

PROJECT MANAGEMENT FOR THE PANAMA CANAL THIRD SET OF LOCKS

by Ken Fortner¹ and Juan Wong²

INTRODUCTION: The Panama Canal plays a vital role in world shipping, while today's locks are nearing their maximum throughput capacity, in spite of all the infrastructure improvement to the navigation channels. Therefore, to accommodate growing traffic demand and also to fit larger post-Panamax vessels, the Panama Canal Authority (ACP) has started executing its ambitious expansion plan to double the Canal's capacity, which includes the building of two large locks in the Pacific and Atlantic ends of the Canal, which are scheduled for completion by 2014.

The ACP has conducted studies and prepared a Master Plan 2005-2025 for the Third Set of Locks (TSL) Project (<http://www.pancanal.com/eng/plan/index.html>) and the proposal for the Canal Expansion was approved on October 22, 2006 in a national referendum. Contracts for deepening and widening navigational channels has started in 2007 for the excavation and dredging of more than 100 million cubic meters of material. The largest contract for the design and construction of the Third Set of Locks was awarded in August 25, 2009, for the total amount of US\$3,118,880,001 and is expected to last 62 months.

The ACP has engaged the services of CH2M Hill, the world leader in program management services, to form a team to jointly administer the programme to its successful completion, incorporating on-the-job training and coaching in program management techniques, tools and processes. This paper discusses these project management approaches, which includes design, interaction with the Contractor, decision making, schedule, cost, document, construction, quality, safety and environmental management.

1. PROJECT MANAGEMENT APPROACH

During development of the request for proposal, much discussion took place over the general project management approach to be implemented in execution of the Third Set of Locks project for the Panama Canal Expansion Program. The extensive management knowledge base that was involved recognized the importance of the precepts engaged in the performance of a design-build project, and also recognized that the primary force in determining the position of the Owner in a contract delivery environment was that of the contractor's behavior. Adversarial behavior breeds a contentious environment. Collaboration provides both parties to the contract the opportunity to work together toward achieving the goals of the project and better manage the risks. Recognizing the need to establish the perspective in the Tender phase, the decision was made and the request for proposal was prepared accordingly.

1.1 Collaboration

Project Management is a discipline that has clear objective approaches when speaking to rigorous details of the work (e.g., schedule management, cost management, design interpretation, document management). The interpersonal aspect of managing the work is more subject to style, personal experience, and skills. The clear alternatives to interactions between Owner and Contractor range from adversarial to collaborative. The collaborative approach is becoming more and more accepted in the industry as Owners realize that fighting through a project is exhausting and often doesn't produce the desired objective. While it still might be considered as a more subjective approach to delivering a project, it can be a very effective way to execute the work – even in traditional delivery formats.

Leading the project team away from adversity first requires establishing the proper perspective within the project management team itself – those administering the contract and acting as agents for the Owner. Often dogged enforcement of the contract documents – or enforcement of the parent company's dogmatic positions – creates an adversarial setting. Many older project managers grew up in the industry being told – and unfortunately believing – that contractors are devious, deceitful people

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who are trying to get away with anything they can. If this is the perspective of your management team, there is a high likelihood that workdays will be filled with adversity. Enforcement of the documents is critical to effective project management. However, enforcement can be productive or it can create adversity. Enforcement is most effective when delivered in a proactive manner between individuals who have an established rapport. Project team members must develop a rapport with their counterpart(s) within the contractor's organization – a good rapport – one based on mutual respect and integrity. This is the basis for proactive intervention – before errors are made. Whether dealing with change, quality assurance, or inspection, preventing errors is far more effective than having to correct errors. Facilitating the contractor's success is the essence of collaborative project management, which ultimately allows enforcement to fall properly into place.

The project management team must recognize that much depends upon the success of the contractor. When one considers the prospect of meeting expectations, the focus of the management team must be on the overall outcome of the project. Every issue, challenge, dispute, argument, debate, change, and so forth, does not have to conclude with a “win – win” result. That would be far from realistic. If any party to the project is keeping a score sheet, trouble is close by. To strive for at worst a neutral, or “didn't lose – didn't lose,” result may be the most viable approach. The project must be the winner.



Figure 1: Third Set of Locks structure – Overall view

1.2 Interaction

Routine interaction with the Contractor can initially be uncomfortable to those not accustomed to collaboration or “proactive intervention”. In order to build a strong project management team, the Owner's team must itself be strong. Many within the project management community – particularly the more experienced – have matured within adversarial environments. Project management has evolved, and before the leadership can focus on the overall team, the Owner's team must first be brought into a common philosophy. This cannot be a consensus arrangement where staff simply accepts the delivery approach. All members of the team must understand and embrace this approach. Should the Owner's management team not advocate and enact a non-adversarial approach, there will be minimal to no influence on the remaining (non-Owner) parties of the team.

The Panama Canal Expansion/Third Set of Locks Project Team recognizes that its function is to monitor and oversee the work performed by a major design-build consortium that brings tremendous international experience to the project. Nonetheless, the effort to ensure compliance with the Owner's requirements as set forth in the contract documents is not a casual matter. In a design-build format, the contractor has made numerous assumptions based upon information provided by the Owner via the Request for Proposal (RFP) as well as gathered by the contractor themselves, and as the work progresses, the accuracy – or inaccuracy – of those assumptions can create issues to which the management team must respond. The approach identified by the leadership of the ACP is to be collaborative rather than adversarial with a focus on developing collective decisions rather than being directive. This then allows the contractor's team to view the ACP management team as a resource rather than an adversary. This is the collaborative approach the ACP team brings to the project. Not everyone will be able to participate effectively. Some cannot shift from the hard-line mentality of confrontation. Some may not agree that this methodology is beneficial for the ACP, or even the project.

1.3 Compliance Monitoring

Regardless of how the collaborative approach to project management is implemented, the most relevant aspect of most contracts is that of compliance with the Owner's requirements (referred to as Employer's Requirements (ER) in the FIDIC-based Conditions of Contract). Some confuse the collaborative approach as one of yielding on the part of the Owner. This is not true, and is certainly not the case with the Third Set of Locks Project. While the delivery platform is design-build, there are numerous requirements specifically called out within the contract documents that are beyond what one would consider performance specifications. The role of the management team then encompasses ensuring the contractor complies with those requirements as well as meeting the performance requirements by establishing a very strong and enabled quality management program. This program is then overseen by the ACP Team's quality assurance (QA) unit, whose job it is to make sure the Contractor's quality staff is doing their job.

1.4 Responsiveness

Throughout any contractual delivery period, the Owner must be responsive to the requests, questions, and observations presented by the Contractor. Several mechanisms have been incorporated to allow prompt responses to the Contractor on the Third Set of Locks Project. One decision that was made very early in the preparation of the RFP was that of implementing *Primavera Contract Manager (PCM)* as the document management tool for the project. This electronic platform allows for virtually immediate transfer of information as the platform itself is shared with all parties to the contract. Controls are in place to restrict access to Owner-sensitive sections (called "modules") within the system. The system is used to process Requests for Information (RFI), submittals – administrative and technical, correspondence, daily reports, deficiency logs, notices of non-compliance (NNC), incident reports (safety), payment applications, and other documents relevant to the delivery procedures.

While the tool allows for fast transfer of information, the individuals responsible for preparing the information must be prompt as well in order for the work approach to be effective. Often there are contractual durations governing administrative processes. While some are in place for the Locks contract, the Locks Team has set for themselves aggressive targets to be confident that the Contractor is getting information in as timely a manner as can reasonably be achieved.

1.5 Quality Focus

An excerpt from the project quality manual reveals the intent of the Owner with regard to quality of the project:

"It is the policy of the Autoridad del Canal de Panamá (ACP) and CH2M HILL, jointly referred as the Program Management Team (PMT), that the Design and Construction of the Third Set of Locks Project ("Locks Project") be planned, developed, and delivered with the highest regard for quality and under the purview of an effective QA program. The contract requirements for submittal of design and construction will define quality requirements and objectives, specify quality related activities and indicators, and assign responsibilities to verify that Project activities are executed to meet ACP requirements."

Clearly the focus on quality is second only to that of safety on the project. Requirements for detailed quality management plans for design and construction features of work are stated specifically in the request for proposal.

2. DESIGN APPROACH

2.1 Interactive Design Development

The level of activity between an owner and a design-build contractor varies from owner to owner and project to project. In the case of the Locks project, the Owner has a strong opinion of what the desired outcome should be, and recognizes that a good project cannot be built unless a good design precedes it. A strong group of design engineers has been assembled to work with the Contractor during the design process. Workshops, meetings, presentations, and frequent updates are the forums used to interact with the Contractor's design team. The Tender design submitted as an element of the technical proposal response to the RFP is the basis for the continuing design activity.

2.2 Over-the-Shoulder Review

A process referred to as Over-the-Shoulder (OTS) review was defined and incorporated into the contract documents. This is a process by which the ACP design team can actively review the design with their counterparts on the Contractor's design team. This step was envisioned to facilitate the formal design review process to the extent that working drawings would be reviewed prior to their submittal for formal review and comment by the ACP design team. The intent is that the OTS review would reconcile any issues or concerns that are raised concurrently with the review thereby allowing the formal process to confirm the reconciliation be incorporated into the design.

2.3 Monitor Employer's Requirements

Foremost to the design process is that the Employer's Requirements identified in the contract documents are met and/or complied with. This is particularly critical to the performance specifications wherein particular metrics and/or functional parameters must be met to satisfy the contract. Of critical importance is the hydraulic system – specifically the filling and emptying system – for which the hydraulic and physical models are the only technical design elements that the ACP actually approves. During the tender preparation period, the participating consortia noted that the approval of the design model was critical to them as the consequences of sole liability for performance of the system was too great a risk to be borne by the consortium. Accordingly, the ACP accepted that risk through an addendum to the documents.

3. INTERACTION WITH THE CONTRACTOR

3.1 Objective (facilitate success)

Definition, instruction, encouragement, and team-building all serve a vital function in developing the project team. Roles, responsibilities, and procedures must be well defined, unambiguous, and unassuming. While most experienced – and some inexperienced – staff will be quick to tell leadership that they know what to do and how to do it, the approach being implemented is quite likely to be different from what they have practiced before. Detailed procedures, including both text and process flow diagrams, can greatly assist team members in understanding what must be accomplished. These were developed in an extensive compendium of processes and procedures, including detailed “desk-top instructions” which provided step-by-step instructions to the staff on the mechanics of completing the document aspect of the specific task identified.

A reporting structure is necessary for the team to understand lines of authority and communication. Leaders must reinforce the requirements and expectations of the team. Open feedback on work processes fortifies the collaborative environment and allows continuous improvement to be a reality as opposed to merely an often-stated goal. The Locks team has participated in extensive training in the tools employed in the project as well as the work approaches expected to be used in developing rapport with their counterparts and executing the administration of the contract. As work progresses, periodic checks on work approaches are performed and the team is asked to provide feedback on the effectiveness of the processes in place. Whether developing, reviewing, or endorsing the procedures and work approaches, the team must participate in and contribute to the plan.

3.2 Awareness of Contractor's Plan(s)

In order to effectively monitor the progress of the work – whether it is design or construction – the Owner must be aware of the Contractor's plans and programme. While the Project Controls Unit is responsible for formal monitoring of the contractor's programme, the team must use the programme and the detailed work plans prepared by the Contractor in accordance with the contract to know where the contractor is planning to proceed, plan for resources to monitor and report on the work in progress, monitor the progress against planned production rates, evaluate the viability of the plan, identify issues that may have been overlooked by the contractor, among others.

Considered to be a key element of effective delivery in a collaborative environment, development of the Contractor's plans through workshops that combine the knowledge base of both the Contractor and the Owner's site representatives has been implemented. This approach has proven to be an effective tool to prepare and present viable plans and also results in the Contractor recognizing of Owner's staff as a resource more so than just a concerned party to the contract. Participating in the planning process certainly gives the field staff greater knowledge about the background of certain work

approaches and/or sequences of work, thereby enhancing their understanding of what they observe in the field.

4. INTERNAL DECISION MAKING

Decisions made throughout the course of any project can carry significant benefits, consequences, and impacts, or they can simply validate the process by taking advantage of the knowledge base available to the decision-makers. Decisions made during development of the TSL request for proposal were often made as a team in a collaborative setting. Involved were the ACP leadership as well as the team of consultants secured to assist in the procedures. While there were numerous decisions that were consequential, none were made quickly or without careful consideration. Timeliness is often a concern when dealing with deadlines and intended delivery dates, and a defined programme established the timeline for the process. One important aspect of decision-making is the need for the team – regardless of individual positions or opinions – to unite in the execution of the decision and not second-guess either the process or the decision. If a decision ultimately proves to be faulty, then the pending action becomes to overcome the issue through a new set of decision-making criteria.

Critical to any decision-making process is the initial step of data collection. Background information, opinions, pure data supporting the decision, historical precedents, innovative alternatives, and just general instinct are all necessary elements to the process. Of importance on major decisions is the assembling of this data and documentation of the decision process as major decisions inevitably are questioned in the event the result is not commensurate with the intent of the decision. Design and construction projects are bereft with decisions, and while not all require the extensive and formal approach, those that do should honor the process. The TSL Team developed a process that would allow the team to function accordingly and derive a decision that hopefully will prove to be optimal.

The premise adopted by the project team was that every decision made must recognize the project as the beneficiary of its decisions. Every decision that is made must reflect the best intent for the project, not necessarily what is best for the Owner or Contractor – but best for the project. This approach is not easily arrived at, and comes into play most ostensibly in the initial stages of a potential dispute. Often positions relative to an issue are established based on financial exposure or liability, and the individual parties regard it as an obligation to maintain their position so as not to imply or reveal a deficiency. Mistakes can lead to a defensive posture that hinders the best solution from being implemented. Vital to making the project the winner is that all the parties “own up” to their part in the issue, whether it be a mistake, missed item of work, an aspect of the work that is something less than optimal, a detail that has been improved upon by technological advances since design, or whatever the basis of the issue. Once that is out of the way, the solution can be established. The question of “Who pays for it?” will always arise, and reconciling that aspect of the issue is often the most challenging. Maybe the solution is a legitimate change to the contract. In all cases the team’s focus must be to act in a fair and equitable manner.

Given this premise for administering the construction contract, is it reasonable to expect an owner with different interests and objectives to reach a conclusion that reflects value to the project? Even if the rules are known, can everyone participate together well and be open to innovative and different solutions? Here, the role of leadership is crucial. Managing design and construction is a matter of the people involved with making the decisions. Despite building a high-performance team, final decision-making still falls to a select few. Decisions made during the construction phase will always have an impact to the Contractor, and those decisions are made reflective of risk and the anticipated response by the Contractor. This realization brings to bear the importance of the team leader and the role they must play in orchestrating the process. The leader must lead the team to effective decisions. When staff associated with the management of the issue cannot reach closure due to situations that potentially compromise the integrity of the work, action must be taken. The leader must have the authority to decide on what lies in the best interest of the project. In the TSL project, the organization is established with clear lines of authority that provide the Employers Representative with that authority.

5. SCHEDULE MANAGEMENT

5.1 Contractor’s Schedule (programme)

The specifications clearly call for the programme to be the responsibility of the contractor, and it clearly establishes that development, status, and updates to the programme are the contractor’s

responsibility. Such a specification does not diminish the importance of the programme to the owner, and there is clearly a high interest in what the contractor prepares and declares as their plan. To accomplish an initial level of interaction, the specifications required a Baseline Programme Workshop – two weeks - that intend to establish a working rapport between owner staff and the contractor and in the end production of a viable Baseline Programme.

5.2 Weekly Status

After much deliberation during development of the RFP, the team decided to require weekly status updates of the Contractor's current programme. This is not to be confused with the monthly update that actually incorporates logic changes, insertion or deletion of activities, or other revisions to the programme that must be documented and explained, but is actually inputting the status (actual start, actual finish, remaining duration, percent complete) of activities in progress over the week.

5.3 Trend Analysis

Project Control staff will be monitoring the programme throughout the work to determine what trends are being established by the Contractor. Of interest will be whether they are consistently meeting the early start targets, whether the actual durations of the activities are as forecasted or significantly different, whether trend data being used to update the programme for similar activities, are resources being applied to activities as needed to meet the planned production rates, are milestones being met, and the rate of float consumption on non-critical sequences.

5.4 Float Monitoring

While the best specifications in the world can provide every consideration of programme float management, the team must recognize that float is not a resource itself, but is a buffer that allows optimization of resources. The contractor must be able to manage resources (labor, materials, and equipment) to allow them to optimize their potential for profitable delivery of the project, yet remain within the terms and conditions of the contract. That being said, the Owner still has a place in understanding the intent of the Contractor and assuring that the Contractor is not posturing for a claim situation that could financially impact the Owner and the project.

While we focus on integrity in the collaborative delivery of a project, the Contractor must maintain viability or they are not able to remain in business. Float consumption is an indicator that must be carefully evaluated. Consumption of all float will clearly place insurmountable demands on existing resources and ultimately require augmentation. This then results in costs to the Contractor which – in a competitive bid delivery – will likely result in a claim situation. Accordingly, it is prudent for the Owner to monitor float consumption by the contractor, but not necessarily take vigorous steps to manage it.

The TSL has an extensive programme specification that despite its details, still leaves much up to the discretion of the Contractor. Nonetheless, float management is a discrete element of the specification, and the most prominent stipulation is that the float belongs to the project – neither the Owner nor the Contractor. Much debate is given the value of such a requirement as many declare that this then is a "first come – first served" specification. In a collaborative environment where both parties demonstrate value in the programme and the efficient delivery of the work, the float will be managed by the Contractor with monitoring and periodic comment by the Owner. Once the collaborative environment deteriorates into adversity, the whole scenario changes and enforcement of the specifications then becomes the task of the Owner.

5.5 Sequence

Baseline programming is a critical basis for establishing the overall sequence of the work. For the TSL, the baseline programme is approved by the Owner. The intent of the specification was such that the expectation was the Tender programme (submitted with the technical portion of the proposal) would serve as the basis of the baseline programme. The baseline programme would then be finalized through a workshop facilitated by the Contractor in which they would reveal the overall plan and detail the first six months of the work. The workshop would be an interactive event and would serve as an opportunity for both the Owner and the Contractor to work collaboratively to define the issues and concerns to be addressed by the programme and the corresponding programme reports. It would also serve as an opportunity for the Contractor to demonstrate to the Owner the depth of their planning and intent to meet the milestones and objectives of the project.

Recognizing that initial plans often change as the work progresses, the specifications clearly allow for the Contractor to adjust their work sequences via the current programme, which is the tool used to report and monitor progress on a weekly basis, with formal updates performed monthly. Should variations occur as the work progresses, then an update to the baseline itself can be presented by the Contractor. In all cases, the baseline programme serves as a comparison model to use for reporting purposes.

5.6 Testing and Commissioning

One of the most extensive requirements of the contract is the performance of the locks chamber filling and emptying system. The performance is linked to time as the ACP must establish and optimize transit times for the vessels.

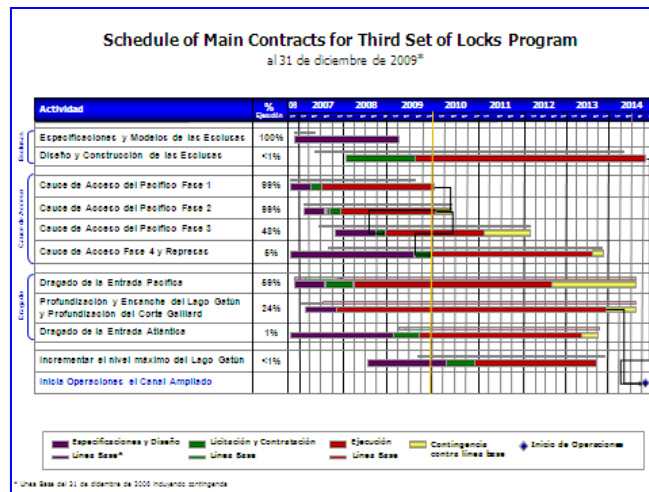


Figure 2: Work schedule for the Third Set of Locks Pacific project

6. COST MANAGEMENT

For a lump sum contract, cost management is somewhat restricted to monitoring progress of the work and endorsing the contractor’s request for interim payments. Included in the process is the detailed steps taken by the Owner’s internal payment procedures, but those are essentially invisible to the contractor. The only impact to them is the time required to complete the transaction. The TSL project team deliberated for some time on the merits of a “cost-loaded schedule”, and the ultimate decision was to incorporate the requirement into the schedule specification. The driver for this decision was that once the cost loading was agreed upon – thereby completing the cost breakdown structure – the process was then focused on progress monitoring.

6.1 Cost-loaded Programme

In the request for proposal, the Contractor was given a high level work and cost breakdown structure which they were required to complete upon award of the contract. The detail of the breakdown was specified, as was the requirement for programme activity level detail. With the programme activities being constrained to within 20 work days, the cost loading was then to follow, cascading down from the baseline programme. Costs assigned to activities were to be all-inclusive and the respective costs add to the overall contract amount. Also required was a means to measure progress – a metric that was readily measurable and objective.

6.2 Analysis of Contractor’s Submission

Critically important was the review of the Contractor’s proposed cost loading. In dealing with the baseline programme, there is the risk of evaluating costs associated with long duration activities (recall that the baseline programme was required to detail only the first six months of the work). Comparison with the Tender submission was of value as the Contractor was required to submit an initial forecast reflecting their Tender programme. Regardless, given the fact that the work is conducted under a design-build format, the costs identified are clearly at a macro level, and the details of developing the cost breakdown structure will follow as the design is developed and construction package defined. There will clearly need to be some latitude in adjusting the cost loading and distribution.

6.3 Monitoring of Percent Complete

Given the fact that the work is conducted under the terms of a lump sum agreement, monitoring percent complete is a control method to ensure that the Contractor is paid what is due against the specific activities in progress or completed within the payment period. In a collaborative setting, this is not expected to be difficult. Further, with the requirement to define a progress metric (e.g., cubic meters, tons, linear meters), then the objective confirmation of the Contractor's request should be fairly straightforward. Further, even if the verification checks are not exact, the 20-day activity duration limit sets the activity up so as not to span more than two payment periods. By the time payment is issued, the activity of concern should be complete. This allows for a double safeguard to paying the Contractor in excess to the value of the work in place.

7. DOCUMENT MANAGEMENT

One of the most critical elements of contract administration is that of document management. The myriad of documents generated over the course of project execution must be properly organized and acted upon should the project team achieve the success all aspire to. Early in the development of the RFP, the ACP decided to implement *Primavera Contract Manager* (PCM) as its primary contract document management tool. Supporting the document management system internally is *SharePoint*, another powerful document management tool. PCM serves as the principal tool for project-wide communication while *SharePoint* serves as the collaboration tool for document development within the ACP project team.

While the best tools available within the industry can provide the platform for effective communication, they are of little value if the users are not capable of effectively using the tools. The team spent much time training, developing and documenting procedures for use of the tools. Process flow charts, procedures, and desk-top instructions were developed to facilitate the learning and subsequent use of the Document Tracking and Control System (DTCS) specified with the contract documents. Flow charts provided diagrammatic presentations of the work processes while written procedures expanded upon the flow chart and detailed each step of the process and defined the users of the process. Desk-top instructions were prepared to provide the user with step-by-step instruction on how to use the system to process the various documents the team would be handling (e.g., correspondence, requests for information, submittals, requests for variations, claims, payment applications, transmittals, reports).

One of the most important requirements of the contract is that both the ACP and Contractor are using a common platform to manage the document flow. Both entities access the DTCS, generating and transmitting documents electronically via PCM for timely and efficient work processing. Routine documents (such as production logs, daily reports, meeting minutes, conversation records, photographs, deficiency logs) are processed quickly and stored in the database for project record purposes. The use of e-mail notifies recipient of documents of the need for their action and the requirement to access the document in PCM. The document control managers and clerks play a vital role in the effectiveness of the system by keeping track of the document flow.

Control of the information within the PCM database is critical as well as there are some modules within the overall database that are restricted to ACP access only. Similarly, not all parties to the contract are provided access rights to all the information within the system. Access rights are established by position within the organization and the need for access to the data/documents. The Document Control Managers for each respective organization coordinate and implement access control to the system. As the work progresses and the need for access rights changes and the team addresses the requirement promptly.

8. CONSTRUCTION MANAGEMENT

The staff serving to administer the work in the field and coordinate with the technical services team (design, engineering) was defined recognizing the fact that delivery of the project is largely the responsibility of the Contractor, while the Owner is essentially monitoring the work for progress and compliance. Within this spectrum does lie the responsibility to report, respond to questions, respond to correspondence, evaluate and mitigate claims, and address issues as they arise in the field. This approach established the need for two distinct groups: Resident Engineers (RE) and Construction Coordinators or Managers (CM). These two groups are supervised by an assigned Construction Manager who is responsible for oversight of the day-to-day activities of the staff.

8.1 Resident Engineering

Resident Engineers provide the technical liaison between the contractor and the balance of the project team. As described in the TSL Construction Management Plan, the Resident Engineer is:

“Responsible for providing on-site construction management and engineering support in the execution of construction services processes and systems on major projects, limited to their engineering discipline expertise. Under limited supervision, will perform the more complex aspects of resident engineering activities, ensuring that all activities associated with progress reporting, financial cost tracking, technical/design support, construction estimating, project controls management, construction sequencing support, and issue tracking/resolution are executed in a timely fashion and in accordance with all project standards and contractual requirements. These tasks include, but are not necessarily limited to coordinating and supporting issue resolution arising from the quality assurance process or from contract administration; tracking submittals, Request for Information (RFI), Requests for Quotes (RFQs), and Contractor Variation Order Requests (VOR) from inception to resolution; supporting negotiations and resolution of variation order request and request for quote proposals in concert with the CM; and providing field engineering to support issue resolution due to unforeseen site conditions, design irregularities or constructability issues. The RE may serve as lead administrator at the field office on all but the most complex issues with some supervision.”

Assigned to the project team are Civil, Structural, and Dam Resident Engineers. To be assigned at a later date are Mechanical and Electrical/Controls disciplines.

Very important to the collaborative aspect of contract administration is the development of a solid work rapport between the RE and their counterpart within the Contractor's organization. This allows for informal yet professional exchange and interaction on issues that develop over the course of the project. Often, the relationship can result in mitigation of issues as the RE and their counterpart can anticipate issues and act in a proactive manner to prevent issues from becoming problems. This requires an attitude of assertiveness as well as an ability to interact comfortably and confidently with others. Such interaction also requires the RE to be very knowledgeable of the terms and requirements of the contract.

8.2 Construction Coordination

Construction Coordinators (referred to as Construction Managers) are assigned to support the work in several key positions entitled Site Coordinator, Materials Management Engineer, and Water Management Engineer. Each position is defined similarly to that of the Resident Engineer, although the time spent in the field is expected to be higher than that in the office, thereby making them more engaged in the construction rather than administration of the contract. As described in the TSL Construction Management Plan, the construction coordinators are:

“Responsible for providing on-site monitoring of Contractor's ... activities as they relate to ... in the construction. Under limited supervision, will perform all aspects of ... within the project site, ensuring that all activities associated with construction tasks under the purview of the ... are executed in a timely fashion and in accordance with established programmes and contractual requirements. These tasks include, but are not limited to, daily interaction with the Contractor's representatives associated with ..., stay abreast of activities and progress, monitoring compliance with production and progress programmes as established pursuant to the Contract Documents; identifying revisions and/or exceptions to production programmes, ensuring such are incorporated into the Contractor's daily production report prior to close of business the same day; assisting the Project Controls Manager with review of payment applications to confirm percent complete estimates and production quantities are accurate, thereby validating amounts of payments due to the Contractor; coordinating ... in the construction; and coordinating with construction representatives as necessary to stay abreast of planned construction activity. The ... may also be expected to perform other related tasks as assigned.”

As is the case for the RE, development of a solid work rapport between the construction managers and their counterparts within the Contractor's organization is vital. While experience and technical knowledge are significant contributors to the effectiveness of these team members, the ability to interact effectively with their Contractor counterpart is a critical element. The brightest and most

experienced individual is lost if they are not able to communicate effectively and interact with their counterpart.

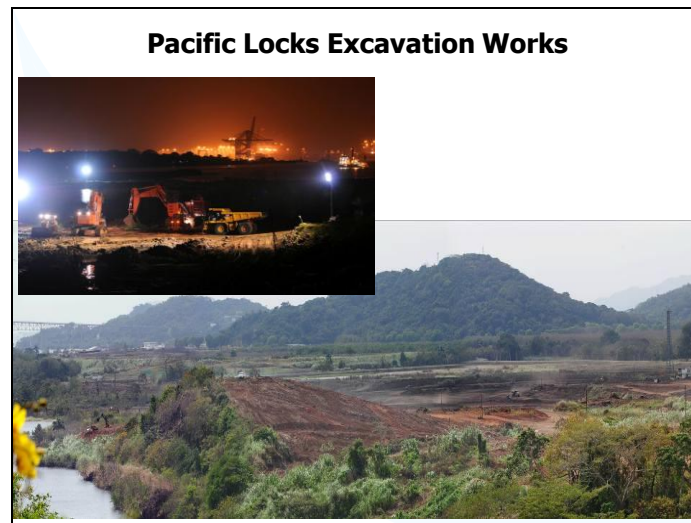


Figure 3: View of work progress

9. QUALITY MANAGEMENT

The quality management plan established for the TSL project reflects the overall approach implemented for the Canal Expansion Program. The organization establishes quality as a priority and the team has a complete quality assurance ethic that incorporates the three phase approach of the ISO Quality Standards. The contract requires the Contractor establish an extensive quality management organization for implementation of an effective quality management plan.

9.1 Quality Assurance

Quality management is assigned to the Contractor as they are responsible for delivery of the project commensurate with the requirements of the specifications. The Owner then accepts more of a quality assurance (QA) function via monitoring the Contractor's QC/QA program. While the Contractor provides the inspection force necessary to ensure construction quality, the Owner's role is to make sure the Contractor is implementing their management plan and satisfying the processes developed to ensure a high quality product. The Contractor's Tender served as the introduction of the quality program, and subsequent detailed plans expanded upon the concepts and organization proposed.

Audits serve to periodically evaluate execution of the various procedures defined within the Contractor's Quality Management Manual. Numerous records are required to be maintained by the Contractor, and they are available to the Owner for review at any time. Deficiency logs are maintained by the Contractor to document non-compliance events or issues and the corresponding corrective action taken to remedy the event/issue. Those deficiencies are monitored to reveal systemic failures, which, if encountered, then warrant issuance of formal Notices of Non-Compliance (NNC) by either the Contractor or the Owner.

Daily reporting of the field activities is a function that falls into a key element of quality management. The reports are prepared and submitted daily by the Contractor and the Owner's team reviews them for completeness and accuracy. Documented within the reports are all relevant data necessary to reconstruct the project activities after the fact. The need for qualitative reports is obvious as in the event of a claim or contract performance issue, the reports may serve as a critical data source.

9.2 Testing

Materials testing, functional testing, performance testing, and operational testing are all required components of the overall quality management program. While the Contractor is required to perform materials testing by an independent third party laboratory, the Owner has both an independent laboratory and their own testing laboratory to conduct verification testing. Given the quality assurance role, verification testing rather than direct quality control testing is the operating scheme for the Owner.

Again, the approach is that of assuring the Contractor's systems are performing pursuant to the specifications and that the resultant quality is being constructed into the Works.

Inspection and test plan requirements are extensive, and are applicable to all features of work in progress. The testing protocols for completed work are also extensive. Much work went into development of the testing requirements for the filling and emptying systems for the new locks. Similarly, performance requirements for gates, valves, and other electrical/mechanical systems were carefully crafted to ensure that the operational requirements of the canal were met. The Contractor's detailed test plans will be forthcoming, but the awareness of the critical nature of the systems is clearly established by the contract documents.

10. SAFETY MANAGEMENT

The Panama Canal Authority is a leader in the industry of Panama when speaking to safety in the work place. Extensive safety protocols exist within the Owner's operational organization and those protocols are passed on to the Contractor within the contract documents. In the case of the TSL Project, safety management is assigned to the Contractor while the role of the Owner is to monitor the Contractor's implementation of their safety program. The overall intent of the safety program is to create and reinforce a culture of safe practices that will hopefully permeate and influence the construction industry in Panama.

10.1 Site Monitoring

Safety representatives are assigned to the site to interact with and monitor the activity of the Contractor's site safety managers and coordinators. While the requirement for the Contractor to implement safety on the project is clearly evident in the contract requirements, safety is not often the priority for the Contractor as the Owner wishes – and specifies – it to be. As is the case with the quality program, the safety program also maintains deficiency records with the objective of developing and documenting a continuously improving safety program that meets or exceeds the requirements of the contract. Monitoring the Contractor's work carries two main tasks – ensure that the Contractor's program is being implemented through their site managers and periodically audit the results of said implementation through inspection of records and site activities.

10.2 Reporting

Reporting of safety effectiveness is always a key metric for every Owner – ACP notwithstanding. Incident reports and timely analysis of the incidents are two key metrics used to observe the effectiveness of the Contractor's program. While incidents are certainly hoped and expected to be minimal, should they occur, the anticipated by-product is the investigation and determination of the root cause and prevent the event from occurring again. The ACP clearly wants the project to be exemplary in every way, and compromising safety in any manner is not acceptable.

11. ENVIRONMENTAL MANAGEMENT

Quality, safety, and environmental compliance are three major areas of attention for the ACP. The multilateral financial institutions supporting the program are keenly observant of what is happening in all three of initiatives. As is the case with quality and safety, the ACP wants to set an example to the country and the community by being a pioneer in environmental awareness and compliance.

11.1 Compliance

Great care is taken to provide the studies, plans, and audits required by ANAM – the Panamanian agency responsible to enforcing the environmental regulations. Periodic site visits by the agency provide the impetus behind close compliance monitoring by the ACP as findings by the agency do not vary in degree of severity; a finding yields non-compliance and potential ramifications. Hence, it is vital that the Contractor conduct their activities in accordance with the guidance documents presented by the ACP and laws of Panama. It is appropriate that the Contractor has secured the services of an experienced local subcontractor in the area of environmental compliance.

11.2 Reporting

Reports prepared and submitted by the Contractor on their environmental activities are extensive, and they have been established to comply with the regulations. Similarly, the ACP must submit periodic reports to both ANAM and the financial supporters for the project. These reports document the

activities of the Contractor and the steps taken with both the ACP and the regulatory agencies to coordinate compliance.

11.3 External Audit

Periodically an independent external audit is conducted by a specialist contracted by the ACP. This audit serves to provide the unbiased inspection and report required by the financial agencies providing loans to execute the work. The audit is conducted with the cooperation of both the Contractor and the ACP. Findings are reported promptly and acted on with equal urgency. The anticipated result is one of promoting exemplary environmental awareness and compliance.



Figure 4: Wildlife rescue in progress

12. CONCLUSION

Project management is about planning, anticipating, responding, and adjusting to the circumstances that are presented throughout the project. Specifications are written with a degree of anticipation and project teams are established based on expectations of contractor activity and behavior. When circumstances present situations that are different from those prepared for, then the Project Manager must adapt the team and corresponding work approaches to deal with the situation. Ensuring that the project team is acting in the best interests of the project is challenging as emotions often run high when dealing with project issues. Coaching the team to act within the terms and conditions of the contract, comply with the requirements of the work, and honor the established processes is a readily definable task for the Project Manager. Building a team that consistently performs at a high level, creating an environment wherein resolution of issues occurs smoothly and professionally is what yields successful projects. The team that is in place for the Panama Canal Expansion Program's Third Set of Locks is clearly striving to achieve that objective.

Theme: Third Set of Locks
Topic: Panama Canal

References

ACP website Third Set of Locks studies and Expansion Program updates: www.pancanal.com

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