

Capital Projects Handbook



Yale Facilities Construction & Renovation

2005

A MESSAGE FROM THE ASSOCIATE VICE PRESIDENT
FOR CONSTRUCTION & RENOVATION

January 2005

Dear Colleagues,

The purpose of the Capital Projects Handbook is to document and communicate the work processes and other important information needed to effectively complete capital projects at Yale University. Our goal is that this handbook will be an important source of information and data for our colleagues needing capital projects as well as the key tool used by Facilities Construction & Renovation staff to guide the delivery of projects.

The first five pages of this handbook summarize the work process, tasks, and the deliverables and approvals required to complete each project phase. The remainder of the handbook provides further detail about completion of projects including project team organization structure, consultant selection, and cost estimating.

We expect to update this handbook with internal project experiences and external benchmarking every three to five years. So, please give us your feedback as projects are completed in your area so that we can improve the handbook over time.

Regards,

Jerry A. Warren, P.E.
Associate Vice President
Yale Facilities Construction & Renovation

Front cover: Sterling Memorial Library (original design by James Gamble Rogers; 1998 renovation by Shepley Bulfinch Richardson & Abbott), Rose Walk (Edward Larrabee Barnes/John M.Y. Lee & Partners), and the Women's Table (Maya Lin). (Photo by Michael Marsland)

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*Branford College dining hall after its 1999–2000 renovation
(original design by James Gamble Rogers; renovation by Perry Dean Rogers & Partners;
photo by Richard Mandelkorn)*

EXECUTIVE SUMMARY

THE CAPITAL PROJECTS HANDBOOK

Yale University engages in capital projects to achieve its strategic goals and to improve the quality of its physical facilities. Considerable resources are committed to capital projects each year, and effective stewardship demands rigorous processes with appropriate controls to ensure the most effective use of these resources. The process used at Yale is similar to those used at peer institutions and other comparable organizations, and due to the size and complexity of the projects it can be rather intricate.

A well-constructed building can endure for many years without significant renovation, so most of the University community has infrequent contact with capital projects. This handbook is intended to provide a brief explanation of Yale's process for delivery of capital projects. It was written to communicate the nuances of the process and to ensure a uniformly high level of performance by the Facilities organizations and their consultants.

FROM IDEA TO COMPLETED PROJECT

The life of a capital project includes five distinct phases. Each phase is made up of a variety of related sub-phases and tasks that must be completed, resulting in a set of deliverables that defines the work to be done in the next phase and serves as the basis for approval to proceed to that phase.

During the first phase, **Identification**, project goals are identified and support for the proposed project is sought from the administration. In **Planning**, the planners work from the defined goals; develop the program; and balance the competing objectives of scope, budget, and schedule. The project then proceeds to **Design**, during which architects and engineers work from the defined scope and budget to develop the design in stages, verifying the budget at each stage and then producing construction drawings

and specifications. In **Construction** a team of contractors works from the instructions contained in these documents to physically assemble the specified materials and equipment into a complete facility. During the final phase, **Closeout**, the occupants move in, minor unfinished items (the "punch list") are completed, and the project records are reconciled and archived.

THE TRIPTYK

The Triptyk (shown on the next page) illustrates the process. Once a project emerges from the Identification phase with a go-ahead, it will follow one of three paths, depending on its size and complexity.

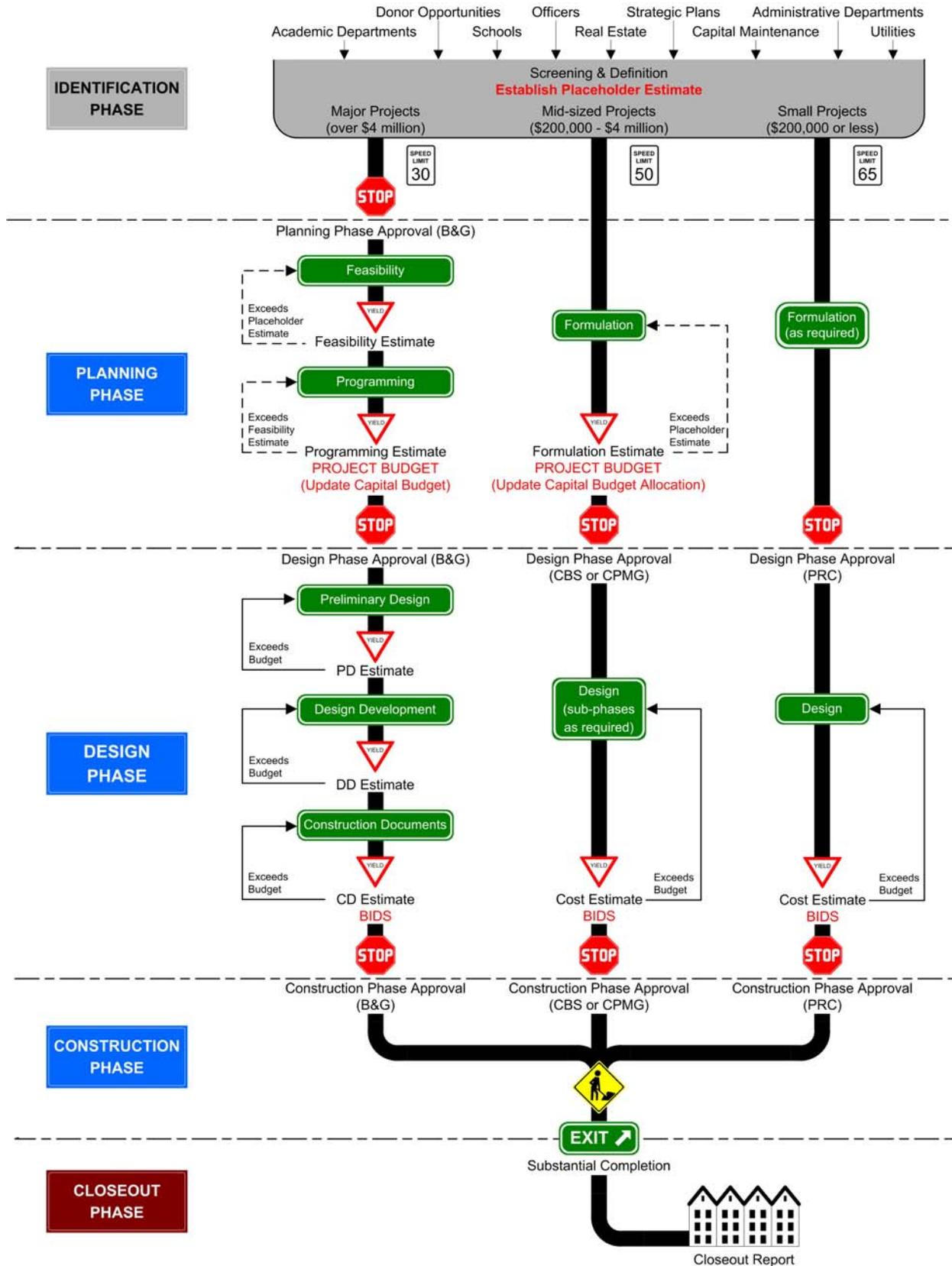
Major projects are those that consume the most University resources and consequently require the greatest oversight. Because these projects require the most intensive planning and design, they must go through every step of each phase and therefore take longest to complete. Projects with budgets over \$4 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 \$200,000 up to \$4 million.

Small projects can move fastest through the process, bypassing some steps and tasks within each phase. The Planning phase can often be significantly condensed without sacrificing quality. Small projects have budgets of \$200,000 or less.

An abbreviated list of steps and significant tasks in each phase of a major project is presented beside the Triptyk. This table also shows the action required to initiate each phase, the primary deliverable produced during the phase, and the primary stakeholders who have the greatest involvement in the phase.

THE TRIPTYK: THREE PATHS FOR DELIVERING A CAPITAL PROJECT



THE TASK LIST: PHASES AND TYPICAL TASKS NEEDED TO COMPLETE A MAJOR PROJECT

(some steps may not be required in mid-size and small projects)

Phase	Sub-Phase	Tasks	Deliverables	Stakeholders
IDENTIFICATION PHASE		Requesting department articulates a need for capital improvements and identifies a potential funding source	Memorandum of Understanding with placeholder estimate	Requesting department, YFC&R, Funding authority, and Cognizant Officer
		Requesting department works with funding authority and cognizant Officer to assess needs		
		Determine project goals		
		Define general scope and options, including enabling projects		
		Develop placeholder estimates based on comparable project costs		
		Confirm funding sources and include in capital budget		
		Select consultants		
PLANNING PHASE	Feasibility	Obtain approval from Corporation Buildings and Grounds Committee	Feasibility Study with recommended option and feasibility estimate	Requesting department, YFC&R, Funding authority, Cognizant Officer, and B&G Committee
		Conduct project orientation meeting		
		Begin documenting compliance with OMB Circular A-21 (only projects over \$10 million for programs receiving federal funding)		
		Define project objectives: accessibility, building codes, community issues, environmental issues, historic preservation, security, sustainability, etc.		
		Identify key site, utility, and building relationships		
		Perform zoning review		
		Develop options with feasibility estimates		
	Programming	Conduct conceptual or component programming	Programming Study with programming estimate; project budget	
		Evaluate options and identify preferred option		
		Confirm acceptability of preferred option with all stakeholders		
		Conduct detailed space programming		
		Develop conceptual design, with siting and massing		
		Develop design guidelines		
		Develop general building systems descriptions		
DESIGN PHASE	Preliminary Design	Determine contracting approach and select CM	Reconciled scope, estimate, and schedule	
		Review conceptual design with Design Advisory Committee and B&G Committee		
		Confirm scope, budget, and schedule with all stakeholders		
		Obtain approval from Corporation Buildings and Grounds Committee		
		Investigate existing conditions		
	Design Development	Analyze code compliance	Reconciled scope, estimate, and schedule	
		Describe proposed building systems and utilities requirements		
		Present to Design Advisory Committee and B&G Committee		
		Conduct progress meetings		
		Conduct stakeholder reviews		
	Construction Documents	Cost estimate, risk analysis, and value management	Drawings & specs; contract price/bid	
		Meet with code authorities for preliminary review		
		Analyze life-cycle costs		
		Perform engineering load calculations		
		Review with Design Advisory Committee and B&G Committee as needed		
CONSTRUCTION PHASE		Conduct progress meetings	Certificate of substantial completion	
		Conduct stakeholder reviews		
		Cost estimate, risk analysis, and value management		
		Establish bidding parameters		
		Bidding & scheduling		
		Obtain approval from Corporation Buildings and Grounds Committee		
		Conduct pre-construction conference		
		Obtain building permits		
		Review shop drawings and construction mockups		
		Conduct progress meetings; distribute project updates to stakeholders		
		Conduct Owner's inspections and tests		
CLOSEOUT PHASE		Arrange for municipal inspections	Closeout Report	
		Conduct commissioning & training for building systems		
		City issues Certificate of Occupancy		
		Architect issues Certificate of Substantial Completion		
		Install furniture		
		Occupants move in		
Complete punch list items	YFC&R			
Receive warranties, O&M manuals, and spare parts				
Close out contracts & purchase orders				
Archive documents				
Conduct post-occupancy evaluation (lessons learned, customer feedback)				

FACILITIES ORGANIZATIONS

FACILITIES ORGANIZATIONAL UNITS

“Yale Facilities” is made up of two closely related service organizations: Yale Facilities Construction & Renovation (YFC&R) and Facilities Operations.

YFC&R is responsible for capital improvements to facilities. The divisions of YFC&R that manage capital projects on the central campus are University Planning, Project Management, Construction Management, and the Small Projects Group. The YFC&R division that manages projects at the Yale School of Medicine is YSM Facilities Construction & Renovation (YSM FC&R).

Facilities Operations is responsible for the day-to-day operation of facilities, and includes functions such as custodial services, building maintenance, fire safety, grounds maintenance, and utilities.

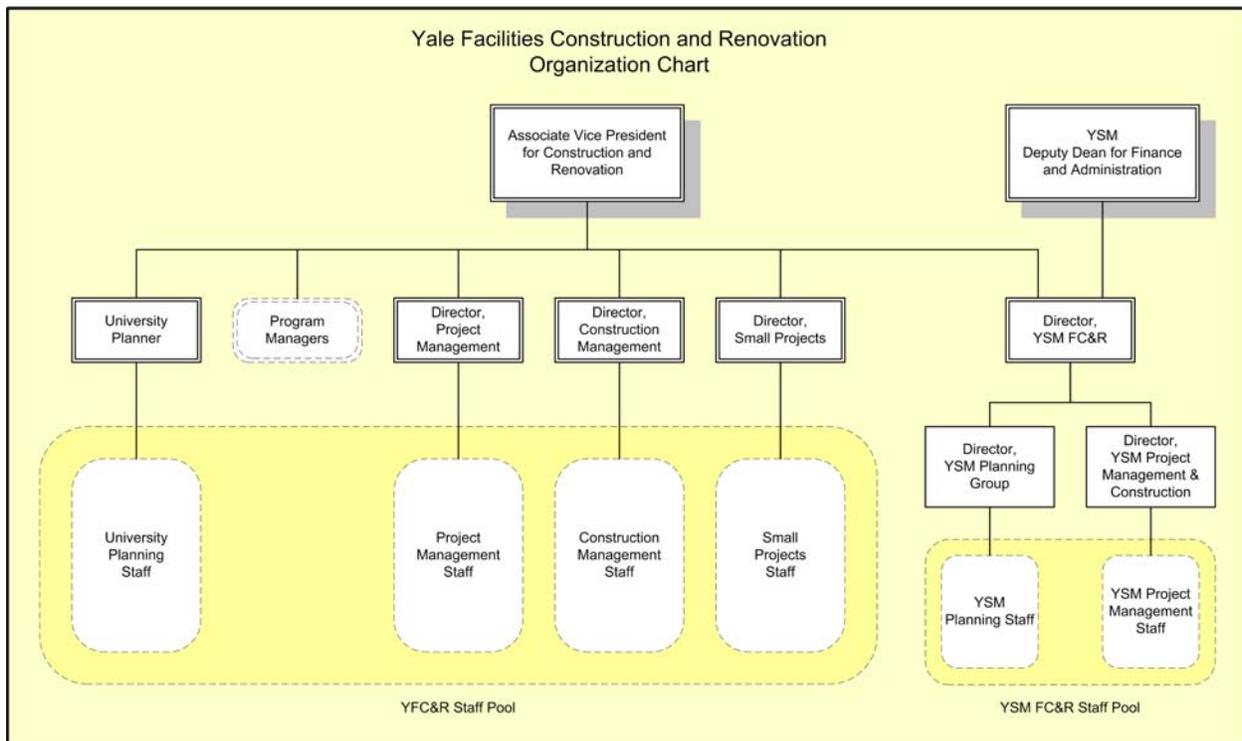
YFC&R MISSION

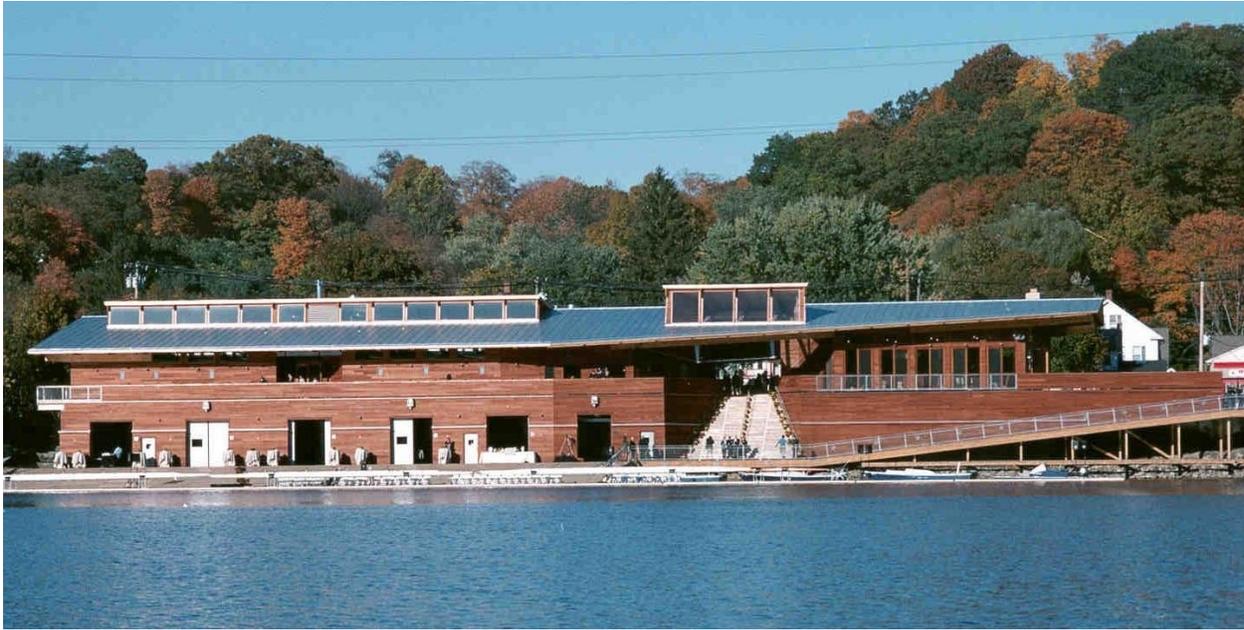
The mission of Yale Facilities Construction & Renovation is to plan comprehensively and effectively

for the future of the University’s buildings and grounds; to design capital projects that will satisfy the needs of the University in a responsible, timely, and cost-effective manner; and to construct safe and suitable facilities that will empower our customers to fulfill their academic, administrative, and service missions. Our duties are carried out with pride by all of our professionals, guided by the principles of superior service and respect for our customers’ individual needs.

UNIVERSITY PLANNING

University Planning translates the strategic plans and academic goals of the University into area plans, which address groups of related buildings as well as large buildings that require multiple renovation projects. Individual projects are generated by these large-scale plans. University Planning tracks these and other identified capital needs for the ten-year capital plan, and manages the Identification and Planning phases for all major non-medical projects.





*The Gilder Boathouse on the Housatonic River in Derby, completed in 2000
(Turner Brooks Architects; photo by Bernstein Associates)*

PROGRAM MANAGERS

Program managers are assigned to the most complex major projects; they serve as project executives throughout the life of the project and have ultimate accountability for keeping the project on budget and on schedule. The program manager directs the project manager and the project team. For some projects the program manager may also perform the role of project manager.

PROJECT MANAGEMENT

Project Management works from the defined scope, budget, and schedule and manages the Design phase for all projects planned by University Planning. After receiving bids from contractors, they oversee the Construction phase and then after the occupants move in they manage the Closeout phase. Project managers have the primary responsibility of ensuring that their projects are completed on budget and on schedule.

CONSTRUCTION MANAGEMENT

The Construction Management group develops construction execution strategies and contract

documents for construction of all projects. This group also supports the project manager by providing a continuing presence at the site during critical periods in the Construction phase.

SMALL PROJECTS GROUP

The Small Projects Group has responsibility for small projects and some mid-size projects (except those at the School of Medicine). This group establishes the scope, budget, and schedule for these projects through an expedited process called formulation. They then manage the project through design, construction, and closeout.

YSM FACILITIES CONSTRUCTION & RENOVATION

YSM FC&R includes the YSM Planning Group and YSM Project Management & Construction. They oversee identification, planning, design, construction, and closeout of all projects at the School of Medicine. YSM FC&R has dual reporting responsibilities to the Deputy Dean for Finance and Administration of the School of Medicine in addition to the Associate Vice President for Construction & Renovation.

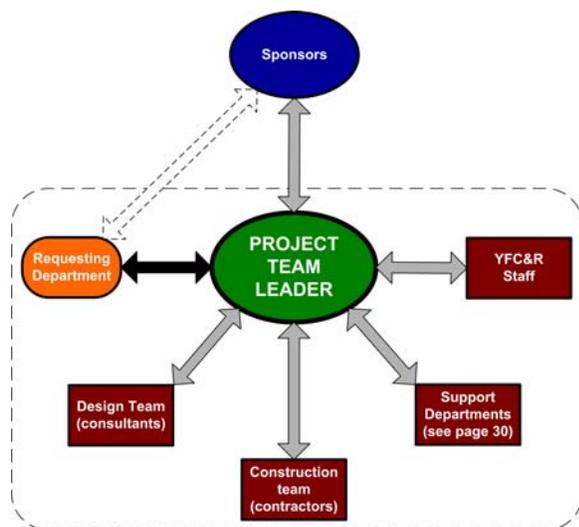
PROJECT ORGANIZATIONS

THE PROJECT TEAM

The project team is composed of representatives of all organizations having an active role in the project.

This includes the requesting department, the architect, and the contractor, and it also may include departments providing project support, such as ITS or Facilities Operations, depending on the nature of the project.

A project team leader is assigned by Yale Facilities Construction & Renovation (YFC&R), and on large or complex projects YFC&R may provide additional personnel to assist. During the Identification and Planning phases, the project team leader is a planner from University Planning or the YSM Planning Group; during Design, Construction, and Closeout, a different skill set is required so a project manager from the appropriate staff pool takes over the leadership role. For the most complex major projects, the project team leader will be a program manager. These assignments are shown in Appendix 4.



The Project Team

The relationships of the various team members are shown in the diagram above. The project team leader is responsible for coordinating the activities of all members of the project team, for keeping the project

on budget, and for maintaining the project schedule throughout the Planning and Design phases so that construction starts on the required date. The project team leader acts as the University's representative to all outside firms, directing the services performed by architects and contractors. The project team leader also coordinates the requirements of the Yale design standards and the input of the various departments providing project support, and resolves conflicts that sometimes arise among them or between them and the project objectives.

It is the responsibility of the project team leader throughout the project to ensure that all stakeholders (cognizant Officer, funding authority, requesting department, and YFC&R) are appropriately informed of issues that affect them. Because two-way communication is essential for a successful project, the project team leader must be involved in every communication in order to properly coordinate all aspects of the project and to make the best use of the University's resources.

THE REQUESTING DEPARTMENT

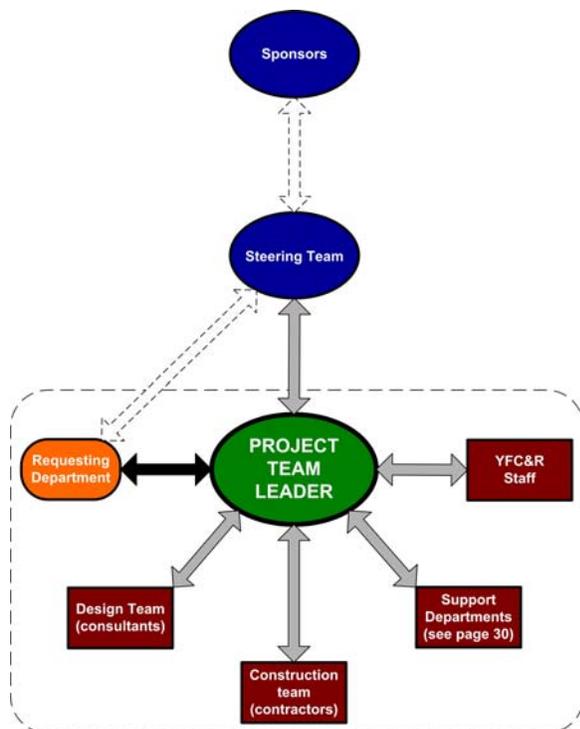
The requesting department (or school) must also form an organization to effectively represent its interests in the project delivery process. During the Identification phase it is usually the responsibility of the department leader (e.g., a Dean, Chair, or Director) to advocate for the project with the funding authority or cognizant Officer, articulate the project goals, and, for major projects, participate in the preparation of the Memorandum of Understanding.

Once the project moves into the Planning phase, the department usually appoints a building committee from within its ranks (except for small projects) to determine the specific needs for which the planners will propose solutions. One of the committee members should be designated as the department's primary project contact, who will represent the department on the project team. Ideally this person will be able to serve as the requesting department's

representative throughout the life of the project and communicate between the project team and the requesting department.

As the project proceeds into Design, the role of the committee diminishes and the role of the department's representative increases, as the focus changes to executing the decisions of the committee. Usually the department's representative attends project meetings and coordinates the department's review of progress documents after each sub-phase of Design (Preliminary Design, Design Development, and Construction Documents).

Once Construction begins, the role of the representative diminishes, as it becomes the responsibility of YFC&R to manage the contractor's activities and keep the department informed of the progress. The department's representative attends project meetings as the need arises, but must still be available to respond to unforeseen issues that often arise during construction. Toward the end of the Construction phase, the representative's role increases again as the move-in date approaches.



The Steering Team Model

THE STEERING TEAM

Steering teams are used only on the most complex major projects. They are intended to expedite the project delivery process and reinforce the role of the project team leader in ensuring that the University's resources are used effectively; that the project meets its program, cost, and schedule goals; and that conflicts between these goals are resolved expeditiously. The steering team is led by the AVP for Construction & Renovation and also includes the project team leader, the leader of the requesting department, the chair of its building committee, a representative of the funding authority, 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. YFC&R must execute the project according to the established parameters. However, Yale University is the owner of all campus facilities, and the best interests of the University are ultimately determined by the President and the Corporation.

Most decisions made by the project team are the result of consensus among the various parties. However, when a consensus decision cannot be made, 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 Steering Team, while for other major projects, the AVP for Construction & Renovation will attempt to resolve the matter with the funding authority and the leader of the requesting department. For smaller projects the issue is usually resolved at the Director level.

An issue should be referred to the sponsors only if the process described above has failed to produce resolution. 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.

AUTHORIZATION PROCESSES

CAPITAL BUDGETING PROCESS

The Corporation approves a capital budget prior to the beginning of each fiscal year (July 1 to June 30). The process for the next year's budget begins in the fall as new projects are listed with placeholder estimates in a ten-year capital plan that is updated throughout the year. This plan is a list of all capital needs that are anticipated over the next decade. During the winter, estimates are revisited and priorities are reassessed and realigned in keeping with the University's strategic goals. Finally, the capital plan is refined to efficiently utilize available funding. The section that covers the upcoming fiscal year is submitted as the proposed annual capital budget.

The capital budget lists major projects individually, and the funding authority for major projects is the Provost. All other projects are included under one of six categories, each of which has a separate budget allocation and funding authority as follows:

- Programmatic renovations: Provost
- Capital maintenance: AVP for Facilities Operations
- Utilities: AVP for Facilities Operations
- Systems and equipment: Vice President for Finance and Administration
- Property acquisitions: Vice President for New Haven and State Affairs
- School of Medicine: Dean, School of Medicine

The capital budget is a one-year spending plan for the University, but it does not directly confer authority to disburse funds for any project. Each project phase must be individually approved through the project approval process described below before financial commitments can be made or funds can be disbursed.

PROJECT APPROVAL PROCESS

The approval process for all projects begins with the project request (see Appendix 3), which is a brief summary of the project prepared by Yale Facilities Construction & Renovation (YFC&R). All cost guidelines described below refer to the anticipated total cost of the project.

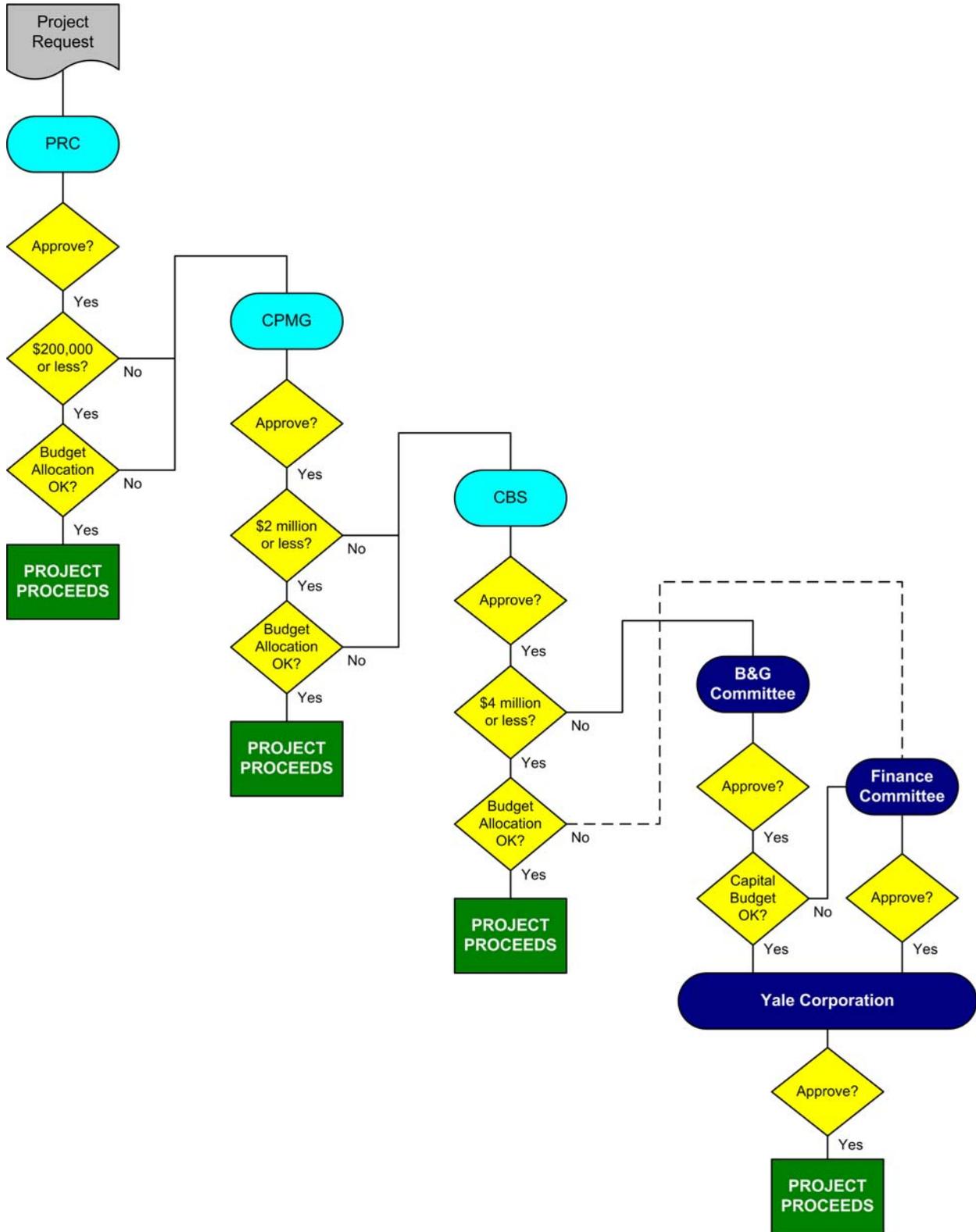
The first approval step is the Project Review Committee (PRC), which meets weekly and includes representatives from Facilities Operations, YFC&R, Finance, and ITS. PRC reviews the project request, coordinates the project with other related work, and offers suggestions for the next phase of the project. PRC has approval authority for projects up to \$200,000 but above that amount it must forward the project for approval at higher levels.

Next is the Capital Program Management Group (CPMG), which meets bi-weekly and is chaired by the AVP for Construction & Renovation. It includes representatives from Facilities Operations, YFC&R, the Finance office, the Provost's office, ITS, and the Development office. CPMG reviews the project request, ensures that it complies with the University's policies and strategic goals, and offers suggestions for the next phase of the project. CPMG has approval authority up to \$2 million but above that amount it forwards the project for approval at higher levels.

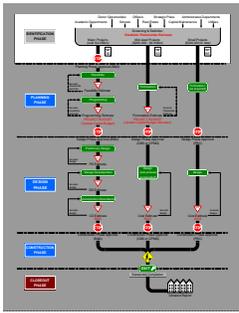
Projects above \$2 million up to \$4 million are approved by the Capital Budget Steering Committee, which meets monthly and is jointly chaired by the Provost and the Vice President for Finance and Administration. It also includes the Vice President for Development, all Deputy Provosts, the Assistant Provost for Science and Technology, the AVP for Finance, the Director of Budget and Planning, the Director of Capital Management, the AVP for Facilities Operations, the AVP for Construction & Renovation, the University Planner, the Director of Project Management, and the Director of YSM FC&R.

Projects above \$4 million must be approved by the Buildings and Grounds Committee of the Yale Corporation, which typically meets four times per year. In addition to reviewing and approving projects, the Committee provides guidance during the development of area planning studies and during the Planning and Design phases of many major projects. The current membership is listed at <http://www.yale.edu/about/committees.html>.

PROJECT APPROVAL PROCESS FLOW CHART



ALL PROJECTS: IDENTIFICATION PHASE



Triptyk – See page 4

DEFINITION

Identification is the process during which the University makes the decision to initiate a capital project.

INCEPTION

Identification begins when the requesting department

articulates a need for new, renovated, or reconfigured facilities and identifies a potential funding source.

Any department in the University can generate requests.

APPROVAL

Before proceeding, an Officer or funding authority must make a general assessment of priorities, benefits, and costs to determine whether the need and timing of the project align with the strategic goals of the University.

OBJECTIVES

The most important objectives of the Identification phase are:

- Identify and define options for meeting the articulated need.
- Align the expectations of all stakeholders (cognizant Officer, funding authority, requesting department, and YFC&R) by documenting the project parameters and goals.
- Identify funding to begin Planning.
- For major projects only, include the project in the capital budget with a risk-adjusted placeholder estimate.

TASKS

- Determine project goals.
- Identify complicating factors such as enabling projects, swing space requirements, code

compliance issues, hazardous materials mitigation, related capital maintenance needs, and utility systems capacities.

- Identify options and define a general scope and placeholder estimate for each option.
- Document the justification, goals, impact of deferral, and options (each with appropriate exclusions, constraints, scope, budget, and schedule).
- Determine which track the project should take when it proceeds into the Planning phase.
- Confirm alignment with the ten-year capital plan and secure the approval of the funding authority.

SCOPE CONTROLS

Once the project goals have been defined and possible approaches have been identified, specific options and scopes of work are developed for satisfying the defined goals. It is possible that further investigation during the Planning phase may determine that some of the options developed during Identification are not feasible for financial or other reasons.

If applicable, enabling projects should also be identified at this time and options for the enabling projects should be developed (including scopes, budgets, and schedules). Examples of enabling projects include relocation of groups currently occupying the affected space or increasing the capacity of utility lines serving the affected location.

BUDGET CONTROLS

A range of placeholder estimates and tentative schedules is developed for all of the options. Placeholders are developed before any planning or design has begun and are based on historical unit costs of comparable projects at Yale and at peer institutions, with a variety of adjustments applied. By themselves placeholders contain high levels of uncertainty, so Yale Facilities Construction & Renovation performs project cost risk analyses to address uncertainties.

When enabling projects will be required, funding sources must also be identified for the enabling projects in addition to the desired project. The same funding source is usually expected to support the enabling projects (except for utilities projects).

SCHEDULE CONTROLS

The Identification phase has the most uncertainty and therefore the amount of time required to complete the phase can vary greatly.

RESOURCES

- *A Framework for Campus Planning*
- Ten-year capital plan maintained by YFC&R
- Historical unit cost information maintained by YFC&R
- Comparable project cost information shared among peer institutions
- Facility condition information, maintenance histories, and systems master plans maintained by Facilities Operations

DELIVERABLES AND REVIEW

MAJOR PROJECT DELIVERABLES: If the identified scope options indicate that the project will require a budget greater than \$4 million, or will entail significant complexity, the Identification phase will conclude with a Memorandum of Understanding (MOU). The MOU consists of a Statement of Need prepared by the requesting department and a Project Description prepared by

University Planning or YSM FC&R (the MOU format is included in Appendix 2). The MOU is developed jointly by the two organizations and is then submitted to the funding authority for review. If the funding authority agrees to sponsor the project, it proceeds to the Planning phase.

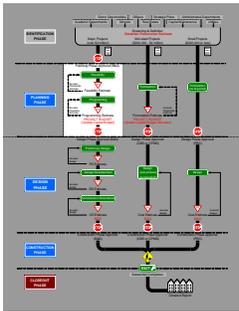
MID-SIZE AND SMALL PROJECT DELIVERABLES: A Memorandum of Understanding may be prepared for complex mid-size projects, but typically the justification and description elements are discussed in meetings between the funding authority, requesting department, and YFC&R. The results of this discussion are summarized by the project planner in a Project Overview, which contains all of the elements of an MOU in an abbreviated format. The Project Overview is circulated for review and is then submitted to the funding authority.

REVIEW: Once the funding authority has reviewed the MOU or Project Overview and agreed to sponsor the project, YFC&R determines which of the three routes on the Triptyk the project will take. Usually the project budget is the determining factor, with budgets of \$200,000 or less considered small projects, budgets above \$200,000 up to \$4 million considered mid-size projects, and budgets above \$4 million considered major projects. However, differing levels of complexity or uncertainty may sometimes require a project to take a route other than the one indicated by the size of the budget.

Installation of Gothic-themed steel trusses in 1997 to support the roof of the Gilmore Music Library in a courtyard of Sterling Memorial Library (original design of Sterling Memorial Library by James Gamble Rogers, Gilmore Music Library design by Shepley Bulfinch Richardson & Abbott; photo by Woody Ford)



MAJOR PROJECTS: PLANNING PHASE



Triptyk – See page 4

GOAL

The goal of the Planning phase is to determine in detail the nature of the project and provide the design team with a clear definition of the scope that is to be designed within defined limits of money and time.

Feasibility the planning consultant works with YFC&R and the requesting department to develop the options outlined in the MOU to the extent necessary to identify key site, utility, and building relationships; preliminary space requirements; and building systems. Feasibility estimates and project schedules are prepared for each option. All viable options become part of the Feasibility Study, which is then presented to the requesting department and funding authority for selection of a preferred option to be developed during the Programming phase.

INITIATION

An approval by the Corporation Buildings and Grounds Committee is necessary to begin Planning for a major project.

APPROVAL

University Planning or YSM FC&R prepares a project request that is based on the Memorandum of Understanding developed in the Identification phase. The Project Review Committee and Capital Program Management Group review the project request before it is submitted to the Corporation.

OBJECTIVES

The primary objective of Planning is to define the specific scope of the project while balancing the competing objectives of quality, cost, and schedule. With the appropriate scope defined, the project budget and schedule can be determined. Before Design begins, all stakeholders (cognizant Officer, funding authority, requesting department, and YFC&R) must agree to the definitions of scope, budget, and schedule.

SUB-PHASES

FEASIBILITY: The Feasibility sub-phase begins with a project orientation that includes the planning consultant, the Design Advisory Committee, the requesting department, and YFC&R. During

PROGRAMMING: During the Programming sub-phase, the preferred option identified during Feasibility is further developed. This sub-phase confirms that the project meets the user's needs as well as the University's budgetary parameters. The project team reconfirms the planning and design goals identified in the earlier sub-phase and develops a detailed space program, conceptual design and massing, a programming estimate, and a proposed schedule. Upon approval the programming estimate becomes the project budget.

SCOPE CONTROLS

The Planning phase is the time during which the project scope is being defined. The primary controls on scope are the project goals and placeholder estimates defined during Identification, which establish expectations for the Planning phase. Scope increases beyond these expectations require justification to and approval of the Officers and/or funding authority.

BUDGET CONTROLS

At the end of the Feasibility sub-phase, the risk-adjusted feasibility estimate is compared with the placeholder estimate. If the feasibility estimate exceeds the placeholder, either the scope must be revised to reduce the estimate, or a request must be made to proceed using a higher budget, or some combination thereof. Increases must be justified.

A similar choice must be made at the end of Programming if the risk-adjusted programming estimate exceeds the feasibility estimate, and, again, increases in cost must be justified. However, once the final project budget is established at the end of the Planning phase, further increases in scope and budget are typically not permitted.

SCHEDULE CONTROLS

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

RESOURCES

- *A Framework for Campus Planning*
- Program Manual for Capital Projects
- Historical cost information maintained by YFC&R
- Comparable project cost information shared among peer institutions
- Facility condition information, maintenance histories, and systems master plans maintained by Facilities Operations

DELIVERABLES AND REVIEW

FEASIBILITY STUDY: This study identifies options for achieving the project goals and lists advantages and disadvantages of each option, including feasibility estimates. There is no standard format for feasibility studies,

Construction of the new addition to Pierson College during its 2003–04 renovation (original design by James Gamble Rogers, renovation by Kieran Timberlake Associates; photo by Philip Handler)

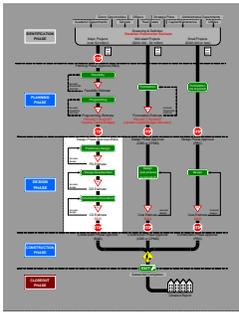
but every study should begin with an executive summary and then systematically define the problem, identify alternatives, evaluate the identified alternatives, and recommend one for implementation. Assumptions should be clearly identified and input data should be included for independent evaluation.

PROGRAMMING STUDY: The Programming Study builds upon the selected option from the Feasibility Study. It defines the project in enough detail that the design team is given a clear understanding of the project scope, with its accompanying budget and schedule. Once the Programming Study is complete, no major uncertainties should remain. Once again, there is no standard format for a programming study, but every study should begin with an executive summary and then restate the project's goals and objectives, identify exclusions and constraints on the project, and describe the scope, budget, and schedule. The estimate developed at the end of this phase becomes a fixed project budget that is expected to remain constant throughout design and construction.

REVIEW: The Feasibility Study and Programming Study are each reviewed by the requesting department and the funding authority. Also, when a project will have an impact on the architectural character of the campus, the conceptual design is reviewed by the Design Advisory Committee and the Corporation Buildings and Grounds Committee so that opportunities to comment are provided before the Planning phase is completed.



MAJOR PROJECTS: DESIGN PHASE



Triptyk – See page 4

GOAL

The goal of the Design phase is to produce drawings and specifications to communicate to the construction team the specific nature of the project to be built. These design documents will

form the basis of a legal agreement by the construction manager to build the project described in the documents for a definite price and within a definite time.

INITIATION

An approval by the Corporation Buildings and Grounds Committee is necessary to begin Design for a major project.

APPROVAL

University Planning or YSM FC&R prepares a project request based on the programming study developed in Planning. The Project Review Committee and Capital Program Management Group review the project request before it is submitted to the Corporation.

OBJECTIVES

The primary objective of the Design phase is to translate the project definition from the programming study into detailed construction documents that can be used by a contractor to construct the project. Design includes the following major objectives:

- Design an aesthetically pleasing facility that also efficiently meets programmatic requirements.
- Design flexibility into the project to accommodate future needs.
- Comply with zoning, building, and fire codes.

- Design a facility that conserves energy and improves Yale's environmental sustainability.
- Address systems and maintenance needs.
- Develop details that are constructable 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 throughout the Design phase so that the Construction phase begins on time.

SUB-PHASES

Each of the design sub-phases listed below (PD, DD, and CD) concludes with document reviews by YFC&R, the requesting department, and appropriate support departments. The design consultant and the construction manager collaborate to prepare a risk-adjusted cost estimate, and a value management exercise is conducted to control the life-cycle costs of the project. Finally, stakeholder approval is sought before proceeding further.

PRELIMINARY DESIGN (PD): During this sub-phase the designer reviews the programming study and develops proposed solutions to the design problems. A construction manager (CM) is usually engaged during PD to provide advice on constructability, cost, and scheduling. Existing conditions are investigated and code requirements are analyzed, while systems descriptions and design criteria are developed for the mechanical systems. Working from the conceptual design and massing developed during Programming, the architect prepares preliminary plans and models with proposals for exterior materials. A presentation is made to the Design Advisory Committee, which comments on the proposed design and offers advice to the AVP and project team leader. Some also refer to this sub-phase as Schematic Design.

DESIGN DEVELOPMENT (DD): In this sub-phase the architect develops the design decisions made during the PD sub-phase and refines all aspects of the design. One of the objectives of DD is to discover and address any problems resulting from those design decisions. 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, and preliminary detailing and coordination are demonstrating the feasibility of the design solutions. The DD sub-phase is the last opportunity for input regarding design issues.

CONSTRUCTION DOCUMENTS (CD): In this sub-phase the design team finalizes details to produce a comprehensive, fully coordinated set of drawings and specifications. Design changes at this point usually cause cost increases and schedule delays. At the end of CD the architect produces a final, complete set of documents and the project is released for competitive bids.

BIDDING AND NEGOTIATION: The construction manager receives the bids and provides the University with a contract price based on the bids. The Design phase ends when the University has received a contract price within budget.

SCOPE CONTROLS

Changes from the scope defined in the Planning phase are not permitted without agreement by all stakeholders. The scope change must be defined in writing with its effect on budget and schedule included, and must be approved by all stakeholders.

BUDGET CONTROLS

Before being engaged for the Design phase, the architect reviews the programming study and must agree to design the defined scope within the specified budget and schedule limits. At the conclusion of each sub-phase of design (PD, DD, and CD), risk-adjusted construction cost estimates are prepared by the CM in consultation with the design professional and YFC&R. If the cost estimates result in a project cost greater

than the project budget, then the project may need to be redesigned. Bids are solicited from contractors at the end of the Design phase, and, again, redesign may be required if the bids result in a project cost that exceeds the budget.

SCHEDULE CONTROLS

Controlling the schedule during Design 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. Furthermore, costs escalate as time passes. 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.

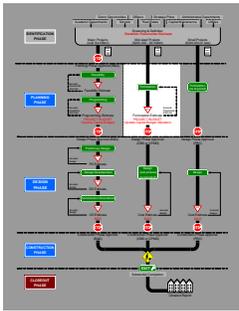
RESOURCES

- Program Manual for Capital Projects
- Connecticut Building Code
- Connecticut Fire Safety Code
- ADA Accessibility Guidelines
- Yale Design Standards Manual
- YSM Project Manager's Guide
- YSM Design Standards
- YSM Designer's Guide
- YSM Constructor's Guide

DELIVERABLES AND REVIEW

The primary deliverables of the Design phase are the drawings and specifications that form the basis of the construction contract, which could be in the form of a fixed price bid, a guaranteed maximum price, or cost-plus-fee (refer to the section on Construction Contracting). In addition, many major projects are reviewed during the Design phase by the Corporation Buildings and Grounds Committee so that the Committee has an opportunity to comment on the project before the phase is completed.

MID-SIZE PROJECTS: PLANNING PHASE



Triptyk – See page 4

GOAL

The goal of Planning is to determine in detail the nature of the project and provide the design team with a clear definition of the scope that is to be designed within defined limits of money and time.

BUDGET CONTROLS

At the end of Formulation, the risk-adjusted formulation estimate is compared to the placeholder. If the estimate exceeds the placeholder, either the scope must be revised to lower the budget, or a request must be made to proceed using the higher budget, or some combination thereof. Increases must be justified. Once the project budget is established, further increases are typically not permitted.

INITIATION

Approval of the MOU or Project Overview by the funding authority is required to begin the Planning phase for mid-sized projects.

OBJECTIVE

The primary objective of Planning is to define the project scope, budget, and schedule. Before Design begins, all stakeholders (cognizant Officer, funding authority, requesting department, and YFC&R) must agree to the defined scope, budget, and schedule.

SUB-PHASE

FORMULATION: A project planner works with the requesting department and the funding authority to develop the options outlined during Identification and identify all major scope elements. Feasibility estimates and schedules are prepared for each option and a preferred option is selected. The project goals are reconfirmed and a detailed space program and conceptual design are developed, with a formulation estimate that becomes the project budget.

SCOPE CONTROLS

During Formulation the primary controls on scope are the project goals and placeholder estimates defined during Identification, which establish expectations for the Planning phase. Increases beyond these expectations require justification to and approval of the funding authority.

SCHEDULE CONTROLS

The iterative nature of developing an acceptable project budget sometimes requires schedule adjustments. However, the project planner is responsible for maintaining schedules developed at the beginning of the Planning phase to the greatest extent possible. Schedule reviews should always be a part of every project meeting during the Planning phase to ensure that unnecessary delays are avoided.

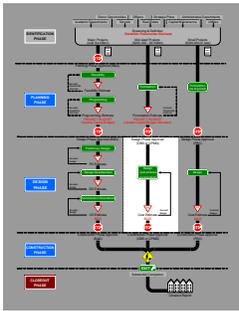
RESOURCES

- *A Framework for Campus Planning*
- Program Manual for Capital Projects
- Historical unit cost data maintained by YFC&R
- Comparable project cost information shared among peer institutions
- Facility maintenance histories and systems master plans maintained by Facilities Operations

DELIVERABLES AND REVIEW

The Formulation Report begins with an executive summary in which the project's goals and objectives are restated. It evaluates the options listed during Identification and recommends one option, with all assumptions clearly stated. The report then defines the selected option in sufficient detail that the design team is given direction regarding the exclusions, constraints, scope, budget, and schedule of the project. The Formulation Report is reviewed by the requesting department and the funding authority.

MID-SIZE PROJECTS: DESIGN PHASE



Triptyk – See page 4

GOAL

The goal of Design is to produce drawings and specifications to describe the specific scope of the project. These documents become a legal agreement by the contractor to build the project according to a defined cost and schedule.

INITIATION AND APPROVAL

For projects up to \$2 million, an approval by the Capital Program Management Group is necessary to begin Design. Projects above \$2 million up to \$4 million also require approval by the Capital Budget Steering Committee.

OBJECTIVES

The primary objective of the Design phase is to translate the goals defined during the Planning phase into well-coordinated construction documents, in compliance with building codes, that maximize the value and minimize the cost of the project.

SUB-PHASES

For mid-size projects the number of design sub-phases is governed by the complexity of the project. Each sub-phase used concludes with a cycle of reviews, cost estimates, and value management.

PRELIMINARY DESIGN (PD): The architect develops design solutions that meet programmatic requirements. Existing conditions are explored and code issues are analyzed.

DESIGN DEVELOPMENT (DD): The architect refines the solutions developed during PD, addressing any problems resulting from those decisions, and advances all aspects of the design. DD is the last opportunity for input on design issues.

CONSTRUCTION DOCUMENTS (CD): The design team finalizes details. At the end of CD the drawings and specifications are released for bids.

BIDDING: Design ends when a contract price within budget is received.

SCOPE CONTROLS

Changes from the scope defined in the Planning phase are not permitted without agreement by all stakeholders. The scope change must be defined in writing with its effect on budget and schedule included.

BUDGET CONTROLS

Risk-adjusted cost estimates are prepared at the end of each sub-phase. If the cost estimates or bids result in a project cost greater than the project budget, the project may need to be redesigned.

SCHEDULE CONTROLS

Controlling the schedule during design is critical to delivering the project as promised. Comparing progress against the design schedule must always be discussed in every regular progress meeting.

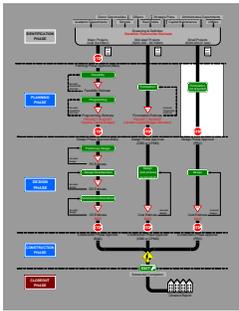
RESOURCES

- Program Manual for Capital Projects
- Connecticut Building Code
- Connecticut Fire Safety Code
- ADA Accessibility Guidelines
- Yale Design Standards Manual
- YSM Project Manager's Guide
- YSM Design Standards
- YSM Designer's Guide
- YSM Constructor's Guide

DELIVERABLES AND REVIEW

The primary deliverables of the design phase are the drawings, specifications, and bids. The contract method is usually a fixed price bid.

SMALL PROJECTS: PLANNING PHASE



Triptyk – See page 4

GOAL

The goal of Planning is to determine in detail the nature of the project and provide the design team with a clear definition of the scope that is to be designed within defined limits of money and time.

SCOPE CONTROLS

The primary controls on scope are the project goals and placeholder estimates defined during Identification, which establish expectations for the Planning phase. Scope increases beyond these expectations require justification to and approval of the funding authority.

BUDGET CONTROLS

At the end of Formulation, the risk-adjusted formulation estimate is compared to the placeholder. If the estimate exceeds the placeholder, either the scope must be revised to lower the budget, or a request must be made to proceed using the higher budget, or some combination thereof. Increases must be justified. Once the project budget is established, further increases are typically not permitted.

SCHEDULE CONTROLS

The iterative nature of developing an acceptable project budget sometimes requires schedule adjustments. However, the project planner is responsible for maintaining the schedule to the greatest extent possible.

INITIATION AND APPROVAL

Approval of the Project Overview by the funding authority is required to begin the Planning phase for small projects.

OBJECTIVE

The primary objective of Planning is to define the specific scope of the project. With the scope defined, the project budget and schedule can be determined. Before Design begins, all stakeholders (cognizant Officer, funding authority, requesting department, and YFC&R) must agree to the defined scope, budget, and schedule.

TASKS

FORMULATION: During Formulation a planner or project manager from YFC&R or YSM FC&R works with the requesting department and the funding authority to develop the options outlined during Identification and identify all major scope elements. Feasibility estimates and schedules are prepared for each option and a preferred option is selected. The project goals are reconfirmed and a detailed space program and conceptual design are developed, with a formulation estimate that becomes the project budget.

The Formulation process can sometimes be significantly condensed when the project is simple and straightforward.

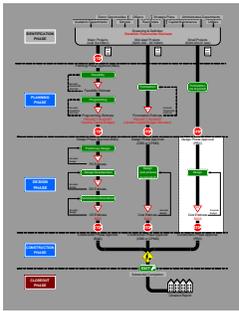
RESOURCES

- *A Framework for Campus Planning*
- Program Manual for Capital Projects

DELIVERABLES AND REVIEW

The Formulation Report begins with an executive summary in which the project's goals are restated. It evaluates the options listed during Identification and recommends one option, with all assumptions clearly stated. The report then defines the selected option in sufficient detail that the design team is given direction regarding the exclusions, constraints, scope, budget, and schedule of the project. The Formulation Report is reviewed by the requesting department and the funding authority.

SMALL PROJECTS: DESIGN PHASE



Triptyk – See page 4

GOAL

The goal of Design is to produce drawings and specifications to describe the specific scope of the project. These documents become a legal agreement by the contractor to build the project according to a defined cost and schedule.

INITIATION AND APPROVAL

Projects up to \$200,000 require approval of a project request by the Project Review Committee before the Design phase can begin.

OBJECTIVES

The primary objective of the Design phase is to translate the goals defined during the Planning phase into well-coordinated construction documents, in compliance with building codes, that maximize the value and minimize the cost of the project.

TASKS

DESIGN: For small projects the design process does not always need to be subdivided. The primary tasks involved in designing a small project are as follows:

- Develop design solutions that meet the programmatic requirements and select one solution.
- Investigate existing conditions.
- Analyze code requirements.
- Draw plans, sections, and elevations.
- Design required modifications to building systems.
- Coordinate all elements of the design.
- Finalize all required construction details.
- Review the design with the requesting department.
- Release the project for bidding.

BIDDING: Design ends when the University receives a bid within the budget.

SCOPE CONTROLS

Changes from the scope defined in the Planning phase are not permitted without agreement by all stakeholders. The scope change must be defined in writing with its effect on budget and schedule included, and must be approved by all stakeholders.

BUDGET CONTROLS

If risk-adjusted cost estimates or bids result in a project cost greater than the project budget, the project may need to be redesigned.

SCHEDULE CONTROLS

Controlling the schedule during Design is critical to delivering the project as promised. Comparing progress against the design schedule must always be discussed in every regular progress meeting.

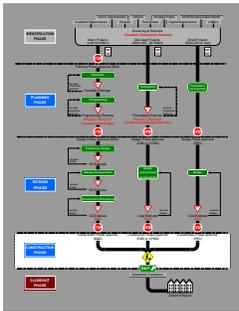
RESOURCES

- Program Manual for Capital Projects
- Connecticut Building Code
- Connecticut Fire Safety Code
- ADA Accessibility Guidelines
- Yale Design Standards Manual
- YSM Project Manager's Guide
- YSM Design Standards
- YSM Designer's Guide
- YSM Constructor's Guide

DELIVERABLES AND REVIEW

The primary deliverables of the Design phase are the bids and the drawings and specifications upon which they are based. The contract method is usually a fixed price bid or a not-to-exceed price bid.

ALL PROJECTS: CONSTRUCTION PHASE



Triptyk – See page 4

GOAL

The goal of the Construction phase is to build the project as designed, on time and on budget, and deliver the facility ready for occupancy by the requesting department.

- Building inspections are conducted by the City.
- The architect certifies progress payments, which are then processed by the project manager.
- Change orders, when required, are prepared by the architect and priced by the contractor before acceptance by the University.
- As completion nears, major building systems are commissioned and maintenance personnel are trained in their operation.
- The City issues the Certificate of Occupancy.
- Furniture is installed.

INITIATION

Approval by the appropriate committee is required before Construction can begin.

APPROVAL

YFC&R prepares a project request based on the contract price. Depending on size and complexity, the project request is approved by PRC, CPMG, the Capital Budget Steering Committee, or the Corporation Buildings and Grounds Committee.

OBJECTIVE

The primary objective of Construction is to build the project while controlling change orders, use of contingency funds, and schedule.

TASKS

Construction is a very task-oriented process. The following is a summary of the major tasks that are required for successful completion of the project.

- Conduct a pre-construction conference to coordinate processes and review the schedule.
- Obtain building permits.
- The design team reviews shop drawings.
- The owner, architect, and contractor conduct regular meetings to review progress and schedule.
- The project manager provides regular updates to the requesting department and other stakeholders.
- Material tests and special inspections are conducted on behalf of the owner.

SCOPE CONTROLS

The drawings and specifications become part of a legal contract that is binding on both the contractor and the University, and deviations require written change orders. Programmatic scope changes also require the approval of the funding authority.

BUDGET CONTROLS

Once in Construction the cost is fixed by contract and can only be adjusted by the change order process. Changes require review at Director level or higher.

SCHEDULE CONTROLS

Adherence to the schedule is addressed at each regular job meeting. The contractor and architect submit written certifications of progress with every application for payment. Schedule changes require review at Director level or higher.

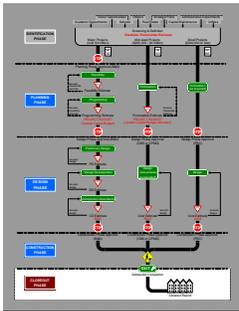
RESOURCES

- Program Manual for Capital Projects
- YSM Project Manager's Guide
- YSM Designer's Guide
- YSM Constructor's Guide

DELIVERABLES

- Certificate of substantial completion, with a list of outstanding deficiencies (called a "punch list")

ALL PROJECTS: CLOSEOUT PHASE



Triptyk – See page 4

GOAL

The goal of the Closeout phase is to occupy the facility, complete any remaining work not finished during the Construction phase, and to finish all required documentation.

- Conduct post-occupancy (“lessons learned”) evaluation of the project with all stakeholders.
- Close out all open contracts and purchase orders and close the project account.
- Complete the Project Closeout Report.

SCOPE CONTROLS

Once the contractor has complied with all of the contract requirements, the architect conducts an inspection and certifies that all required work has been satisfactorily completed; the final payment is then released. Also, for major projects and some mid-size projects, an audit is conducted of adherence to the terms of the construction contract.

BUDGET CONTROLS

If the construction manager held a contingency, the unspent construction contingency is returned to the University’s project account. All unspent project funds are returned to the funding source when Closeout is complete.

SCHEDULE CONTROLS

For major projects the Closeout phase usually does not end until the contractor’s warranty period expires (typically one year from the date of substantial completion). Mid-size projects often close out in four to six months, depending on complexity, and small projects can close out within one or two months.

RESOURCES

- Program Manual for Capital Projects
- YSM Project Manager’s Guide
- YSM Designer’s Guide
- YSM Constructor’s Guide

DELIVERABLES

- Record documents
- Post-occupancy evaluation
- Project Closeout Report

INITIATION

The Closeout phase begins when the architect issues the Certificate of Substantial Completion, indicating that no significant construction work remains to be done, and the premises are transferred back to the control of the University.

APPROVAL

Additional funding should not be required during the Closeout phase, so formal approval to begin the phase is not necessary. However, when project closeout is complete, CPMG approves the return of all unspent funds to the funding source.

OBJECTIVES

- Occupy the facility.
- Complete all outstanding deficiencies.
- Document the work done in YFC&R records.
- Reconcile all project accounting.

TASKS

- Occupants move in.
- Punch list items are completed.
- If a Temporary Certificate of Occupancy was issued, obtain the final Certificate of Occupancy.
- Obtain record documents from the architect and deliver them to the Plan Room.
- Conduct warranty reviews; problems reported to Physical Plant during the warranty period are serviced by the contractor.



*Sprague Memorial Hall renovation, completed in 2003
(original design by Coolidge & Shattuck, renovation by Kuvabara Payne McKenna Blumberg; photo by Jeff Goldberg)*

CONSULTANT SELECTION

The University uses a selection process based on qualifications and commercial terms to identify the most appropriate consultant for each project. The prime consultant must be an experienced architecture or engineering firm licensed to practice in the State of Connecticut; for most projects the consultant will be an architect. 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 architect provides comprehensive services, including structural, mechanical, and electrical engineering, and is retained during the Planning phase. The services of the same architect may be retained for the Design phase, or it may be deemed in the project's best interest to retain the services of a different architect. The process includes the following steps:

IDENTIFICATION OF CANDIDATE FIRMS: The University Planner or YSM FC&R prepares a list of consultant firms in consultation with a selection committee that includes representatives of the Officers, the Design Advisory Committee, the requesting department, and YFC&R. 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 the University
- Quality of previous work on campus
- Size of the firm relative to the scope of the project

REQUEST FOR QUALIFICATIONS (RFQ): The candidate firms are asked to submit their qualifications for the project, focusing on the criteria listed above. The selection committee reviews the qualifications and creates a refined list of firms from whom proposals will be solicited.

REQUEST FOR PROPOSAL (RFP): The RFP contains a project description (project brief) including

background information, building program, design goals and objectives, construction budget, and project schedule. The firms are asked to submit proposals describing how they communicate, analyze programs, and design solutions, and also to submit their fee proposal. 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 not.

INTERVIEW: Based on a review of the proposals, the finalists are invited to an interview with the selection committee. The focus is on the firm's approach, process, and design solutions to other similar projects. Schematic designs and models for the particular project are inappropriate.

RECOMMENDATION: After interviews are completed the firms are ranked according to specific criteria. The goal is to reach consensus and to recommend a consultant firm to the AVP for Construction & Renovation and the President.

MID-SIZED PROJECTS

For mid-sized projects the process is streamlined to reflect reduced size and complexity. The candidate firms generally have a history at the University and the process begins with the RFP. In some cases the interview is 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. The AVP for Construction & Renovation makes the selection.

SMALL PROJECTS

The process is simplified for small projects. A firm with a good track record and project-appropriate experience, able to provide services within the required schedule and budget, is selected by the Director, Small Projects, or YSM FC&R.

CONSTRUCTION CONTRACTING

Before selecting a construction contractor, the project team leader must decide which type of construction delivery method is best suited for the project. The methods generally used at Yale are described below (not listed in any order of preference).

DESIGN-BUILD

In the design-build (D-B) method, a construction contractor partners with design professionals to complete both the design and construction for a fixed price. The fixed price is typically based on program requirements and performance specifications. The D-B contractor is selected by the project team based on proposals, including design concepts, from three to five D-B contractors.

The D-B approach best suits a project where schedule and cost are the key objectives and the program requirements are not complex. Changes to the program or architectural design after the Planning phase are usually very costly. Design-build proposals will be based on different architectural designs, because no architect is hired in advance by Yale to prepare design documents.

GENERAL CONTRACTOR

In this delivery method a General Contractor (GC) is hired to construct the project for a fixed price based on complete drawings and specifications prepared by an architect hired by Yale. The GC is selected based on competitive bids from three to five firms.

The GC approach best suits a project where the primary objective is to get the lowest market price. GC firm price projects take several months longer than the other two contract types because the design documents must be 100 percent complete before the bidding process begins. Changes during construction are usually very costly. Since the GC only becomes involved in the Construction phase, the project team leader must hire other construction consultants during the Planning and Design phases to provide constructability advice and cost estimating services.

CONSTRUCTION MANAGEMENT

In this delivery method a Construction Manager (CM) is selected to construct the project based on fully completed drawings and specifications prepared by an architect hired by Yale, but the CM provides advice during design. The CM is selected based on competitive proposals from three to five firms.

The CM approach differs from the other methods in the following ways:

- The project manager approves the CM's construction management staff and their required time on the project.
- The CM provides pre-construction services, including construction cost estimating and constructability review, throughout programming and design.
- The project manager approves the subcontractor bidders list and the selected subcontractors.
- All of the costs of the CM and subcontractors are "open book" to the project manager and subject to the project manager's approval. There is no profit mark-up by the CM on the subcontracts.

The CM approach best fits a project where design requirements are complex, the owner wants to supplement the expertise of its project management staff, and the owner wants full control of the design and construction process. This approach is considered the most cost effective since the CM is involved early to help assure the design is constructable and affordable, and the owner can control the level of services that are purchased.

The CM method is significantly faster than the GC method when a "fast-track" approach is used. In this approach the CM starts construction on each of the project components as soon as that particular portion of the design is completed and bids are received for that work. In new construction the earthwork and foundations can begin months before the rest of the building design is fully completed.

Two types of CM contracts are commonly used at Yale:

- **COST-PLUS-FEE:** In a cost-plus-fee contract the owner pays the CM the actual cost of the construction (based on competitive bids for each trade subcontract) plus certain reimbursable expenses without any profit mark-up, and is charged a fixed fee by the CM for the services provided.
- **GUARANTEED MAXIMUM PRICE (GMP):** In this contract the CM agrees beforehand that the cost of the work will not exceed a specified figure, known as the GMP. The GMP is based on competitive bids for each trade subcontract, but the CM charges an additional fee for taking on the risk of the guarantee. The CM is also allocated some contingency to pay for construction changes that are within the design intent of the project. Changes beyond the design intent require approval by all stakeholders.

SELECTION PROCESS

The CM selection process for major projects is described here, as it is the most common of the contract types used for major projects at Yale.

YFC&R develops an initial list of CM firms that are thought to be capable of successfully constructing the project. The project manager then sends a Request for Qualifications (RFQ) to the CM candidates at the beginning of the Programming sub-phase. Once the qualifications are received, the project manager and YFC&R colleagues pick three to five finalists from which the CM selection will be made.

The project manager then develops a Request for Proposal (RFP) that is sent to the finalists asking for their specific proposal to provide pre-construction and construction services for the project. The candidate firms complete their proposals and are interviewed individually on campus by YFC&R. The selection is made using the following criteria:

- Depth of related experience for the type of project
- Strength of the team organization proposed for the project
- Project execution plan and proposed schedule
- Cost of the proposed fees and reimbursable expenses for services
- Financial viability of the firm

Typically the CM that performs the pre-construction services will later be selected to build the project during the Construction phase. The contract is based on a fee for construction services and reimbursable expenses that is negotiated before construction begins.

CONTRACTS

Yale has developed a variety of standard contracts and forms for the design and construction process. Major and mid-size projects use written contracts tailored to the project requirements while the smallest projects typically use standard purchase orders.

Because each major project is unique, many contract terms require negotiation with the other party. In some cases this negotiation process can delay execution of the contract.

Design contracts are typically set up on a fixed fee basis (plus reimbursable expenses), but not-to-exceed contracts based on hourly rates are sometimes used for smaller projects when scopes are not fully defined.

Construction contracts can have many forms, as described in the sections above. In addition, not-to-exceed contracts based on time and materials used are occasionally executed for the smallest projects when scopes are not fully defined.

Changes to contracts must be carefully defined with regard to the scope of the change and the resulting changes to the contract cost and schedule. Contract changes must be signed by all parties before the change takes effect.

ESTIMATES AND BUDGETS

Project budgets are typically derived from one of two sources: estimates and bids. Estimates are prepared during the Identification, Planning, and Design phases; bids are solicited at the end of Design to form the basis for the project budget during Construction. This section describes the various types of estimates and budgets, and also addresses the risk analysis and value management processes used to control the estimates and budgets.

Construction estimates are not guarantees. Actually all estimates are predictions of bids that will be solicited in the future, after the design has been completed, and are most appropriately expressed as falling within a range of values. Many factors are subject to change: material prices can be volatile, the labor required to complete a given task may vary based on conditions at the project, and bids can vary depending on supply and demand in the construction market, to name a few of the most critical factors.

Estimates are developed in two basic formats: Unifomat and CSI. Unifomat arranges elements of the cost estimate by building function and is most useful during Planning, whereas CSI arranges them by type of product and is most useful during Construction. Conversion from one format to the other is usually accomplished by sorting the estimate according to codes associated with each line item.

PLACEHOLDER ESTIMATES

Placeholder estimates are produced during the Identification phase before any planning or design has begun and before a preferred option is selected. In the early stages of a project, before designs are specific enough for itemized cost estimating, project budgets are established using data from comparable projects. Comparables are usually in the form of unit costs such as dollars per gross square foot of building area. They are derived from databases of prior projects completed at the University or undertaken at peer institutions over the past ten years.

Use of data from comparable projects requires adjustments to the unit costs to account for differences in scope, scale, location, and time. As a result, budgets derived in such a fashion are imprecise and require additional analysis to identify and quantify risk factors (see the section on Risk Analysis below).

PLANNING PHASE ESTIMATES

Estimates produced during the Planning phase include the feasibility estimate, the programming estimate, and the formulation estimate. Like placeholders, planning estimates are derived from comparable project unit cost data, and therefore the procedure for developing a planning estimate is similar to that used to produce a placeholder. However, since some project planning has been completed and some uncertainties have been addressed, the adjustment and risk analysis procedures are beginning to improve in accuracy and precision.

DESIGN PHASE ESTIMATES

Design phase estimates (as opposed to placeholder estimates and planning estimates) are itemized cost estimates produced during the sub-phases of Design as the project design takes shape. The design process resolves uncertainties as it progresses.

Because these cost estimates are based on some stage of an actual design, they are typically developed by itemizing and quantifying all materials and labor that will be required to complete the project as defined in the current design, based on historical databases and current market costs of similar work.

As with placeholders and planning estimates, design estimates also require adjustments to account for differences in scope, scale, location, and time. Undefined costs must be quantified using the project cost risk analysis procedure, although as design progresses the magnitude of the undefined costs decreases.

PROJECT BUDGETS

The construction cost provided by a construction manager or contractor is only one part of the total project cost. The line item costs that make up the project cost are the following:

- Construction cost
- Consultant fees
- Yale management fee
- Operations
- Equipment and furnishings
- Testing
- Contingency

Construction costs escalate over time. This is due in part to ordinary inflation, but also to factors such as changes in technology, as more complex systems must be built into facilities, and changes to building codes, which usually become more restrictive with each new edition. All budget figures provided by YFC&R are expressed in real dollars (i.e., today's dollars), but the costs will escalate until construction begins. It is the responsibility of the Finance Office to account for escalation in the ten-year capital plan.

RISK ANALYSIS

Estimates address defined portions of a project, but additional adjustments for undefined costs should be made using a project cost risk analysis process. This involves gathering data about risk factors that may cause the project to exceed its defined cost, evaluating these risks by assessing probability distributions and correlations, and applying probabilities and costs to each identified risk. This process should be used on all estimates produced during the Identification, Planning, and Design phases.

Underground utilities were replaced throughout the Old Campus in the summer of 1998, which created an opportunity to provide new landscaping for the entire space (Kenneth Boroson Architects, with Olin Partnership, landscape architects; photo by Philip Handler)



This risk analysis process quantifies anticipated but undefined costs. Project contingencies should also be included to account for unknowns.

VALUE MANAGEMENT

Traditional value management (VM, also known as value engineering or VE) is a process in which the project professionals and customer representatives critically analyze all aspects of the project; if a fresh outlook is desired, sometimes a few external professionals not previously involved with the project will be included. This group performs a functional analysis, questions the appropriateness of all major design decisions, and investigates alternatives in an effort to identify solutions with the lowest life-cycle cost that balance the competing needs of the project. The intent of the exercise is to maximize the value of the project to the University and to the occupants.

The approach described above is appropriate for the largest and most complex projects, but abbreviated versions of the process are often utilized, usually involving the construction manager. For smaller projects the value management process can be as simple as a review by YFC&R personnel.

Reductions from the approved project program are not appropriate recommendations of a value management exercise unless agreed to by all stakeholders.

FACTORS INFLUENCING PROJECTS

Institutional projects are impacted by many factors that do not affect simpler projects. A brief discussion of some of the more important factors follows, with links to sources of more detailed information for those who require it. The discussion also addresses some of the processes, standards, and guidelines that the University has adopted to deal with these issues.

PLANNING CONSIDERATIONS

The purpose of planning and formulation is to define the scope of the project so that the architect knows what is to be designed. The two terms imply different levels of investigation: planning refers to an in-depth process for a major project and is conducted by an outside consultant, while formulation is a less intensive in-house effort that is used for less complex projects.

In both cases planners must consider a wide range of factors that may affect the project to assure that the scope is properly defined from the outset. In addition to defining the programmatic needs for the space and its equipment and furnishings, the following is a representative list of factors to be considered during the planning/formulation process:

- Accessibility
- Adjacency requirements
- Capital maintenance needs
- Code compliance
- Community issues
- Construction sequencing and phasing
- Design standards
- Enabling projects
- Environmental conditions
- Framework plan guidelines
- Historic preservation issues
- Media services
- Moving and storage
- Operation and maintenance costs
- Prior studies and reports
- Security
- Swing space
- Tele/data systems

- Temperature/humidity requirements
- Utility systems capacity
- Zoning and other governmental regulations

DESIGN STANDARDS

In order to provide the desired level of quality in Yale's facilities and to promote efficient maintenance, the Facilities departments have developed design standards for certain architectural, mechanical, and electrical systems. Designers are required to incorporate the design standards into their projects, except where adherence to the standards is not feasible or where a cost-benefit analysis indicates that an alternative approach would be preferable. In such situations the project manager will provide direction to the designer.

Due to the specialized nature of medical facilities, YSM FC&R has developed additional standards for use on YSM projects.

ACCESSIBILITY STANDARDS

Most accessibility issues are governed by state building code provisions based on the Americans with Disabilities Act (ADA) Accessibility Guidelines. In addition to these requirements, the University's Advisory Committee on Resources for Students and Employees with Disabilities has developed supplementary standards to clarify certain ambiguities in the regulations and to alleviate specific problems experienced at the University.

PROJECT SUPPORT

Improvements to facilities can have an impact on many departments throughout the University, and all affected departments are invited to provide input at various review opportunities during Design. The comments are compiled and edited by the project manager to ensure coordination with each other and with the project objectives before being forwarded to the architect for inclusion in the design.

Typical projects require involvement by many of the following Yale departments that may provide support during the life of the project or after occupancy:

- Facilities Operations
 - ✦ Physical Plant
 - ✦ Custodial Services
 - ✦ Systems Engineering
 - ✦ Customer Service Group
 - ✦ University Fire Marshal
 - ✦ Grounds Maintenance
 - ✦ Utilities
- Information Technology Services
 - ✦ Telecommunications
 - ✦ Data Network Operations
 - ✦ Media Services
- Accessibility Committee
- University Security
- Environmental Health and Safety
- Dining Halls
- Parking and Transit
- Purchasing
- General Counsel
- Development
- New Haven and State Affairs

REGULATORY AUTHORITIES

The City of New Haven regulates land use through its zoning ordinance. University projects that involve new buildings, additions to existing buildings, or changes in use require approval of the City Plan Commission, the Board of Zoning Appeals, or the Board of Aldermen, depending on the nature and size of the project and the wetland and zoning

This photo of exposed structure was taken during the 2002 renovation of 149 Elm Street, the oldest surviving residence in New Haven. These wooden beams were hewn in 1767 (renovation design by Gregg, Wies & Gardner, architects; photo by Philip Handler)



classification of the property. Other restrictions, such as title or gift limitations, may also come into play. In addition the University and the City sometimes enter into voluntary agreements covering issues such as fire safety compliance or the parking system.

The Board of Aldermen approves proposals for new or altered planned development districts as well as zone changes. The Board also maintains jurisdiction over City property, such as streets, so its approval is required for placement of Yale utilities within New Haven's streets, for placement of signs beyond Yale's property lines, and similar activities.

Some projects may have aspects that require regulatory approval from state or federal authorities. Certain hazardous conditions, for example, are regulated by state and federal environmental authorities. The State Traffic Commission may have jurisdiction over the traffic impact of a large new building. Historic preservation issues are regulated at local, state, and federal levels. The Department of Public Health regulates medical facilities.

While the Department of Public Safety adopts the State Building Code and the State Fire Safety Code, the City has jurisdiction for enforcement of these codes. The City must issue a building permit before construction can begin. Full adherence to all codes is required unless compliance is not feasible, in which case a request can be made for modification of a specific provision of the code.



*The servery at Pierson College, following its 2003-04 renovation
(original design by James Gamble Rogers, renovation by Kieran Timberlake Associates; photo by Philip Handler)*



*A biosafety level 2 research laboratory within the Anlyan Center at the Yale School of Medicine, completed in 2003
(Venturi, Scott Brown & Associates/Payette Associates, architects; photo by Sean Dunn)*

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Construction of the Class of 1954 Chemistry Research Building made it necessary in 2004 to move this historic house from 285 Prospect Street to its new location at 380 Edwards Street (renovation design by Christopher Williams Architects; photo by Philip Handler)

APPENDIX 1 GLOSSARY

- ADA: Americans with Disabilities Act, an act of Congress confirming the civil rights of people with disabilities, including accessibility to buildings and programs open to the public.
- AIA: American Institute of Architects, a professional association that has, among other things, developed the most widely used standards for construction contracts and associated documents.
- AVP: Associate Vice President.
- B&G: Buildings and Grounds Committee of the Yale Corporation, the approval authority for all major projects.
- Benchmarking: The process of comparing Design phase cost estimates or contract prices with adjusted unit costs of comparable projects to serve as a check of a project's scope and budget.
- BZA: Board of Zoning Appeals, City of New Haven.
- CAD: Computer-Aided Drafting, software such as AutoCAD that is used to assist in the design of buildings and facilities.
- Capital Budget: The section of the ten-year capital plan that covers the upcoming fiscal year, itemizing major projects and creating allocations for groups of mid-size and small projects, that is approved by the Corporation.
- Capital Plan, Ten-Year: A list of all capital needs that are anticipated over the next decade.
- CBS: Capital Budget Steering Committee, a committee jointly chaired by the Provost and the Vice President for Finance & Administration; has project approval authority up to \$4 million and reviews all larger requests.
- CD: Construction Documents, the third of three sub-phases of the Design phase.
- CM: Construction Manager, a contracting firm selected to provide advice during design and then construct the project based on fully completed drawings and specifications prepared by an architect hired by Yale.
- CO: Certificate of Occupancy, issued by the City of New Haven to permit occupancy of the facility when all construction work is complete.
- Constructability: The degree of ease or difficulty with which a detail or design can be constructed using standard materials and techniques.
- CPC: City Plan Commission, City of New Haven.
- CPMG: Capital Program Management Group, a committee chaired by the AVP for Construction & Renovation; has project approval authority up to \$2 million and reviews all larger requests.
- CSI: Construction Specifications Institute, a professional association that has developed the most widely used standards for specification formats; these formats are also widely used in construction cost estimating.
- D-B: Design-Build, a delivery method in which a contractor partners with design professionals to complete both design and construction for a fixed price, based on a program description and performance specification.
- DD: Design Development, the second of three sub-phases of the Design phase.
- Design Advisory Committee: A group appointed by the President to assist the Corporation, the Officers, and YFC&R in their stewardship of the Yale campus and its architectural character by offering advice on the design of major projects.
- Formulation Report: The deliverable at the end of formulation (the Planning phase for mid-size and small projects), describing in detail the project parameters so that the design team is provided with a clear definition of the project.
- Funding Authority: The individual responsible for administering a funding source (see page 10).
- GC: General Contractor, a contracting firm selected to construct a project based on fully completed drawings and specifications prepared by an architect hired by Yale.

GMP: Guaranteed Maximum Price, a figure, based on competitive subcontract bids, that can be provided by a CM in which the firm guarantees that the cost of the work will not exceed a specified amount.

HVAC: Heating, ventilating, and air conditioning.

LCI: Livable City Initiative, City of New Haven (enforces the State Building Code).

Major Projects: The largest and most complex capital projects, usually with budgets above \$4 million.

Massing: The spatial forms created by the major volumes that make up a building, and the relationship of those forms to the building's appearance, proportioning, internal organization, and context.

MEP: Mechanical, electrical, and plumbing.

Mid-Size Projects: Capital projects of moderate size and complexity, usually having budgets above \$200,000 up to \$4 million.

MOU: Memorandum of Understanding, the deliverable produced during the Identification phase for major projects, consisting of a Statement of Need written by the requesting department and a Project Description written by YFC&R.

PD: Preliminary Design, the first of three sub-phases of the Design phase.

Placeholder: An estimate developed prior to any study of the project, based on unit costs derived from databases of comparable projects completed at Yale and at peer institutions.

PM: Project Manager, a professional assigned by YFC&R to coordinate the project, maintain the schedule and budget, direct the services performed by architects and contractors, resolve conflicts, and maintain proper communication among all stakeholders and team members.

PRC: Project Review Committee; has approval authority for projects up to \$200,000 and reviews all other project requests.

Project Budget: Sum of money allocated for a project, including the cost of the contractor plus other costs such as design consultant fees, Yale management fees, operations costs, furnishings and equipment, testing, and a project contingency.

Project Overview: The deliverable at the end of the Identification phase for small projects and less-complex mid-size projects, including the justification and description elements of an MOU but in an abbreviated format.

Punch list: A list of minor deficiencies remaining when construction is determined to be substantially complete and the site is returned back to the control of the University.

RFP: Request for Proposal, a document requesting a proposal for services and associated fees from the respondent that will assist in narrowing down a group of potential service providers to a short list of finalists who may then be invited to interviews.

RFQ: Request for Qualifications, a document requesting a description of the respondent's qualifications that will assist in narrowing down a large group of potential service providers to a smaller list from whom proposals will be solicited via an RFP.

Small Projects: The smallest and least complex capital projects, with budgets of \$200,000 or less.

Stakeholders: All Yale entities having a significant stake in the project, including the requesting department, funding authority, and YFC&R, and sometimes including the cognizant Officer.

TCO: Temporary Certificate of Occupancy, issued by the City of New Haven to permit occupancy before full completion of the construction work if all essential code requirements have been met.

Uniformat: A classification standard for building systems that arranges elements of cost estimates by building function.

VE: Value Engineering (see VM, Value Management).

VM: Value Management, a process of reviewing all aspects of a design to re-examine all assumptions and minimize the life-cycle costs of the project (used interchangeably with Value Engineering).

YFC&R: Yale Facilities Construction & Renovation, the unit responsible for delivering capital projects.

YSM: Yale School of Medicine.

YSM FC&R: Yale School of Medicine Facilities Construction & Renovation.

APPENDIX 2

MEMORANDUM OF UNDERSTANDING FORMAT

The Memorandum of Understanding, prepared at the end of the Identification phase for all major projects and some mid-size projects, is a two-part document that is addressed to the University administrators who are requested to sponsor the project.

The first part, the Statement of Need, is written by the requesting department. The second part, the Project Description, is prepared by YFC&R. This information forms the basis for the project requests that initiate Planning, Design, and Construction.

STATEMENT OF NEED

The Statement of Need addresses the aspects of the project that are within the purview of the requesting department. Enough detail should be provided to justify a commitment of the University's resources. It should include the following sections:

INTENT: Summarize the desired goals and the proposed improvement in one or two paragraphs. What is to be accomplished with this project?

JUSTIFICATION: Describe the factors that justify the investment of University resources in this project. How does it align with the University's mission, strategic goals, or academic plans?

IMPACT OF DEFERRAL: Describe the consequences if the project does not proceed at this time.

BACKGROUND: Describe the relevant history of the program. Include other pertinent factors, such as changes in the research or business environment outside of the University.

PROGRAM ELEMENTS: Describe the program elements that are desired and the characteristics of each, and note whether each is essential or optional.

ALTERNATIVES: Describe potentially feasible alternatives that may fulfill the desired goals.

PROJECT DESCRIPTION

The Project Description addresses the aspects of the project for which expertise is furnished by YFC&R, and includes the following sections:

SCOPE OPTIONS: Describe several feasible alternative scopes of work that will accomplish all of the essential program elements and varying numbers of optional elements. Each alternative should also address the following:

- **CONSTRAINTS:** List any factors that may preclude full accomplishment of the project goals for the option described, or will significantly increase the cost of the option.
- **EXCLUSIONS:** List scope elements that might be expected to be included in the project but will not be addressed under that option.
- **RELEASED SPACE:** Identify space that will be vacated after the project is complete.

ENABLING PROJECTS: List all related projects that will be necessary to fully accomplish the goals described in the Statement of Need. Provide a brief description of scope options, placeholder estimates, and tentative schedules for each such project.

PLACEHOLDER ESTIMATES: Provide a risk-adjusted placeholder estimate for each option evaluated. All placeholder estimates should be based on unit cost data from comparable projects with appropriate adjustments applied, and should also include amounts for undefined costs as well as contingencies. Supporting data should be attached. All budget figures should be expressed in real dollars.

TENTATIVE SCHEDULES: Provide a schedule of time required to plan, design, and construct the proposed improvements for each option evaluated, including contingency time for undefined tasks.

**APPENDIX 3
PROJECT REQUEST FORMAT**

Project Name

Project No: *Number*

Building Name

For consideration by *Approval Committee* on *Date*

REQUEST

Increase the prior approval of *Dollar Amount of Prior Approval* by an amount of *Dollar Amount of Increase* for a new total of *Dollar Amount of Requested Total* to complete *Phase* for *Project Name*, funded by *Funding Source*.

PROJECT INTENT

State the intent and justification of the project in a sentence or short paragraph.

PROJECT SCOPE

Project Size: *Gross Area GSF* *Assignable Area ASF*

Project Scope Change, Current Request:

- *Provide a short bullet list of major scope items.*

Previously Approved Project Scope:

- *Provide a short bullet list of major scope items.*
-
-
-

Options/Alternates: *List the identified options (for Planning phase authorization) or anticipated major bid alternates (for Design phase authorization).*

Exclusions: *List the major exclusions from the project scope.*

FINANCIAL

<u>Current Request</u>		<u>Anticipated Total Cost (ATC)</u>	
Previous Approvals	\$	ATC on Previous Approval	\$
Requested Increase	+ \$ _____	Current ATC	- \$ _____
Requested Total	\$	ATC Variance	\$

Cause of Change in ATC: *State reason for variance.*

<u>Unit Costs (based on current ATC)</u>		<u>Capital Budget</u>	
Construction Cost per GSF	\$	Current Year Amount	\$
Project Cost per GSF	\$	Budgeted Total Cost (BTC)	\$
Project Cost per ASF	\$	Capital Plan Variance (BTC - ATC)	\$

SCHEDULE

Planning: *m/yy-m/yy* Design & Bidding: *m/yy-m/yy* Construction: *m/yy-m/yy*

Schedule Issues: *List pertinent schedule issues, if any, including impact of deferral.*

APPENDIX 4 PROJECT TEAM LEADER ASSIGNMENTS

COMPLEX MAJOR PROJECTS

Phase	Sub-Phase	Team Leaders	
IDENTIFICATION PHASE		Project Planner	
PLANNING PHASE	Feasibility		
	Programming		
DESIGN PHASE	Preliminary Design	Project Manager	Program Manager
	Design Development		
	Construction Documents		
CONSTRUCTION PHASE			
CLOSEOUT PHASE			

OTHER MAJOR PROJECTS

Phase	Sub-Phase	Team Leaders	
IDENTIFICATION PHASE		Project Planner	
PLANNING PHASE	Feasibility		
	Programming		
DESIGN PHASE	Preliminary Design	Project Manager	
	Design Development		
	Construction Documents		
CONSTRUCTION PHASE			
CLOSEOUT PHASE			

MID-SIZE PROJECTS

Phase	Sub-Phase	Team Leaders	
IDENTIFICATION PHASE		Project Planner	
PLANNING PHASE	Formulation		
DESIGN PHASE	Sub-phases as required	Project Manager	
CONSTRUCTION PHASE			
CLOSEOUT PHASE			

SMALL PROJECTS

Phase	Sub-Phase	Team Leaders	
IDENTIFICATION PHASE		Project Planner as required	
PLANNING PHASE	Formulation as required		
DESIGN PHASE		Project Manager	
CONSTRUCTION PHASE			
CLOSEOUT PHASE			

APPENDIX 5
PROJECT SCOPE CHANGE REQUEST

Project Name

Project No: *Number*

SCOPE CHANGE

- *Provide a bullet list of scope elements being added, deleted, or modified.*
- *Include changes in GSF or ASF if applicable.*
-

JUSTIFICATION FOR CHANGE

- *Describe the reasons for proposing the change.*
-

BUDGET IMPACT

	<u>Budget Amounts</u>	<u>Project Cost per GSF</u>
Previous Project Budget	\$ _____	\$ _____
Increase/Decrease Due to this Change	\$ _____	\$ _____
New Project Budget	\$ _____	\$ _____

Note: Budget increases will require submission of a new project request to the applicable authorizing body.

SCHEDULE IMPACT

	<u>Current Phase</u>	<u>Occupancy Date</u>
Previous End Date	<i>Date</i>	<i>Date</i>
Increase/Decrease Due to this Change (days)	0	0
New End Date	<i>Date</i>	<i>Date</i>

APPROVAL

REQUESTING DEPT:

YFC&R:

FUNDING AUTHORITY:

Name
Title
Date: _____

Name
Title
Date: _____

Name
Title
Date: _____

Approvers for Major Projects:

AVP for Construction & Renovation

Provost

Approvers for Mid-Size Projects:

AVP for Construction & Renovation

Budget Allocation Authority (see p 10)

Approvers for Small Projects:

*Director, Small Projects or
Director, YSM FC&R*

Budget Allocation Authority (see p 10)



*The Anlyan Center at the Yale School of Medicine, completed in 2003
(Venturi, Scott Brown & Associates/Payette Associates, architects; photo by Matt Wargo)*

*Back cover: A living room within a student suite in Vanderbilt Hall, following
its 2002–03 renovation (original design by Charles C. Haight, renovation by
Herbert S. Newman & Partners; photo by Woodruff & Brown)*

