Acknowledgements

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Preface

These *Contract Administration Guidelines* address the administrative and reporting requirements for the Construction Manager (CM) during the execution of construction projects. These procedures supplement Chapter 6 of the *CM Standards of Practice*, also published by the CMAA by providing an overview of the typical construction management responsibilities on a typical project from concept to occupancy. Each project may have a set of unique tasks because of project characteristics, such as:

- **Project Type**
  Airports, transit facilities, healthcare facilities, courthouses, and bridges have a whole set of coordination and management tasks unique to each type of project.

- **Geographic Location**
  Projects in certain geographical areas may require addressing union issues, and congested urban sites require extensive staging and sequencing management. Overseas projects obviously have another set of issues, including language, currency rates and metric measurement.

- **Renovation versus New Construction**
  Projects involving renovation or rehabilitation in and around on-going operations require yet another set of management tasks.

- **Project Delivery Method**
  Whether a project is being delivered under a traditional general contract, multiple prime contracts, construction management at-risk contract, design-build contract, etc. will significantly impact the CM's responsibility for project management and coordination.

- **Sustainability Requirements**
  Projects may have requirements to meet current sustainability requirements such as LEED ratings or Green Globes. Many of these may be jurisdictional requirements for federal, state or local government facilities.

Further, the CM may only be involved with one phase of the project, e.g. the construction phase or all phases based on the scope of work negotiated with the owner and the project delivery method used. Numerous procedures that are listed herein during the Pre-Design and/or Design Phases may need to be accomplished during the construction phase by the CM, if those services are in the CM agreement with the owner. Accordingly, this manual should be read with the understanding that the procedures herein must be tailored to fit the needs of a particular project, the CM's scope of work, and the project delivery method selected.

The services performed by the CM may or may not include all the services and tasks discussed in this manual. Nothing in this manual shall be construed to define a CM's scope of services for contract administration but rather, if included in its agreement, how the CM should accomplish these services.

Specific activities and procedures regarding Quality Management, Time Management and Cost Management can be found in the Guidelines published by CMAA for each subject.
Chapter 1: Introduction

This chapter provides an overview of contract administration and discusses these functions for specific project phases (Pre-Design, Design, Procurement, Construction and Post-Construction), with recommended actions and/or techniques to accomplish the stated objectives.

Contract Administration Objectives

The role of the CM in an agency relationship is to represent the best interests of its client, typically the owner. These interests include timely completion of the project, within the budget, and in conformance with the contract requirements. To effectively accomplish these objectives, the CM establishes systems, policies and procedures necessary to ensure adequate project controls are in place. Specifically, the CM must understand the basic responsibilities and interrelationships of all team members; i.e., the owner (both project management and user), the designer(s), the contractor(s), and others, such as consultants and the CM. Additionally, the CM must have the functional knowledge to define the interrelationships between such management components as time, cost, information, quality, safety, sustainability and risk.

The CM must utilize this proficiency in team member responsibilities and functional interrelationships to clearly set forth the project objectives and the team control mechanisms during the various stages of the project. Decision making, including obtaining sufficient information to make reasoned decisions, is probably the key element leading to a successful project.

The two key planning tools utilized in contract administration are the Project Management Plan (PMP) and the Project Procedures Manual. Although these two tools appear to be synonymous, they are clearly different. The Project Management Plan outlines the project scope, the milestone schedule, the budget, the Owner's Project Requirements (OPR), the team organization, the Basis of Design (BOD) as prepared by the design team, the strategy to be used in contracting and procurement, and the management systems to be utilized. The Project Procedures Manual details the specific process to be followed in controlling the various management components utilized in meeting the objectives contained in the Project Management Plan. During the course of the project, both the Project Management Plan and the Project Procedures Manual must be kept up to date with changes required due to various constraints such as budget, schedule, regulations, etc.

In representing the owner, the CM has a responsibility for the operational and administrative provisions of the contracts used on the project. This responsibility does not extend to the writing of contracts nor infringe upon the legal profession. However, the CM is functioning in a system that is dependent on a specific realignment of traditional contracting roles and responsibilities.

It is often the CM's responsibility to establish the contracting format for the project, including each contractor's and consultant's requirements. Each project must be evaluated from a contracting format perspective, taking into consideration the unique conditions and requirements of the project and local construction contracting practices. This includes the recommendation of formats to the client, assistance in assembling contract documents, review of the documents for suitability and the coordination of their use on the project. To support the format, the CM must ascertain that appropriate contract provisions are inserted for contract administration, which conforms to basic industry standards, as well as the PMP and the Project Procedures Manual.
The execution of these responsibilities requires a thorough understanding of contracts, construction law and standard contracting documents. A complete knowledge of traditional contracting procedures, construction management procedures and the possibilities for contracting innovation is necessary. In order to fulfill these responsibilities, the CM must understand the following:

- Contract documents including production, strategies, purpose and layout, contents of specific sections including General Conditions, Special Conditions, Division 1 Specifications, Specifications Language, Technical Specifications.
- Construction materials and methods, including use of materials, equipment, means and methods of construction, construction safety, and temporary construction structures, etc.
- Risks associated with construction materials and methods.
- Advanced principles and practices of construction management.
- Methods and techniques of contract negotiation and administration.

**Time Management**

Time Management encompasses all aspects of scheduling during the course of the project. Scheduling integrates the restrictive elements of time and resources from planning through design, construction and project occupancy. The main contributions of scheduling are to mitigate (or eliminate) time and resource crises and to predict a completion date. Scheduling should be used as a flexible tool; a means to an end, not an end itself; and a process that reflects the management philosophy of the CM system.

The CM must be able to make scheduling a major focus of the project. This requires a blend of abilities in the technical aspects of scheduling and sensitivity to the project’s needs and capacities. The scheduling process must be designed to employ scheduling techniques that meet the specific project requirements and effectively integrate the process and techniques into the overall management effort.

Scheduling can be presented in several forms, all of which have an appropriate place on a project. Depending on the project requirements, the scheduling technique could utilize relatively simple bar charts or could require critical path method (CPM) scheduling to be able to effectively portray the project needs for time management. The computer based system, with appropriate scheduling software, is an invaluable tool; however, it does not replace knowledge of basic planning/scheduling concepts and management uses.

During the Construction Phase of a project, it is imperative that the scheduling system be capable of supporting the time analysis portion of the change order process. Most projects will use a CPM system to schedule the project and do routine updates. The procedures utilized for the scheduling system must be capable of performing time impact analyses for any job changes that could affect progress, including weather. The CM must have a thorough working knowledge of the as-planned schedule, float, fragnets, time impact analysis, schedule updates and schedule revisions for any assigned project.

**Cost Management**

The CM usually has the responsibility to generate and track all project costs, from the initial conceptual estimate to the final accounting. The detailed project budget, prepared by the CM before design begins, becomes the Designer’s guide as the process moves toward the Procurement Phase. After bids are received, the value of the accepted Contractor proposals provides the budget basis. As construction proceeds, contract changes and allocated expenses are recorded. Every aspect of the project’s cost is estimated as early as possible and substantiated as it occurs.
The full scope of the cost management function requires a broad range of knowledge and ability in the areas of pricing and estimation. These include conceptual estimating, construction estimating, feasibility formats, comparative cost studies, change order estimating, material and labor costs, equipment and labor production rates, material technology, industry standards, labor practices, the impact of sustainable design, construction principles and implementation, construction details and techniques, and construction industry economics.

The CM must be able to reasonably forecast project budgets based on preliminary information without the aid of detailed drawings, and be able to estimate construction costs with a high degree of accuracy from completed contract documents. This process, from conceptual estimates for budget purposes into detailed, line item construction budgets, is essential for project cost control. Non-construction project costs, such as planning, design, real estate, permits, quality management inspections, commissioning, occupancy, etc. must also be derived and furnished to the owner, in a format that is easily understood and that can be accurately maintained and updated as expenditures are made.

In short, the establishment of a cost management system applies skills and techniques to ensure that the project is planned, designed, procured and constructed in the most economical way while meeting the original project budgetary requirements.

**Information Management**

Proper information flow is crucial to the success of a project. The CM should establish a system for the management of information on every assigned project. Should any party not receive critical information during the course of their work, all parties can be subjected to additional costs and the potential for unexpected liabilities. Examples could include the transmission of data relating to ceiling supported loads affecting the structural design during the Design Phase; or the timely need for a shop drawing review during the Construction Phase.

A construction project normally generates a tremendous amount of information that must be disseminated to all appropriate parties on a timely basis. The source of this information will cover the full spectrum, including contracts, meeting minutes, drawings and specifications, submittals, requests for information, etc. The CM should provide for the Management Information System (MIS) in both the Construction Management Plan and the Project Procedures Manual. Information management includes document control, and encompasses all types of information flow, since documents may be hard copies or electronic data such as e-mail and computer files. Documents will include letters, memoranda, submittals, LEED checklists, scorecards and sustainability documentation, forms, meeting minutes, drawings and any other data that can be transmitted by mail or facsimile. Electronic transmission of data is becoming more common as an accepted and economical means of communication. An e-mail system enables users to quickly transmit information and retain a record for future use. Computer files, such as CADD, spreadsheets, logs, database files, and word processing documents can be transmitted on a network, by modem or by disk.

All of these forms of information constitute the project record. The CM is the hub for the management of all types of data flow and must have knowledge in the fields of correspondence, technical writing, meeting recording and reporting, management information systems, business protocol, computer systems and networks, and the legal precedents regarding contract documentation.

The basic focus of the MIS should be to keep the Project Team informed, on a current basis, as to the overall status and forecast of the project versus the established plan. Examples of the types of reports and data that should be considered during each phase of the project are as follows:
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<th>PHASE</th>
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**Quality Management**

Quality Management begins in the Pre-Design Phase of every project and continues throughout the project and into the owner's use of the facility. It is an inherent CM responsibility and, as such, it is essential that the CM be knowledgeable of and capable in all aspects of Quality Management.
The following descriptions are accepted in defining Quality Management:

**Quality** – The degree of achievement of the project's various requirements, such as budget, schedule, function, fit, finish and public acceptance.

**Quality Management** – The process of planning, organizing, implementing, monitoring and documenting a system of policies and procedures that coordinate and direct relevant project resources and activities in a manner that will achieve the desired quality.

**Quality Control** – The continuous review, certification, inspection and testing of project components, including persons, systems, materials, documents, techniques and workmanship: to determine whether or not such components conform to the plans, specifications, applicable standards and project requirements.

**Quality Assurance** – The application of systematic methods to verify that quality control procedures are being effectively implemented.

**Quality Objectives**

During the Pre-Design and Design Phases of a project, the responsibility for specifying quality normally belongs to the Designer. The specifications are the result of its interpretation of the owner's requirements or desires as well as personal preferences based on its experience. From the perspective of the CM, three things are important:

- The quality of everything is specified.
- The quality specifications of system components are compatible.
- The quality specified is at a level that is commensurate with the project needs.

The CM should work with the owner, designer and other consultants to ensure that these objectives are met. Using contract document reviews, constructability reviews and sustainability reviews, the CM should check drawings, specifications and associated documents to minimize gaps, inconsistencies or vagueness that will create errors or uncertainties in cost estimates, schedules, bidders lists or purchase orders.

During the Construction Phase, the CM develops a Quality Assurance Program that allocates Quality Control responsibilities to the various project participants, to ensure that the constructed product conforms to the contract plans and specifications. This includes an Inspection Plan for each critical component/attribute of the project with checklists of items to be developed from the contract documents, industry codes, and standards referenced in the specifications. It should also establish documentation procedures for inspection and test reports. Careful, detailed review of shop drawings and samples is essential to ensure that trade contractors, vendors and suppliers maintain the quality standards specified. The CM must establish and maintain procedures for managing the review and control of required shop drawings and samples.

Finally, the CM should perform internal audits of its field office operations to ensure that the approved Quality Assurance Program and Procedures are being implemented properly. These audits will focus on inspection procedures, inspection documentation, data quality, the document control system, CPM schedule analysis effort, quality assurance documentation, sustainable design documentation and safety program.
Safety Management

The CM must be aware of his/her contractual obligations regarding safety on the project site. In the past, safety on the job site was considered to be the sole responsibility of the Contractor. However, federal and state governments, as well as the legal system, are increasingly holding all construction professionals and the owner responsible for job site safety.

The CM must have a thorough understanding of the current local, state and federal safety laws and requirements. The CM should coordinate the incorporation of these requirements into the contract documents, as well as into the Construction Management Plan and the Project Procedures Manual.

The basic objectives of an adequate safety plan should include provisions to ensure that:

- All Contractors will be required to comply with the provisions of the Occupational Safety and Health Acts (OSHA) and all additions and revisions thereto, to the extent that the provisions and standards thereof affect the work of the project, as well as all other applicable federal, state, and local requirements.
- A Safety and Substance Abuse Policy and Program is established for the project. This includes the barring of illegal drugs and intoxicating beverages on the job site, whether in vehicles, on a person, in offices, or in any other work locations on site. The Program should also include provision for random drug tests, consistent with applicable laws.
- No employee shall be required or knowingly permitted to work in an unsafe environment except for the purpose of making safety corrections, and then only after proper precautions have been taken for his/her protection.
- Each employee is responsible for learning and abiding by the rules and regulations applicable to his/her tasks and for reporting observed or anticipated hazards to his/her immediate supervisor. If the hazard is not corrected, the affected employee will report the unsafe conditions to the site safety personnel.

Sustainability

Sustainable goals and objectives must be built into the program as early as possible. This requires the owner to define and convey desires and expectations for a sustainable project, and the project team to develop and employ tools that include and refer to processes required to meet sustainability objectives.

The project team should conduct early workshop meetings in which project stakeholders establish sustainability goals and design parameters for the project. The process establishes familiarity with client and stakeholder expectations, educates stakeholders on sustainable design principles and possibilities, identifies sustainable design opportunities for the project, and identifies a framework for achieving project sustainability goals.

Once a framework for sustainable design development is established (such as USGBC's LEED, GBI's Green Globes or any other sustainability guidance), the design team can advance design development in a manner intended to achieve the project's sustainability goals. The CM should include the sustainability objectives, team responsibilities and sustainability procedures in quality and project management plans and procedures.

Depending on the project's sustainability requirements, specific technical and administrative skill sets such as commissioning and specialty engineering or design support may be required to assure the project
successfully meets sustainability goals. Skill level requirements should be considered when procuring design services and explicitly articulated in advertisements. Design and construction contract documents should reflect sustainability goals and requirements.

**Risk Management**

Risk is an inherent component in every design and construction project. Successful CMs assist the owner in identifying and assessing the sources of risk well in advance of critical project decision making and then help the owner manage risk through the project lifecycle. The objective is not to eliminate or cover up risk, but to manage it proactively, with an understanding of the divergent interests of all the project's stakeholders.

One of the primary strategies used in the construction industry for managing risk is a process commonly referred to as risk allocation. Risk may be allocated through contract language, generally recognized trade practices, or court decisions. Of these allocation methods, the most controllable is the allocation, or assignment, of risk through contract language.

However, the goal should not be to allocate all risk from the owner to the other Project Team members. Most owners, experienced with the construction process, recognize that a more rational approach to risk allocation results in better working relationships among project participants, fewer delays, and lower total project costs. Following the timely identification and assessment of risks, a rational approach to risk allocation can proceed based upon the following general principles:

- Risk should be assigned to the party who can best control it.
- Risk should be assigned to the party who can bear the risk at the lowest cost.
- Risk should be assigned to the owner when no other party can control the risk or bear the loss.
- Assumption of risk by the other parties in the construction process results in increases in cost (visible or hidden) to the owner.

Other strategies for managing risk include such items as insurance, contracting methodology, establishment of management practices, subsurface investigations, phased projects, as well as claims avoidance and mitigation.

For example, the owner may consider whether to utilize a wrap-up insurance package with its associated higher administrative costs for a safety and health program. The designer's contract and any limits on liability that may be included should also be considered in risk management. Another factor is the number and phasing of bid packages for the project. More bid packages will require more management effort by the owner and CM, but will decrease owner exposure if phased properly.

Claims avoidance starts in the Pre-Design Phase of the project. Procedures must be in place to eliminate/minimize errors, omissions and ambiguities in the contract documents. Claims mitigation focuses on the timely recognition of contract changes and the timely settlement of all contract changes/claims. Detailed contemporaneous documentation will frequently defuse many disputes because entitlement and quantum issues become clearer and easier to resolve. Alternative disputes resolution (ADR) procedures such as partnering, step negotiations, and Disputes Review Boards (DRB) enable issue resolution at the lowest possible organizational level of the project.

The CM must have a sound understanding of these various means of risk allocation and the owner's ability or desire to accept risk. At the initial project conception, risk should be discussed and the owner
should make informed decisions relative to the amount of risk that he/she is willing to assume and weigh that against the potential effects on the cost, quality, and schedule objectives for the project.
Chapter 2: Pre-Design Phase

The Pre-Design Phase affords an excellent opportunity for the CM to provide real value to the owner through assistance in the completion of planning for the project, initiating overall coordination with the various Project Team members, and selecting the designer.

Project Management Plan

Once mobilized, the CM works with the owner and other Project Team members to define and document the project requirements. The resulting document, known as the Project Management Plan (PMP), should be prepared by the CM in narrative form, outlining the plan and strategy for fulfilling those requirements; it normally goes to the owner for review and approval.

The Project Management Plan typically establishes the project scope, budget, schedule, environmental conditions and the basic systems to be utilized and the methods and procedures to be followed. The scope of a project is typically documented by a combination of conceptual drawings, descriptive narratives, performance numbers, and the owner's budget for the project. The type of information and amount of detail can vary considerably based upon the type of project. Documentation of overall cost and time is primarily the CM's responsibility, with the input of various Project Team members. The establishment of basic systems and procedures by the CM links the task elements of the Project Management Plan.

A typical Project Management Plan includes the following basic components:

- Project description
- Sustainability Plan/Owner's Project Requirements for Sustainability (LEED)
- Milestone Schedule Master Schedule
- Quality management approach
- Design team's Basis of Design document
- Reference to project documents
- Project organization chart and staffing plan
- Explanation of roles, responsibilities and authority of team members
- Project budget with work breakdown structure
- Environmental or archaeological considerations
- Reference to Project Procedures Manual
- Management Information System
- Communications protocol
- Bid packaging and contracting strategy
- Site mobilization and utilization phase
- Commissioning plan

Project Procedures Manual

The CM should develop a Project Procedures Manual that clearly defines the responsibilities of the Project Team, levels of authority, and the systems, methods and procedures to be followed for project execution.
The basic elements of the Project Procedures Manual include:

- The budget and the systems required for monitoring and controlling project costs.
- The quality assurance program established by the team and how it is to be implemented.
- The project schedule and how it is to be developed, implemented and maintained.
- Specific project systems, methods and procedures (i.e. bidding, payments, change orders, submittals, correspondence, reports, performance records, claims avoidance/resolution, etc.)
- Defining sustainability requirements for the project and establishing procedures to monitor and confirm the requirements have been met.
- Functional responsibilities and limits of authority.
- Correspondence distribution matrix.
- Checklists.
- Meetings, types and frequency.
- Sample forms to be utilized.
- Detailed procurement phase procedures.
- Coordination between the team members during all project phases.
- Design review process and procedures.
- Project acceptance and closeout procedures.
- Procedures for verifying compliance with all safety laws and regulations.

### Project Delivery Methods

Even before design, the CM should provide guidance to the owner concerning various methods available to deliver the project, e.g. design-bid-build, design/build, multiple prime contractors, CM-At-Risk, etc. Delivery methods should be evaluated as to which one best satisfies the owner's objectives for the project. The owner's familiarity with the construction process and the level of in-house management capability has a large influence over the amount of outside assistance required during the process, and may guide the owner in determining the appropriate project delivery method. An owner must make an assessment of its ability to properly administrate the various types of delivery methods. The delivery method chosen has a significant impact on project team member organization, roles and responsibilities, project risk, and thus, the contract administration procedures that will be followed.

### Project Delivery Methods Available to Owners

A **project delivery method** is a contractual system designed to achieve the satisfactory completion of a construction project from conception to occupancy. A project delivery method may employ any one or more contracting types to achieve the completion of the project. Because of financial, organizational and time constraints, various project delivery methods have evolved to fit particular project and owner needs. Most common delivery methods used today are Design-Bid-Build, Construction Management-At-Risk, and Design-Build. In recent years, another risk sharing approach has been utilized and has been entitled as Integrated Project Delivery (IPD), and is also described here as a result of the current interest in understanding this new concept. The various delivery methods and the primary variations are as follows:

**Design-Bid-Build (DBB)** – The traditional U.S. project delivery method, which typically involves three sequential project phases: The design phase, which requires the services of a designer who will design the project; the bid phase, when a contractor is procured; and a build or construction phase,
when the project is built by the contractor. This sequence usually leads to a sealed bid, fixed price contract. A common variation of this method is labeled as follows:

- **Multiple Primes** – An owner contracts directly with separate trade or discipline contractors for specific and designated elements of the work, rather than with a single general or prime contractor. This method enables the owner an opportunity to fast track the project.

**Construction Management-At-Risk (CMAR) (also called CM-At-Risk, CM/GC, or CMC)** - A delivery method that entails a commitment by the CM for construction performance to deliver the project within a defined schedule and price, either fixed or a Guaranteed Maximum Price (GMP). The CMAR acts as consultant to the owner in the development and design phases, but assumes the risk for construction performance as the equivalent of a general contractor during the construction phase.

**Agency Construction Management** - A management process that can be implemented regardless of the project delivery method used where there is a defined relationship between the CM and the owner. Agency construction management establishes a specific role of the CM acting as the owner's principal agent in connection with the project and/or program.

**Design-Build (DB)** – A project delivery method which combines architectural and engineering design services with construction performance under one contract. Variations include:

- **Bridging** – A designer is retained by the owner to develop the design documents to a specific point (usually schematic level) prior to engaging the Design-Build contractor, who then finishes the design and constructs the project.
- **Public Private Partnership (P3)** – A private entity or consortium of investors provides some or all of the required capital with a commitment to deliver a completed project for a public sector owner in exchange for revenue that the completed facility is anticipated to generate.

**Integrated Project Delivery (IPD)** – A project delivery method that contractually requires collaboration of the primary parties - the owner, the designer, and the builder, so that the risk, responsibility and liability for project delivery are collectively managed and appropriately shared whether through partnership agreements or multi-party contracts.

Each of these project delivery methods carries a different level of risk for the owner. There are benefits and trade-offs that come with various delivery methods, and it can be invaluable for the owner to have professional CM advice to determine what makes the most sense for any given project or program. For example, one owner may value the speed to completion and the potential for design innovation that Design-Build promises while another owner may not wish to accept the reduction in owner control of the final design that accompanies Design-Build delivery. In addition, many alternate delivery methods require the owner to have sufficiently experienced staff resources to fully define the project or be willing to allow another entity to define it. Generally, the level of control provided to the owner correlates with the level of risk.

The CM must be aware of the project delivery method chosen by the Owner and provide appropriate contract administration processes to manage the type of contract and/or contracts selected.

**Management Information Systems**

During this phase, the CM should also establish a Management Information System (MIS) that will keep the Project Team informed as to the overall status and forecast of the project compared to the
established Project Management Plan. The MIS should address team member information needs, data sources and elements for time and cost control functions, output measures and how the system is to be organized and implemented. It should provide a sound basis for managing the project and identifying and evaluating problem areas and variances. This requires a comprehensive system that is capable of being tailored to a specific project. The MIS must also be simple to understand and use since some members of the project staff may be using the system for the first time and may not have the benefit of past experience with a similar project control system.

To satisfy the need for a system that is simple to use, easy to understand, and is capable of efficiently handling many tedious tasks, the CM should consider the use of a computerized MIS. While not essential, a computerized system offers the CM the ability to track, monitor and organize thousands of items with a minimum investment of manpower. Systems that are not computerized tend to limit the number of items that can be addressed, rely very heavily on the individual staff members' capabilities, and do not provide the ability to quickly create status reports focused on specific problem areas. Computerized management systems present the possibility of transmitting data between parties via electronic media, providing an opportunity to enhance overall efficiency and economy. Computerized management systems also reduce paper consumption and waste output from all of the parties involved.

The reporting of financial status, current and projected, must be designed to enable both the owner and CM to plan, monitor and effectively control the application of available funds to the project. The format of reports should accommodate a continuing input of data, and the resultant information should serve as a budgeting and cost control tool on a contract phase and total project basis. Financial reporting should cover budgeted, authorized and committed funds, expenditures to date, cost to complete, invoices, payment and retention, change orders, projected total costs and projected cash flow.

The CM should interview the owner's and the designer's staff personnel and determine the type, format, and frequency of information and reports required. As a minimum, information should include schedule and progress reporting, drawing schedules, budget versus cost of services, and change requests (approved and pending) for design services. The first reports should be issued during the design phase and thereafter, on an agreed frequency.

**Sustainability Plan**

The sustainability plan should enable the Construction Manager to coordinate efforts, track progress and focus energies on the deliverables and milestones specifically related to the project's sustainability goals and requirements. A sustainability plan is both a guidance document and the foundation for a reporting system. It should be as concise as possible. Sustainability should be seamlessly integrated into scope, cost and time management processes for the project.

The five basic guiding principles for new construction sustainability are as follows:

1. Employ an integrated design;
2. Optimize energy performance;
3. Protect and conserve water;
4. Enhance indoor environmental quality;
5. Reduce environmental impact of materials.
Owner's Project Requirements (OPR) Document

If the owner does not already have a prepared Owner's Project Requirements Document (OPR), then the CM can work with them to develop one. This document provides an overview of the project, and specific guidance to the design team regarding the owner's sustainability goals for the project. These goals can include LEED ratings, anticipated energy use rates and reuse of existing or recycled materials. During the development of the OPR, the CM can advise the owner on the cost and schedule impact of these goals, so the owner can make informed decisions and trade-offs of the goals before the project is designed.

The Owner's Project Requirements (OPR) is a document prepared by the owner of a project to convey the functional requirements of a project and the expectations of the building's use and operation. The OPR should address the following minimum issues as applicable to the project:

- **Owner and User Requirements:** Describe the primary purpose, program, and use of the proposed project (e.g., warehouse with data center) and any pertinent project history. Provide any overarching goals relative to program needs, future expansion, flexibility, quality of materials, and construction and operational costs.
- **Environmental and Sustainability Goals:** Describe any specific environmental or sustainability goals (e.g., LEED Certification Level)
- **Energy Efficiency Goals:** Describe overall project energy efficiency goals relative to local energy code or ASHRAE Standard or LEED. Describe any goals or requirements for building siting, landscaping, façade, fenestration, envelope and roof features that will impact energy use.
- **Indoor Environmental Quality Requirements:** As applicable and appropriate, describe the intended use of each usage area; anticipated occupancy schedules; space environmental requirements (including lighting, space temperature, humidity, acoustical, air quality, ventilation and filtration criteria); desired user ability to adjust systems controls; desire for specific types of lighting; and accommodations for after-hours use.
- **Equipment and System Expectations:** As applicable and appropriate, describe the desired level of quality, reliability, type, automation, flexibility, and maintenance requirements for each of the systems to be commissioned. When known, provide specific efficiency targets, desired technologies, or preferred manufacturers for building systems.
- **Building Occupant and O&M Personnel Requirements:** Describe how the facility will be operated, and by whom. Describe the desired level of training and orientation required for the building occupants to understand and use the building systems.

**Communication Procedures**

Once the MIS is established, the CM implements the procedures for recording and controlling the flow of information between all parties. This includes expediting timely responses for any outstanding critical issues, and participating in periodic planning progress meetings to ensure proper, as well as responsive, coordination within the Project Team.

**Conceptual Studies**

The CM assists the owner and/or designer by preparing initial cost estimates and construction schedules to support preliminary feasibility and design studies. The CM may also make recommendations regarding construction materials and methods that are either best suited or common to the proposed project and its location, or feasible alternatives to meet the project’s sustainability goals. The CM may
assist the owner in the evaluation of preliminary design alternatives being considered. Existing conditions at project site and code compliance issues should also be considered. Working with the owner to determine sustainability goals for the project, the CM can help determine cost and schedule impacts of obtaining these goals. Construction financing alternatives need to be evaluated to determine the viability of a project.

**Pre-Design Cost Investigation**

The CM establishes a cost management plan, which becomes the basis and framework within which the costs of the project are controlled. This includes providing cost estimating support for project feasibility and energy conservation studies as well as conceptual budgeting. In this, the CM develops cost models to identify all project costs including probable costs of construction, site acquisition, permits, consultants, escalation and financing. Once the master budget for the project is established, preliminary cash flow and funding studies should be performed.

**Master Schedule**

The CM develops a master schedule to govern the life of the project by establishing the overall schedule completion goals of all future phases, including construction, in summary fashion. The Master Schedule highlights major project milestones and details the front-end activities of the project during the Pre-Design and Design phases. In developing the Master Schedule, the CM must also take into consideration the budget, since the overall duration of the project and duration of each phase has a significant impact on project cost.

The Master Schedule should be updated each month at a minimum or at shorter appropriate intervals. The update is a simple process, indicating the activities completed, activities in progress and their percentage of progress. Any necessary revisions to the durations and sequence of activities should also be made at this time. Any delays need to be evaluated as to their cause. Recovery options must be identified and explored along with the possible impact to cost or quality. Recommendations must be made to the client related to recovering the delays or accepting the delay and the resultant impact.

The CM must take immediate action if any potential delays are identified as well. Timely resolution of issues and decisions is critical to keeping the project on schedule. Pre-Design Phase involves critical decisions related to project scope that have a great influence on the balance of the project. The CM must facilitate this process through the establishment of clear communications and procedures.

**Milestone Schedule**

The Milestone Schedule acts as a "pull out" from the Master Schedule. The purpose of a Milestone Schedule is to highlight the key events in a project, as an executive level summary. Since the Master Schedule consists of detailed activities, especially related to Pre-Design, the Milestone Schedule helps the Project Team be cognizant of the "big picture" by identifying the key milestone activities and critical dates for their completion. By establishing the Milestone Schedule and monitoring it with each update of the Master Schedule, the CM can keep the Project Team abreast of critical time elements and their status throughout the course of the project.

**Design Consultant Selection**
When the delivery method chosen requires a separate design contract, the CM can assist the owner in selecting a designer. This includes developing Requests for Proposals (RFP) and criteria to be used in evaluating the proposals. The CM then assists the owner in reviewing proposals, conducting interviews and evaluating the short-listed candidates to make a final selection. This may entail checking references and verifying past project performance. Once the selection is made, the CM may also assist the owner in contract negotiations.

**Design Consultant Contract**

If requested, the CM assists the owner in preparing the designer’s contract, ensuring that the contract scope of work is clear and complete and the submittal requirements for the deliverables are explicit. Specific responsibilities for the designer must be delineated and carefully coordinated with those of the owner and CM to prevent overlap. The designer’s contract should include a detailed Design Phase schedule and specific Design Phase project controls.
Chapter 3: Design Phase

The goal during this phase is to produce a complete set of contract documents that define a project and can be delivered in the current local market within the owner's established budget, performance, time and quality requirements. In many ways, the most critical project phase, the Design Phase establishes the financial, legal, sustainability and quality-based criteria for the project. Many of the obstacles that surface during Construction and Post-Construction can be avoided by the development of good design documents and taking appropriate action in the Design Phase. In this phase, the CM coordinates the design contract(s), manages the development of drawings and specifications, develops more detailed cost and schedule parameters, develops contract documents, and makes sure that the design conforms to the Owner’s requirements.

Administration and Coordination of Design Contracts

The CM reviews the contract, including the scope of work, of each designer and sub-consultant, to fully understand what is expected of each. The CM must have a working knowledge of the design practice and standard procedures of a design firm, including deliverables, scheduling requirements, and productivity capacity. The design consultants are responsible for their performance. The CM’s role is primarily coordination and guidance to assist the owner in its contract administration of the designer. To this end, the CM will:

- Schedule and conduct meetings to communicate the owner’s desired features and all available project information to the designer to facilitate the design process.
- Assess the impact of scope changes on the designer’s schedule and fee and provide the owner with a preliminary estimate of the cost of scope revisions prior to their implementation.
- Review the designer's progress to assure timely completion.
- Review the designer's payment request and submit appropriate recommendations to the owner.

Additionally, the Construction Management Plan prepared in the Pre-Design Phase is updated to include the designer and any other new team members in the project organization and staffing plan. The Project Procedures Manual is also revised to update procedures for implementing and maintaining the project record, submittal, and document control system. The CM uses this manual to explain the procedures for implementing and maintaining lines of communication as well as the roles, responsibilities and authority of all team members. The Procedures Manual can also now be updated to detail the contractual relationship of team members and to identify methods to resolve conflicts as well as prevent duplications and omissions of responsibilities between the owner, the CM and the designer. It should be revised to describe the designer’s quality assurance procedures to evaluate the specific documentation and reporting requirements. Finally, the Procedures Manual should provide the accepted method to address changes in the designer’s scope of work.

During the Design Phase, it is important that the design team prepares a Basis of Design (BOD) document. This document describes how the design meets the owner's goals outlined in the OPR. The BOD provides the construction and commissioning teams with a complete narrative of the project design and the intent of the design team.

The CM also assists the owner in monitoring the designer’s contract costs by preparing a detailed project cost report for all design stages. The report is updated monthly and includes:
• Tracking of designer’s actual versus budgeted cost
• Changes in budget or added items of work for each consultant
• Progress to date in terms of man hours expended, and percent complete
• Estimate of final cost to complete

Master Schedule

Once the design scope of work is finalized, the CM amends the Master Schedule to include a detailed design schedule. The Master Schedule should have design, review, agency approvals, and permitting milestones to include:

• Schematic design, review periods, and cost estimate preparation.
• Value engineering, sustainability and constructability reviews.
• Design development, review period, cost estimate preparation.
• Commissioning reviews of design development and construction document phases.
• Agency approvals, time and funding authorization milestones.
• Review of design documents to ensure goals from the OPR are included in the design documents.
• Completion of the Basis of Design Document by the design team.
• Construction document completion, with approval time at appropriate percentage of completion, accompanied by review periods and cost estimate preparation.

Within a partnering atmosphere, the CM obtains each stakeholder’s input in the schedule development, and thus gains acceptance by the entire Project Team before implementation.

Based on the design concepts being developed and geographic location of the project, the CM performs schedule analyses to identify actual and potential constraints to the project goals and potential corrective action. This includes assessing the impact of procurement lead times for specified equipment and materials, and researching the local construction market to assure sufficient expertise of contractors and tradesmen to satisfy the schedule requirements.

The CM conducts periodic design progress meetings to identify and discuss design problems that affect project progress. The Project Team works proactively to develop methods to mitigate their impact on the project schedule. Based on these meetings, the CM adjusts the Master Schedule activity durations, logic and completion dates to reflect actual progress of the design work. The CM also evaluates the construction schedule in light of the revised design schedule with special attention to secondary, or ripple, impacts necessitating even further revision of the construction schedule.

The CM issues a monthly schedule update report usually in both graphic and narrative format that clearly identifies the scheduled completion dates of both the design and the overall project. In the report, there is also a discussion and detailed analysis of any changes to the schedule during the last period and the effect on the completion dates. The CM provides its recommendations for corrective action, if required.

Design Phase Communication
The CM develops and implements a system to expedite and control the flow of information during the Design Phase. Effective communications will enhance productivity, hasten design completion, expedite problem resolution and minimize unexpected events or surprises. Helpful procedures include:

- Establishing the key individual(s) through whom all communications will be channelled.
- Utilizing a Document Control System to monitor the status of design submittals, inquiries and design review comments.
- Conducting periodic design review meetings within individual disciplines as needed. Schedule and coordinate project design review meetings at 10%, 30%, 60%, 90% and final design completion. At these meetings, review the status of open design submittals, Requests for Information (RFIs) and changes.
- Maintaining and distributing written records of all design review meetings. Special emphasis should be placed on any revisions proposed or adopted.

**Design Reviews**

The CM schedules design reviews and contributes to these reviews to assist in minimizing design changes. These reviews prevent certain problems, some of which include unreasonable delivery schedules, confusion over responsibilities, unreasonable quality expectations, and improperly investigated conditions. These problems usually manifest themselves in added cost to the project in short term and life cycle terms, as well as schedule slippage.

Design reviews include the following tasks:

- Reviewing the design narrative and/or program.
- Verifying agency reviews/approvals required.
- Scheduling/conducting periodic design conferences.
- Scheduling conferences with regulatory agencies.
- Reviewing the design team's Basis of Design (BOD) and attainment of sustainability goals for the project.
- Reviewing schematic design submittal.
- Developing schematic design cost report for owner.
- Incorporating owner comments and obtaining approval to proceed.
- Reviewing design/development submittal.
- Reviewing cost estimate, incorporate revisions, obtaining approval to proceed.

**Sustainability Reviews**

The owner and the CM should agree on the detailed scope and number of sustainability reviews that will be required in design based on the requirements and goals set at the initial stage of the project. Sustainable design seeks to reduce negative impacts on the environment, and the health and comfort of building occupants, thereby improving building performance. The basic objectives of sustainability are to reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments. Sustainable design principles include the ability to:

- Optimize site potential;
- Minimize non-renewable energy consumption;
- Use environmentally preferable products;
d. Protect and conserve water;
e. Enhance indoor environmental quality; and
f. Optimize operational and maintenance practices.

Utilizing a sustainable design philosophy encourages decisions at each phase of the design process that will reduce negative impacts on the environment and the health of the occupants, without compromising the bottom line. It is an integrated, holistic approach that encourages compromise and tradeoffs. Such an integrated approach positively impacts all phases of a building’s life-cycle, including design, construction, and operations. Key sustainability tasks and milestones should be identified for early inclusion in the Master and Milestone Schedules.

**Construction Specifications and Drawings**

The specifications describe the required materials, execution, and quality of performance whereas drawings and other graphic documents are used to show the size and extent of construction and geometric relations between the various construction components. The specifications incorporate various standards, codes and other publications and thus provide guidance on the full requirements of the contract.

**Construction Contract Format**

The Construction Specifications Institute (CSI) publishes the standard system that is used most often in the construction industry for formatting construction specifications. Since construction projects use many different kinds of delivery methods, products, and installation methods, there is a need for a common system of specifications for all parties to ensure the correct and timely completion of the work. Efficient information retrieval is only possible when the same standard organizational system is used by everyone. The CSI MasterFormat and UniFormat system (as well as other standards CSI maintains) helps to organize a project’s information at every stage, from conception to completion.

1. The CSI UniFormat system is a method of arranging construction information based on functional elements, or parts of a facility characterized by their functions, without regard to the materials and methods used to accomplish them. These elements are often referred to as systems or assemblies. UniFormat is often seen in performance specifications and preliminary project descriptions (PPDs). It’s most notable use is as a format for estimators to present cost estimates during the schematic design phase. UniFormat breaks a facility into systems and assemblies that perform a predominating function, such as a substructure, shell, interiors, and services, without defining the technical solutions to provide these functions. This allows the facility to be priced at the elemental level; allowing design alternatives to be better evaluated, and allows facility performance to be established at the system level as the project design is being refined.

UniFormat’s approach to organizing data is also important to the continued development of building information modeling (BIM) software, as its system organization allows objects to be placed before their properties have been fully defined.

2. The format for preparation of a construction contract is usually based on the Construction Specification Institute (CSI) MasterFormat. The MasterFormat system is a master list of numbers and titles classified by work results. It is primarily used to organize project specifications, detailed cost information, and other information during the design and construction phases. It is used to organize specifications and other project information for most commercial building design and construction projects in North America. It lists titles and section
numbers for organizing data about construction requirements, products, and activities. By standardizing such information, MasterFormat facilitates communication among architects, specifiers, contractors and suppliers, which helps to meet building owners’ requirements, timelines and budgets. An example of the MasterFormat specification system divisions and the first level of sub-divisions for a construction contract are presented in outline form in Exhibit #1 below, and it can be used as a guide in preparing all applicable construction contract specifications. This is a partial listing that excludes some unassigned sub-divisions for purposes of brevity.

### EXHIBIT#1

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- 14 70 00 - Turntables
- 14 80 00 - Scaffolding
- 14 90 00 - Other Conveying Equipment
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<tr>
<th>Division 21 - Fire Suppression</th>
<th>Division 22 - Plumbing</th>
<th>Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)</th>
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<th>Division 31 - Earthwork</th>
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<td>• 21 00 00 - Fire Suppression</td>
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<td>• 21 10 00 - Water-Based Fire-Suppression Systems</td>
<td>• 22 10 00 - Plumbing Piping</td>
<td>• 23 10 00 - Facility Fuel Systems</td>
<td>• 25 10 00 - Integrated Automation Network Equipment</td>
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<td>• 32 10 00 - Bases, Ballasts, and Paving</td>
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<td>• 21 20 00 - Fire-Extinguishing Systems</td>
<td>• 22 20 00 - Unassigned</td>
<td>• 23 20 00 - HVAC Piping and Pumps</td>
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<td>• 21 30 00 - Fire Pumps</td>
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<td>• 23 30 00 - HVAC Air Distribution</td>
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<td>• 21 40 00 - Fire Suppression Water Storage</td>
<td>• 22 40 00 - Plumbing Fixtures</td>
<td>• 23 40 00 - HVAC Air Cleaning Devices</td>
<td>• 25 40 00 - Unassigned</td>
<td>• 26 40 00 - Electrical and Cathodic Protection</td>
<td>• 27 40 00 - Audio-Video Communications</td>
<td>• 28 40 00 - Electronic Monitoring and Control</td>
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<td>• 22 50 00 - Pool and Fountain Plumbing Systems</td>
<td>• 23 50 00 - Central Heating Equipment</td>
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<td>• 31 40 00 - Shoring and Underpinning</td>
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<td>• 23 70 00 - Central HVAC Equipment</td>
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<td>• 31 60 00 - Special Foundations and Load-Bearing Elements</td>
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<td>• 31 70 00 - Tunneling and Mining</td>
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Division 33 - Utilities
- 33 00 00 - Utilities
- 33 10 00 - Water Utilities
- 33 20 00 - Wells
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- 42 00 00 - Process Heating, Cooling, and Drying Equipment
- 42 10 00 - Process Heating Equipment
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- 43 00 00 - Process Gas and Liquid Handling, Purification and Storage Equipment
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- 44 00 00 - Pollution and Waste Control Equipment
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- 44 20 00 - Noise Pollution Control
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- 45 00 00 - Industry-Specific Manufacturing Equipment
Division 46 - Water and Wastewater Equipment

- 46 00 00 - Water and Wastewater Equipment
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- 48 00 00 - Electrical Power Generation
- 48 10 00 - Electrical Power Generation Equipment
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**Technical Specification Reviews**

The CM uses the expertise of the Project Team to review the specifications for accuracy, clarity, and intent. This assures that the contractor can determine the full project requirements.

Reference specifications should be checked for applicability, consistency and clarity. Project specifications should be reviewed against the requirements of local jurisdictions, whose requirements may ultimately be the standard of acceptance. If "or equal" procurement provisions are utilized, ensure that criteria against which alternates are to be evaluated are clear and complete. Clarify if bidders will be required to pre-qualify alternates during the bid period or during construction.

The general construction requirements must also be consistent with actual project requirements. Review warranty and guarantee provisions for both acceptability and feasibility. All conflicts between specification sections, or between specifications and drawings, should be resolved. Finally, the CM should provide input to special provisions covering items such as construction office details, CPM scheduling requirements, utility relocation, and other non-design issues.

The CM should review the technical specifications to confirm necessary requirements to meet the goals set forth in the OPR are included. The technical specifications should include requirement for such things as resource management, indoor air quality requirements and commissioning of building systems.

**Constructibility Reviews**

Too often projects are designed with little consideration for the cost or difficulty to construct them. As a major value-added contribution, the CM reviews the contract documents from a constructibility, maintainability, and claims avoidance viewpoint. The CM makes recommendations to the owner for alternative construction and contractual methods and procedures if advantageous to the overall project schedule and budget. The CM strives to minimize potential change orders and claims throughout the Construction Phase. These reviews verify that:

- Design documents are easily understood and clearly communicate the design intent, and are free of significant design errors, omissions and ambiguities.
- Documents follow standards set by governing agency or owner requirements.
• Contract provisions are easily administered and can be enforced.
• The design is compatible with available materials, equipment and construction techniques.
• Alternate construction phasing, work sequencing, and fabrication and erection procedures that may be adopted are evaluated.
• The project schedule is realistic.
• Construction details are simplified and improved.
• Potential conflicts between structural, mechanical, architectural, electrical, and other disciplines are resolved.

It is recommended that constructability reviews take place periodically throughout the design performance period. Ideally, reviews should take place at the 30%, 60% and 90% design stages, along with a final pre-bid review after completion of design. The CM should utilize checklists for reviews of plans and specifications to review whether various items of the constructability review may have been overlooked. The CM should prepare these checklists early in the design period, and review them with the owner and designer. The reviews should include a visit to the site to spot-check conditions that may not be indicated on the plans.

**Commissioning Reviews**

As part of a sustainability (LEED) program, the commissioning agent (CxA) must make commissioning reviews of the Design Phase documents. The CxA review during the design phase must confirm that design documentation (plans, specifications, Basis of Design (BOD), etc.) are consistent with each other, include commissioning requirements, meet the Owner's Project Requirements (OPR) and clearly show:

• The building systems are designed in such a manner to ensure they can be operated and maintained by the owner after project completion.
• The documents meet the owner's sustainability requirements as laid out in the OPR.
• The design and specification of the building controls systems are complete and accurate enough to be built and operated in an efficient manner.

**Design Phase Activities** should include the following:

• Update the commissioning plan. If a plan has not been developed, create one as described in the pre-design phase. Updates to the plan during design may include more detail about the construction phase schedule and responsibilities, new project team members and communication protocols. The commissioning plan should be consistent with the specifications.
• Conduct a design phase commissioning kick-off meeting to review the commissioning plan and activities with the commissioning team.
• Review the OPR for completeness and clarity. The OPR should be included as a supplement to the construction documents.
• Ensure the OPR and BOD documents are updated to reflect any Owner approved changes made during the design process.
• Perform periodic commissioning-focused reviews of the design submissions using experienced qualified personnel.
• The commissioning reviews focus on verifying that the OPR and BOD are met relative to facilitating the commissioning process. In particular, the reviews confirm that there
are adequate access points, test ports, monitoring capabilities and points, and control features. Reviews also verify that energy-efficiency, operation, control sequences, maintenance, training and O&M documentation requirements are consistent with the OPR and BOD.

Value Engineering

The CM arranges and participates in a value engineering (VE) review for the project. The goal of value engineering is to obtain the best overall value for the life of the project and its intended uses. VE reviews are best performed by a multi-disciplined team that is able to bring the full and balanced perspective of all disciplines to the review. The VE team should identify features that do not contribute to quality, utility, durability, aesthetics or other specific owner requirements.

It is critical that the project’s sustainability objectives are carefully considered and not compromised by the VE process.

Additionally, the VE team should consider alternate methods or materials that will provide an equal or superior product at lower cost. Finally, project components are evaluated in terms of total, or life cycle, costs with respect to the initial cost, long term cost, anticipated life of the component and all other time-related factors. This includes the cost associated with the maintenance and operation of the item. It is recommended to conduct the VE review at the 30% design stage with follow up sessions as required by project size or complexity.

Construction Contract Packaging

The CM assists the owner in the development of an overall procurement strategy for the project. This plan considers local practices, local labor market, and chances of unfavorable site conditions, etc. to evaluate the use of a general contractor, multiple-prime contractors, design-build or other delivery methods, as well as the utilization of phased construction. The plan also includes the development of bid strategies for the individual contract(s) such as:

- Competitive bidding – open to all qualified bidders
- Competitive bidding – to invited bidders only
- Negotiated contracts
- Cost reimbursable (or Time and Material) contracts
- Unit Price Contracts

The direct purchasing of major equipment or components by the owner can be of great benefit, but also increases the owner’s risk. There are potential savings of cost and time as well as the additional flexibility to obtain the exact product desired. However, there are the logistical issues of equipment material delivery to include unloading and storage requirements, as well as the additional risks assumed when supplying equipment directly to the contractor. It is important to establish who (contractor, owner, CM) will manage the supply contract(s) during construction. The CM should determine what additional information must be included in contractor bid packages to accommodate this.
The CM assists the designer and recommends and/or prepares the contract documents required to implement the procurement plan. All such documents should be reviewed by the owner and legal counsel prior to use to include:

- Instructions to Bidders – provides detailed instructions and requirements for the submission of a bid.
- Bid Form – standard format on which bid data will be accepted. Information required can be varied to suit the requirements of the individual contract.
- Standard Bond Forms – as required.
- Form of Agreement – to be utilized for the contract.
- General Conditions – defines the participants and general rules that govern their activities. These are typically lengthy legal documents requiring extensive preparation. Proven Standards, such as those prepared by CMAA or others, should always be considered.
- Detailed Scope of Work.
- Supplemental Conditions – are used to add, delete, modify and clarify general condition requirements to suit the particular circumstances or requirements of the owner.

The CM should be aware of and recommend the inclusion of all supplemental information required by the contractor to facilitate a complete and accurate bid. The results of subsurface explorations and any as-built information on adjacent structures or facilities are extremely helpful. There should be a clear definition of contract limits. The contractor should be made aware of all project time constraints and intermediate completion requirements (milestones), and preliminary project schedules or narratives indicating the work of adjacent contractors, owner’s workforces, etc. Any special safety requirements, such as when the work is on a hazardous waste site, are also of significant importance to the contractor. The contractor must be made aware of all sustainability requirements for the project and their role in meeting these requirements.

Finally, the CM should review the proposed owner/contractor agreement for common pitfalls such as:

- Poorly defined scope of work, gaps in scope, or duplication between contracts.
- Failure to define allowable mark-ups for the general contractor, subcontractors, and sub-subcontractors, as well as the mark-ups on deductive changes.
- Unrealistic schedule or phasing provisions.
- Lack of damages clauses for missed milestone completions.
- Lack of method to deal with unforeseen conditions.
- Lack of establishing contingent or alternative bid items.
- Lack of clearly defined sustainability goals and defined responsibilities in meeting these goals.
- The appropriateness of assigned permit responsibility.
- The evaluation criteria to determine low bidder. Are unit prices, alternatives, and value engineering included in evaluation of base bid?
- Clear bonding and insurance requirements.
Construction Phase Budget

The CM should prepare detailed cost estimates as information becomes available during the Design Phase. These detailed cost estimates prepared during the design phase will constitute the final project construction budget, against which actual construction costs will be monitored.

Early in design, before the Construction Specifications Institute (CSI) specification sections are established, cost models must be developed using other formats. It is important to establish the relationship of scope, quality and time to cost. By linking a functional program to elements of the project, a model can be developed to track scope and cost through the design process. Once CSI specification sections are developed, standard off-the-shelf computer models can accurately track project cost. As each phase of design is completed, the CM updates the cost model and holds a meeting with the Project Team to review the status, and make adjustments as necessary.

The CM prepares a monthly report identifying the status of project costs including construction costs and soft costs. The report tracks costs in each major element and section, or by contract and category of the project, so that impacts to the budget may be identified easily. The cost estimate must be adjusted to account for project-specific impacts to normal productivity rates as follows:

- The magnitude of the scope of work and phasing requirements due to abbreviated contract duration.
- Limitations on work hours and access to work and staging areas due to on-going operations.
- Working in and around dangerous areas – electrified tracks, runways, freeways, etc.
- Working during nights, weekends or under adverse environmental conditions.
- Dust, noise control or other environmental protection restrictions.
- Reuse and recycling of project resources.
- Coordination with on-going construction projects.

Scheduling Specification

The CM recommends and/or prepares the scheduling specification. The specification should be appropriate for the complexity of the project in terms of the level of detail and the software required. The CM may also wish to consider the scheduling capability of likely contractors for the project. The CM should prepare the specification section on scheduling and establish milestone dates and any constraints, if appropriate, placed upon the sequence of the work or duration of key activities. The scheduling provisions must discuss preparation and acceptance of the contractor's schedule, as well as responsibility and procedures for updating the schedule. If the schedule is to be resource loaded and progress payments made based on the schedule update, the scheduling provisions must agree with the payment provisions of the contract.

The specifications should also clearly outline how changes may be introduced into the schedule in the event unforeseen conditions are encountered. The CM should clarify in the schedule specification the basis upon which the contractor may be entitled to a time extension. The CM must also verify that there is clarity on the achievement of any milestones, with special attention directed to any provisions, substantial completion or beneficial occupancy, final acceptance, and any warranty milestones to the extent they are related to the contractor's satisfaction of the schedule requirements.
Pre-Bid Construction Phase Schedule

The CM develops a guide in the form of stipulated milestones or preliminary construction schedule to be included in the construction bid packages. The pre-bid schedule serves as a basis to record information from which the overall construction time is estimated. Any special assumptions made regarding shift work or extended hours should be indicated on the pre-bid schedule. Additional information pertinent to preparation of the pre-bid construction schedule (a CPM schedule is strongly recommended) includes:

- Key project milestones.
- Long-lead procurement activities.
- Owner procurement activities.
- Work to be performed by the owner.
- Necessary time for regulatory approvals.
- Activities of concurrent construction projects.
- Environmental restraints such as stream crossing restrictions.
- Seasonal restrictions.
- Known interference with owner activities.

The designer, by previous contractual obligation, may be charged with preparing the pre-bid construction schedule, in lieu of the CM. In such a case, the CM thoroughly reviews the schedule for accuracy and completeness and makes specific recommendations for editing, expanding, or revising the schedule to comply with the project goals.

Additional Project Specific Tasks

As previously discussed, CM services vary according to project type and many of these services fall outside the traditional scope of construction services. For example, in the renovation of an occupied building, the CM may be involved in negotiating, planning and implementing swing space; planning temporary protection measures for the public and/or occupants; organizing and conducting informational meetings to discuss disruptions to building operations; keeping phone and computer service uninterrupted; and developing an office furniture relocation plan. The CM will also be involved in the development and implementation of an indoor air quality plan to minimize the transmission of odors and dust from construction into occupied spaces.

For a transportation project, an owner may wish the CM to coordinate right-of-way negotiations; utility service relocation and temporary utilities; public information, public meetings, displays and publicity; temporary access provisions; and a project website for long or complex projects affecting the surrounding communities.

It is important that these responsibilities are clearly identified during the Design Phase so that timely execution and coordination of these services can be accomplished.

For a project with an Energy Performance Contract, contract documents should be reviewed to assure funding, monitoring and verification, and other requirements are properly addressed in the contract documents, and in the Project Management Plan.
Chapter 4: Procurement Phase

In a typical Design-Bid-Build project delivery process, the Procurement Phase typically bridges the time between the completion of the design and the start of construction. However, it should be recognized that the Procurement Phase may be started earlier in the project life-cycle depending on the method of project delivery. For example, if a Design-Build project delivery method is chosen, then the Procurement Phase will be necessary before the design is completed. This phase of the project will have to be matched to the project delivery method selected by the Owner. The goal in this phase is to assist in securing contractors who are qualified, competitive, interested in the work, and capable of doing the work within the project time requirements. The Project Management Plan that was developed during the Pre-Design Phase of the project should clearly outline the systems, methods and procedures to be followed during the Procurement Phase.

Development of Bidders List

Project bidding may be open to all interested bidders or only open to pre-qualified bidders, depending on the owner's requirements and government restrictions. The CM assists the owner in developing a list of potential bidders from any of the following categories:

- Contractors successfully employed by the owner in the past.
- Contractors recommended by either the CM or designer.
- Contractors known to be looking for work and that possess the necessary expertise and capacity to perform the work.

Bidders Interest Campaign

For a selected bid list, the CM conducts a telephone/written campaign to generate maximum interest among qualified contractors. This includes contacting local and regional builders found in the telephone book, referred by local designers, construction or trade associations and bidding exchanges, etc. Information received from the bidders should be recorded formally and presented with other data used in determining the bidders list.

Bidders Pre-Qualification

If the CM can legally implement a process to evaluate potential contractors through pre-qualified submittals, the CM should develop a contract scope breakdown for each trade contract on the project. The breakdown should consider availability of design information, schedule, and local contracting practices. In conjunction with the scope development, schedule information should be produced that includes key dates for receiving technical information, reviews and approvals, bidding, evaluation, and contract award. Typically, the following information is provided by the contractor during the pre-qualification process:

- Past experience on similar or other relevant projects.
- Current workload and capacity to handle additional work.
- Experience on projects with similar sustainability goals.
- Qualifications of key personnel.
- Financial statement.
- Statement of owned equipment.
• Financial credit references.
• Client references.
• Bonding capacity.
• Insurance information.
• Safety performance record – Experience Modification Rate (EMR).
• List of outstanding claims and lawsuits.
• Listing of firm shareholders and any convictions or pending convictions.

With this information, the CM can evaluate the contractor and submit recommendations to the owner on which contractors should be invited to bid.

**Bid Advertisement**

In the public bid process, the CM assists the owner in preparation and placement of notices. Government agencies usually have a prescribed method for contacting vendors and contractors. All legal requirements must be adhered to. When the method of advertising the bid is not dictated by the owner, the CM must develop a program to attract qualified contractors. The notice should be clear regarding scope, schedule, bonding, pre-qualifications and any special owner requirements. Notices are usually placed in newspapers, trade publications, bid services, etc. in the project's geographic region. Contractors who have expressed interest should be contacted directly.

In setting the bid date, avoid conflict with bid dates for other major projects in the area, and allow sufficient time to ensure response from all interested bidders.

**Distribution of Bidding Documents**

The CM, in coordination with the designer, should control the distribution of bid documents by establishing specific procedures. This includes determining whether documents will be distributed for free, for a charge or for a deposit. Deposits are normally refunded to unsuccessful bidders upon return of the documents in good condition. It is important to ensure that adequate copies of the bid documents are available for distribution.

The designer should issue only complete sets of project documents. Under no circumstances should partial sets of plans or specifications be issued on behalf of the owner, since this can open the door to omissions or conflicts in the bids. Bid documents may be mailed or be picked up by the contractor. If documents are mailed, it is appropriate to charge the contractor any postage and handling fees.

To minimize environmental impacts, and expedite distribution, documents can be transmitted electronically. Confirmed receipt documentation must be received from all recipients.

The CM should maintain a complete list of all document holders, including their contact information. This list is usually distributed to all document holders shortly before the bid is due. Bid documents should also be made available for review at the offices of the CM, the owner and local bidding services or exchanges. This can be particularly important if separate, adjacent contracts are being bid at the same time.
Addenda

All clarifications and changes made after the bid documents are distributed must be issued to all plan holders in the form of an addendum. During the bid period, the CM monitors the preparation of addenda by the designer and controls their distribution. Addenda should be numbered and dated for easy reference and be mailed to all plan holders of record. They are often sent via certified mail to assure receipt.

Addenda must be sent with sufficient time to allow the bidders to evaluate and incorporate changes into their bids. Commonly, no addenda are issued during the last week of the bid period unless they contain an extension of time for the bid period. Again to minimize environmental impacts and expedite delivery, addenda can be forwarded electronically.

To ensure responsive bids, space should be provided on the bid form for the bidder to acknowledge receipt of addenda. Each addendum should be identified by number and date.

Pre-Bid Conference

The CM should conduct the Pre-Bid Conference, take minutes, and coordinate the responses to questions with the owner and designer. The Pre-Bid Conference gives bidders an opportunity to become familiar with the project site and surrounding areas. The conference also provides an opportunity to review the project, emphasize particular aspects of the project, review the sustainability goals of the project, discuss schedule milestones, and review staging areas, access, security, permits and special safety requirements. To this end, a guided site tour should be part of the Pre-Bid Conference agenda. Based upon the conditions of the site or the complexity of the work, the CM determines whether a site visit is mandatory to all prospective bidders. Notice of the Pre-Bid Conference should be included in the solicitation.

The CM should schedule the Pre-Bid Conference approximately halfway through the bid period. This allows contractors time to review the bid documents and formulate questions. The CM will coordinate the recording of questions raised during the meeting. For large or complex projects, court stenographers and videotape can be used for documentation. The minutes, including the substance of any verbal response to a bidder’s questions, should be incorporated into an addendum to be published immediately after the meeting and distributed to all plan holders.

Information to Bidders

The CM establishes the procedures that set deadlines for bidders’ questions, coordinates responses to questions, and distributes the answers to plan holders. To facilitate this, all questions should be directed to a single contact within the CM’s organization to be kept for future reference. The CM documents all inquiries and responses.

The CM coordinates with the owner and designer to determine the proper response to a question, including preparing supplementary drawings or other information to adequately explain or clarify the issue. Responses must be distributed to all prospective bidders in the form of an addendum.

Bid Opening and Evaluation

The CM assists the owner in receiving and recording bids at the formal bid opening and performs a thorough evaluation of all information contained in the bid. Most public agencies and many large
private owners have specific procedures for bid document protocol and bid openings. The CM must understand these and instruct Project Team members accordingly.

Public bids are typically read aloud at the bid opening, with the bidders' representatives in attendance. At such openings, the apparent low bidder, based on price only, is announced based upon the cursory reading of the prices disclosed in the bids. The formal announcement of the low bidder is only made after a complete review of all information contained.

The award of a contract only on the basis of apparent low price can be a serious mistake if the bid is incomplete, non-responsive or otherwise contains a serious error. As such, the CM should review all packages for completeness, confirming that all required information has been submitted, including the required bonds. The CM should also check that receipt of all addenda has been acknowledged. It is important to identify any exclusions or bid qualifications stated by the contractor and determine the impact of such exceptions in terms of cost, quality and schedule.

To facilitate the evaluation of bids, the CM should prepare a tabulation sheet for the direct comparison of all bids, including any alternates and unit prices. Bids are reviewed for any obvious mathematical or computational errors. Should the low bid contain a serious mathematical error, the contractor should be contacted and allowed to withdraw its entire bid. In bids containing multiple bid items, the review should attempt to determine if the pricing is "unbalanced." This can be common in unit price contracts and may indicate an error in an estimated quantity that could drastically affect the final cost of the project. Based on the owner's decision of which alternates (if any) will be chosen, and the value of any contractor exclusions to provide an accurate comparison of the total project cost, the lowest responsible bidder for the project is determined.

The bid prices should be in the general range estimated for the project during the Design Phase. If bid prices are higher than estimated, determine whether the owner can proceed with construction or if redesign is required. If the low bid is significantly lower (10% or more) than other bids, the contractor should be contacted to confirm that it is capable of completing the project for that price.

The CM should resolve the low bidders' exceptions, conducting post-bid interviews as required. Where the low bid contains qualifications that might affect the decision to award the contract, the CM will meet with the contractor to resolve the issues. Since the resolution of such qualifications may affect the contractor's bid price to the extent that it is no longer the low bidder, it may be similarly necessary to meet with the second bidder.

The CM should review the qualifications, capabilities, track record and reputation of the low bidder and make an award recommendation with justifications. This is normally done in the form of a bid analysis report to the owner, recommending the appropriate course of action, which is typically to award the contract to the lowest qualified (responsible) bidder.

Once the owner has reached a decision on the successful bidder, the CM issues the Notice of Intent to Award letter for the owner, which instructs the selected contractor to proceed with administrative submittals such as bonds, insurance and other requirements prior to signing a contract.

**Pre-Award Meeting**

The CM reviews the project with the recommended successful bidder prior to the contract signing to ensure that there is a clear understanding of the project scope. The CM should review the project's technical requirements with the contractor and confirm the absence of any bid errors or
existence of any errors and omissions in the contract documents. The CM should review the sustainability goals with the contractor and confirm they understand their role in obtaining these goals.

The contractor's work plan and schedule should be discussed. All administrative submissions required prior to commencing work on site such as permits, bonds, insurance, and labor affidavits should be reviewed.

Finally, the terms and conditions of the construction contract should be reviewed. Items discussed should be documented for the project record in the form of minutes and these minutes should be made part of the contract documents.

**Notice to Proceed (NTP)**

Once the parties are satisfied and the contract is executed, the CM prepares the Notice to Proceed for the owner and issues it to the contractor. The Notice to Proceed establishes the construction contract start date and authorizes the contractor to proceed with the work.

**Schedule Maintenance**

With the successful contractor(s) selected, the CM should update and revise as necessary the Project Master Schedule utilizing information gained from the bid process. This includes updating the actual dates for receipt of bids, award of contract, notice to proceed, etc. Schedule logic, activity durations, etc. need to be revised to reflect the contractor(s) work plan. The CM then distributes an updated project schedule report, containing an explanation of the effects of this information on the overall project. The CM should enforce the project schedule reporting requirements, making sure information is provided in a timely manner from the contractor. This often requires reviewing the project's scheduling specifications with the contractor and assisting in formulating preliminary schedules and reports.

**Cost Reporting**

The CM should update the cost report to reflect actual bid prices compared to the budget figures. This may include updating the cost elements in a cost-loaded, computerized Project Master Schedule and preparing the appropriate cash flow projections.
Chapter 5: Construction Phase

All of the planning and organizational efforts during the Pre-Construction Phases have been performed to successfully implement the Project Management Plan during the Construction Phase. The goal is to expedite and improve the efficiency of the construction process through professional planning and execution of project activities, with a focus on fulfilling the owner's scope, cost, quality and time requirements.

Thus, at the time of construction contract award, the standards against which to measure the timeliness, quality, and cost of the contractor's performance are established. What remains then is to ensure that these standards are met. Contract administration is really planning for implementation of the drawings, specifications, standards, policies, procedures, and the accompanying references to industry standards which are already in place in the contract.

Contract administration planning at this point then necessitates the identification of:

- Contract administration team members and responsibilities
- Contract milestones
- Contractor reporting procedures
- Quality assurance/quality control guidelines
- Submittals procedures
- Owner reporting procedures
- Inspection and acceptance procedures
- Payment procedures

Pre-Construction Conference

The CM should chair a meeting of all key project participants as soon as possible after award of the construction contracts. The purpose of this Pre-Construction Conference is to introduce the key team members to each other, familiarize all concerned with the various administrative requirements of the project, and ensure that each participant understands what is required to fulfill their contracts.

Attendees at this meeting should include, at a minimum, the following:

- The owner or its authorized representative(s).
- Key members of the CM's staff.
- Representatives from the designer and its principal sub-consultants.
- The general contractor or each prime contractor, including executives, project manager and project superintendent(s), as appropriate.
- Major subcontractors, represented by their project managers and/or superintendents, as appropriate.
- The commissioning agent.
- The sustainability consultant.
- Representatives of relevant public agencies, utilities or regulatory authorities.
- Any important material or equipment suppliers.
The CM should review the sustainability goals for the project with the contractor and their subcontractors and confirm they understand their roles in completing these goals. The commissioning agent should attend the meeting and review the commissioning requirements for the project.

Each project is different; however, there are certain concerns and issues common to all types of construction. A typical Pre-Construction Conference will include the introduction of key project personnel and establishing each individual’s role, responsibility and authority. This includes reviewing the relationships and responsibilities of the owner, CM, and designer.

The coordination of the activities of utilities, public agencies, other contractors and the owner's field or operational personnel needs to be discussed as to how it will interface with the contractor's operation.

Correspondence distribution should be reviewed to include submittals and shop drawings. Applicable procedures, number of copies required, timing of submissions, turnaround time for review, and Designer’s specific responsibilities must be discussed. The types of project meetings and schedule for each should be established. The CM should review project safety plans and procedures to clarify each party’s responsibility. It is also appropriate to confirm the location and availability of temporary water, electric, sewage and other similar services, and confirm whose responsibility it is to provide, maintain and pay for these services. Project requirements for maintaining and documenting indoor air quality need to be reviewed and confirmed.

The project's sustainability goals should be discussed and confirmed by the owner. For projects with sustainability requirements, a separate sustainability Pre-Construction Meeting is recommended.

If this option is not available, sustainability should be on the Pre-Construction Meeting agenda, and should include at a minimum:

- The level and urgency of the sustainability effort.
- Review of preliminary checklists or scorecards.
- Review of roles and responsibilities during construction phase. Designate the personnel from each firm (designer, CM, contractor, owner and others if applicable) responsible for LEED/Green Globe or other sustainable project effort and compliance.
- Review specific 'green' RFI expectations; particularly if they are to be submitted to the USGC or GBI for review and comment.
- Review documentation submittal expectations
  - LEED letter templates
  - Waste manifest detail
  - Local suppliers detail
  - Recycled material detail
- Review expected sustainable practices on-site

Construction permit requirements and status should be reviewed to ensure they are being obtained expeditiously. The contractor(s) and CM should discuss the logistics of their on-site offices in terms of proximity for communication and meetings, computer network, and space availability. Other related subjects include parking, truck traffic, storage areas, and site access. All contractually required computer and telecommunications equipment, furniture, etc. should be reviewed.
On some projects, the local citizens and the media play a major role in the perception of project success. Public information and community interaction procedures need to be discussed and spokespersons identified. It is also customary to review project quality control procedures, discussing contract document precedence in the case of ambiguity, reporting of non-conforming work, decisions regarding non-conforming work, as well as specific inspection and testing requirements. Projects with sustainability requirements are often of interest to the public and providing this information can improve project perception with the public.

The CM should review the project scheduling requirements to include the overall time allotted for project completion and any intermediate milestones to be accomplished. The contractor should identify the overall plan or sequence in which the project is to be constructed. Related constraints or issues should be discussed. The CM should establish when a formal schedule is to be prepared and how often it is to be updated, as well as specific submission requirements and format.

The parties should discuss all potential material and equipment issues such as substitutions and "or equal" items, long lead time purchases and any owner furnished items. Common sustainable project requirements such as VOC levels, certified lumber and formaldehyde-free plywood should be discussed. The CM also reviews progress payment procedures including applicable forms, lien waivers, timing of application, promptness of payment, retention, partial release of retention and final payment. Since cleanup and rubbish removal is commonly a source of irritation during construction, all ground rules and special requirements contained in the contract documents should be discussed during the Pre-Construction Conference. Commissioning requirements need to be reflected in the schedule and the commissioning agent should attend the Pre-Construction Conference.

The CM should review all relevant policies and procedures including procedures for dealing with the discovery of changed conditions, owner or designer initiated changes, pricing of changes and backup documentation required, time extensions, deductive changes, value engineering change proposals and payment for change order work. Notification requirements to discuss should include the specifics of where notices are to be sent. Time limitations need to be detailed and who can authorize extra work should be reviewed.

The Pre-Construction Conference is also an opportunity to review a number of issues related to project completion so that there are no surprises at the end. This includes defining substantial completion and procedures dealing with completing the punch list items. Warranty requirements and how "call backs" will be handled should also be discussed. Finally, contract closeout requirements, such as record drawings, operation and maintenance manuals, LEED Construction Phase documentation, commissioning documentation, owner training requirements, lien releases and final payment, should be reviewed.

**Contract & Specification Requirements**

Once a contract has been awarded, the first task in administering it is to review the requirements and the specific obligations of the contractor, the CM and the owner. These requirements and obligations are set forth in the contract itself, largely in the specifications, contract clauses, special clauses, and applicable industry standards. It is a basic rule of contract law that the obligations of the parties - the owner (and/or CM) and the contractor - are established and governed by the language of the contract. After the contract is signed, it is presumed that the contract expresses what was
agreed to. The specifications describe the required materials, execution, and quality of performance whereas the drawings and other graphic documents are used to show the size and extent of construction and geometric relations between the various construction components. The specifications incorporate a number of standards and various publications. Quality control measures are also specified and it should be noted that the inspection requirements are also established in the contract.

**Construction Management Plan**

The Construction Management Plan and Project Procedures Manual should be updated to include the contractor(s) and any other new members to the Project Team, as well as any changes in procedures or responsibilities arising out of the Pre-Construction Conference, including any changes to the project sustainability goals and requirements.

**Partnering**

Depending on the size, type and complexity of the project, the team may benefit from a partnering approach in order to promote cooperation, minimize confrontation, and resolve disputes amicably and expeditiously. By establishing these relationships and building trust, the team shares risk, allowing for a more efficient operation. For example, the schedule can be shortened with verbal approvals on shop drawings, field redesigns can occur to address unknown conditions, or major equipment can be ordered without cost confirmation. There are many other aspects of a project that can be enhanced through a cooperative and collaborative environment, whether or not formal partnering is instituted.

Partnering may be accomplished informally or formally. The latter requires that the CM arrange and sponsor a partnering workshop with a professional facilitator to develop a commitment to teamwork, identify mutual goals and the obstacles to achieving these goals, and find solutions to these obstacles. The workshop will establish issue resolution procedures, and identify a process by which the partnering process can be periodically evaluated by the Project Team.

Team members develop a mission statement, establish a schedule for monthly partnering meetings, identify potential issues, refine the issue resolution techniques, and develop a partnering charter. A key to success is the belief in the process and active participation by all participants.

However, it is important that all parties remember that partnering, whether formal or informal, does not replace contractual requirements. Insistence on fulfilling those requirements should not be construed as a lack of partnering.

**Documentation of Existing Conditions**

Because of the potentially litigious nature of construction projects, the CM can minimize the potential damage of claims by implementing a thorough review of existing conditions of property impacted by the construction. The CM conducts a walk-through of the project site and documents the condition of existing structures and other areas of note. This inspection can be recorded by photographs or on videotape with a date stamp to preserve a benchmark of existing conditions prior to construction. It is recommended that the contractor participate in this inspection to minimize opportunities for disagreement later concerning damage caused by the contractor.
This process can also be used to document existing materials and quantities that may be reused or recycled.

**Assignment of Owner Furnished Items**

As discussed previously, to obtain time or cost savings or ensure product control, the owner may contract separately for certain long lead or specialty items. During the Construction Phase, the CM assists the owner in establishing the procedures for the transfer of owner provided materials and equipment. This requires identification of specific personnel (either contractor or owner) responsible for administration of the suppliers and determining responsibility for delivery coordination, shipping charges, insurance, receipt, unloading, storage and installation. A key element in this is to review the material delivery schedules and their relation to the overall project schedule to ensure that owner furnished equipment does not become a source of delay to the project.

It is important that the CM assist the owner in assuring that the owner furnished items, sometimes purchased before documents are complete, comply with the project sustainability requirements.

**Permits, Insurance, Labor Affidavits, and Bonds**

The CM should monitor the contractor's progress in securing proof of insurance, permits, bonds, and labor affidavits. Administrative submittals need to be closely tracked to ensure that the contractor meets scheduled submittal dates. The CM should ensure that the contractor begins no work until the required permits, insurance, etc. are in place. The CM should receive copies of all documents secured by the contractor and review each for compliance to the specifications. These permits and documents might address such issues as:

- Sediment and erosion control
- Waterway occupancy and wetlands occupancy
- Historical trust
- Grading
- Hazardous waste removal
- Occupancy permits
- Street or sidewalk closing

Additionally, the CM should obtain copies of all bonds secured by the contractor to include payment and performance bonds. The CM should also receive copies of insurance certificates secured by the contractor including builder's risk, general liability, workman's compensation, and railroad or other owner specific required policy. This may also include professional liability insurance if the project is being delivered under a design-build arrangement. The owner and CM should be named as additional insurers and the dollar limits should be commensurate with the scope of work being performed. The CM should verify that subcontractors also have the specified insurance coverage.

As an alternative, the project may have a wrap-up insurance program. A wrap-up, which can be sponsored by the owner or contractor, consolidates insurance coverage for all contractors and subcontractors working on the project. The sponsor negotiates and purchases the insurance, and the contractor's insurance costs are not included in its bid. The advantages can include reduced insurance costs since, by buying in bulk, discounts are available, as well as expanded coverage and
higher limits through the collective buying leverage. Additionally, the quality and quantity of insurance are controlled and there is a centralized safety program.

Disadvantages of a wrap-up program may include contractor resistance since individual contractors also want control of their insurance coverage and any associated profit. There is also a significant administrative burden for the sponsor and this must be considered when determining overall cost benefits. It is important to remember that not every project benefits from a wrap-up, so a study must be completed. In general, ideal candidates are large projects in excess of $100 million and/or projects with large insurance premiums.

**Communication Procedures**

The CM should prepare communication procedures to ensure the prompt and efficient exchange of information. Initially, the CM should create and distribute a project directory to include all key project personnel and their addresses, telephone numbers, fax numbers and e-mail addresses, and should include home telephone numbers in case of an emergency.

The CM should prepare matrices, which indicate who has responsibility and authority for different aspects of the project, including the project's sustainability requirements, and the CM should create a submittal flow chart. The CM should coordinate the Request for Information (RFI) procedure, deficiency reporting procedure, payment application procedures, and request/authorization procedures for changed or additional work. The CM should be the focal point of all project communication and should take the initiative in following up any matters not promptly solved.

Should the owner not have a public relations staff or a firm on retainer, the CM should take the lead in dealing with the public and press should the need arise. The identification of a public relations firm, prior to construction, could prove beneficial should an unexpected event occur on the project that requires public information.

**Meetings**

The CM creates a meeting plan for the project. The CM prepares and distributes meeting notices and agenda for receipt by all parties in advance of the meetings. The CM also prepares and distributes minutes accordingly. Minutes have an action list detailing items requiring follow-up, the parties responsible, and the schedule by when action is expected. A list of open issues is also maintained and efforts are made to work these items off the list.

The CM should arrange and conduct periodic meetings to review the progress of the work in the field, along with any project sustainability requirements. These usually occur monthly, but more frequent meetings may be necessary during different phases of the project. This includes reviewing the CPM schedules, outstanding or potential problems, possible solutions, current versus budgeted line items, technical issues, project sustainability requirements, and safety concerns. Timely response to submittals, RFIs and redesign requests should be verified.

It is also suggested that the CM and the contractor's project manager jointly hold weekly coordination meetings with appropriate subcontractors to review the week's intended activities. These meetings are essential in order to minimize delays caused by poor coordination of the various contractors' activities. Discussion topics should include delivery of material, availability of on-site storage, staging areas for work preparation, access for cranes, means and methods to include blocking off certain areas or safety of other workers above and/or below, quality assurance and
quality control requirements, proper sequencing of operations to prevent rework/claims, impact of on-going operations or other construction projects, and general safety concerns.

LEED and/or sustainability goal progress should be a topic at each progress meeting. Starting early in the project, LEED and/or sustainability goal specific meetings should be held. The frequency of these meetings will increase as the project draws toward conclusion. At these meetings, the team should review LEED scorecards, documentation status, and all potential open credits that may be obtainable with team effort.

**Documentation Procedures**

The CM should establish project documentation requirements prior to the actual start of construction. These should include any required project sustainability documentation requirements. Complete documentation of the progress of construction and all relevant surrounding events is imperative. Any project can become the subject of lengthy claims and litigation. Written documentation can be used to reconstruct the actual events that occurred and its existence adds tremendous credibility to any testimony, opinion or evaluation that an individual or firm may be requested to provide.

The actual record of what it took to perform certain work activities – how long, using what forces, and under what conditions – can be invaluable when evaluating and negotiating contractor requests for additional time and compensation. In addition, a written record documenting the use of the proper materials and methods can be very valuable should questions relating to quality of construction arise at a later date.

Proper documentation is an integral part of Construction Management. In the case of the owner who is a frequent builder, the required project documentation procedures are usually well defined. Clients with less experience in the construction field may leave the details of project documentation to the CM. Project records should be made contemporaneously and based upon direct knowledge of the event(s). It is important that the documentation contains adequate detail to allow reconstruction of the situation from the records at a later date.

The CM should establish a project documentation system capable of recording, storing and retrieving information pertaining to all technical, financial, and administrative aspects of the project. While all projects are different and have different record keeping requirements, certain types of information are typical to all types of construction projects. The following is typical of the information that must be handled by a project documentation system:

**Pre-Contract Documents**

- Bid package drawings and specifications, including all addenda
- Pre-Bid Meeting minutes
- Any pre-bid schedules showing milestone dates or anticipated work by others
- Schedules or similar submissions included in contractor bids or proposals
- All cost estimates and takeoffs made during the Design Phase
- The contractor's bid package or proposal
- Bidder prequalification information
- LEED scorecards
- Owner Project Requirements
- Basis of Design Documents
- Technical proposals or submissions
- Bid analysis
- Pre-Award Meeting Minutes
Contract Documents

- Original contract or agreement
- Bonds and insurance certificates
- Record of any pre-contract negotiations
- Plans and specifications issued for construction
- Notice to Proceed
- Any notices of changed conditions, requests for change orders or change order proposals
- Work orders or field directives
- Contract modifications or change orders
- Request for final inspection
- Punch lists
- Certificate of substantial completion closeout documentation

Technical

- Log and file of all design revisions
- Log and file of all field revisions
- Log and file of all submittals, shop drawings, catalog cuts, etc.
- Log and file of all requests for information
- Log and file of inspection/testing/quality control reports
- Log of all sustainability requirements such as material VOCs, recycled material content, FSC wood compliance, and reused material.
- Log and file of record drawings
- Operation and maintenance manuals
- Warranties and guarantees

Contemporaneous

- Daily reports
- Daily diaries
- Daily labor reports
- Accident reports
- Progress photos
- Material delivery reports
- Safety violations
- Issue files

Correspondence

- Log and file of general correspondence
- Letters, memos, e-mails and speed memos
- Directives
- Meeting minutes

Scheduling

- Project/Program master schedule
- Preliminary contractor schedule
- Approved contractor baseline schedule
- Periodic updates
- Scheduling meeting minutes

Cost

- Approved schedule of values
- Applicable labor rates
- Work order time sheets
- Periodic labor distribution
- Budget reports
- Payment requests and actual disbursements with explanation of discrepancies
- Lien waivers
- Sustainability requirements checklist, with responsibility and deadline columns
- Project sustainability documentation

Computerized Information Management

The goal for the CM is to provide timely flow of information to the Project Team as to the overall status and forecast of the outcome versus the plan. Although a high-end computerized MIS may not make sense on smaller projects with a CM staff of one or two, every project will benefit from some form of computerized system to track the construction progress and to store data for future use.

There are numerous off-the-shelf software packages that have been developed expressly for this purpose. In addition, a number of CM firms have developed their own software systems that are particular to the type of construction they manage. Software effectiveness depends on the
capabilities of the person inputting the data, making training a key element of any computerized MIS.

In developing a system tailored to the particular project, the team should consider the expected outcomes of the system, the detail level and frequency of reporting, the effort required to maintain the system, and the capabilities for the user after construction.

The system should have search and reporting abilities. For example, should an issue arise on a particular subject, the system should be capable of scanning all of the components and developing a chronological list of supporting data. The system should have the ability to sort by date, by specification section, or by subcontractor. Again, the people maintaining the system must have the training necessary to take advantage of the software features.

Besides the benefits of storage, search, and reporting, the system can greatly assist the CM in proactively managing the project. Many of these systems, for example, will alert the CM each day as late, or soon to be late, submittals or activities. The "ball-in-court" feature clearly identifies a bottleneck. Digital photos on inspector's daily reports signal poor workmanship before the concrete pour, not after. The success of the system will be determined by how well these features add value to the project's management.

Quality Control

Quality Control (QC) Methods

There are various methods of performing quality control for the project. Although different agencies/owners have their preferred methods, no one plan is best, and often the type of project and delivery system used will suggest one method over another. The goal is to verify that the work is being performed in accordance with the construction contract documents, shop drawings, and installation procedures, providing the owner with the specified level of quality. Two of the most widely used methods are:

- **CM provides Quality Assurance, Contractor provides QC** – In this format, the contractor is responsible for establishing a separate QC organization, independent from their superintendent's staff, to perform all inspection and testing, submitting results to the CM/owner. The CM is responsible for reviewing and approving the contractor's QC Plan, and overseeing the implementation to verify that the requirements are being met. This method is the most common method and is often used for design/build projects, private projects and projects for federal agencies such as GSA, the Corps of Engineers, and the Navy. Advantages include risk sharing and streamlining of the QC Plan. A drawback is the lack of control, by placing the contractor in charge of the quality of the work.

- **CM and Owner provide QC** – Usually found in horizontal construction with distinct pay quantities and unit prices, the CM is responsible for inspecting the work and sampling/testing the materials in the field. For laboratory testing and analysis, the CM retains a materials testing lab or utilizes the owner's laboratory. The contractor, still responsible for the quality of its work, performs its own testing for scheduling purposes (when to strip forms, etc.) and as a check on performance. Departments of Transportation and Departments of Public Works are typical users of this QC system. An advantage to the owner is control, but there is redundancy (hence, cost, to project) in testing.
Quality Control Plan

Regardless of the QC method, the process benefits from the establishment of a formal plan. The CM should develop the QC Plan, or review the contractor's plan, with emphasis on inspection, test control, scheduling, testing and operating status, certification of records, corrective action, and audits. The preparation and review must be done in accordance with the specifications – requiring more stringent testing may result in changes and/or delays. Key aspects of the QC Plan include:

- Assignment of experienced, knowledgeable inspection personnel to the job.
- Performance of all field testing not included in the contractor's scope of work.
- Maintenance of all quality related documentation including test reports, certificates of compliance, etc.
- Documentation of non-conforming work, determination of corrective action necessary and follow-up on its performance.

All QC Plans must incorporate any applicable project sustainability requirements for the project. This process starts with insuring that the organization or personnel responsible for QC are knowledgeable regarding the applicable requirements. Obviously, submittals, installed work, and associated documentation must meet these project requirements.

Organization

Most often, the owner requires an independent organization perform QC, whether established by the owner, CM, or the contractor. The QC organization should not include personnel who have direct supervisory control over the labor force. The organization section of the QC Plan lists the firms, their respective assigned QC personnel, their role on the project, and delineates the qualifications necessary for QC personnel. An independent third party commissioning agent may be part of the QC program and needs to be coordinated through the QC Plan. The QC management team varies by project, but typically the members charged with the responsibility include the QC manager, the contractor's project manager, the project engineer for submittals, the designer's project manager, and an outside materials testing and inspection agency. A full scope is written for each position, clearly stating the limits of authority and responsibility.

Documentation

The QC Plan sets forth the approved document forms to be utilized by inspection personnel. Copies of the forms, complete and incomplete, are included. Documents include the Inspector's Daily Report, QC Test Report, Non-Compliance Report, and miscellaneous materials testing forms.

Submittal Procedures

The CM, in cooperation with the designer and the contractor, prepares a list of items for which submittals are required, broken down by specification section. Long lead items are identified and noted on the list. This list is keyed to the project schedule and reviewed monthly to assure that no submission is missed. This list is also reviewed during the Inspection Preparatory Meetings for each work element. The appropriate trade contractor is given a copy of the list and must submit the required shop drawings.
The QC Plan clearly delineates the procedures for receiving, routing, reviewing, and returning submittals, including the time periods allowed for each review step. Procedures will be given for submission of "or equal" items.

**Inspection of the Work**

Inspection must be proactive, not reactive. Effort should be taken to perform the work correctly the first time, minimizing delays that may adversely affect other elements of the project. The key is a clear understanding of the expectations of all stakeholders. A standard three step approach, in one form or another, is often used. This approach includes a Preparatory Meeting, Construction Phase Verification, and Follow-Up.

**Preparatory Meeting**

The QC manager holds a Preparatory Meeting with the appropriate contractors and subcontractors before each element of work commences. Critical elements include:

- A thorough review of the contract specifications and plans.
- Verification that shop drawings are approved and the required material will be on-site.
- An understanding of the means and methods of construction planned by the contractor in accordance with the approved CPM schedule and resources available.
- Verification that all predecessor and preparatory activities are completed.
- A check on the activities required by others, such as utility relocation.
- A review of the QC requirements, including items to be inspected, materials to be tested, level of workmanship, results expected, and actions taken if results are not acceptable.
- Preparation and distribution of minutes of the meetings. Minutes must acknowledge that all above actions have taken place.
- An initial commissioning meeting should be held early in the project. The commission agent will chair and document the meeting.

**Construction Phase Verification**

The inspectors verify that the work is in compliance with the contract documents and within the specified tolerances. QC personnel must also verify that required controlled inspections and tests are taking place and reports are being distributed in a timely fashion. It is necessary to verify the actual level of workmanship and that it meets minimum acceptable workmanship standards. The work should be compared with sample panels/mock-ups as appropriate. All differences between actual workmanship and expected workmanship must be resolved.

The CM should record all discussions about the levels of workmanship required, all parties to these discussions, and deficiencies discovered. These should be included in the Inspector's Daily Report. The commission agent will perform periodic reviews and maintain a commissioning issues log.
Follow-Up Phase

These inspections are documented daily. Final follow-up checks are conducted and all deficiencies must be corrected prior to the start of additional features of work, which may be affected by the deficient work. The contractor must not build upon or conceal any non-conforming work. The superintendent and foreman will be kept informed regarding the level of workmanship, both good and bad. If deficiencies exist, QC personnel will work closely with the trades to develop procedures to assure improved performance. All commissioning log items must be closed prior to the project completion.

The QC staff must develop efficient lines of communication to quickly inform the contractor of non-conforming work. The goal is to create a cooperative, not adversarial, relationship by assisting the contractor to perform as expected. Expedient communication with the contractor regarding activities that may result in non-conforming work is paramount. The QC staff informs the contractor if an item is about to be, or has just been, performed incorrectly, permitting a quick, less costly change. After the fact notification of non-conforming work must be minimized. By following the Three Step approach, the contractor is more fully aware of the owner's expectations, and QC is continuously and consistently performed in a non-adversarial manner.

Field Reports

The CM should ensure that an adequate daily reporting system is implemented for the project. The daily report is the most important element in the documentation of an ongoing construction project. Daily reports are prepared by all personnel with supervisory control of construction such as project managers, trade or area superintendents, project engineers and inspectors. These reports are prepared at the end of each workday and contain, at a minimum, the following information:

Report number (consecutively numbered for each person reporting).

- Date and day of report.
- Project name and number.
- Weather conditions – note any direct effect on project progress.
- Name of any contractor whose work was specifically involved.
- Workforce
  - Identify the number and classification of all craft labor at the site for each contractor.
  - Identify the number and type of major construction equipment on the job.
- Specifically note if equipment was idle or active.
- Work in progress – include as appropriate quantities or estimate percentages of work completed, specific locations of work performed. Any specific testing or quality control procedure should be noted. Refer to specific testing report if applicable.
- Problems or difficulties encountered – note any directives, approvals or rejections given or received, including the personnel involved.
- Completed form should be signed and dated.

Daily reports should be promptly reviewed by the supervisor. Any items requiring attention should be attended to promptly and so noted on the original inspection report. Modifications to original report are noted and initialed by the supervisor at time of review. Information contained in the daily reports should be summarized as appropriate to form the basis of any weekly or monthly reporting that is required.
The CM normally provides a photographic record of the progress and construction methods of the Project, which is separate from the contractor's progress photographs. Photographs must be date stamped by the camera, and identified on the reverse as to location and description of the photograph. Many CMs are using digital technology to attach photographs to daily reports to provide a better understanding of events.

**Safety**

Safety is the ultimate responsibility of the contractor and its subcontractors. However, in the contemporary legal environment the CM and owner must be involved. Owners are requesting CMs to take a larger role in safety management, but insurers are advising CMs to take a smaller role. The CM should monitor the implementation of the contractor's safety program in an effort to minimize accidents and the owner's exposure should they occur.

The CM, depending on its contractual status (Agency or At-Risk), reviews the contractor's safety plan, but may or may not be responsible for implementation or compliance. It is essential to develop a system that periodically evaluates the contractor's compliance with its safety plan, and periodically prepares a formal report on such. These procedures should be outlined in the CM's Construction Management Plan.

The CM should report the identification of safety violations and monitor the correction of these safety violations. The report should include the name of the contractor; time, date, and location of the hazard; reason why the observer believes a hazard exists; and the OSHA or other regulation reference.

The contractor's safety program includes methods to prevent accidents, reduce hazards, implement site safety management, safety training, and regulatory compliance. A senior safety review team is established to include the safety director of the affected agency (Railroad, DOT, etc.), the CM, the contractor's safety supervisor, and the insurance carrier's safety representative. Components of the program should include:

- **Safety Meetings**
  The CM should attend weekly safety meetings chaired by the contractor(s). The CM may assist with training construction workers for particular hazards.

- **Agency Certification**
  Most agencies (AMTRAK, SEPTA, FAA, etc.) require certifications for workers to work in high-risk areas. Risk areas include high-speed rail or vehicle traffic, confined spaces, high steel, asbestos/lead paint, and environments with fumes. The CM's staff should have all the appropriate certifications for the workplace environment and the CM should monitor the contractor's certification program for its workers and subcontractors.

- **Personal Protective Equipment**
  Depending on jobsite conditions, the contractor's safety program should list the required safety equipment for each labor classification. Such equipment includes hard hats, safety vests, safety shoes, clothing, hearing protection, eye protection, and fall protection.

- **Safety Awards Program**
  Contractor's may institute an incentive plan for workers with awards for safety compliance.
• **Safety Inspections**  
  Jobsite inspections by CM staff or a safety consultant.

**Change Management**

Much of the construction contract administration activity in which construction managers participate is concerned with contract changes and modifications of some sort. The basic construction contract expressly sets forth the rights and obligations of the parties thereto. The contractor has a duty within the time specified to complete the project prescribed by the detailed technical plans and specifications, and he must do this in accordance with the terms and provisions of the contract. The Owner has a legally enforceable right to this performance. In return, the Owner is bound to pay the contractor a fixed-price (most are fixed-price contracts, but may be various other types as well) for successful completion of the project and the contractor has a corresponding legally enforceable right to such payment. If, after the basic contract comes into existence, any change that is required to the contract will have to be accomplished by a contract modification in accordance with the procedures set out by the Owner and/or CM. The management of the cost and schedule implications of these changes needs to be established in formal processes at the outset of the project.

During construction, requests for changes may come from the owner, the contractor, the designer, third parties, or they can be generated by the CM. The CM should analyze each change request as follows:

- Necessity
- Scope
- Reasonableness
- Thoroughness
- Cost
- Impact on the project schedule
- Responsibility

The CM obtains and/or prepares the necessary information for justification, and then submits to the owner or designer an assessment with a recommendation for the actions to be taken.

The CM should respond to changes in the work in a timely manner. Problems in handling changes can be minimized if certain procedures are made part of the contract documents or agreed to by all parties at an early date. This includes requiring prompt written notification of the CM by the contractor of any changed conditions, omissions or discrepancies that may result in extra work, and by the owner or designer of any desired design modifications. Those members of the CM's staff who can authorize changes to the scope of work, the schedule and the method of performing the work, should be clearly identified in the Construction Management Plan. Written direction should be required before any extra work is begun. The means by which equitable compensation for changed work will be decided upon should be identified, as well as the detail and back-up required for the submission of any cost proposals for changed work. A time limit should be set by which the owner and/or designer must respond to a change proposal by the contractor. Similarly, the CM should establish procedures required for the contractor to demonstrate that it is entitled to a time extension (or reduction) because of changed work.
The CM should issue a monthly Change Order Report that identifies both approved and potential changes. The owner should be apprised of the status of all changes to the project. The monthly Change Order Report includes the date of discovery, or notification, of the issue with a brief description of the issue, including references to applicable contract documents, and any time or cost adjustments requested or proposed by the contractor. The report may also include the CM's evaluation of the issue with estimates of time and cost due. All potential changes should be assigned a reference number, which is best tracked back to the originating RFI or communication.

As change issues are resolved, the Change Order Report is updated for the date of resolution, approved costs and schedule impact, and change order number, as appropriate.

**Cost Control**

The CM should establish and maintain a computerized system of cost control. The system consists of a cost database and a cost analysis method to track change requests and claims estimates, actual contractor bid prices, and contractor progress payments. The system should be compatible with the owner's systems. The system should accurately track the overall budget including costs-to-complete changes, force account work, and cash flow projections.

Since not all changes can be negotiated in advance of the work being performed, procedures for handling force account (time and material) work must be implemented. The CM should monitor and maintain daily cost records of expended labor, material, and equipment to establish costs through a system that segregates and documents force account work and resources from contract work. It is recommended that the contractor be required to incorporate all additional work into as-built drawings and other job records.

In evaluating changes, the CM should prepare an independent cost estimate for contract change requests to verify reasonableness of contractor requests. Each estimate should be broken into construction items, with unit prices and total cost for each item. Each item shall be divided into elements of labor, material, and equipment. Based on the CM's evaluation, a payment recommendation is made to the owner.

**Schedule Monitoring**

The CM performs scheduling duties to effectively monitor the progress of the project and coordinate the Project Team. These duties include the reviewing of the contractor's schedule, the schedule of consultants, the time sensitive services of the designer, analyzing time extension requests, tracking of force account work, and reporting monthly progress.

**Initial Review**

The CM reviews the contractor's baseline schedule to check its conformance with the specifications and the Master Schedule. Schedule conflicts are identified and resolved. Conflicts with the Owner and third parties should be mutually resolved in order to develop a schedule acceptable to all parties. The approved baseline schedule should be incorporated into the Master Schedule. A typical checklist for the review of the baseline schedule includes:
• Check the schedule for specification compliance as follows:
  o Adequate activity detail – required number and duration of activities, inclusive of final
close-out documentation (if project is registered with USGBC, GBI, or other, a specific
document submittal process must be followed and accounted for in schedule).
  o Descriptive written narrative.
  o All relationships (logic) should be shown.
  o Printed format requirement (sheet size).
  o Computer sorting requirements.
  o Allowance for times of reduced productivity.
  o Number of calendars used.
• Verify that milestones and completion dates are consistent with contract requirements.
• Check procurement and submittal activities with outside influence, ie, materials with long
lead times.
• Check owner responsible activities, such as owner supplied materials or approvals for
sufficient time. Owner may state the minimum durations.
• Check overall logic for any conflicts in required construction sequencing.
• Verify that all contract work items are included.
• Review equipment and labor resources. Determine potential resource leveling problems or
conflicts.
• Verify that the critical path(s) is clearly defined and check activities closely for accuracy and
reasonable time allocation.
• Look for excess float – logic or relationships may be changed to reduce float and possibly
change the critical path and shorten schedule.

Monthly Updates

Once the contractor's baseline schedule has been approved, it should be updated at least monthly.
To help eliminate misunderstanding and incorrect information, a process must be established
whereby the CM and contractor jointly review the updated information before updating the
schedule. In performing its review, the CM should check the specifications to determine if the
schedule update complies with revision requirements and verify that the written narrative describes
the progress accurately. It is important to identify all changes in logic, activity duration, and
resources, as well as any deletion or addition of activities, and evaluate the acceptability of each. The
CM should also verify that the progress of activities and any other as-built information is accurate.
The CM points out any loss of float and alerts the Project Team of all actual or potential delays and
disruptions to the schedule. The CM should also make recommendations to the owner on how to
regain any lost time in the schedule.

Progress Payments

Unless one exists under the owner's current operations, the CM should establish a system to control
contractor payments consistent with the owner's objectives and requirements. Progress payments are
based upon the actual amount of work performed through the period of the payment request.
Method of payment is typically established through the contract specifications. The following
methods are widely used:

• Unit prices
• Schedule of values
• Cost-loaded CPM schedule
• Cost reimbursable (cost plus)

Each method has its advantages, disadvantages and peculiarities, and there are general procedures common to all arrangements. The contractor must submit his proposed payment breakdown to the CM for approval prior to receiving the Notice to Proceed. In the case of a unit price contract, this has been done as part of the bid package. The project should be divided into reasonable work packages to allow easy identification and verification. Estimated quantities of the completed work should be included, where appropriate. The CM then reviews the contractor's proposed payment breakdown. The proposed value of each item should be verified as being reasonable. Unbalanced payment schedules can create serious problems. Any questions should be resolved with the contractor prior to the first payment. The payment schedule should be reviewed and approved by the owner prior to the first payment.

At the end of each pay period, the actual amount of work performed must be determined. A summary of daily records that contains accurate registers of work accomplished is the best method to evaluate progress. On unit price contracts, this is especially important, as the quantity of work performed will determine the actual final value of the contract. The CM also reviews the completion status of any additional work (change orders) that was formally incorporated into the contract during the period. Progress payments should not be made against outstanding or unresolved change orders. Payment requests should be reviewed for materials stored on or off site. The CM should verify the quantity of such materials through delivery tickets and/or personal inspection of the material. The CM must determine that the contractor has satisfied all contract requirements dealing with payment for such material.

After the value of work completed for the period has been determined, any retainage, liquidated damages for interim milestones missed, penalties or applicable back charges are deducted from the value of work completed. The CM forwards the completed payment request to the owner, indicating the contractor's net reimbursement for the period and the CM's recommendation for payment.

If the project is registered with an authority to certify its level of sustainability, the CM should consider recommending a separate retainage be held until the required documentation is submitted and approved by the overseeing authority (i.e. USGBC, OBI, etc.)

**Status Reports**

The CM has responsibility for establishing a reporting system for keeping the owner informed of project events and progress. The type, format and frequency are usually established in the Project Procedures Manual for the project.

**Schedule**

After analyzing the results of the updated monthly schedules, the CM should prepare a monthly narrative progress report that will address the project status to include all critical project elements. The report should provide an updated narrative describing status of schedule float (if using CPM), changes in work sequence, planned schedule milestone slippage, and plans of recovery. An Open Issues status log is also provided with a discussion of all known problems and their potential impact on the schedule. Finally, the CM reports the estimated time to completion based on actual progress.

**Cost**

The monthly report to the owner regarding project budget should include the overall costs to date.
with actual versus estimated percentage completion. The report should also identify all potential and actual construction change requests/orders and claims, including status of negotiations, and estimated cost.

**Cash Flow Projection**
The CM should provide a cash flow chart showing the projected monthly and cumulative expenditures for the contract based on the Master Schedule, schedules submitted by the contractor(s) and the schedule(s) of value. The current estimate and cash flow should be analyzed in detail by the CM on at least a quarterly basis and a report prepared for the owner including recommendations for budget adjustments based upon the CM's current estimate to complete the project.

**Exception**
The CM should prepare a summary narrative to the owner pointing out impacts, exceptions and revisions to the Construction Management Plan. This report should identify problems, impacts, changes, delays, and describe the planned approach to resolving/mitigating the effect of these items.

**Sustainability Goals**
The CM should prepare a monthly sustainability report documenting the progress toward the sustainability goals. This may include updates to the LEED scorecard, documentation logs for material submissions, commissioning progress and commissioning issue logs, and recycled material logs.

**Claims Mitigation/Evaluation**
Proactively implementing all the previously discussed procedures will help avoid or mitigate most issues that arise. On large projects, the establishment of a Disputes Review Board (DRB) can also assist in resolving disputes at the project level. Unfortunately, even on the best run construction projects, claims can occur. It is important that the CM receives and evaluates all notices of claims by the contractor, and makes recommendations to the owner in a timely manner. The evaluation of any claim can usually be divided into two separate distinct parts.

**Entitlement Evaluation**
The contractor submits its claim notification to the CM. This notification may or may not include the contractor's proposed settlement value. If the contractor provides a verbal notice of claim, it should be documented in the project records and the contractor advised to provide written notice immediately. Upon receipt of written notification by the contractor, the CM responds in writing, acknowledging receipt, and requesting any appropriate additional information required for evaluation. Copies of this correspondence are sent to the owner.

The CM investigates the claim for entitlement to determine whether the contractor has a valid claim under the terms of the contract. The merit of a claim must be determined before any effort is expended in determining the compensation owed to the contractor. The entitlement analysis should be performed by personnel not associated with the actual occurrences, to ensure an objective analysis. The CM then prepares a recommendation to the owner regarding the merit of the claim, including the impact of any special circumstances involved. After the concurrence of the owner with the merit recommendation, the contractor is notified as to the results of the entitlement evaluation.
**Damages Assessment**

Upon determination that the contractor's claim has merit, the determination of damages can start. All records pertinent to the claim should be retrieved, copied, numbered, and retained in a separate file pertaining only to the claim. Using these records, the CM assesses the full impact to the contractor attributable to its claim. The CM should analyze both direct and indirect costs relating to the claim to determine the total compensation due to the contractor. During the damages analysis, it may be in the best interest of all parties to meet with the contractor to obtain information and explore potential forms of settlement.

The results of the claims analysis are presented to the owner in report form, documenting the strengths and weaknesses of both the contractor's and owner's positions. This report contains the CM's proposed settlement value and recommendations on proceeding with settlement negotiations (if applicable).

**Record Drawings**

The CM establishes procedures for assembling and handling record or as-built drawings, and reviews these drawings before approving final payment. Record drawings should be prepared in a timely manner, while the information is current and available. To accomplish this, one set of contract drawings should be maintained in the contractor's field office for the express use of recording as-built information. Periodically, the CM's staff examines the contractor's as-built drawings to ensure that pertinent information is being recorded in an accurate and timely manner. If adequate as-built records are not being maintained, an appropriate reduction in the contractor's periodic payment request should be considered. A complete set of as-built drawings, reproduced in both number and format specified by the contract documents, must be received from the contractor and checked by the CM prior to the release of the contractor's final payment.

In many cases record drawings are sent to the design team for their review and approval as well. Time should be included for their review, input and final approval when contracted to do so. Once record drawings are accepted, and when a building is registered with a certifying oversight body (i.e. USGBC, GBI, etc.) specific record drawings may be required to document final condition. Formats and procedures for submitting this documentation, as defined by the certifying body, must be followed. Release of final payment should be tied to this process as well, when applicable.

**Punch Lists**

The CM will normally provide for inspection of the project work, noting both the status and quality of work in place. Items that require corrective action are placed on a punch list, and the contractors are required to make necessary corrections. This process is continuous and all punch list items must be remedied before a project is closed out and accepted by the owner. If a punch list item will be covered over or will delay subsequent construction, immediate remedial action should be ordered. The owner and/or the designer will also make an inspection and possibly add items to the punch list when the contractor declares substantial completion and corrective action will be managed by the CM.

**Commissioning (Cx) and Functional Performance Testing**

The commissioning team led by the commissioning agent (CxA) will perform final testing on all operational equipment of the project. These tests will be documented and any deficiencies will be
logged. All deficiencies must be cleared before the commissioning process can be completed. The level of commissioning performed on each project will depend on the original contract specifications and the size and complexity of the project and every project will not necessarily have an independent Commissioning Agent (CxA).

Successful construction phase commissioning is a well-coordinated quality assurance process that encompasses installation, start-up, functional testing and training. During the construction phase, the commissioning team works to ensure that equipment, systems and assemblies are properly installed, integrated, and operating in a manner that meets the Owner’s Project Requirements (OPR). Functional testing and documentation provide valuable performance benchmarks, acceptance criteria and a baseline for the future operation and ongoing commissioning of the facility. A synopsis of the activities of a good commissioning process during the construction phase is provided in the chart and listing below.

**Construction Phase Commissioning Activities**

- CxA gathers and reviews all design and project documentation
- The Cx Plan, BOD, and the OPR are updated to reflect changes to the project.
- Conduct a construction phase commissioning meeting to integrate the process and schedule into the overall construction project.
- The CxA should review submittals of commissioned equipment concurrently with the design team.
- Verify that the controls system and system sequences are complete, verifiable, coordinated and meet the OPR.
- Develop the master list of commissioned equipment.
• Complete development of project specific construction verification checklists and startup documentation.
• Develop functional testing procedures and test data forms.
• Conduct regularly scheduled commissioning coordination meetings.
• The CxA reviews contractor start-up and quality control testing documents and witnesses selected or critical startups and contractor quality control tests (e.g., system pressure tests, generator load bank tests, etc.).
• Review the Testing, Adjusting and Balancing (TAB) plan and report.
• The CxA confirms test readiness for construction phase activities (field observation, review of start-up reports and construction checklists, observation of control system and equipment operation).
• The commissioning team is responsible for executing all functional tests and the CxA coordinate’s, witnesses and documents the functional tests as defined in the commissioning plan and specifications.
• Review contractor as-built documents, warranties and O&M Manuals and verify they meet contract documents.
• Compile the construction phase commissioning report.
• Prepare a systems manual.
Chapter 6: Post-Construction Phase

This phase provides the bridge between construction and operation of the facility.

Accomplishing this transition smoothly is an important part of the process. Achievement of a successful Construction Management Plan during the Design and Construction Phases will limit problems in the Post-Construction Phase and create the mechanism for timely closeout of the project. During this phase, the CM coordinates the archiving of project documentation, completes administrative closeout of the contracts, initiates occupancy of the completed facility and provides for warranty enforcement processes.

A CM's post-construction responsibilities typically include various turnover and close-out activities, including managing testing and the compilation of final project documentation that demonstrates compliance with contractual obligations. In the case of a project that has sustainability goals, close-out activities and documentation must demonstrate achievement of relevant sustainable design and construction commitments.

- Post-construction checklist
- Sustainable project requirements documentation (LEED, GBI, etc)
- Acceptance and performance testing
- Commissioning and LEED certification
- Final inspection and punch lists
- Owner occupancy (partial acceptance and beneficial occupancy)
- Assembling record drawings for as-built documentation
- Warranty, guaranty, and operation and maintenance manuals
- Training
- Final payment and contract closeout
- Post occupancy

Post-Construction Checklist and Schedule

The post-construction checklist is a useful tool in managing the post-construction process. The CM should develop a post-construction checklist using the Sustainability Plan in conjunction with the project's governing management guidance (the Quality Management Plan, Project Management Plan, etc.)

- The post-construction checklist should address all aspects of the project which require submission to the owner for record purposes.
- Operation and maintenance manuals
- CM project correspondence files
- Shop drawing logs and related drawings
- Project photographs
- Job cost records
- Schedule development, revisions, and monitoring data
- Certification of any required minority participation
- Project diaries and quantity books
- Record field set of drawings
• Comprehensive list of job participants, including design representatives, CM team members, utility company representatives, owner representatives, etc. --include team members' names, organization, and specific role in the project
• Disposition of any outstanding items

For a project that seeks to achieve sustainability goals or comply with sustainability requirements, the post-construction checklist must also identify sustainable design and construction processes and documentation requirements, such as those required by sustainable design and/or construction rating systems, sustainable guidelines or high performance code requirements.

Milestone scheduling should be employed by the CM to assure the timely execution of the post-construction operations, which may include flushing out the building or performing off-gassing procedures, post-construction air quality testing, commissioning and providing O&M documents to use for training on systems. A detailed plan and schedule is important as the post construction/pre-occupancy period often gets compressed and the operating characteristics of the building can suffer greatly leading to owner discomfort and dissatisfaction and ultimately cause an extension of the closeout period for the project.

**Maintenance and Operation Manuals**

The CM tracks maintenance manuals and operating procedures developed by the contractor through the submittal portion of the Document Control System and verifies the turnover of the documentation to the owner. The CM should also coordinate the training of the owner's staff in the operation of contractor-installed equipment. This entails defining the procedures for training and subsequent scheduling, monitoring and documenting the training sessions. The training programs are conducted by the systems installers or specialty contractors to ensure that the owner's personnel can:

• Start, operate and shut down the systems efficiently and safely.
• Efficiently maintain and, if appropriate, repair the systems.
• Identify parts and service supplies.
• Understand warranty terms and conditions.

Increasingly, sophisticated projects, including sustainable construction projects with complex building controls and energy modeling systems, require that operation and maintenance manuals for custom or off-the-shelf programmable controls systems, energy models, scheduled maintenance systems and other data-intensive systems, must be tested and updated by the service provider prior to training to allow sufficient time for training manual updates reflecting programming or operational adjustments.

**Operations Personnel Training**

Training for facilities operators, maintenance personnel and owners may be necessary for equipment, assets and models or computer-based management systems that lend to a project's "sustainability" characteristics. Appropriate training should be specified in the contract documents, in any commissioning plans, and in the post-occupancy checklist. Prior to closeout this training should be completed. All training programs should include in their introduction a reiteration of the project's overall sustainable goals objectives, and a clear articulation of how the equipment or asset in question relates to these objectives.
After completion and approval of the maintenance and operation manuals, a complete training plan should be submitted by the contractor for approval. After approval of the plan, it must be implemented and documented. Operational training is critical to the owner being able to take over the building maintenance. The earlier this can occur in the project the sooner the owner’s maintenance personnel can take over these functions.

**Spare Parts and Warranties**

The CM coordinates the submittal of the specified spare parts and warranties by the contractor to the owner. A comprehensive checklist should be developed for all constructed items having a warranty or spare part requirement. Progress is monitored through the submittal portion of the Document Control System. A system for transfer, cataloging and storage of spare parts should be developed in conjunction with the owner's staff. All warranty and guarantee information should be assembled in a logical format and turned over to the owner.

**Final Permits**

The CM oversees the acquisition of all required operating permits and compliance with regulatory requirements. The CM coordinates any required agency inspections and the securing of occupancy permits. The status of all permits should be tracked using the submittal portion of the Document Control System.

More and more jurisdictions are requiring new construction to meet sustainable objectives, most commonly using the USGBC LEED certification process. The CM must be fully aware of these requirements and be prepared to assure they are met so as not to impede the projects occupancy or punitive stipulations established by building code, permit and zoning officials. In order to meet sustainable objectives criteria such as LEED, the process must be initiated at the beginning of the project and during all subsequent phases.

**Sustainable Project Documentation**

Project teams pursuing LEED certification from the U.S. Green Building Council, Green Globes certification from the Green Building Institute, or compliance with any other sustainable design or construction rating system will have registered their project in accordance with applicable requirements, typically prior to construction commencement.

The CM's responsibility is to assure that contractors provide all documentation necessary for certification and/or as required by the contract and that contractual responsibilities have been met. The CM cannot wait until the Post-Construction Phase to begin fulfilling this responsibility and must be diligent throughout the process to assure the documentation is being compiled throughout the process. Key documentation on waste disposal, construction air quality and like sustainable approaches cannot be recreated and can lead to the loss of valuable certification points. USGBC or GBI application is submitted by the party designated in the contract documents. This could be the CM, GC, designer or a project sustainability consultant.
All items or processes required to attain these objectives that fall within the post-construction phase should be methodically identified and included in the post-construction checklist so that their completion can be monitored and managed in a timely fashion. Post-construction efforts in this category are typically identified in the specified system, and usually include commissioning activities, requirements related to energy performance contracting, compilation of as-built documentation, and training – all supported by rigorous documentation.

Upon receipt of the review notification from the relevant party noting the sustainable credit status (pending, approved or denied), the CM must organize a meeting with the designer, contractor and owner, independent commissioning agent, etc. to review comments and establish an action plan to resolve all open issues in accordance with contract documents, owner's guidance, and sustainable goals. Process and deliverables identified in this plan should be added to the post-construction checklist for monitoring and management.

Acceptance, Performance Testing and Commissioning

The CM is often required to monitor acceptance and performance testing of specified systems to verify performance in accordance with contract requirements. The general contractor must provide access for observance of these tests by the CM, as well as filing all appropriate test reports.

The purpose of building systems commissioning is to assure that systems are operating according to design intent and that they are providing proper indoor air quality, comfort and energy efficiency. The commissioning process is theoretically designed to yield a properly functioning facility, properly trained operations staff and documentation that describes the system's design intent and commissioning procedures.

The appropriate party, as specified in the contract documents, is responsible for submitting a Commissioning Plan. (The systems to be addressed by the Commissioning Plan are project specific, and should involve all systems that influence energy demand, systems control and other mission-critical parameters such as air quality and comfort. Such systems typically include HVAC, lighting, energy management systems, optical devices for day-lighting, adjustable shades and other equipment involved in a facility's energy performance.) The Commissioning Plan should detail the commissioning process, identify commissioning team members, and specify their responsibilities in each phase, including post-occupancy.

Post-Construction Phase commissioning activities include the following activities:

- Complete seasonal and/or deferred functional testing
- Verify completion of as-built documents
- Complete any outstanding O&M documents
- Complete commissioning documentation
- Verify completion of outstanding O&M personnel training
- Provide for formal Owner acceptance of the systems
- Update & complete Commissioning Report

Commissioning for the purposes of LEED certification should be planned and performed in accordance with relevant contractual requirements and guidance documents. The CM should be familiar with these requirements and is referred to the United States Green Building Council publications for reference. The CM, in coordination with the project designer, may oversee the
commissioning process when an independent commissioning agent is retained, or be responsible for managing the commissioning process, assuring that all LEED documentation is submitted for certification of Construction Phase points, in accordance with contract documents. It is strongly recommended that, for a LEED project, the CM have a LEED Accredited Professional on staff as an integral part of the Project Management Team.

**Beneficial Occupancy**

The CM is often requested to coordinate the owner's move-in to the completed project and the startup of project systems. The CM should assist the owner in developing an occupancy plan for the completed project that best suits its schedule and operational needs. Phased occupancy requirements must be well planned and communicated to ensure a smooth execution.

**Claims Resolution**

The CM should continue to assist the owner in resolving any outstanding claims brought by the designer or the contractor. Disputes, and the resolution of disputes, are often a difficult, time-consuming and disruptive aspect of construction projects that can continue long after the construction is completed. When possible, it is recommended that litigation be avoided by taking advantage of various alternative disputes resolution (ADR) processes to resolve disputes. These include:

- Mediation
- Mini-trial
- Disputes Review Board (DRB)
- Step negotiations
- Neutral fact-finding

Lengthy arbitration and litigation should be used only as a last resort in resolution of construction related issues.

**Contractor Closeout and Final Payment**

The CM conducts a final assessment of the project, in conjunction with the owner and the designer, to verify that all work is complete. This involves implementing the project closeout procedures contained in the Project Procedures Manual and Construction Management Plan. The CMP will establish the parameters for conducting the final inspection, which includes a means of determining whether the project is ready for the final inspection, and will establish the acceptance criteria that will permit final payment.

As part of the project closeout procedure, a formal review of key submittals including certificate of substantial completion, certificate of punch list completion, final lien waivers, guarantees/warranties, and final applications should be conducted. Once all parties are satisfied that the contractor has met all of its required contractual obligations, the CM should process the contractor's final payment application.

When a design or construction contract involves a Performance Contract in which the owner agrees to an incentive payable based on a demonstration of performance after a specified interval of
continuous facility operation and in accordance with specified criteria, the contractual obligations should be itemized in a performance contract closeout package.

Final payment may also be linked to contract assurance that the project will be delivered to meet certain sustainable objectives or certifications. The CM must recognize these requirements and make recommendations for payment once these objectives have been achieved, or recommend withholding payments consistent with the Contract Documents when certification is in question or pending.

**Closeout Report**

The owner should require that the CM prepare a project closeout report and stipulate its contents. The CM prepares this final report for the project, capturing all pertinent project data including schedule and cost information in summary form. The written narrative of the report provides a brief project history. All reports issued during the project should be in final form and attached. The report should also note the date of substantial and final completion and the commencement date for all warranties.

**Contractor Warranty Responsibilities**

The CM may continue to coordinate contractor response to warranty items as identified by the owner's operations and maintenance staff, but this is not always cost effective. At a minimum, the CM should provide the owner with a list of key contacts for warranty or maintenance work.

**Post-occupancy Review for Energy Performance Contracts**

For projects that employ Energy Performance contracts, the post-occupancy performance review will involve testing a facility's performance following a specified period of time after construction completion with systems in full operation. Energy Performance contracts typically specify the duration, performance criteria, performance testing protocols and associated incentives or penalties.

Post-occupancy review may take the form of "re-commissioning", which is employed to restore a facility's intended operating performance after a period of performance decline. In either case, the requirements of the post-occupancy review are typically developed by the owner in conjunction with a designer or engineer and CM pursuant to contract documents.
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