Architecture, Engineering and Construction (AEC)

User’s Guide to Construction Projects
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The capital projects process is a collaborative effort with many stakeholders representing collective interests. The sponsor or user advocates for the project by representing the user's needs and goals. The department of Architecture, Engineering, and Construction has been delegated various levels of authority and many responsibilities to ensure that projects meet approved guidelines and standards, and are aligned with the university's mission. Early goal setting among stakeholders is critical in order to clarify scope and establish a common framework for making informed decisions.

This user’s guide has been developed to provide a condensed explanation of the University of Michigan’s process for delivery of capital projects and to document and communicate important information needed to effectively complete projects.
USER’S GUIDE TO CONSTRUCTION PROJECTS

As University of Michigan buildings can endure for many years without significant renovation, engagement with the capital projects process may be infrequent for many units. This guide serves as an important source of information and use of the established processes assists project teams in making decisions that help projects meet required parameters and reduce university risk.

U-M undertakes capital projects each year to renovate existing buildings and construct new buildings to meet its strategic goals, and these projects demand great investments of university resources. Therefore, effective management is essential and requires rigorous processes with appropriate controls to ensure the most efficient use of resources. These processes, which are fully detailed in the Department of Architecture, Engineering and Construction’s (AEC) procedure manuals, have been created to ensure that projects are aligned with the university’s academic mission, satisfy the user’s needs, meet approved guidelines for design, sustainability, and quality, are completed within budget and on schedule, and are constructed with safety as the first priority.

OVERVIEW OF PROCESS

In general, the capital project process begins with the project sponsor gaining approval from central administration to initiate. In the case of a general fund building, in addition to the Finance and Capital Projects Committee, the Provost’s Office must approve moving forward. The process to gain this approval is outlined later in this guide. In the case of non-general fund buildings, the Finance and Capital Projects Committee endorses proceeding forward.

With the approval of the administration, the project moves into a pre-design phase. This effort produces a program (written description), and a conceptual design (graphics), including a schedule and estimate of the construction work. During the pre-design effort, design managers and planners work from the defined goals to develop a program and balance the competing objectives of scope, budget, and schedule. With a budget, a schedule, and funding source identified, a project is ready to begin a formal design effort. Major projects are presented to the Board of Regents for project approval and authorization to appoint an architect. With the Regents’ approval of the project, the project then proceeds to design, during which AEC’s design manager directs a design professional (architects and engineers) to work with the project team from the defined scope and budget to develop the design phases, verifying the budget at each phase, and then producing construction drawings and specifications. The design effort for a major project can range between one to one and one-half years, depending upon the size and complexity. During the design effort of a project, approvals are gained from various authorities, concluding with a Regents’ authorization to issue a project for bids and awarding construction contracts. An abbreviated list of steps and significant tasks in each phase of a major project is presented in the appendices.

During construction, AEC’s project manager works with a team of contractors that builds from the instructions contained in the construction documents to physically assemble the specified materials and equipment into a substantially complete facility. Construction of a major project can last between one to two years, depending upon the size and complexity. In the activation phase, the substantially complete building is turned over to occupants and the Facilities Maintenance Department. In this phase, furniture and user-owned equipment is installed, occupants move in, and minor unfinished items (the punch list) are completed by the contractors. The last and final stage is not as noticeable by most team members. This is where financial closeout occurs during which the contracts are closed and remaining funds are returned to the unit and/or funders of the project.
PROJECT TYPES

In general, there are three types of projects – major, mid-size and small. Major projects are those that consume the most university resources and consequently require the greatest oversight. Because these projects require the most intensive planning and design, they must go through every step of each phase and therefore take the longest to complete. Projects with budgets of more than $5 million are considered to be major projects. Mid-size projects are less complex and can bypass some steps, which will vary from project to project. Mid-size projects typically have budgets above $1 million up to $5 million. Small projects may move fastest through the process, bypassing some steps and tasks within each phase. The planning phase can often be significantly condensed without sacrificing quality. These projects have budgets less than $1 million.

All general fund building projects over $2 million require Provost Office’s approval before pre-design may begin, and all general fund building projects over $5 million require formal submission as detailed in the Capital Projects Guidelines and as summarized in the approval process section of this guide.

MAJOR PROJECT MILESTONES

| Initiation | User identifies capital project need |
|           | User requests project               |
|           | Provost determines if the need is an institutional priority |
|           | Provost approves proceeding with a program study |
|           | Finance and Capital Projects Committee approves investigation |
|           | Program developed along with estimate (sometimes with potential concepts) |
|           | Project funding plan identified     |
|           | User requests projects              |
|           | Finance and Capital Projects Committee ensures program and funding plan align |
|           | Finance and Capital Projects Committee approves moving forward |

| Pre-Design | 4-6 months |
|           | A/E selected, program verified and benchmarked |
|           | Regents approve project and architect appointment |

| Design | 12-18 months |
|        | Schematic design is developed; cost estimates and schedule updated |
|        | Regents approve schematic design |
|        | Design continues to construction documents; cost estimates and schedule updated |
|        | Regents approve out-to-bid and award, if bids are within budget |

| Construction | 12-24 months |
|              | Bid, award, start of construction |
|              | Construction, commissioning |
|              | User occupancy |
Capital Project Stakeholders

Capital projects involve many stakeholders: U-M units, outside design professionals, contractors, consultants, governmental agencies, and many others. Therefore, project teams are normally large, and the process from inception to completion of projects is complex.

The University of Michigan Standard Practice Guide (SPG) is an overview of the general operating policies and procedures of the university and delineates the executive vice president and chief financial officer (EVPCFO) as having the responsibility for the physical properties of the university. Facilities and Operations departments report to the EVPCFO and are delegated the authority to ensure that the university safeguards the university's physical assets and fulfills its legal obligations.

The responsibilities delegated to AEC by the EVPCFO primarily consist of the management of the design and construction activities of all the U-M properties and campuses: Ann Arbor, Dearborn, and Flint. Architectural and related services are a restricted commodity and require pre-approval by the AEC executive director.

ARCHITECTURE, ENGINEERING AND CONSTRUCTION

AEC is responsible for managing the design and construction activities for all University of Michigan capital construction projects. AEC also provides real estate services and general professional services to support the university's physical assets.

This guide focuses on the capital construction process for new or renovation projects. The primary project management responsibilities include selection of all consultants and construction contractors, and leadership throughout all stages of design and construction through final occupancy.

AEC uses a cross-functional team approach in managing projects. The project team includes all members necessary to meet the objectives of those who will ultimately occupy the space being created or renovated by the project. The team must also meet the requirements of the university community and administration, meet the parameters of the university planning principles, and deliver the project within the established safety, budget, and schedule goals, and the design quality parameters defined in the university's design guidelines. The members of the cross-functional team come from the different areas of AEC. The major areas and their roles are described below.

Planning: Campus Planning (CP) oversees master planning and site planning. CP also manages the review of all exterior element design reviews including signage, furnishings, public art, and lighting. In addition, interactions with the City of Ann Arbor for activities conducted within AEC are coordinated through CP.

Design Management: The design managers within AEC are responsible for the activities and design deliverables of the pre-design and design phases. The design manager is the lead and focal point for administration of the project during design, addressing overall design, change management issues, quality control, budget, schedule, and communication with the user and other affected university departments.

In addition, AEC self performs design functions through the in-house Architecture and Engineering (A&E) department. A&E has responsibility for most small and some midsize projects.

MISSION AND VISION

The mission of AEC is to deliver efficient, productive and responsive professional services to create the most functional and enriching environment for the University community.

Our vision is to be the benchmark of excellence for facilities planning and construction for higher education.

6 Capital Project Stakeholders

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(UMHHC) projects, the design manager also performs the duties of the project manager during the construction phase.

**Construction Management:** The construction management group consists of project managers that are responsible for development of construction execution strategies and for the construction phase through project closeout. The project manager is the lead and focal point for administration of the project during construction, addressing safety, change management, quality control, budget, schedule, and communication with the user and other affected university departments.

**Project Directors:** Project directors are assigned to the most complex major projects in addition to the design manager and project manager. They provide leadership to the project team during both design and construction, and have ultimate accountability for the project’s safety, budget, schedule, and quality goals throughout the life of the project.

**Additional Support:** Other areas in AEC that provide support to all projects include Project Controls, Estimating, Commissioning, Plan Review, and Interior Design.

**PROJECT TEAM**

Because of the number of separate entities involved in a capital project, a clear project team organization (including organization within the university) and a team leader is essential. The project team is composed of representatives of all organizations having an active role in the project. This includes the requesting department, AEC, the architect/engineer, contractors, and Facilities & Operations units providing project support, such as Facilities Maintenance and the department of Environment, Health and Safety (EHS), depending on the nature of the project.

**THE REQUESTING DEPARTMENT (USER)**

The requesting department must also form an organization to effectively represent its interests in the project delivery process. During the initiation phase it is usually the responsibility of the department sponsor (i.e., the dean, chair, or director) to advocate for the project at initiation and through the capital project process, to articulate the project goals, and control project scope requests throughout the project. Once the project moves into the design phase, the department usually appoints a facilities planning committee from within the department’s ranks (except for small projects) to determine the specific needs for which the design professional will propose solutions. One of the committee members should be designated as the department’s representative to serve as the primary contact for the project and to represent the department on the project team. Ideally this person will be able to serve throughout the life of the project and communicate between the project team and the requesting department (user).

As the project proceeds through design, the role of the committee diminishes and the role of the department’s representative increases as the focus changes from defining direction to executing the
representative attends project meetings and coordinates the department’s review of progress documents after each sub-phase of design (schematic design, design development, and construction documents). Once construction begins, the role of the representative diminishes because the design is complete. The department’s representative may attend project meetings as the need arises, must be available to respond to unforeseen issues that often arise during construction, and must keep the requesting department informed of project progress. Toward the end of the construction phase, the representative’s role increases again as the move-in date approaches and activation activities begin.

### PROJECT TEAM COORDINATION

The project team is led by the AEC project team leader. Each group provides input, guidance and professional expertise throughout the design, construction and closeout phases of the project. During the design phase, the design manager is the project team leader and is responsible for coordinating the activities of all members of the project team, keeping the project on budget, and maintaining the project schedule throughout the planning and design phases so that construction starts on the required date. The AEC design manager acts as the university’s representative to all outside firms, directing the services performed by architects and consultants. The design manager also coordinates the requirements of the U-M design standards and the input of the various departments providing project support, and resolves conflicts that sometimes arise among them or between them and project objectives. For projects with large or complex mechanical and electrical systems, additional supporting design managers, typically from AEC’s commissioning group, are assigned to manage those specific areas of the project.

It is the responsibility of the design manager to ensure that all stakeholders are appropriately informed of issues that affect them throughout the design phase. Because two-way communication is essential for a successful project, the design manager must be involved in every communication to properly coordinate all aspects of the project and to make the best use of the university’s resources.

A project manager who will lead the project in the construction phase is also assigned during the design phase to contribute important input regarding the budget and schedule and construction issues that need to be incorporated into the design process. As the project reaches the bid phase, the project manager will take the lead for the project, and the design manager will assist in addressing design issues through project completion.

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**TYPICAL PROJECT TEAM**

![TYPICAL PROJECT TEAM Diagram](image)

*Notes: FAC members and other Users participate in design work groups as needed, along with DP, consultants, and other necessary individuals.*

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Capital Project Stakeholders

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During construction, the project manager's focus is now associated with construction administration but remain similar in regard to quality, schedule, budget, and communication. Typically the bid process occurs at completion of design. Depending on the project delivery system chosen, the bid process may overlap design and therefore affect the responsibilities of the design manager and project manager during this overlapping phase.

**EXECUTIVE TEAM**

Executive teams are used only on the most complex major projects. They are intended to expedite project decision-making processes and reinforce the roles of the project team members in ensuring that the university's resources are used effectively; that the project meets its program, cost, and schedule goals; and that conflicts between the goals are resolved expeditiously. The executive team is led by the AEC executive director and includes the AEC project director (or project manager and design manager, as defined by the project organization), the provost, the executive vice president and chief financial officer, the associate vice president for facilities and operations, the sponsor of the requesting department, and representatives of other departments as appropriate.

**DECISION-MAKING PROCESSES**

Each stakeholder represents a particular interest. The requesting department has an interest in securing the facilities it needs to accomplish its mission, while the funding authority is the steward of financial resources that are subject to many competing demands. AEC must execute the project according to established parameters. However, U-M is the owner of all campus facilities, and the best interests of the university are ultimately determined by the president and the Regents. Most decisions made by the project team are the result of consensus among the various parties. When a consensus decision cannot be made, however, the issue is referred to the next level of authority above the representatives on the project team. For the largest major projects the matter will be referred to the executive team, while for other major projects, the AEC executive director will attempt to resolve the matter with the university administration or the provost and the sponsor of the requesting department. Where there is no executive team, if important enough, it may be referred to the president, who will balance goals, needs, resources, and constraints to determine the overall best course for the university.
Capital Project Approval

PROJECT APPROVAL PROCESS

In general, all construction projects over $1 million require approval by the university’s Finance and Capital Projects Committee, the president, and the Regents. When a request for a project is submitted, AEC will assist the requestor and manage the approval process. The capital projects guidelines authored by the executive vice president for academic affairs and provost detail the approval process for general fund building projects exceeding $2 million, and provide an overview of the roles and responsibilities involved.

For projects under $1 million, the user sponsor (dean or delegate) is the approving body and all that is required to begin a project is to contact AEC with the desired scope of work. For all projects, AEC will prepare a project form for the user’s approval that summarizes the scope of work, budget, and schedule.

Process Overview

The capital projects process for general fund projects includes the following phases, each of which is described in the Capital Project Guidelines:

1. Unit defines need
2. Provost’s Office initial review
3. Program of needs study and evaluation of existing space
4. Consideration of options and project estimates
5. Unit funding plan, capital project proposal package, and provost sponsorship
6. Financial review of budget and funding plan
7. Institutional review, prioritization, and approval
8. Conceptual design through completion

For a high-level overview of the process and the offices and committees involved in the process, refer to the flowchart:
BOARD OF REGENTS

It is the Regents’ policy that all new construction and renovation projects that exceed $1 million shall be submitted to the Regents for approval, except in emergency situations. A list of all projects with budgets between $500,000 and $1 million is submitted quarterly as part of the monthly project status update item for information to the Regents. In addition, per historical practice or university procurement policy, furnishings, environmental, and equipment purchases do not require the Regents’ approval regardless of total cost.

METHODS OF SUBMITTAL TO BOARD OF REGENTS

Major projects are typically submitted to the Regents in three separate steps:

1. **Approval of Project and Authorization to Appoint an Architect:** Before initiating schematic design, projects are presented to the Regents for approval of project. At this time, the Regents are typically asked to appoint an architect (design professional) for the project.

2. **Approval of Schematic Design:** In addition to meetings with users and sponsors, a meeting may be held to present the project to the president before schematic design approval is requested from the Regents. The A/E presents the project to the Regents. Other project presentations for approval purposes may also be required.

3. **Authorization to Issue the Project for Bids and Award Construction Contracts:** After construction documents are completed and estimates are reconciled, approval to proceed with bid and award is requested.

A variation of the above is also utilized when project scope and needs warrant a different submittal.

Mid-size and small projects that are simple renovations, land improvement, or lab upgrades, are typically presented to the Regents one time to request **Approval to Proceed with the Project** for all phases including bid.
A selection process based on qualifications is used to identify the most appropriate design professional for each project. The prime design professional must be an experienced architecture or engineering firm licensed to practice in the state of Michigan. For most projects, the design professional will be an architectural firm. The type of services provided and the phase during which the firm's services are retained depend upon the size and complexity of the project.

**MAJOR PROJECTS**

For major projects, the design professional provides comprehensive services, including structural, mechanical, and electrical engineering, and is normally selected and retained during the pre-design phase through a full selection process. The services of the same design professional are usually retained for the design phase, or it may be deemed in the project's best interest to retain the services of a different design professional. The process for major projects includes the following steps:

**Identification of Candidate Firms:** The project lead prepares a list of consultant firms in consultation with a selection committee that includes representatives of the requesting department, AEC, and F&O. Criteria for placing a firm on the initial list of candidates include:

- Professional reputation
- Experience with comparable projects
- Demonstrated success in working with institutions comparable to U-M
- Quality of previous work on campus (if applicable)
- Size of the firm relative to the scope of the project

**Request for Proposal (RFP):** The RFP contains a project description including background information, building program, design goals and objectives, construction budget, project schedule, and selection criteria. Prospective firms are asked to submit proposals describing how they communicate, analyze programs, and design solutions. Their approach to the project is of greatest interest, including their management plan, task schedule, and ability to deliver the project scope within the described budget and schedule. Observations about the project are appropriate, but proposed design solutions are discouraged.

**Interview:** Based on a review of the proposals, finalists (usually 3 firms) are invited to an interview with the selection committee. The focus of interviews is on each firm's approach, process, and design solutions to other similar projects. Use of schematic designs and models for the particular project are not appropriate at the RFP stage.

**Recommendation:** After interviews are completed the firms are evaluated according to specific criteria. The goal is to reach consensus and to recommend an architect to the AEC executive director. Major projects where the scope is primarily renovation, infrastructure or utilities may be designed in-house by AEC, without a selection process.

**MID-SIZE PROJECTS**

For mid-size projects the process is streamlined to reflect reduced size and complexity. The candidate firms generally have a history at U-M and the process begins with a review of qualifications on file. In most cases interviews are not required and the recommendation is based upon their track record, approach to the project, and ability to provide services within the required budget and schedule. If the scope of the project is primarily renovation, infrastructure or utilities, the project may be designed in-house by AEC.

**SMALL PROJECTS**

Most small projects, except Michigan Medicine projects, are designed in-house by the Architecture & Engineering group. If, due to workload, additional support is needed, a design professional may be selected by AEC from the established design professional departmental contracts, or from a selection process similar to that described for mid-sized projects. For Michigan Medicine projects, a design professional is selected for all small projects.
The initiation and pre-design phases are the most important phases of the project. In these phases, the project team has the greatest opportunity to develop an efficient and cost-effective approach to the project. A thorough understanding and review of the goals by the sponsor, facilities planning committee, and all affected users, as well as communication with other stakeholders, will provide a design that meets all goals and will eliminate potential costly revisions during the design and construction phases which may affect overall budget, schedule and quality.

**INITIATION**

Initiation begins when the requesting department articulates a need for new or renovated facilities and identifies a potential funding source. During the initiation phase, the capital project approval process is followed. Projects that have been pre-approved through a capital plan are started as a project. All others projects begin as a study. Pre-programming efforts may be performed by AEC to develop a placeholder budget, normally in the form of a budget range. As the project moves into the pre-design phase, a preliminary estimate, schedules, and project goals are identified, including related projects (relocation of affected group, increasing capacity of utility lines, etc.).

The initiation and pre-design phases have the most uncertainty and require funding approvals. Therefore the amount of time required to complete these phases can vary greatly.

**PRE-DESIGN GOAL**

The primary goal of the pre-design phase is to define the specific scope of the project while balancing the competing objectives of quality, cost, sustainability, and schedule. With the appropriate scope defined, the project budget and schedule can be determined. Before design begins, all stakeholders (requesting department, AEC, and, for projects over $5 million, the Finance and Capital Projects Committee) must agree to the definitions of scope, budget, and schedule. This is typically confirmed and documented in a goal setting meeting.
PRE-DESIGN SUB-PHASES

In the pre-design phase, there are two sub-phases: programming and concept design.

Programming: This phase typically evaluates the user's statement of need, and a project description is prepared, that includes the project scope and facility and system impacts in architectural and engineering terms. In this phase for renovation projects, the facility condition analysis (FCA), which is a list identifying and prioritizing capital repair items for the building, is consulted to determine what improvements to existing conditions would be appropriate to include in the project. The program, which may include several options, is then presented to the requesting department and funding authority for selection of a preferred option to be developed during the concept design phase. A placeholder budget will be established during this sub-phase.

Concept Design: During the concept design sub-phase, the preferred program option approved by the project sponsor and facility planning committee is further developed. This sub-phase confirms that the project meets the user's needs as well as the university's needs and budget parameters. The project team reconfirms the program identified in the earlier sub-phase and develops a detailed conceptual design and massing, a cost estimate, and a proposed schedule. Upon approval, the programming estimate is incorporated into an updated project budget.

BUDGET DEVELOPMENT AND CONTROL

During project initiation, a placeholder budget is developed based upon the defined scope, expected quality levels, and anticipated schedule. Construction costs are established based on benchmarking data that evaluates U-M experience with similar projects, as well as construction costs for similar projects at other universities or private entities.

At the end of the programming sub-phase, the program estimate is compared with the placeholder budget. If the program estimate exceeds the placeholder budget, either the scope is adjusted or the project is approved to proceed using a higher budget, or some combination thereof. Increases must be justified. Once the final project budget is established at the end of the pre-design phase and the project is approved by the Regents, further increases in scope and budget are typically not permitted.

SCOPE DEVELOPMENT AND CONTROL

The pre-design phase is the time during which large parameter project scope is defined. Primary controls on scope are the project goals and placeholder estimates. Scope increases beyond these expectations require justification to and approval of the sponsor and, if applicable, the project executive team and/or the Provost’s Office.

SCHEDULE DEVELOPMENT AND CONTROLS

One of the purposes of the pre-design phase is to eliminate major uncertainties, which sometimes result in the discovery of complicating factors not detected during initiation of the project. In such cases additional iterations may be required before acceptable solutions are developed. However, the design manager is responsible for maintaining schedules developed at the beginning of the pre-design phase to the greatest extent possible. Schedule reviews should be a part of every project meeting to ensure that unnecessary delays are avoided.

DELIVERABLES AND REVIEW

The project form and programming report are the deliverables from the pre-design phase. The deliverables are reviewed by the user and other stakeholders, and if the project is approved in accordance with the approval process detailed herein, it moves into the design phase.
GOALS

The final goal of the design phase is to produce construction drawings and specifications to communicate to the construction team the specific nature of the project to be built that meets the user and the university’s needs. These design documents will form the basis of a legal agreement with a building contractor to build the project described in the documents for a defined price and within a defined time. The primary goal of the design phase is to translate the project definition from the program and concept design into detailed construction documents that can be used by a contractor to construct the project. Design includes the following major goals:

- Design an aesthetically pleasing facility that also efficiently meets programmatic requirements.
- Design flexibility into the project to accommodate future needs.
- Comply with building and fire codes.
- Design a facility that conserves energy and improves U-M’s environmental sustainability.
- Address U-M requirements for design and maintenance of each building system.
- Develop details that are constructible and effective.
- Specify materials, finishes, products, furnishings and equipment that are of appropriate quality and durability for the intended use.
- Coordinate the physical elements of the project.
- Determine phasing and sequencing requirements.
- Maximize the value and minimize the cost of the project.
- Maintain the project schedule and budget throughout the design phase so that the construction phase begins on time and for the approved budget.

SUB-PHASES

Each of the design sub-phases listed below concludes with a formal document review by the requesting department, AEC, and appropriate support departments. The design professional and third-party estimator (depending on project delivery method) prepare cost estimates which are reconciled, and a value management exercise is conducted to control the life-cycle costs of the project. Finally, stakeholder approval is sought before proceeding further.

Schematic Design (SD): During this sub-phase, the design professional reviews the pre-design deliverables and develops proposed solutions to the design problems. Existing conditions are investigated and code requirements are analyzed. Working from the conceptual design and massing developed during pre-design, the architect prepares preliminary plans, models, and proposals for exterior materials. Systems descriptions and design criteria are developed for all major building systems including mechanical systems. On projects where a construction manager (CM) is utilized, the CM provides advice on constructability, cost, and scheduling.
**Design Development (DD):** In this sub-phase the design professional further develops the design decisions made during the SD sub-phase and refines all aspects of the design. Upon conclusion of DD, all building systems are known and coordinated with each other. By completion of this sub-phase, the design should be developed to the point that no questions remain regarding scope, program, relationships, form, size, and appearance. Preliminary detailing and coordination demonstrate the feasibility of the design solutions. The DD sub-phase is the last opportunity for input regarding fundamental design issues.

**Construction Documents (CD):** In this sub-phase the design professional finalizes details to produce a comprehensive, fully coordinated set of drawings and specifications. Design changes at this point usually lead to cost increases and schedule delays. At the end of the CD phase, the architect produces a final, complete set of documents. If the project is proceeding under a phased or fast track delivery method, changes during the CD phase are heavily discouraged. A full explanation of benefits and risks associated with the delivery approaches is included in the construction phase section of this guide.

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**ENERGY CONSERVATION AND SUSTAINABILITY**

The University of Michigan has a long history of environmental stewardship in its approach to facility design and construction. With the significant growth taking place on the Ann Arbor campus – 12 percent population increase and a 22 percent increase in building area from fiscal year 2004 - 2011 – incorporating energy reduction in building design is one of the most effective ways for U-M to reduce its carbon footprint. This practice not only minimizes total energy resource use, but helps moderate future energy costs and reduces carbon dioxide emissions.

All new construction is required to meet the American Association of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90.1-2007. In addition, for projects with a construction budget of $10 million or greater, the university adopted the goal of exceeding ASHRAE 90.1-2007 energy code requirements by 30 percent. U-M requires the incorporation of numerous mandatory energy conservation measures on projects, requires comprehensive evaluation of additional energy efficiency measures, and requires comprehensive modeling of energy usage for proposed projects and development of energy impact statements at each phase of design.

To support the implementation of sustainable design concepts for new construction, U-M adopted Leadership in Energy and Environmental Design (LEED) silver certification as mandatory, as of June 2010 for all new buildings and additions (new construction) with a construction budget of $10 million or greater.

All projects (new construction and renovation) with a construction budget of $5 million or greater are subject to an environmental review process to help guide the design from a sustainable practices standpoint. At the conclusion of schematic design, the architect is required to develop a preliminary LEED® score, using accredited personnel, even if the project is not subject to the LEED® Silver certification requirement.

U-M’s design guidelines outline detailed requirements related to energy efficiency, as well as sustainable design and environmental stewardship:

- Energy and Water Conservation
- Sustainable Design and LEED Requirements
- Sustainable Products Portfolio

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VALUE ENGINEERING

During the course of design, decisions are made on a daily basis with the goal of achieving desired project objectives at the lowest cost. In addition to this on-going value management process, at each major phase of design the project team pauses to engage in a systematic analysis of all aspects of the project. This organized analysis of systems, materials and equipment for the purpose of achieving prescribed functions at the lowest life-cycle cost consistent with required performance, reliability, quality and safety is known as value engineering.

A value engineering analysis begins with review of the design professional’s cost estimate for accuracy and thoroughness. Project costs are then examined both in total and by building system to ensure that the best possible value is being added by each group of construction expenditures. System improvement and cost reduction recommendations are developed and compared to the base design. These value engineering alternatives, when accepted by the project team, are incorporated into the project to bring the project into alignment with established goals and cost objectives. Necessary redesign is completed prior to providing documents to contractors for bidding purposes.

SCOPE CONTROL

In a broad sense, changes from the scope defined in the pre-design phase are not permitted. After SD is completed, any scope change must be approved by stakeholders in writing. Prior to the SD phase, stakeholders authorized to approve changes will be identified.

BUDGET CONTROLS

Before being engaged for the design phase, the design professional reviews the pre-design deliverables and must agree to design the defined scope within the specified budget and schedule limits. At the conclusion of each sub-phase of design, estimates are prepared by the design professional. At each phase, adjustment to scope and redesign may be required for the project to remain within budget.

SCHEDULE CONTROLS

Controlling the schedule during the design phase is critical to delivering the project as promised. It is very difficult to make up for lost time during the construction phase, and construction activities are often weather-sensitive or constrained by the academic calendar. Design schedules must be established at the beginning of the design phase, taking into account the time needed for end-of-phase reviews, cost estimate reconciliations, value engineering, and redesign if necessary. Comparing progress against the design schedule must always be discussed in every regular progress meeting. The design schedule is of utmost importance in a phased/fast-track delivery approach, as any delay in the delivery of the design documents will mutually affect the overall budget and schedule of the project.

DELIVERABLES AND REVIEW

The primary deliverables of the design phase are the drawings and specifications that form the basis of the construction contract (U-M Design Deliverables). If the project is approved in accordance with the approval process detailed herein, it moves into the construction phase.

At the end of each phase of the design process, a complete review takes place by all members of the project organization. This review is especially important to the users of the project because it is the opportunity to verify that the designers have properly addressed all of their interests. For that reason, it is important that users spend the time to check the documents for conformance with their program requirements. The finalized contract documents constitute the final agreed upon scope of the project. For users that may not have experience with drawings and specifications, arrangements can be made by the design manager to assist the review.

An additional estimate is prepared at the end of the CD by a separate estimating firm to confirm the design professionals estimate. If the reconciled estimate is higher than the budget, adjustments in scope or budget will be required prior to providing the documents to contractors for bidding purposes. When all necessary redesign or adjustments are completed and the project is within budget, bids are solicited from contractors. If the bids result in a project cost that exceeds the budget, further adjustments to the design and a re-bid may be required. In addition, to protect the budget and schedule, bid alternatives in the amount of 5% of the construction cost must be identified by the project team and incorporated into the bid documents. These alternatives are scope items, identified separately in the bid documents so that the contractor can provide a separate price for the specified work. The project team should start the process to identify these alternates with the Users early in the SD phase and review them at the conclusion of each subsequent phase. Bid alternates shall be derived in cooperation with and shall be accepted by the Users prior to bidding. At the completion of CD, the project team will have identified and approved the final list of items to be bid as alternates. If the bids are not within budget, some or all of the scope identified within the bid protection alternates may be eliminated from the project.

If a major project is proceeding on a phased or fast-track delivery approach, usually a construction manager (CM) is added to the project team, and the CM also produces a construction estimate during the design phase and at each sub-phase of the design. The design professional and CM are required to reconcile the estimates and produce a final estimate to be used to proceed with the project. The phased/fast-track delivery method requires that decisions are made early in design. Construction begins at the end of design development, and therefore changes are highly discouraged. In addition, since redesign is not an option with this delivery method, an additional 5% of work scope must be identified by the project team early in the design phase and carried through construction documents, and which may be removed from the project in the event that the bids are not within budget.
AEC: The University of Michigan’s department of Architecture, Engineering and Construction is delegated with the responsibility for the management of design and construction activities and the management of real estate on all U-M properties and campuses.

AEC Project Form: The document by which a construction project sponsor or requesting department authorizes AEC to undertake work on a project and commits funding for this effort.

A/E: Abbreviation for “architect/engineer.” Can be used in reference to the individual design professional firm leading a design effort, or can be used in reference to the entire design team consisting of the design professional and his/her sub-consultants.

Capital Project: A project that involves a long-term and substantial university investment to acquire, develop, improve, and/or maintain a capital asset (such as land, buildings, infrastructure, roads). Capital projects are subject to the university’s capital projects process.

Commissioning: Building commissioning provides documented confirmation that building systems function according to criteria set forth in the project documents to satisfy the owner’s operational needs. Commissioning existing systems may require developing new functional criteria to address the user’s current requirements for system performance.

Consultant: A person and/or company hired by the university to provide expertise. A consultant may or may not be a registered architect and/or a professional engineer.

Department Representative: Department primary contact for the project to represent all departments on the project team. Many times this will be the facility manager.

Department Sponsor: Person that advocates for the project at initiation and throughout the capital project process to articulate project goals and control requests related to scope. Typically, this person will be the dean, chair, or director.

Design Deliverables: The set of minimum documentation required at each major phase of construction project design (defined in detail in the AEC Design Guidelines).

Design Guidelines: The set of design requirements for all university capital projects (available on the AEC website).

Design Manager: AEC design managers are responsible for administration of the project during design including addressing quality control, budget, schedule, and communication with the user.

Design Professional: The legal entity contractually entrusted by the university with the responsibility for design and/or construction administration services. Either employs or subcontracts the services of architects, engineers, planners and/or designers as required by the specifics of the project and the legal agreement with the university. On small projects, the design professional may be a designated in-house AEC staff member.

Design Standard: Generally accepted uniform procedures and/or requirements of construction components/assemblies that directly affect the design and performance of a facility. Design standards may be required by building codes and/or by university design guidelines.

Facility Planning Committee: Represents the interests of the faculty, students, and staff in advising the project team on all aspects of the project design, including space requirements, functionality requirements, interior and exterior aesthetics, and the overall architectural design.

Finance and Capital Projects Committee: The committee considers all needs of the university with regard to new capital projects, and the executive vice president and chief financial officer makes recommendations to the Regents regarding new capital projects.

Infrastructure: The basic, underlying framework of facilities/systems for a building or campus.

Major Projects: Projects with budgets of more than $5 million.

Mid-Size Projects: Projects with budgets more than $1 million but less than $5 million.

Owner: Regents of the University of Michigan.

Program: Generally developed by the user, the program is a written description of the proposed project including rationale, goals, space requirements, schedule, and funding.

Project Director: In addition to the design and project manager, a project director may be assigned to the most complex major projects to provide overall leadership during both design and construction.

Project Form: A form, generally signed by the sponsor or user, authorizing AEC to proceed with the project and to encumber funds.

Project Manager: AEC project managers are responsible for administration of the project during construction, addressing safety, quality control, budget, schedule, and communication with the user.

Small Projects: Projects with budgets less than $1 million.

Users: Those who will ultimately occupy the space being created or renovated by the project.
**Future Sections**

- Construction Phase
- Closeout Phase
- Safety
- Construction Contracting
- Estimates and Budgets
- Factors Influencing Projects

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Revised January 3, 2017
Appendices

Design Phases and Typical Tasks ................................................................. 21
Project Goals Template ........................................................................ 22
User Satisfaction Evaluation .................................................................. 23

AEC Website References:
  U-M Design Guidelines and Deliverables
  Project Estimates
  Contracts and Agreements for Professional Services
DESIGN PHASES AND TYPICAL TASKS
(Some steps may not be required in mid-size and small projects)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Sub-Phase</th>
<th>Tasks</th>
<th>Deliverables</th>
</tr>
</thead>
</table>
| **Initiation**   | **(Statement of Need)** | Requesting department articulates a need for capital improvements and identifies a potential funding source  
                        Analyze space request  
                        Assess needs  
                        Determine project goals  
                        Define general scope and options, including enabling projects  
                        Develop placeholder estimates based on comparable project costs  
                        Select consultants  
                        Capital Projects approval may be required | • AEC Project Form  
                        and/or  
                        • Statement of Need |
| **Pre-design Phase** | **Program**  
                        (if undertaken separately from concept design) | Conduct project orientation meeting  
                        Define project goals: occupant growth & unique character, building codes, community issues, environmental issues, historic preservation, security, etc.  
                        Identify energy and sustainability goals  
                        Identify key site and building relationships  
                        Conduct detailed space programming  
                        Perform evaluation of existing space  
                        Develop options with feasibility estimates  
                        Evaluate options and identify preferred option  
                        Confirm acceptability of preferred option with all stakeholders  
                        Obtain approval from Capital Projects Committee | Program Report and Evaluation of Existing Space with recommended option and estimate |
|                  | **Concept Design** | Develop conceptual design, with siting and massing if needed  
                        Develop general building systems descriptions  
                        Determine contracting approach  
                        Confirm scope, budget, and schedule with all stakeholders  
                        Obtain approval from Regents | Concept Design Report with estimate and project budget |
| **Design Phase** | **Schematic Design** | Hold progress meetings to develop design  
                        Describe proposed building systems and utilities requirements  
                        Investigate existing conditions  
                        Analyze code compliance  
                        Conduct stakeholder reviews  
                        Cost estimate, risk analysis, and value management  
                        Obtain approval from Regents | SD Documents;  
                        Reconciled scope, estimate, project budget, and schedule |
|                  | **Design Development** | Hold progress meetings to develop design  
                        Perform engineering load calculations  
                        Develop major features of all building systems  
                        Meet with code authorities for preliminary review  
                        Analyze life-cycle costs  
                        Review with Capital Projects Committee as needed  
                        Conduct stakeholder reviews  
                        Cost estimate, risk analysis, and value management  
                        For fast track projects, obtain approval to bid from Regents | Monthly Project Reports; DD Documents;  
                        Reconciled scope, estimate, project budget, and schedule |
|                  | **Construction Documents** | Hold progress meetings to finalize design  
                        Articulate entire design in drawings & specifications  
                        Site Plan Review; approvals as necessary  
                        Coordinate all building elements  
                        Conduct technical review  
                        Conduct final review with code authorities  
                        Develop submittal list  
                        Identify bid alternates, allowances, unit prices  
                        Conduct stakeholder reviews  
                        Cost estimate, risk analysis, and value management  
                        Establish bidding parameters  
                        Obtain approval to bid from Regents | Monthly Project Reports; CD Documents; Drawings & specs;  
                        Reconciled scope, estimate, project budget, and schedule |
Project Goals:

Goal setting among the critical stakeholders for a project is intended to clarify major scope issues as well as establish a common framework which can be used to evaluate future decisions. The following is a generic list of potential goal categories which may (or may not) be applicable to our project, which is not intended to be all inclusive but rather serve as a catalyst to a discussion of project specific goals and objectives.

1) Stakeholders (i.e. Facility Planning Committee membership)
2) User program needs
3) Provost requirements
4) Special uses (i.e. special events or etc.)
5) Flexibility of spaces (i.e. generic vs. custom, future uses, etc.)
6) Budget
7) Funding restriction/requirements (i.e. grants, capital outlay, gift agreements, etc.)
8) Schedule (i.e. interim milestones/deadlines and overall completion)
9) Square footage (i.e. standards, efficiency ratio, etc.)
10) Site planning principles
11) Stormwater management planning needs
12) Parking and transportation needs including displaced and new parking for employees, visitors, patients
13) Sustainability (including energy efficiency)
14) Regulatory issues (i.e. AHJ, flood plain, animal, etc.)
15) Risk assessment (for projects =>$100M)
16) Anticipated approach for City project review, if applicable
17) Community engagement process, if applicable
18) Facility environmental requirements (i.e. HVAC, sound, vibration, etc.)
19) Historic preservation
20) Deferred maintenance items (i.e. FCA, etc.)
21) Existing building code and life safety issues
22) Accessibility issues
23) Quality (i.e. level of finish and building systems)
24) Security and safety
25) Classrooms (i.e. number and type)
26) Special spaces (i.e. food service, workout facilities, server rooms, etc.)
27) Operational considerations (i.e. total cost of ownership, reliability of systems, and maintainability during operation, etc.)
28) Furniture and equipment
29) Other:
USER SATISFACTION EVALUATION

PRE-EVALUATION FORM - DESIGN PHASE

AEC is committed to providing excellent customer service and in doing so, we continually look for ways to improve. We use a project-specific user satisfaction evaluation survey to establish clear expectations for AEC’s performance during both the design and construction phases for projects with a budget of $5 million or greater. Survey responses are used to identify areas of concern and enable us to improve the quality of our services. The evaluations also provide an opportunity to recognize staff for favorable performance and thank them for a job well done.

This pre-evaluation form is used to make the User aware of the evaluation process and to provide a copy of the design phase evaluation questions (page 2) that will be used to evaluate AEC’s performance. The questions cannot be changed but project-specific comments or concerns may be written in the comments section or included on a separate piece of paper. At the end of the design phase, the design manager’s supervisor will ask you to evaluate AEC’s performance by completing the survey. A similar process will be followed in the construction phase and will be handled by the project manager/director.

Thank you in advance for participating in the User Satisfaction Evaluation process. Your feedback plays an important role in helping us maintain our commitment to excellence.

Date of Design Pre-Evaluation: _____________________
Design Manager’s Signature: _________________________
User/User’s Representative Signature: _________________________________
USER SATISFACTION EVALUATION

DESIGN PHASE EVALUATION FORM (complete this form at the start of the bid phase and prior to contract award recommendation)

List Names of All Evaluation Participants (required participants in bold):
AEC Design Manager’s Supervisor: <name>
User Representative(s): <name>

<table>
<thead>
<tr>
<th>Design Phase Questions</th>
<th>1 Unsatisfied</th>
<th>2 Somewhat Unsatisfied</th>
<th>3 Somewhat Satisfied</th>
<th>4 Satisfied</th>
<th>5 Highly Satisfied</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Was the ‘design process’ document reviewed and the process clearly explained at or prior to the design kickoff meeting?</td>
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<td>Were the design meetings organized and productive?</td>
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<td>Did meeting minutes accurately reflect decisions made at design meetings?</td>
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<td>Were the User’s ideas and input given proper consideration given the fiscal and physical constraints of the project?</td>
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<td>Was the overall design schedule as agreed at the design kickoff meeting met?</td>
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<td>If the schedule slipped, were there documented reasons?</td>
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<td>Did AEC personnel foster an environment that made the interaction between the design professional and the user representative(s) conducive to a successful design process?</td>
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<td>Was the project scope change process explained and followed in an appropriate manner?</td>
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<td>Do you believe the final design meets your expectations considering the available resources?</td>
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<td>Were the design team’s (external architects and/or AEC) explanations as to design choices clear and sufficient?</td>
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<td>How pleased were you with the overall design process?</td>
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Comments:

DATE DESIGN PHASE EVALUATION COMPLETED: ________________________  ________________________

AEC Supervisor Signature  User Representative Signature

Form Date: 12/18/14
AEC is committed to providing excellent customer service and in doing so, we continually look for ways to improve. We use a project-specific user satisfaction evaluation survey to establish clear expectations for AEC's performance during both the design and construction phases for projects with a budget of $5 million or greater. Survey responses are used to identify areas of concern and enable us to improve the quality of our services. The evaluations also provide an opportunity to recognize staff for favorable performance and thank them for a job well done.

This pre-evaluation form is used to make the User aware of evaluation process and to provide a copy of the construction phase evaluation questions (page 2) that will be used to evaluate AEC’s performance. The questions cannot be changed but project-specific comments or concerns may be written in the comments section or on a separate piece of paper. At the end of the construction phase, the project manager/director’s supervisor will ask you to evaluate AEC’s performance by completing the survey.

Thank you in advance for participating in the User Satisfaction Evaluation process. Your feedback plays an important role in helping us maintain our commitment to excellence.

Date of Pre-Evaluation: _____________________

Project Manager/Director Signature: _________________________

User/User’s Representative Signature: ___________________________
CONSTRUCTION PHASE EVALUATION FORM (complete this form within one month after substantial completion)

List Names of All Evaluation Participants [required participants in bold]:
AEC Project Director/Supervisor: <name>
User Representative(s): <name>

<table>
<thead>
<tr>
<th>Construction Phase Questions</th>
<th>1 Unsatisfied</th>
<th>2 Somewhat Unsatisfied</th>
<th>3 Somewhat Satisfied</th>
<th>4 Satisfied</th>
<th>5 Highly Satisfied</th>
<th>Comments</th>
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<tr>
<td>Was the construction process clearly explained at or prior to the construction kickoff meeting?</td>
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<td>Did the project team emphasize and explain the project’s safety program?</td>
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<td>Were questions regarding the project budget answered adequately given the fiscal constraints of the project?</td>
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<td>Was the project scope change process explained and followed in an appropriate manner?</td>
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<td>Was the construction schedule managed appropriately including interim and final completion dates (taking into account user changes)?</td>
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<td>Were occupancy activities such as furniture and equipment installation, IT and phone installation, and other user managed items given adequate consideration in the overall project schedule?</td>
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<td>Were construction impacts to facility operations (noise, dust, utility shutdowns, infection control, etc.) adequately managed by the construction team?</td>
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<td>Did AEC personnel foster an environment that made the interaction between the construction team and the user representative(s), when needed, conducive to a successful project?</td>
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<td>Does the final product meet your expectations in terms of construction quality and adherence to the project design?</td>
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<td>How pleased were you with the overall construction process?</td>
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Comments:

CONSTRUCTION PHASE EVALUATION DATE: __________________________

AEC Supervisor Signature ____________________________________________
User Representative Signature ________________________________________
## POST OCCUPANCY PHASE EVALUATION FORM

(complete this form at the end of the first year of occupancy)

List Names of All Evaluation Participants (requested participation in bold)

<table>
<thead>
<tr>
<th>Post-Occupancy Phase Questions</th>
<th>1: Unsatisfied</th>
<th>2: Somewhat Unsatisfied</th>
<th>3: Somewhat Satisfied</th>
<th>4: Satisfied</th>
<th>5: Highly Satisfied</th>
<th>Comments</th>
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**POST-OCCUPANCY EVALUATION DATE:**

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**AEC Supervisor Signature**

**User Representative Signature**

Form Date: 3/2/14/14
Architecture, Engineering and Construction