

## 2.0 PLANNING & DEVELOPMENT GUIDELINES

### 2.1 INTRODUCTION

- 2.1.1 The consultant shall use the planning information in this section to plan and develop University facilities.
- 2.1.2 The criteria represent minimum levels of performance, quality, and/or standardization that are sometimes different from those accepted in private and commercial industry. This is in recognition that these facilities must be cost effective over the life of the facility, while supporting the academic and research missions of the University.
- 2.1.3 The planning and development criteria compliment the Design Guidelines. The consultants shall familiarize themselves and be responsible for implementing all criteria and guidelines.
- 2.1.4 The consultant shall plan facilities with consideration given to serviceability and maintainability of these facilities.

## 2.2 GENERAL

2.2.1 Design submittals shall, as a minimum includes items in this section and Table 1 below.

2.2.2 The consultant shall

2.2.2.1 Develop and economically justify designs within the prescribed budget and space allocations.

Design to obtain the lowest life-cycle cost consistent with a high quality facility.

Design to harmonize architecturally with the buildings upon the University campus and/or as instructed by the PM.

cooperate mutually with the owner and with any other such consultants employed by the owner.

2.2.3 Provide an experienced Architectural or Engineering Project Manager capable of effectively coordinating a multi-disciplined team and with experience in the communication and administrative skills necessary for that role. The same manager will be used for both design and construction unless approved by the University.

2.2.4 Design to the University's Codes and Standards as listed in section 2.4 of this manual.

2.2.5 Make all correspondence between the University and the consultant during the design phase through the PM.

2.2.6 Make project design presentations to the Board of Curators for projects as required by the PM. See section 1.1.1.

2.2.7 Identify any construction alternates included in the design as additional to base bid design. The University typically includes construction alternatives to protect the budget.

Table 1 Minimum Design Review Submittal Requirements

	Section Number Reference	Description	S D	D D	C D
General	2.7.1	Schematic Design Brochure	x		
	2.3; 2.7.2.5; 2.8.1.7	Energy Report		x	x
	2.7.2.2,	Quantative Cost Estimate	x		
	2.8.1.7	Design Summary		x	
	2.7.2.3	Description of Construction	x		
	2.8.1.7; 2.9.4	Specifications		x	x
	2.8.1.8	Detail Cost Estimate		x	x
	2.7.2.4; 2.7.1.9; 2.9.2.3	Construction Schedule	x	x	x
Architectural	2.9.3.21	Demolition		x	x
	2.5; 2.7.2.1; 2.8.1.2	Floor Plans	x	x	x
	2.8.1.3; 2.9.3.18	Roof Plan and System	x	x	x
	2.7.2.1; 2.8.1.4	Building Sections & Elevations	x	x	x
	2.8.1.2.5	Fixtures Locations		x	x
	2.8.1.2.6	Built-in Features		x	x
	2.8.1.5	Interior Finish Schedule		x	x
	2.4.4	Building Accessibility (ADA)	x	x	
	2.6; 2.7.1.4; 2.8.1.7.2	Area Tabulation	x	x	x
	2.8.1.7.2	Code Summary	x	x	x
Civil	2.8; 2.9	Demolition/Excavation		x	x
	2.7.2.1; 2.8.1.1; 2.8.2.3	Site Plan	x	x	x
	2.8.1.1; 2.8.2.3	Existing Structures		x	x
	2.8.1.1; 2.8.2.3	Existing Topography	x	x	x
	2.8.1.1; 2.8.2.3	Final Topography		x	x
	2.8.1.1	Drainage Method		x	x
	2.8.1.1; 2.8.2.3	Exterior Elements		x	x
	2.8.1.1	Grade Elevations	x	x	x
	2.4.4; 2.8.1.1	Site Accessibility (ADA)	x	x	x
	2.8.1.1	Walkways, Drives, etc.	x	x	x
	2.8.1.1; 2.8.2.2, 2.8.2.3	Existing Underground Utilities	x	x	x
	2.8.1.1; 2.8.2.3	New Underground Utilities		x	x
	2.8.1.1; 2.8.2.3	Staging Area		x	x
	2.8.7.2	Design Calculations		x	

	Section Number Reference	Description	S D	D D	C D
Structural	2.8.2.4; 2.9.3.19	Design Loading	x	x	x
	2.8.2.4; 2.9.3.19	Grid Reference		x	x
	2.8.2.4; 2.9.3.19	Junctions at Floor, Roof, Wall		x	x
	2.8.2.4; 2.9.3.19	Construction & Expansion Joints			x
	2.8.2.4; 2.9.3.19	Special Jacking & Lifting		x	x
	2.8.2.4; 2.9.3.19	Concrete Protective Cover			x
	2.8.2.4; 2.9.3.19	Anchor Bolts			x
	2.8.2.4; 2.9.3.19	Special Connections Details			x
	2.8.2.4; 2.9.3.19	Shoring			x
	2.8.2.4; 2.9.3.19	Construction Sequence		x	x
	2.8.2.4; 2.9.3.19	Bolt Torque			x
	2.8.2.4; 2.9.3.19	Connection Capacity			x
	2.8.2.4; 2.9.3.19	Rebar Type & Location			x
	2.8.7.2	Design Calculations		x	
Mechanical	2.8.2.5; 2.9.3.21	Demolition		x	x
	2.8.2.5; 2.9.3.20	Pipe Routing & Location		x	x
	2.8.2.5; 2.9.3.20	Water, Sanitary, Gas Isometrics		x	x
	2.8.2.5; 2.9.3.20	Ductwork Routing & Location		x	x
	2.8.2.5; 2.9.3.20	Equipment Location		x	x
	2.8.2.5; 2.9.3.20	Equipment Schedules		x	x
	2.8.2.5; 2.9.3.20	Plumbing Fixtures		x	x
	2.8.2.5; 2.9.3.20	Air Handling & Conditioning Units			x
	2.8.2.5; 2.9.3.20	Boilers, Chillers, Cooling Towers			x
	2.8.2.5; 2.9.3.20	Heat Exchangers, Pumps, Fans			x
	2.8.2.5; 2.9.3.20	Steam Traps, VAV Boxes, Tanks			x
	2.8.2.5; 2.9.3.20	Air Devices & Fume Hoods			x
	2.8.2.5; 2.9.3.20	Airflow Diagrams w/rates			x
	2.8.2.5; 2.9.3.20	Waterflow Diagrams w/rates			x
	2.8.2.5; 2.9.3.20	Control Diagrams w/Sequence		x	x
	2.8.7.2	Design Calculations		x	

	Section Number Reference	Description	S D	D D	C D
Electrical	2.8.2.6; 2.9.3.21	Demolition		x	x
	2.8.2.6	Power & Control Wiring			x
	2.8.2.6	Lighting			x
	2.8.2.6	layout and wiring		x	x
	2.8.2.6; 2.9.3.20	fixture schedule and type			x
	2.8.2.6	details			x
	2.8.2.6	Distribution Diagrams		x	x
	2.8.2.6	primary service		x	x
	2.8.2.6	secondary service			x
	2.8.2.6; 2.9.3.20	Utilization Schedule		x	x
	2.8.2.6; 2.9.3.20	Substation & motor control center			x
	2.8.2.6; 2.9.3.20	lighting and power panels			x
	2.8.2.6; 2.9.3.20	telephone panels			x
	2.8.7.2	Design Calculations		x	

## 2.3 ENERGY

- 2.3.1 The energy conservation criteria contained in this section shall be followed by the consultant.
- 2.3.2 Facility designs shall include energy conservation features that can be economically justified on life cycle cost criteria. Principal considerations are first cost, operational cost, maintenance cost, climatic conditions, site configuration, building orientation, building functional arrangement, building envelope, and mechanical systems as applicable to minimize the use of fossil fuels.
- 2.3.3 Develop an energy budget for new building, building additions, and renovations based on the following:
  - 1. Building function and classification, and information received from the PM.
  - 2. Latest edition of ASHRAE Standard 90
- 2.3.4 Building envelope and mechanical and electrical systems shall meet the minimum requirements of ASHRAE Standard 90.
  - 1. The consultant shall document compliance at the conclusion of schematic design, design development, and contract document phases.
  - 2. If the design does not achieve compliance, then redesign is required.
- 2.3.5 The consultant shall develop an energy conservation report for each new building, building addition, or renovation (see section II.G for format and requirements):
  - 1. When total energy consumption is expected to exceed the 500 million BTU per year or the building is larger than 10,000 gross square feet
  - 2. Included as a part of the schematic design, where final selection of energy conservation features is made
  - 3. Updated during the design development and contract document phases
  - 4. For new buildings, additions, or renovations of existing buildings where total energy consumption is less than 500 million BTU per year, An energy conservation report is not required unless requested by the Project Manager (PM)
- 1. 5. An energy analysis comparing at least three (3) different alternatives is required

2.3.7 Use of computer programs and other methods for energy analysis is required with the following parameters:

1. Hour-by-hour simulations and energy analyses

- (1) Heated and cooled buildings
- (2) Heated buildings equal to or greater than 20,000 gross square feet
- (3) The preferred computer energy analysis programs are TRACE, CARRIER E20-II HAP. BLAST and DOE II may also be used
- (4) Use of any other computer program for energy analysis requires approval by the PM

2. Modified bin method

- (1) Heated buildings less than 20,000 gross square feet

2.3.8 Specific criteria listed in this manual supersede both BOCA and ASHRAE requirements

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#### 2.4.1 BUILDING CODES AND STANDARDS FOR UNIVERSITY FACILITIES

#### 2.4.2 Basic Building Code Policy

2.4.2.1 All University facilities shall comply with the International Code Council [ICC] Codes.

2.4.2.2 Codes and standards required by accreditation agencies, such as the Joint Commission for Accreditation of Hospitals (JCAHO) will also be used unless the ICC requirements are more stringent.

2.4.2.3 In the event that special design features and/or construction systems are not covered in the ICC codes, the applicable edition of the National Fire Protection Association [NFPA] family of standards and/or the NFPA 101 Life Safety Code shall be used.

2.4.2.4 **Codes** that apply to University design & construction.

1. ICC International Building Code and reference standards
2. ICC International Fire Code
3. ICC International Plumbing Code
4. ICC International Mechanical Code
5. NFPA 70 National Electric Code (NEC)
6. Americans with Disabilities Act Accessibility Guidelines (ADAAG) and American National Standards Institute (ANSI) 117.1 Guidelines for Accessible & Useable Buildings & Facilities.
7. NFPA 101 Life Safety Code (as noted in 2.4.1 above)
8. American Society of Mechanical Engineers (ASME) Safety Code of Elevators and Escalators A17.1 (1996) and other codes as adopted by The Missouri Division of Fire Safety, Elevator Safety Unit.

2.4.2.5 **Standards** that apply to University design & construction.

1. National Fire Protection Association (NFPA) standards
2. Missouri Standard Specification for Highway Construction, Missouri State Highway Commission
3. American Concrete Institute (ACI)
4. American National Standards Institute (ANSI)
5. American Refrigeration Institute (ARI)
6. American Society for Testing and Materials (ASTM)
7. Underwriter's Laboratories, Inc. (UL), Federal Specifications
8. National Electrical Manufacturers Association (NEMA)
9. Williams Steiger Occupational Safety and Health Act of 1970 (OSHA)
10. American Society of Heating Refrigeration & Air Conditioning Engineers (ASHRAE)



**2.4.2.6 Automatic Fire Suppression Systems.** All new buildings will be designed with automatic fire suppression systems throughout. Exceptions to this requirement may be granted by the UM Director of Facilities Planning & Development for facilities such as garages, temporary facilities, etc. Work to existing facilities will be designed to meet code. However, it is highly recommended to provide automatic fire suppression systems as a part of major renovation projects.

**2.4.2.7 The Authority Having Jurisdiction [AHJ]** as referred to in the building codes is the UM Director of Facilities Planning & Development, University of Missouri System. All requests for the AHJ will be made through the Project Manager to the UM Director of Facilities Planning & Development.

#### 2.4.3 Design Procedures

**2.4.3.1** The University's general policy is not to deviate from the adopted codes. Consultant must certify in writing on the contract document that the project has been designed in compliance with the University codes, see section 3.0 Contract Documents for additional information.

**2.4.3.2** The Consultant shall perform a project code analysis before the completion of design development, but preferably during the schematic design phase. The Consultant shall reference applicable codes and editions and note the occupancy, construction type, egress conditions, and other information necessary. The Consultant is encouraged to use drawings to illustrate conditions. The code analysis will note any potential nonconforming construction. The Consultant may employ a Code Consultant to augment their design team. Failure of design work to meet the established University basic building code will result in redesign at no cost to the Owner.

**2.4.3.3** The University may employ an Independent Code Consultant to review designs for code compliance. This does not relieve the Consultant from responsibility to design to code. On major projects, a follow-up code analysis will be performed on design development and contract documents submittals.

#### 2.4.4 Variance Procedures

**2.4.4.1** Consultant must request approval of any code variances in writing through the University Project Manager (PM) to the UM Director of Facilities Planning & Development. The University AHJ will issue a written ruling on all requests. A code variance request must include:

1. An explanation of the situation, the applicable codes, and the reason why code compliance is not possible. Copies of referenced codes, informational sketches, drawings, calculations, and other supporting material should be attached to the request.

2. A discussion and recommendation related to the impact on building use and occupant safety.
3. A discussion and recommendation of equivalent systems available and cost implications of each.

#### 2.4.5 Code Change Administration

2.4.5.1 Changes to the ICC Code will be implemented by the January 1 following issuance. Changes to the NFPA, and other listed standards, will be adopted similarly as the ICC code. Revisions to ADAAG will be implemented immediately.

2.4.5.2 Projects with Design Development approval will not be required to incorporate subsequent code revisions, with the following exceptions:

1. Projects where construction does not begin within 18 months of approval of design development documents or within 12 months of approval of final construction documents will be revised to incorporate subsequent code revisions.
2. Changes, which significantly improve the access, health, and safety of building occupants, will be incorporated into all projects.

2.4.5.3 The University will notify Consultants engaged in University design work of any code revisions in writing. The Consultant shall promptly advise the University Project Manager of any implications of a code revision to the design work. Any resulting abandoned work resulting from a University code revision may be eligible as an additional service under the Consultant's agreement.

## 2.5 STANDARD FLOOR AND ROOM NUMBERING

### 2.5.1 General

1. At MU, the Office of Space Planning and Management will provide all newly assigned room numbers. Provide MU with an electronic copy of your plan drawings.
2. At UMKC, UMSL, and MUS&T, the consultant in accordance with the following procedure will assign room numbers. At the initial design phase and throughout the design and construction phases, room numbers will comply with these guidelines.
3. The definitions used here facilitate general understanding of floor and room and do not always conform to NFPA or ICC code definition.
4. Include numbers in the project drawings. Room numbers must be shown correctly on drawings before advertisement for bids.

### 2.5.2 Floor Designators

1. First floor - lowest floor having a grade level entrance or exit.
2. If there is no floor at grade level, the first floor above grade is the first floor.
3. The floor immediately below the first floor is the basement floor.
4. Floors below the basement are to be called the first sub-basement, second sub-basement, etc. as needed.
5. Floors above the first floor are to be called second floor, third floor, etc., as needed.

### 2.5.3 Numerical Designation of Rooms by Floor

1. Sub-basement rooms - label by alpha indicators only.
2. Basement rooms - label with numbers 0-99.
3. First floor rooms - label with numbers 100-199.
4. Second floor rooms - label with numbers 200-299.
5. Third floor rooms - label with numbers 300-399, etc., as needed.

### 2.5.4 Alpha Prefixes and Suffixes for Numeric Room Designators

1. For large buildings with over 100 rooms per floor, reference to magnetic north and, where appropriate, to building north, must be shown on drawings. Assign appropriate alpha character N, E, W, S, as prefix to numeric indicator. This allows for 400 unique assignable alphanumeric prefix.
2. For remodeling or for very large buildings with over 400 rooms per floor, the 26 letters of the alphabet may be used as suffix to numeric indicators. Conventions for application are as follows:
  - (1) Wall or doorway will distinguish between new room and existing parent room.
  - (2) No alpha suffix derived room area will be created that is not in contact physically with existing parent or alpha suffix derived parent room.
  - (3) Rooms with internally derived alpha suffix rooms inside will be marked with word "complex" after parent room number.
  - (4) Rooms will be marked with tactile letter signs at 5 foot height located on wall adjacent to door on opposite side from hinge, as stated in ANSI part A117.1 (1971), in order to coincide with section 504 of the Rehabilitation Act of 1973 specifications.
  - (5) Certain types of rooms will be marked as to function as well as room number such as Rest Rooms and Mechanical Rooms.
  - (6) Assigned alpha numeric system will provide for 10,800 unique alpha numeric indicators per floor and will require designators of not more than six elements (1 alpha, 4 numeric, 1 alpha) even in buildings over 10 floors.

#### 2.5.5 Room Area Definition

1. All areas in every building must follow this convention and be marked accordingly. Any area separated from an adjacent area by a full floor to ceiling partition and/or has a highly differentiated function from that adjacent area will be labeled as a discrete entity. This will be characterized by a building unique numeric or alphanumeric code to indicate its uniqueness.
2. In the case of low walls, see-through partitions, wire cages, or no walls at all, the above convention implies the possible application of unique designators within larger open areas. (Example: stack and reading areas within Ellis Library.)

#### 2.5.6 Numbering Rooms

1. If floor has 100 or less rooms per floor:
  - (1) Starting from an entrance, apply numeric designators in clockwise (counter clockwise-MUS&T) direction to each individual room area.

- (2) Where hallways are present, in some cases, use of even/odd designators may be used to further differentiate sides of hallways and eliminate confusion
- (3) Where intermediate hallways or isolated rooms are encountered, numbers are to be assigned in the clockwise (counter clockwise-MUS&T) sequence at the first entrance to the hallway or isolated area.

2. If floor has more than 100 rooms per floor:

- (1) Follow the above convention after having used alpha prefix designators in accordance with magnetic orientation to building.
- (2) Use alpha suffix designators if more than 400 rooms per floor or if remodeling of present rooms creates new room areas to be designated use of the clockwise (counter clockwise-MUS&T) and odd/even conventions described above.
- (3) Rooms not accessible from a corridor or common area will be numbered by the use of an alpha suffix. The prefix and the number will be the same as the room through which common access is available. For example, rooms accessible through room E101 will be numbered E101A, E101B, etc.
- (4) Rooms not accessible from a corridor or common area and are at a different level than the room which provides access will be called mezzanines. Mezzanines will be numbered described above.
- (5) If a room is subdivided into more than one room and the new rooms created are accessible from the corridor or common areas, and if room numbers in the appropriate sequence are not available for use, the original room number will be retained and numerical suffixes (-1, -2, -3, etc.) will be used for each new room created.
- (6) For remodeling projects requiring new room numbers, the starting point for numbering will be in vertical alignment with the starting point of numbering on adjacent floor(s).
- (7) Rooms spanning more than one floor will be numbered according to the main level entrance to the room if one entrance is on the main level. If no entrance is on the main level, the room will be numbered according to the entrance closest to the main level.
- (8) The main corridor will be numbered 100, 200, 300, etc. on the first, second, third, etc. floors. Other corridors, stairwells, vestibules, and elevators will be numbered using the number of the main corridor with the addition of an alpha suffix, applied in a clockwise fashion.
- (9) The consultant shall obtain written approval of the room numbering at Design Development and notify the Project Manager of any desired changes as they occur prior to issuance of Construction Documents.

## 2.6 BUILDING AREAS DEFINITIONS

### 2.6.1 Gross Area

1. Gross Area is the sum of the floor areas of the building included within the outside faces of exterior walls for all stories or areas having floor surfaces. Gross area is gross square feet (GSF).
2. Calculate gross area by measuring from the outside face of exterior walls, disregarding cornices, pilasters, buttresses, etc., which extend beyond the wall face. Gross area includes basements (except unexcavated portions), attics, garages, enclosed porches, penthouses, mechanical equipment floors, lobbies, mezzanines, balconies (inside or outside) utilized for operational functions, and corridors, provided they are within the outside face lines of the building. Stairways, elevator shafts, mechanical service shafts, and ducts count as gross area on each floor through which the shaft passes. Exclude open courts and light wells, or portions of upper floors eliminated by rooms or lobbies rising above single-floor ceiling height.

### 2.6.2 Net Assignable Area

1. Net Assignable Area is the sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant, including every type of space functionally usable by an occupant (except spaces defined as custodial, circulation, mechanical, and restroom areas). Net assignable area is assignable square feet (ASF).
2. Calculate assignable area by measuring from the inside finishes of surfaces that form the boundaries of the designated areas. Do not include unusable areas having less than 6'6" clear headroom. Include space subdivisions for offices, classrooms, laboratories, seminar and conference rooms, libraries, file rooms, storage rooms, etc., including those for special purposes (e.g., auditoriums, cafeterias, TV studios, faculty and student locker and shower rooms, maintenance and repair shops, garages), which can be put to useful purposes in accomplishment of the institution's mission. Deductions are not made for columns and projections necessary to the building.

### 2.6.3 Nonassignable Area

1. Nonassignable area is the building area that is not available for assignment to building occupants but is necessary for the general operation of the building. By definition, nonassignable area consists exclusively of the following: circulation, custodial, mechanical, and restroom areas. Calculate nonassignable area the same as assignable area.

## 2.7 SCHEMATIC DESIGN PHASE

## 2.7.1 Board of Curators Report

For major construction projects, the PM will direct the consultant to produce and present a Schematic Design Report to the University's Board of Curators. The report is distributed to Board members, University administrators, and other officials and may be used in conjunction with development activities by the University. It is imperative this document be succinct, accurate, and of professional quality. The following outline should be used in developing the report along with any supplementary directions given by the PM.

1. Provide a one to two page Executive Summary summarizing the size and scope of the project, estimated costs, and general programmatic information identifying programs and activities directly benefiting the University.
2. Provide background information on the history of the project; the programs benefitting from the project; and problems it will solve, e.g. space shortages, obsolete facilities, future growth. Describe other parameters affecting definition of the problem, such as master planning issues, existing structural limitations, and site conditions. Typical subheadings might include Project Background, Space Program, Planning Issues, and Design Objectives.
3. When the project is a Master Plan or is part of a multi-phase development, include a summary of the planning associated with the total project. The summary should describe how the project fits into the overall objectives and parameters of the master plan, and may include conceptual plans and other available drawings, and projected costs.
4. Include a table of assignable square footage that clearly illustrates the proposed assignments of space and use the column headings shown below.

Department/ <u>Type of Space</u>	Current <u>Assignments</u> *	Proposed Assignments		
		<u>Renovated</u>	<u>New</u>	<u>Total</u>

\* If available or applicable

5. Prepare a presentation rendering at the direction of the PM for university approval.
6. Provide a concise presentation of the proposed Schematic Design solution. The narrative should focus on important features of the design addressing the project statement outlined in the introduction. Include a general description of proposed materials and building systems. Also explain how the design accommodates future

modifications (flexibility) and expansion (expandability). Typical subheadings might include Site Plan, Interior Design/Building Organization, Architectural Solution, Exterior Design/Building Appearance, and Future Expansion.

7. Schematic design drawings (photographically reduced) should include site plan(s), floor plans, primary elevations, at least one primary building section, and any other drawings necessary to adequately convey important features of the proposed building.
8. Use the following Project Cost Estimate with approved costs from the PM.

Construction Cost (Approved Estimate)	\$
New Construction (if applicable)	\$
Renovation (if applicable)	\$
Site Development (if applicable)	\$
Construction Contingency (By Owner)	\$
Other Construction Costs (By Owner)	\$
Consultant Fees (By Owner)	\$
Other Consultant Costs (By Owner)	\$
Project Management (By Owner)	\$
Other Project Costs (By Owner)	\$
 Total Project Costs	 \$
 Construction Cost Per GSF	 \$/GSF

9. Use the following project schedule outline of project schedule milestones:

Consultant Selection	(date)
Schematic Design Approval	(date)
Contract Award (if known)	(date)
Construction Complete (if known)	(date)

For projects with unknown construction awards and completes (usually due to funding), indicate the construction period in months.

10. Include an Outline Specifications using the following outline as a guide. This is a brief summary of building systems and materials proposed in the schematic design. Allow no more than 2 pages. Typical headings are: Sitework, Structure, Building Shell, Finishes, Furnishings and Equipment, Conveying Systems, Mechanical Systems, Life safety Systems, Electrical Systems, Building Controls, Telecommunications, Information Technology



### 2.7.2 Schematic Design Submittal

1. Schematic design drawings must include site plans, floor plans, roof plan, primary elevations, at least one primary building section, and any other drawings necessary to adequately convey important features of the proposed building. Include a code summary on the schematic plans.
2. Project Cost Estimate
  - 2.1 Submit a written quantitative estimate of construction developed from complete schematic plans and outline specifications.
  - 2.2 Break down the construction estimate into the major architectural, civil, structural, mechanical, and electrical building components by labor and material for major divisions of work.
  - 2.3 Use the format shown in the appendix as a guideline.
  - 2.4 Include and identify your design contingency.
  - 2.5 Provide a life cycle cost analysis of the proposed roofing system.
  - 2.6 For projects at MU, the consultant should exclude from the construction cost estimate the following construction related services and procedures which are performed directly by MU Campus Facilities: asbestos testing, energy management equipment, meters and transformers, fire extinguishers, HVAC testing and balancing, keys and locks, landscaping and signage. The PM will develop the budget for these items and will review the scope of work performed by MU Campus Facilities with the consultant.
3. Description of construction. Provide a description of:
  - 3.1 Construction, i.e., structural system, wall system, roof design, waterproofing, exterior, and interior finishes, etc.
  - 3.2 Plumbing, air conditioning, heating and ventilating systems, including controls, ducts, filtration, and piping. Include appropriate code references to be followed in design.
  - 3.3 Electrical services, including voltage, number of feeders, and whether feeders are overhead or underground. Provide a specific description of items to be served by emergency power and describe consideration for special areas.
  - 3.4 Fire protection system required for building occupancy.
4. Provide estimate for construction period and lead time for special items.
5. Energy Report: furnish an energy consumption report consisting of calculations (including any computer printouts) and a written summary of the results and clearly indicate assumptions. Include the following as a minimum.
  - 5.1 Identification of analysis methods: include loads and building systems analysis.

- 5.2 Building energy consumption
- 5.3 Energy budget determination
- 5.4 Methodology of life cycle costing analysis.
- 5.5 Description of major energy conservation features selected, such as building envelope U-values (or R-values), type of fenestration and percent of gross wall area, type of air handling system, reheat systems, automatic system control features, lighting levels and controls, etc.
- 5.6 Estimates of building energy consumption (see below for energy conversion values) is subdivided as follows:
  - 1. Energy consumption per month by energy type. Including maximum demand per month
  - 2. Total monthly and annual energy consumption (BTUs)
  - 3. Annual energy consumption (BTUs) per building system, i.e., lighting, HVAC, hot water, equipment, etc.
  - 4. Annual energy consumption per square foot of building space (BTU/GSF/year)
  - 5. Energy conversion values, from 10 CFR Part 436 are:

Electricity	3,412 BTU/KWHr
Fuel Oil (#2)	137,000 BTU/gallon
Natural Gas	1,030,000 BTU/1000 cubic feet
Liquefied Petroleum Gas (LPG) propane	21,560 BTU/pound
Coal	24,500,000 BTU/short ton
Steam (80% boiler and 15% line loss)	1,390 BTU/pound
  - 6. Discuss energy metering: include types of metering and compatibility with existing or projected energy monitoring and control systems (EMCS).

## 2.8 DESIGN DEVELOPMENT PHASE

### 2.8.1 General Requirements

#### 1.0 Site Plan:

Overall dimensions of the proposed building(s) or work area including alternatives. Indicate reference to a benchmark and baseline.

Location and extent of existing structures on the site within 300 feet measured from the exterior walls of the proposed building. Identify structures and streets by proper names.

Existing and proposed contours.

Method of general drainage of the site as affected by the proposed building.

Indication of exterior elements; e.g., outdoor facilities, streets, service drives, parking areas, disabled access, paved areas, covered walks, landscape development, stairs, pools, retaining walls, terraces, etc. Include any elements to be demolished. At MU, final landscape design is done by the campus with input from the consultant.

Section(s) through site, to explain changes in level in the proposed building as related to the site.

Underground campus utilities and structures.

Small-scale campus map indicating project location on title sheet.

Appropriate scale for project location, staging, limits, and parking areas.

#### 2.0 Floor Plans:

2.1 Locations, sizes, and space numbers of programmed spaces and other required gross areas, including corridors (width), stairs, toilets, janitors' closets, mechanical spaces, storage rooms, etc.

2.2 Location of doors and windows. Indicate door swings. Indicate fire separation.

2.3 Overall dimensions of each major area of the building(s).

2.4 Provisions for making facilities accessible to persons with disabilities.

2.5 Location of plumbing fixtures such as lavatories, floor drains, water closets, urinals, service sinks, drinking fountains, fire hose cabinets, fire extinguishers, and sprinkler systems.

2.6 Indicate principal built-in features such as fixed auditorium seats, kitchen equipment, display cases, counters, shelves, lockers, etc.

2.7 Indicate extent of any demolition work.

2.8 Use the scale listed later in these requirements.

### 3.0 Roof Plans and Roof Details

- 3.1 A roof plan and detail of existing conditions (reroof) or other components and penetrations (new).
- 3.2 Photographs of overall roof condition and show locations of inspection openings (reroof project only).
- 3.3 An outline of the method of reroofing.
- 3.4 A narrative report discussing major design features and options (reroof).
- 3.5 Identification of existing components and methods of attachment.
- 3.6 Simple sketches showing method of detailing new system.
- 3.7 Consultant must submit to the Project Manager (PM) calculations used to determine control and expansion joint width and spacing, including long bands of windows.

### 4.0 Elevations and Sections

- 4.1 Exterior elevations for the building must show windows, doors, window vents, stairs, platforms, retaining walls, etc. Indicate grades, paved areas, etc.
- 4.2 Indicate floor heights and windowsill heights.
- 4.3 Include longitudinal and transverse sections for each major area, indicating floor elevations, finish exterior grades, ceiling heights, pipe tunnels, unexcavated areas, basement and areaways, rooflines, and parapets.
- 4.4 Include small-scale plan or diagram to indicate section lines for each elevation and section (see scale requirements).
- 4.5 Include larger scale (1/4" = 1'0") indication of special design features with notes related to materials and design.
- 4.6 Various floor and grade elevations including those for interior and exterior stairways, walls, terraces, walks, etc.

### 5.0 Interior Planning

- 5.1 The following space types must be thoroughly dimensioned to illustrate details clearly:
  - (a) Classrooms and lecture halls
  - (b) Kitchens and related service areas
  - (c) Laboratories and any other programmed spaces
  - (d) Toilet and locker rooms
- 5.2 Include an interior finish schedule that indicates, in general terms, floor, wall, and ceiling finishes together with special items of finish.
- 5.3 Indicate location of moveable items of furniture and equipment listed in the space description sheets. Differentiate from built-in furniture and equipment.
- 5.4 See scale requirements later in this section.

- 6.0 Area Tabulation - Tabulate net assignable square foot (NASF) and overall gross square foot (GSF) areas. Show space-by-space comparison of preliminary assignable area with program assignable areas. Tabulate by floor and include totals for the building.
- 7.0 Outline Specifications and Design Summary
  - 7.1 Specifications must be in outline form using CSI format.
  - 7.2 Provide a design summary documentation in an indexed report format with all assumptions and references stated. Include:
    - (a) Architectural design calculations (including occupancy classifications, type of construction, fire resistive ratings, exiting calculations, allowable building height and area, toilet fixture calculations and any unusual provisions or exceptions applicable to the project)
    - (b) Structural design calculations (including live load, roof load, snow load, wind load, lateral soils load, and seismic load calculations. Also include any unusual provisions, special loads, or exceptions applicable to the project)
    - (c) Mechanical design calculations (including building loadings, equipment sizing, steam pipe stress analysis, annual energy usage and any unusual provisions or exceptions applicable to the project)
    - (d) Electrical design calculations (including fault current calculations, transformer loading, circuit sizing, building energy usage and any unusual provisions or exceptions applicable to the project)
    - (e) Civil design calculations (including storm drainage, sanitary sewer, domestic water service and any unusual provisions or exceptions applicable to the project)
    - (f) Basis of design equipment and material information (e.g. catalog material, charts, tables, performance curves, etc.)
    - (g) Update energy conservation report and life cycle costing
    - (h) Verification of compliance with University standards, guidelines, and codes
- 8.0 Cost Estimate
  - 8.1 Submit a written quantitative estimate of construction developed from complete design development plans and specifications. Use the format in the appendices.
  - 8.2 Show estimated contractor overhead and profit, unit costs applied and materials and labor quantities.
- 9.0 Construction Phasing Schedule - Provide a construction-phasing schedule in bar chart and/or outline (narrative) form.

## 2.8.2. Design Drawings

- 1.0 Scale
  - 1.1 Plot, site, & utility plans can be either 1" = 10' or 1" = 20' scale.
  - 1.2 Building floor plans and roof plans will be 1/8" or 1/4" = 1'.
  - 1.3 Details will be drawn at 1/2", 1", or 1 1/2" = 1'.
- 2.0 Existing Utilities Capacity - Show verified capacity at points of connection to existing utilities.
- 3.0 Plot Plan
  - 3.1 Indicate routing of outside utility lines from point of connection to existing utilities to the building.
    - a. Show existing utilities including those underground.
    - b. Show existing and final topography of site.
    - c. Show proposed site access, staging areas, and project limits.
- 4.0 Structural Plans
  - 4.1 Include the design loadings (dead, live, wind, snow, seismic), material specifications and design stresses (steel, concrete, masonry, soil bearing, etc.) assumed during the design, plus assembly stresses where applicable.
  - 4.2 When structures employ a beam-column framework, a grid reference system using alphabetic and numeric symbols will be utilized. When additions are made to existing structures, the original reference system will be extended where practical.
  - 4.3 Detail junctions between floors, roof, and exterior wall to assure continuity and load path.
  - 4.4 Drawings will clearly dimension and accurately describe non-standard details and construction requirements. Included but not limited to:
    - Construction and expansion joint details
    - Special jacking and lifting procedures`
    - Protective cover (concrete)
    - Anchor bolt material and projection
    - Special connection details
    - Shoring requirements
    - Construction sequence
    - Bolt torque
    - Concrete reinforcing details
    - Connection capacity
    - Water stops, etc.
  - 4.5 Type and location of rebar splices.

## 5.0 Mechanical

## 5.1 Plumbing Plans

- a. Indicate all required demolition.
- b. Indicate locations of main wastes and vents, as well as service mains, including water, air, gas, vacuum, etc.
- c. Indicate pieces of equipment, showing location and required piping connections, including pumps, tanks, generators, etc.
- d. Provide equipment schedules for plumbing fixtures.
- e. Provide isometrics for water, sanitary, and gas piping.

## 5.2 Heating, Ventilating, Air Conditioning and Piping Plans

- a. Indicate all required demolition.
- b. Indicate service mains, including steam, return, hot water, chilled water, condenser water, etc.
- c. Indicate air moving equipment and double line duct runs to all outlets including supply and exhaust fan systems, fume hoods, etc.
- d. Indicate pieces of equipment, showing locations and required piping connections including pumps, tanks, converters, etc.
- e. Provide equipment schedules indicating sizes, capacities and operating characteristics.
- f. Provide air and water flow diagrams for supply and exhaust air, and water distribution systems. Diagrams are to indicate flow rates in mains and branches to assist in balancing.
- g. Control schematics and sequence of operations.

## 5.3 Large Scale Drawings of Equipment Rooms

- a. The scale should be no smaller than  $\frac{1}{4}'' = 1'0''$ .
- b. Indicate layout of equipment to assure adequate space allowance.
- c. Include elevations of built-up fan units to assure proper air flow and access to component parts of the units.
- d. Show pump layout and piping runs.

## 5.4 Fire Protection

- a. Show pipe runs, sprinkler locations, pumper connections, and test connections.
- b. Show coverage rate of sprinklers.
- c. Show any special equipment, Halon, CO<sub>2</sub>, etc.
- d. Show control schematic.

## 6.0 Electrical Plans

## 6.1 All required demolition.

- 6.2 Show the power and control layouts on one set of drawings and the lighting layouts on a different set of drawings using standard symbol conventions. Show all conduit sizes and the size and number of conductors.
- 6.3 Provide single line electrical distribution diagrams showing primary service to substations and secondary service to distribution switchboards, motor control center, and panel boards for power and lighting. Show all conduit sizes and the size and number of conductors.
- 6.4 Indicate the point of connection to external utilities, i.e., high voltage, telephone, and signal systems.
- 6.5 Indicate and provide utilization schedule for each load center unit substation, motor control center, distribution and switchboards, telephone equipment rooms, and closets.
- 6.6 Indicate type and locations of lighting fixtures in typical offices, laboratories, corridors, examination rooms, etc., and use a schedule for detail.
- 6.7 Indicate fault current at all manholes.



## 2.9 CONTRACT DOCUMENTS

### 2.9.1 Introduction

1. The consultant shall prepare the contract documents that consist of the project manual, the drawings, and addenda.
2. The term "Project Manual" refers to the written portion of the contract documents.
  - a. Bid forms (Bid for Lump Sum, Bidders Statement of Qualifications, MBE/WBE Evaluation)
  - b. General Conditions for Construction Contract
  - c. Special Conditions
  - d. Prevailing Wage Rates
  - e. Specifications
3. The term "Drawings" refers to the graphic portrayal of elements included within the scope of the contract documents.
4. There should be no duplication between portions of the contract documents; instead, they should be complementary.

### 2.9.2 General

1. The consultant shall develop the Contract documents to be complete and ready for seals and signatures. Contract document originals will be sealed, signed, and dated by the consultant of record prior to printing of bid documents.
2. The consultant shall make all corrections to drawings and specifications identified during design development and subsequent intermediate reviews in the contract documents.
3. The consultant shall provide a final logic bar chart schedule for project construction and identify the critical path. The schedule will include purchase and delivery activities and durations for all major equipment and building components.
4. The consultant shall provide a revised, detailed construction estimates will be submitted. These estimates will become the basis for the University estimate to be used at bid opening. The estimates will include separate estimated costs for any construction alternates included in the bid documents but not part of the base bid. Follow the cost estimate format in the appendix.
5. During the construction bidding, the consultant will accept and reply to all contractor inquiries relating to clarification and interpretation of the plans and

specifications. These questions and answers will be formally documented, and those that identify significant change or clarification will form the basis of a formal contract addendum prior to actual contract award. The consultant will participate in all pre-bid meetings and publish minutes of those meetings.

### 2.9.3 Drawing Format

1. The following are minimum requirements for projects involving construction of new facilities, or renovations of or additions to existing facilities.
2. Completed tracings, whether hand drawn or CADD produced, will be of excellent quality for the production of good duplicates and microfilming.
3. A scale of  $\frac{1}{4} = 1'0"$  or  $\frac{1}{8} = 1'0"$  is preferred for building floor plans, elevations, and sections.
4. A scale of  $1" = 10'$  or  $1" = 20'$  is acceptable for site plans and utility plans. Location plans and plans showing contractor access routes may be smaller.
5. Details will be drawn  $\frac{1}{2}"$ ,  $1"$ , or  $1\frac{1}{2}" = 1'0"$ .
6. A graphic scale will be required on drawings.
7. Drawing size will be D size sheets ( $24" \times 36"$ ), unless otherwise directed by Project Manager (PM). The consultant will contact the PM for CADD requirements.
8. Drawings will be segregated into disciplines (Architectural, Civil, Structural, Mechanical, Plumbing, Electrical).
9. Pertinent information will be shown only on discipline drawings applicable to that Division of work. If information must be located on drawings of a different discipline, drawings will be cross-referenced.
10. HVAC equipment and electrical equipment schedules will be included on the drawings. Door, window, and room finish schedules may be included on the drawings or in the project manual.
11. Manufacturer and product names will be referenced in equipment schedules on the drawings.
12. Symbols and abbreviations used on drawings will be explained and shown on legends.

13. Design details will be shown on the drawings, not in the specifications.
14. Each drawing sheet will display the following:
  - a. Advertisement/issue date
  - b. Title of the project
  - c. An individual sheet title
  - d. Alphanumerical number indicating discipline and sheet number
  - e. Scale
  - f. The seal of a professional architect or engineer registered in the State of Missouri, signed and dated.
  - g. Campus project number
15. Title sheet in each set of drawings will contain the following:
  - a. Consultant will certify the following on the title sheet of the drawings:

"I hereby certify these drawings  
and/or specifications have been  
prepared by me, or under my  
supervision. I further certify that to  
the best of my knowledge these  
drawings and/or specifications are as  
required by and in compliance with  
the Building Codes of the University  
of Missouri".

\_\_\_\_\_.Signature
  - b. Title of the project and project number
  - c. Owner's name: (University of Missouri - Campus Name, For The Curators of the University of Missouri)
  - d. Consultant's name
  - e. Drawing index
  - f. Site location plan
  - g. Advertisement/issue date
  - h. Professional architect/engineer seal, signed and dated
  - i. Code review data
16. Sections and details will be numbered and cross-referenced.
17. Project construction limits, construction fencing, and contractor access will be clearly shown on the site plan drawings. Included will be any required tree protection.
18. Roofing
  - a. The roof plans shall include all features and elements of the roof, including roof slope and drainage, all penetrations and mechanical equipment. On reroofing projects, clearly indicate items to be demolished

and/or removed, existing materials to remain and new materials and construction. The following items should be shown on the roof plans, accurately located, and drawn to scale.

- Mechanical units, exhaust fans, vents
- Piping, conduit, and related supports
- Roof walkways, screens, hatches, and ladders.
- Roof drains, overflow drains, and scuppers
- Miscellaneous penetrations
- Expansion joints and area divided curbs
- Gutters and downspouts
- Valley, ridges, saddles and crickets

- b. The drawings shall include complete details of roof system and components including:
  - Each roof perimeter condition
  - Each penetration condition, including vent flashing
  - Each roof-related sheet metal fabrication
  - Equipment curbs, skylight curbs, and roof hatches
  - Roof expansion joints and area dividers
  - Piping & equipment supports
  - Typical roof drain and overflow drain including sumps and flashings
  - Scuppers
- c. Roof flashing details shall indicate following components:
  - Roof deck and wall substrate and other adjacent materials
  - Insulation including separate layers and vapor retarders
  - Roof and flashing membrane
  - Cant strips, if applicable
  - Flashing attachment, if applicable
  - Counterflashing and reglets
  - Sealants
  - Wood nailers and blocking, including adequate attachment

19. Structural construction drawings shall include structural loadings and details (floor, roof, cross-sectional, etc.)

20. Mechanical & Electrical construction drawings shall include:

- a. Double line drawings for ductwork and equipment room piping. All other piping may be single line. Show ductwork on separate sheets, not with utilities. Show location of all dampers and valves.
- b. Completed equipment, lighting, and power panel schedules
- c. All details, cross-sectional and elevation views
- d. Air and water flow (balancing) diagrams
- e. Control schematic, point listing, and sequence of operation

- f. Show equipment schedules and sequence of operation information on mechanical drawings.
  - g. Identify circuits and show equipment schedules on electrical drawings.
21. The consultant, at the direction of the PM, will incorporate drawings that illustrate the location of any expected asbestos containing materials. The consultant will not be responsible for the identification and removal of asbestos.

#### 2.9.4 Project Manual and Specifications

1. Language of the project manual will be brief and consistent.
  - a. Do not repeat information contained in either the General Conditions or the Special Conditions in any other section.
  - b. Do not repeat information contained in the specifications on the drawings (except in equipment schedules).
2. Consultant will use the CSI numbering system as directed by the PM.
3. Titles of unused divisions will remain in the table of contents with parenthetical notation on each to state "(Not Used)." No reference shall be made to unused divisions in the body of the specifications.
4. There shall be no blank spaces between paragraphs or within sentences within sections in the specifications. The end of each section should be marked "End of Section".
5. The architect or engineer seal of professional registration in the State of Missouri shall be affixed to the cover sheet of the specifications, signed, and dated.
6. Provide the University Original copies of the specifications in a computer file format acceptable to the PM. If the PM allows paper, it shall be of such quality as to be satisfactorily scanned to PDF electronic files. White paper of sufficient weight to prevent ghosting shall be used for all specification pages to increase contrast.
7. No allowances shall be provided in the contract documents unless approved by the project manager.
8. The term "Contractor" shall be used throughout the specifications in the context defined in the General Conditions.
9. The General Conditions cover all one-year guarantees. Guarantees other than one year will be stated at the end of the applicable section. Do not repeat one-year

guarantees in the specifications. Guarantees or warranties greater than one year will be stated in the Special Conditions.

10. As stated in the General Conditions, local building permits, inspections, etc. will not be required for work located on University property except when connections are made to city utilities and at drives and sidewalks adjoining city streets.
11. Only the "Owner", "Owner's Representative", "Architect", and "Contractor" will be referred to in the specifications.
12. Design details, sketches, and drawings will not be included in the specifications.
13. Specifications will indicate the type and quality of material to be used. To the greatest extent possible, all colors will be identified in the specifications.
14. A minimum of three manufacturers will be listed and the words "or approved equal" will be stated. Proprietary items may be specified only with the University's approval. Criteria will specify critical parameters which will identify what constitutes an approved equal.
15. If asbestos containing materials are expected to be removed during the construction of the project, the University's Asbestos Removal Specifications will be incorporated into Division 2 of the specifications. The current edition of the University Asbestos Removal Specification can be found at the FPD Website.
16. Consultant will list all required submittals, shop drawings, operation manuals, warranties, and certifications in the Submittals section of the Special Conditions in Division 1.
17. The geotechnical report will be included as part of the contract documents, and clearly marked For Reference Only, in General Requirements, Division 1.

### 3.0 GENERAL REQUIREMENTS (DIVISION 1) FORMAT

1. The current edition of the University Division 1 in Word and PDF format is available at  
[www.umsystem.edu/ums/departments/fa/management/facilities/guidelines/](http://www.umsystem.edu/ums/departments/fa/management/facilities/guidelines/)
2. Preparation of the general requirements, or Division 1, of the project manual will follow format shown in the University standard. This is present only as a guide. Notations enclosed by bold parentheses [**sample**] indicate general information that will be inserted by the consultant.
3. General Conditions outline the commercial conditions under which the University performs construction contracts. Consultant will make no modifications to the General Requirements unless directed by the Project Manager.