Internal Construction Management at Michigan State University

MSU Construction Industry Research and Education Center

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MSU Internal CM Report

Introduction

The Physical Plant EAS Group at MSU has identified an opportunity to utilize in-house construction management and trade expertise to benefit both the MSU community and the people of the State of Michigan in the delivery of capital construction projects by self-performing construction management (CM) tasks. The primary objective of the program is to enhance the MSU customer experience by staffing projects with MSU PP and EAS staff that have a long-term vested interest in the project and understand the unique concerns of the University. Some expected outcomes, as compared to contracting for external CM services, include reducing the overall delivery time of projects and reducing costs to the University by utilizing fixed-cost MSU employees and other associated resources.

This purpose to this report is to take a broad-based view of the EAS efforts and propose recommendations. This has been accomplished by comparing and contrasting the various CM approaches of project delivery to the more traditional methods of general contracting and design-build, by diagraming the approach proposed at MSU, by outlining some objectives and expected outcomes, and examining pilot projects that used the internal CM method. Finally, recommendations for the success and continuation of the internal CM effort are included. It should be noted that the recommendations are qualitative in nature given that no projects had been completed at the time this report was compiled. Data for this report was furnished by the EAS group and from meetings with EAS personnel involved in the project.

As any Owner, MSU has to choose a project delivery method and contracting format that efficiently delivers the project. A contracting format is an arrangement for the distribution or allocation of construction project risk (most frequently cost or performance risk) between the parties to a contract. A number of contracting formats exist including fixed price, guaranteed maximum price, cost plus fixed or variable fee, and unit price contracts. A project delivery method is designed to achieve the satisfactory completion of a construction project from conception to occupancy. A project delivery method may employ any one or a number of contracting formats to achieve the delivery. Project delivery methods define scope as part of their process. This report focuses mainly on the project delivery methods that MSU is interested in.

Traditional Approaches and the Construction Management Approach to Project Delivery
The Construction Management Association of America (CMAA) defines Construction Management (CM) as a professional management practice consisting of an array of services applied to construction projects and programs through the planning, design, construction and post construction phases for the purpose of achieving project objectives including the management of quality, cost, time and scope. It is a discipline and management system specifically created to promote the successful execution of complex capital projects for owners.

A Construction Manager (CM) provides the Owner with specialized knowledge, experience and resources to navigate through the complexities of a construction program or project. Construction management services may be tailored to satisfy the needs of the novice or sophisticated Owner. The CM adds value by providing the resources and expertise needed to manage quality, cost, schedule, scope and risks associated with design and construction to help the Owner achieve its objectives.

While somewhat confusing, Construction Management also refers to a specific project procurement and contractual system that is an alternative to the General Contractor (GC) and Design-Build (D-B) approaches. Haltenhoff (1999) states that the differences among the three lie in the philosophical approaches to the execution of the contract as evidenced by the configuration of the contractual agreements between the parties in the project delivery process.

**Traditional Approaches – General contracting and Design-Build**

In a traditional GC agreement the GC is an independent contractor who contracts with the owner to provide contracting and construction services. The GC will typically self-perform portions of the work, contract and coordinate specialty trade contractors, and procure materials for a project. In this arrangement the owner contracts separately with an architectural and engineering firm (A/E) to provide design services and guidance with respect to bidding and administrative services.

In a D-B project the owner has an agreement with a single entity, the D-B contractor. Here the A/E is under contract to the D-B contractor; however some D-B contractors provide A/E services in-house. The trade contractors and the material suppliers are also under contract to the D-B contractor in this arrangement. The popularity of D-B contracts arises from the notion that the owner only contracts with a single entity (the D-B contractor) that handles all details of a project.

**The Agency Construction Manager (ACM) Approach**
Haltenhoff (1999) posits that CM gained popularity because the GC and D-B approach were not providing owners with satisfactory results. Both of these approaches rely heavily on the successful performance of an independent contractor who has profit as a primary motivation. CM philosophically changes this outlook by introducing agency into the process where the primary goal of the agent is to protect the owners’ interests. CM has been called *Innovative Contracting* (Haltenhoff 1999) because of the flexible contractual arrangements offered by this method. Haltenoff (1999) has identified Agency CM (ACM) as the root form of CM along with three distinct subforms; the extended services CM (XCM), the guaranteed maximum price CM (GMPCM) (oftentimes called CM at Risk), and the owner form of CM (OCM). Each of these four CM approaches as described by Haltenoff (1999) differ in the types of vested responsibilities of the ACM team members, as discussed below.

ACM is a contracting structure that consists of agency prime contracts between the owner and an A/E and between the owner and the ACM contractor, purely fiscal contractual relationships exist among the owner and various trade contractors. The A/E has responsibility for design and partial responsibility for project management and contract administration services. The ACM has sole responsibility for construction coordination and partial responsibility for project management, contract administration, and contracting services. The trade contractors (e.g. electrical, HVAC, etc.) have responsibility for the special services they provide.

Extended Services CM (XCM) is a form of CM where other services such as design, construction, and contracting are included with ACM services provided by the construction manager.

The guaranteed maximum price CM (oftentimes called CM-at-Risk), is an arrangement wherein the CM guarantees a ceiling price to the owner for the cost of construction in addition to the providing ACM services.

The owner form of CM (OCM) is simply an arrangement in which the owner acts as the CM. This approach requires in-house staffing to provide some or all of the CM services. There are three variations of the OCM; the Owner-Manage CM, the Owner-Design CM, and the Owner-Design/Manage CM.

- The Owner-Manage CM uses outside design services and internal CM services
- The Owner-Design CM uses inside design services and outside CM services;
- The Owner-Design/Manage CM uses in-house personnel for both functions.

MSU uses all three of these OCM variations depending on the nature of the project and also amends these approaches to suit its unique needs.
The Michigan State University Approach to CM – a Modified Owner-Design/Manage CM Approach

Figure 1 illustrates the Owner-Design/Manage CM approach that has been piloted at MSU. The Physical Plant EAS group has capitalized upon the flexibility of the CM project delivery method to develop an innovative approach to managing capital projects at MSU. However, instead of hiring external CM’s to the University the group will utilize in-house personnel who will effectively act as agents on behalf of the Board of Trustees (BOT) and The Office of the Vice-President for Finance and Operations (VPFO). The approach can best be described as a “Modified Owner-Design/Manage CM.” It is considered modified because of the inclusion of self-performed work and the use of external design and professional services in addition to in-house capabilities (see Figure 1). The group has recognized that MSU possess a wealth of construction aptitude and knowledge within its ranks such as shops, telecommunications, and landscaping services and incorporated these resources into the pilot CM effort to include self-performed work.

The MSU CM project delivery team includes a project manager, field superintendent, project engineer, and an intern that act as construction managers. The project manager coordinates the project, establishes the budget and schedule, and interfaces and informs with the CIPWIG and the Board of Trustees. The field superintendent coordinates the construction activities of the prime contractors and MSU self-performed work crews throughout the project. The project engineer handles administrative duties such as processing shop drawings, change orders, requests for information, and correspondence. The intern assists other team members as needed.

On the A/E side the team includes architectural, mechanical, and electrical designers. The architectural designer coordinates architectural design elements and ensures compliance with MSU construction standards and planning principles. The mechanical and electrical designers coordinate mechanical and electrical design elements and ensure compliance with university standards. Outside A/E firms are utilized as necessary depending on such factors as workload and complexity of the project in relation to the skillsets of the MSU A/E team.
The Construction Manager Typical Role

Construction managers are required to have the ability to make expert recommendations regarding:

- Most effective use of available funds
- Enhanced control of the scope of the work
- Optimal project/program scheduling options
- Best use of individual project team members’ expertise
- Maximum avoidance of delays, changes and claims
- Enhanced design and construction quality
- Optimum flexibility in contracting/procurement options

Figure 1: Owner-Design/Manage CM Approach at MSU modified to include self-performed work and occasional procurement of A/E services (adapted from Haltenhoff 1999)
The services that owners typically use the construction management project delivery method for generally include the following:
- Development of a written scope understood by all of the participant
- Development of thorough design criteria for issue to the Designer
- Design quality assurance throughout the design process
- Consideration of material, systems and process alternatives
- Constructibility review
- Code compliance review
- Milestone cost estimating—to ensure design complies with the budget
- Matching construction spending to funds availability
- Construction specification enforcement
- Continuous schedule enforcement

**Objectives and Expected Outcomes**

The MSU CM approach is expected to be used sparingly and only on projects with certain characteristics. The use of the MSU approach is envisioned to be on long-term, schedule critical, and not “overly-complex” projects, and have project values in excess of $750,000 (or multiple projects that are close together and meet this target value) that are suited to the existing technical skillset and material resources of the University. Some MSU customers (e.g. The Caustic Storage Containment System customer) have requested that EAS manage their project. Additionally, the use of in-house resources must provide an overall greater economic benefit to the University.

**Evaluation of Pilot Projects**

For the latest data available (dated March 30, 2010), the Caustic Storage Containment System, the Biomedical Physical Science – Alterations to Suite 1440, and the Fuel Handling Modification projects have been the primary pilot projects.
- The Caustic Storage Containment System consists of modifications to the existing system to increase the amount of soft water available for the boiler of the TB Simon Power Plant.
- The Biomedical Physical Science Alterations consist of converting existing space into new computing laboratories and collaborative workspaces.
- The Fuel Handling Modifications consists of installing new railroad rack, a structure to cover the coal, and associated site and mechanical and electrical improvements.
The Physical Plant EAS Group has asked the Center to evaluate the performance of these projects. Haltenhoff (1999) states that ACM services only have four culmination points where success can be objectively measured, these are:

1. When the bidding process produces costs that are within the budget
2. When the owner occupancy occurs on schedule
3. When an owner walk-through reveals expected quality, and
4. When no claims are brought against the owners by contractors.

In a nutshell, the philosophy underlying CM is to provide maximum value for the owner, giving a complete and maximum effort, and not simply control a controllable set of circumstances. In practice, this can only be approximately ascertained in relation to other similar CM projects given the unique nature of construction projects.

**Evaluation and Recommendations**

Given the information provided to the Center by the Physical Plant EAS Group the Pilot Program appears to be successful In terms of the criteria mentioned above. The bidding process has not revealed any irregularities. The projects are on schedule and do not appear to be experiencing any difficulties other than is considered normal in the construction process. It is too soon in either project to evaluate item 3. Finally, although one claim has been lodged against the Fuel Handling Modification rail package it is our opinion that this would have occurred in any delivery method and is not a consequence of the MSU CM attempt.

In terms of delivering value for MSU the pilot projects appear to be saving money. For typical projects EAS charges a 3.5% of total costs fee, this has been maintained for both projects. More importantly, the University has benefited from not paying the typical 3% of total costs CM fee had an external firm been hired.

In other areas of concern the PP EAS Group has aggressively endeavored to “learn the ropes” of performing the CM approach. They have engaged the services of Skanska, a leading international project development and construction company, and Kramer Management Group, a firm that is familiar with the Mid-Michigan Construction market, to help with work scope and other important issues such as procuring bid packages, making the MSU project manual owner “CM friendly”, and delineating technical work scope that are part and parcel of the CM process.
The Kramer Management Group and C2P2ai provided a thorough review of the project manual that is currently being used by EAS to realize the CM model. This review was in the spirit of how to better implement the CM model.

In the areas of safety they have partnered with the MSU PP Safety Officer to monitor job site safety and trained the field superintendent in OSHA regulations. Finally, the Group is also working with other MSU units that may self-perform work to ease the transition to the CM approach.

Summary and Recommendations

C2P2ai has related some general recommendations, observations, and areas to numerically track to the EAS CM Group. These include:

- The scope of the projects for which EAS will use this approach seems well defined and within the capabilities of the department.
- EAS’s approach with respect to safety on the CM model is admirable and it is hoped that this diligence is maintained.
- There must be a clear understanding of the scope and staffing needs for this undertaking by EAS.
  - A formal training/education and experience in construction management is strongly recommended for personnel assigned the role of Construction Manager from EAS. Education may include 2-year or 4-year degrees in Construction Management, or training offered by the Construction Management Association of America, or other professional or higher education organizations.
- Continue to further define and develop success criteria for these projects in addition to the Scorecard (customer satisfaction), economic, and safety criteria already considered.
- A system of ongoing auditing of this approach should be agreed upon by all parties to ensure that it is meeting the stated goals and objectives.
- CPA should review and provide input on the Project Manual used by EAS for this model to make sure it is consistent with MSU procurement rules.
- EAS needs to develop a policy statement in the form of a handbook addressing the following issues:
  - Lowest responsible bidder will be selected as trade contractors.
  - Releasing trade contractors from a job will follow the same procedures as on capital projects.
That every project will have 3 MSU people assigned to handle various duties (submittal review, budget etc.).
That one superintendent will handle up to 2 concurrent projects
That general conditions and budget control rests with the Project Manager
The PM should be assigned to a project very early in the process such that they can provide input to the owner and designer.
Skire will be used for project contract administration
Requirements for PM-run coordination meetings
Projects will be tracked in FAMIS

- Investigation of similar efforts at other universities should be investigated to examine best practices.
- Specific Construction Management Functions:
  - Continue to provide master schedules, including percent work complete, for each project.
  - Track schedule and cost variances for each project. Cost variances over 5% should be investigated and discussed with the vendor. Schedule variances appear to be closely tracked and this should continue. Tracking and discussing these items will aid the various parties determine the success of the projects

It is the Centers’ opinion that the CM approach to project delivery be allowed to continue at MSU under a pilot standing, and on a case-by-case basis, until enough data and experience is available to make a decision on whether to permanently adopt this model. We recommend that a quarterly review process be conducted to monitor and evaluate the costs and benefits of the effort. Training should also be made available for EAS personnel who don’t have a formal training/education and experience in construction management.

References


The Construction Management Association of America accessed on March 5, 2010 at http://cmaanet.org/faq#construction.

CM Report provided by EAS, dated April 13, 2010.