase; in the example project, the studies could be completed within three months.

Hydrologist/Hydraulics Specialist

In conducting the technical studies, 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 will also be important.

Soils Expert

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

Environmental Specialist

This individual would be included in the initial site visit team in order to assess the reported ruin and endangered nesting area. He or she would also assess the impact of the floodwall and its associated floodgate on the environment, and would participate in discussions with the villagers.

Project Team Leader

The project team leader should be present during this stage and work closely with the community outreach specialist in reviewing the alternatives for protecting the village. The team leader will be responsible for finalizing the study reports.

Project Manager and Engineer

These individuals should also visit the site while the Phase 1 specialists are present. This is an ideal time to exchange ideas as well as learn from the experts about the information they may be uncovering.

EXAMPLE NEXT STEPS

For the purpose of laying out the sequence of actions in Phases 2 and 3 of the A/E contract, the example project's studies reports have recommended that a floodwall is the best alternative, which is also the conclusion of residents in the project area. The studies' conclusions are:

- The soils are acceptable; a special design of the footing, including support piling, will be necessary.
- The hydraulics specialist has determined that the wall height could be reduced by 2 feet based on the predicted 100-year storm, but notes that 1 foot must be added because of the expected impact of climate change.
- 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 10 years. This expert also notes that records are sketchy and that this is his best estimate. Thus, the original floodwall height estimate will not be changed.
- The draft EIS was found to be acceptable and will be finalized in Phase 2.
- The proposed alignment of the floodwall represents the best cost, 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 team, including the mission director.

PROJECT RESPONSIBILITIES

The project manager's role during the studies or predesign phase of a project is basically to monitor progress and expedite any approval process. This individual will also approve 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 conditions should be included. The project manager should be alert for signs that the A/E is not performing as planned or the assigned staff are not qualified for the intended work.

6. DESIGN

The design phase entails the detailed project engineering and preparation of the construction plans and specifications. In the example project, at this time, the A/E team has completed the study of alternative approaches to meet the project's needs. 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 assessment, and working with villages in the project area to gain approval of an alternative approach. These studies also provide a basis for firming up the project costs for each alternative. The result was the selection of the flood wall option.

To complete the design phase, the project manager has asked the contracting officer to amend the cost plus fixed fee contract to include estimates of costs and manpower requirements, and a schedule for the design phase, which are to be provided by the A/E team. Once this has been agreed, the contracting officer will issue the notice to proceed with the design.

Preliminary Design	Data collection and analysis Surveys Hydraulic and other technical analyses Preliminary specifications Updated cost estimates Construction drawings Environmental impact statement
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/rights of way Release of bid documents

PRELIMINARY DESIGN

Data Collection and Analysis

A significant portion of this design phase is taken up by data collection. Soil cores will be required to determine the soil conditions over the 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 verses a concrete wall. The soils are also a critical factor in determining the floodwall's alignment. The general alignment was established in the studies phase; however, because of the nature of the marshy soils, further value engineering can be gained with a more complete soil survey.

Surveys will be also required to establish both vertical and horizontal controls. 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 statement will also need to be finalized.

The results of the work during this phase 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.

Of great importance is the inclusion of an updated cost estimate, because funding adjustments may require a timely process or may not even be possible.

The codes and standards used should meet the standards in which the country is located or local area standards. These generally will depend on appropriate international standards. US standards are typically used on USAID projects, especially when using US A/E firms and construction contractors. These usually exceed local codes and standards.

Deliverables

Specific preliminary design deliverables should include:

- Preliminary construction drawings
- Outline specifications
- Basis of design reports
- Cost estimates
- Environmental impact statement.

Project Responsibilities

The project manager will be responsible for the review of these documents. He or she should use the engineering and related skills available, being especially mindful of environmental issues, costs, the appropriateness of the technology, sustainability, operations and maintenance, project sustainability, and local concerns and issues.

The project manager should provide his or her formal comments to the A/E team for their consideration, corrections or inclusion in the detailed design. He or she also needs to assure that the USAID review is timely and meets the project schedule.

DETAILED DESIGN

Once the project management team has completed its review and the A/E team has been given permission to undertake the detailed design, major project decisions will have been made. The project manager's focus should be on monitoring the A/E team' progress and anticipating and resolving problems. The A/E team will provide progress reports as required by the contract; however, project meetings are still a valuable monitoring tool.

Deliverables

Specific detailed design deliverables include:

- Construction drawings (plans) to an acceptable standard showing in detail the proposed construction
- Technical 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.

Project Responsibilities

The project manager needs to assure that the necessary lands and rights-of-way are available for the floodwall, pump station, borrow pits, disposal sites and work areas. This is usually the responsibility of the local government sponsor. The project manager must assure that this requirement is accomplished prior to the award of a construction contract.

Occasionally construction will be managed by someone other than the A/E team. If so, the project manager must address how this will be accomplished, such as obtaining another firm or qualified individual to undertake this work.

The project manager also needs to assure that the construction documents are reviewed and approved by concerned USAID and host country government officials in a timely manner. The project manager must work closely with the A/E to assure that any corrections or changes are incorporated in a timely manner.

Bid Documents

Once the A/E team has made any final changes or corrections, the final review and approvals will be made by the USAID team and the host government. The contracting officer will then release the bid documents to the prequalified contractors.

7. PRE-CONSTRUCTION PHASE

This phase of a project entails securing a qualified contractor and executing an agreement with the contractor that clearly spells out the work to be performed. An important element of this phase is being assured that the work is completed in accordance with the host country's understanding and USAID's regulations and polices. This phase, in part, will run concurrently with the design phase.

PREQUALIFICATION

Prequalification is the process of reviewing contractors' qualifications in advance of seeking bids. The purpose is to assure that only qualified contractors are permitted to bid, which will reduce problems during the construction phase. The factors considered could include:

- Experience with similar projects
- Size of projects completed
- Value of work completed
- Key staff
- Equipment
- Work backlog.

Projects can be bid without prequalification; however, this is not recommended.

CONSTRUCTION CONTRACT TYPES

The common types of contracts used for construction are:

Lump Sum

These are frequently used for construction where materials and labor are easily quantified and the risk is low.

Unit Price

Unit price construction is when the 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.

Cost Plus Fixed Fee

These contracts are valuable for situations where the extent of work is not measureable in advance or in emergency situations when survey and design are not possible before construction begins.

Fixed Amount Reimbursement

These contracts are used when USAID is helping facilitate the work, but is not in direct control. Such contracts are often used to reimburse host county construction companies when the host country takes the risk on any overruns.

All of these contract types are considered to be fixed price contracts, except for the cost plus fixed fee, which is a cost reimbursement contract. Other contract types that are applicable to USAID work

include incentive contracts, indefinite delivery contracts, and time and materials contracts. All types of contracts have innovations such as incentives. Also used by USAID are design-build contracts, which are also called turnkey contracts. These generally are lump sum or unit price contracts. Project officers/engineers should become acquainted with all contract types, their variations and uses.

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.

INVITATION FOR BIDS

The Invitation for Bids (IFB) is the basic document of a construction contract. In addition to asking firms to compete for USAID work, it includes the plans and specifications that become the contract's core. It also establishes the criteria against which all bidders will be evaluated on an equal basis.

An IFB that is not precise will lead to problems requiring correction. The end result is generally a delay in the 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

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.

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
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

Some Elements of the Instructions to Bidders
A statement that the contract will be awarded to the lowest responsive, responsible bidder
A statement that the contracting agency may, at its option, reject all bids
A statement that requests for clarification of the IFB and explanations of the award should be addressed to the contracting officer

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.

Bill of Quantities

The bill of quantities (BOQ) lists the component parts of the contract work and provides for the pricing of each of these elements. The BOQ relates to the technical specifications components of the work. The quantities the A/E firm has estimated for each item will be included as appropriate. The bidder fills in the unit price for the item, and the total 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 are useful when funds are fixed and can be deleted or included according to the budget available. Lump sum amounts may be included as appropriate.

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 US commercial practice.

A bank guarantee is often allowed in lieu of a bond. If it is used, the amount of the guarantee must be stated.

Form of Agreement

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

Conditions of the Contract

These are standard or model documents that are generally in two parts; they must be amended to meet the needs of each specific project. For example, Part 1 is titled General Conditions and Part 2 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 the FIDIC model.

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:

- 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 contractor will perform the work, set forth precisely the rights and obligations of the parties, and include provision for payment, inspection, and release of bonds or guarantees. Further, they generally contain all provisions to define the relationship of the parties and, where a consulting engineer (A/E) is used, the engineer's rights and obligations.

Technical Specifications and Drawings

The technical specifications and drawings are the contractor's road map for completing the project. Their preparation represents the primary product of the design phase.

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 contracting officer, who in turn will depend on the project manager/engineer for many of the responses. The contracting officer will combine the questions and answers and provide a joint response to all recipients of the bid documents.

Pre-bidding conferences (see below) are also a time for contractors to raise questions. Those requiring further input before answering will be recorded and answered in a joint response. Pre-bidding conferences are also used to explain the details of the project, which are not always easily conveyed in the plans and specifications. More importantly, they will flag contractor concerns that could cause a higher bid price if not clarified. Pre-bidding conferences can include a site visit. With international projects this is not always convenient or possible. Many 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. Bids can be received by mail or by hand delivery, and the time of receipt is to be recorded.

Opening the bids is generally done in a public setting where all proposers can be present. Each tender 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.

BID EVALUATION

The biding documents need to be carefully reviewed to assure that all required supporting documentation is included. For example, have the required bid bonds been included? Have exceptions been made? Are all required signatures there? Are there errors in the bid price extensions? Such problems should be discussed with the legal counsel and the contracting officer, as many of them 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 USAID 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.

PRE-CONSTRUCTION CONFERENCE

The purpose of the pre-construction conference is to update all the stakeholders in the construction process and clarify the responsibilities of each party. In addition, the conference can help clarify the working relationships between the parties and allow them to state their expectations. It is important to identify the key players and their responsibilities.

The conference should be hosted by the USAID team and could be led by either the project officer or the contracting officer. Both should play leading roles in the conference. The mission director should be invited to open the meeting.

Alternatively, USAID could assign the hosting of the preconstruction conference to the construction management contractor, but should remain a major participator. Delegation is usual for larger projects involving many contractors, all of which are under the management of one construction management contractor.

The selected contractor will also be a key party, presenting its construction approach and schedule of work, as well as any concerns it may have. The details of the contractor's planned schedule will be especially important.

At this point, the A/E team will move to the role of construction manager and should present its QA/QC approach. If possible, a representative of the host government as well as people living in the project area should be invited. Others that would find the meeting useful would be subcontractors and suppliers that are expected to provide services to the project.

In general, the meeting should be used to acquaint the parties, establish key players and lines of authority, and get the construction off to a proper start.

Minutes of the conference should be recorded by USAID and made available to all the participants.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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 going to be achieved at each step of the process.

ASCE describes 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 plan. A QC program would include inspections, testing, training, and maintenance of detailed records (logs, written reports and photos, etc.).

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 acceptable international standards. The CMC may rely on independent testing firms for concrete, soils and materials testing. If these are not available, the CMC must provide equipment and trained personnel to undertake this work.

Safety monitoring and training is a requirement of both the construction contractor and construction manager. The construction manager should also be responsible for assuring that the contractor's safety program is adequate and being implemented.

During the design phase the A/E would be responsible for developing the scope of work for the construction management phase, including quality assurance/quality control requirements. Similarly, the construction contract will also follow the QA/QC and safety requirements during the construction process.

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PROJECT RESPONSIBILITIES

The project manager may take the lead in each of these preconstruction activities, or they can be assigned to the contracts manager, except for possibly defining the type of construction contract. The type of contract would usually be determined jointly by the project manager and the contracting office.

As a minimum, the project manager should lead the USAID team by playing an active roll in each activity and retaining final approval authority.

8. CONSTRUCTION PHASE: CONTRACT ADMINISTRATION

Contract administration provides the necessary support and oversight to assure that the construction is completed in a timely manner, on budget and with minimal problems. The key elements of contract administration are:

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

PROJECT SCHEDULE

The schedule is probably the most important tool in assuring that work is completed in an orderly and timely fashion. The schedule assures that the flow of work progresses efficiently and that manpower, materials and equipment arrive in a timely manner. Thus, it must be used by all of the people and firms involved in the project; otherwise, the schedule will lose its value.

The schedule should be modified when unexpected problems arise that will require changes to the project. Weather is often a problem that will causes delays. In the event of inclement weather, materials supply disruptions and similar events, the schedule must be adjusted as needed to assure that conflicts do not occur at the work site.

The schedule's implementation usually requires routine meetings of the concerned staff. Depending on the nature of the project, these may be held on a daily, weekly or as-needed basis. Meetings will also be held at various levels of the project's administration. Most important will be the construction contractor management team. Second will be meetings between the construction contractor and the construction manager. Meetings at this level should be on a scheduled basis supplemented by ad-hoc meetings in emergencies. The USAID project manger /engineer will usually meet with the construction contractor and/or construction manager on an ad-hoc basis, but more complex or high-visibility projects may also require meetings on a prescheduled basis. At the working level, safety meetings must be held on a scheduled basis.

Scheduling Tools

In any given construction project there is one sequence of operations that will take the longest amount of time to complete. This is called the "critical path." It shows the contractor where work cannot be allowed to slip. It will also show where other project activities have slack and can be delayed without affecting the project's completion date. Several computer programs are available to assist contractors with project scheduling.

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 contractor's schedule. Completing the concrete floodgate structure is estimated to take 90 days and the storm water pumping station 100 days. Thus, the earthworks portion of the project is on the critical path because it will take the longest to construct.

The contractor can accomplish this work with two crews. One will be responsible for the levee construction, while the other 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.

PAPERWORK FLOW

All three parties involved in the project are responsible for recordkeeping:

- The *on-site construction manager* will have primary responsibility for keeping a detailed record of construction progress. He or she 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 construction manager will also note how the work is progressing relative to the schedule. This information is very important for determining extensions and resolving claims. For the example project, weather conditions can be the basis for a time extension since the earthwork is on the critical path. The construction manager will also complete a monthly progress report.

- The *USAID project manager* must maintain adequate records in order to be able to readily produce reports on the project's status, problems, and successes. He or she will reply primarily on the construction manager's reports, contractor billings, and the USAID controller's reports on funding status. It is important that the project manager makes routine site visits and records his/her observations, especially concerning problem areas. Photographs are important and should be part of the project manager's files.

- The *construction management contractor* will maintain his or her own records. Most important among these will be billing files and copies of official submittals such as shop drawings, warrantees, equipment manuals, and product information. The CMC will generally accept, review, and maintain the original contractor submittals until construction has been completed. This 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 the claims process. They will remain confidential if a claim is being considered.

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 manager until the end of the project, when they will be turned over to USAID and the host country O&M team.

QUALITY CONTROL

Quality control is described by ASCE as "The review of project services, construction work, management, and documentation for compliance with contractual and regulatory obligations and accepted industry practices." Simply put, quality control is the implementation of the quality assurance plan.

Quality control is the responsibility of both the construction contractor and the construction

manager. The construction manager's role is to assure that the construction contractor is providing the quality required in the contract documents and as expected from normal construction practices. If properly prepared, the project documents will reflect the expectations of the beneficiary and USAID, and will be implemented by the construction team to meet these expectations. The USAID project manager should be aware of quality control and make this a part of his/her review process and site visits.

PROGRESS PAYMENTS

On a unit price contract, progress payments are typically made monthly to the contractor. Regulations allow a minimum time to process these requests unless they are in error.

On a lump sum contract, the work is typically broken into a "bill of quantities." The monthly payment request is based on the percentage completed of the items set forth in the bill of quantities. Typically, a construction contract provides for withholding 10% of the value of the work that has been completed, which is to be paid upon final project acceptance.

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, possibly at little additional cost.

Progress Payments in the Example Project

In the example project, payments on the earthwork levee may be based on the number of cubic yards of material to be incorporated into the construction. The floodgate structure may be a lump-sum item. However, the floodgate itself may be fabricated off site, delivered, and stored on the site until it is needed. The contractor's pay request may be based on the number of cubic yards of select fill that have been incorporated into the levee, the estimated completion 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 construction manager should not authorize payment for this lump-sum item until the issue is resolved.

PROJECT RESPONSIBILITIES

The USAID project manager must maintain a project file that includes all important reports and actions concerning the project. This individual will be the primary source of information on the project within USAID. He or she 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 correspondence and issues that may range from a Congressional inquiry to a concern by the US Inspector General. He or she will also process requests from the contractor and construction manager, such as change orders requiring USAID approval and payment requests.

It is incumbent on the project manager to maintain a working relationship with the construction manager and construction contractor. Site visits are necessary to assure that he/she stays well informed.

9. CONSTRUCTION PHASE: OVERSIGHT

Oversight of the construction is necessary to provide independent assurance to USAID and the host country beneficiary that the contractor is performing the work in accordance with the construction documents. The level of construction oversight can vary from a cursory review to a detailed review depending on the complexity of the construction. The level of oversight is directly proportional to the level of assurance that the structure was built in accordance with the construction documents.

The skills required for construction oversight depend on the project and could include architects, civil, mechanical and electrical engineers, surveyors, geotechnical engineers, GIS specialists, and administrative support staff. The assigned field personnel's integrity and attention to detail are very important. Some of the construction oversight is best provided by experienced mid- or senior-level professionals. They may be supported by in-country professionals and technicians, who usually would require training. This could be a project requirement in support of USAID's capacity building goals.

CONSTRUCTION MANAGER RESPONSIBILITIES

Construction oversight is typically the primary responsibility of a construction manager (CM). It is common to have the design professional also undertake the construction management role. This individual is most familiar with the design details and specifications. Section 4 ("Request for Qualifications Contract Award") presents a discussion of this approach as well as an outline of duties expected by a construction manager. These duties are:

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

Scheduling and Briefings

The CM is the coordinator between USAID and the contractor as well as the local village and host country representatives. He or she is responsible for seeing that all parties are informed of activities related to the construction that may concern them.

Shop Drawing Approvals

The contractor will provide any required shop or related drawings to the CM for approval. A timely turnaround is required.

Site Inspections

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

A record of All Construction-Related Activities

Logs are common tools used for recordkeeping as well as written reports. Keeping a record of the daily progress is critical in resolving any disputes that may arise.

Correspondence Record

A detailed record of incoming and outgoing correspondence and shipments is required. Such a record is most useful in resolving cases of alleged lost documents.

Verification of Correctness and Approval of Billings

The CM is in the best position to verify the correctness of the contractor's billings and must verify their correctness before forwarding them to USAID for payment.

Acceptance of Warrantees, Guarantees, and Other Required Subcontract Submissions

The CM must accept and verify the adequacy of required contract submittals.

Punch Lists and Turnover Preparation

As segments of work are near completion, the CM should complete a detailed list of corrections and outstanding items yet to be completed. The turnover process may require training of the beneficiary staff, collecting and organizing O&M manuals, and planning an official dedication ceremony requiring organization, and media coverage.

As-Built Drawings

The CM 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.

Assistance with Claims and Disputes

Claims and disputes are common in construction contracts. The CM should analyze each case and resolve the issue if possible. Cases involving additional funding or that are in violation of policy or regulations must be referred to USAID for a decision.

Project Startup and Training Activities

Training may be required prior to startup to assure that the local staff is ready to take over the project. This activity may be shared between the contractor and the CM. For example, mechanical equipment suppliers would typically be required to provide instruction on their equipment. The CM may be required to provide training regarding the staffing and operation of the overall system.

Project Dedication

The CM may be asked to arrange for a dedication ceremony. This would require arranging for a venue to hold the ceremony, preferably at the project site. Seating, refreshments, decorations and draft speeches are required. Media arrangements need to be made. Transportation

may be required. A tour of the project should be arranged. Major dignitaries to consider are the US ambassador, mission director, host county representatives, and village representatives. The contactor should also be recognized.

Media/Outreach Support

On a typical USAID project the CM may be asked to assist in 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 project officer.

For the example project, the CM has been tasked to work closely with the people in 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 CM also is expected to keep USAID fully informed of the steps being taken and of any problems that arise.

PROJECT MANAGER RESPONSIBILTIES

The project manager needs to stay current on the progress of construction and monitor any problems or issues that arise, such as delays, accidents, cost overruns, and disputes. The project manager must also keep the USAID counterpart team members informed of issues that concern them. Regular visits to the construction site are valuable and highly recommended in this regard.

10. POST-CONSTRUCTION

Once construction is complete, work on the project is not necessarily over. Often, the project team will continue work on the project if the contract calls for such activities as operations and maintenance support. This last section details the responsibilities of the contractor and project manager post-construction.

CONTRACTOR RESPONSIBILITIES

The construction contractor's responsibilities will often continue after construction has been completed. There may be startup requirements and warrantees on equipment to attend to, or training may be required. Punch list items of a minor nature still may need correction. On a larger scale, USAID and the beneficiary may have agreed to a follow-on contract for operations and maintenance. This may be awarded as an extension to the construction contract or through a new procurement.

In the past, USAID has provided for post-construction operations support for facilities requiring complex operating procedures, such as a wastewater treatment plant.

PROJECT MANAGER RESPONSIBILITIES

The project manager's role post-construction will require that he or she become involved with new activities, such as an O&M contract, as well as continuing with the close out of the construction and CM contracts. Resolving outstanding construction claims and audits of problem projects can be time consuming. Also, high-visibility successful projects often become Mission showcases, resulting in the project manager expending time as a tour guide.

For the example village flood control project, the 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 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.

Before construction was complete, the contractor had delivered the appropriate operating manuals and trained an operator from the beneficiary agency. His presence was required at the tests. The tests would also show if the operating manuals were adequate and that the operator needed further training.

MANUALS

Two types of manuals are essential to the beneficiary country after construction is complete:

Operating and Maintenance Manual

These manuals are typically completed during the construction phase so they can be available for the project start up. They will depend heavily on the manufacturer's documentation for off-the-shelf equipment. Constructed and fabricated components may require special documentation.

Manuals are also required for training the operations staff prior to or at turnover. The O&M manual should be updated and supplemented during operations as changes occur. It is important that the as-built drawings are included with the manual. These may not be available at the project turnover.

Refinements and changes will occur during the operations period and these should be addressed in the manual. All manufacturer information on the equipment should be included. New equipment and repairs may require changes and updating of the manuals.

Safety Manual

A manual on safe operating procedures should also 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 training of the O&M staff. The construction management contractor would be best qualified to assure that such a manual is prepared and included with the other operating and maintenance manuals and associated training plans.

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