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THE UNIVERSITY OF TEXAS SYSTEM  
UT HEALTH SCIENCE CENTER AT HOUSTON  
7000 Fannin Street  
Houston, Texas 77030

## **OWNER'S DESIGN GUIDELINES**

AGREEMENT BETWEEN THE BOARD OF REGENTS, THE  
UNIVERSITY OF TEXAS SYSTEM, OWNER,  
AND THE PROJECT ARCHITECT/ENGINEER

Original – September 1, 1997

Revision – February 5, 2018



## **Foreword**

University of Texas Health Science Center at Houston (UTH) maintains the Owner's Design Guidelines referred to in the Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer.

The Project Architect/Engineer shall comply with the Owner's Design Guidelines in the design of UT System construction projects. The Owner's Design Guidelines is generic in nature and applies to all UT System construction projects. In addition, the UT System may provide supplementary information for specific projects.

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THE UNIVERSITY OF TEXAS SYSTEM  
UT HEALTH SCIENCE CENTER AT HOUSTON

**OWNER'S DESIGN GUIDELINES**  
**A List of Guidelines and Requirements**

**1. Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer**

University of Texas Health Science Center at Houston (UTH) will transmit to the Project Architect/Engineer the Agreement for the Project Architect/Engineer to execute in accordance with the instructions accompanying the transmittal.

The instructions accompanying the Agreement include the Good Faith Effort Program Guidelines for Professional Services Contract which incorporates the Historically Underutilized Business (HUB) program requirements, the Statement for Architectural/Engineering Services (See 2., below), and the Good Faith Effort Program Guidelines.

The Project Architect/Engineer shall designate a single representative to act on its behalf under the Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer.

**2. Architect/Engineer Fee Statement (Also see 1.)**

The Project Architect/Engineer shall use the OPFC format for the Statement for Architectural/Engineering Services, including Exhibits A and B, for all fee statements submitted to UTH. The format is included in the Good Faith Effort Program Guidelines for Professional Services Contract referred to in 1, above.

The Project Architect/Engineer shall enter the format, including Exhibits A and B, on a word processor for submission under the Project Architect/Engineer's letterhead stationery. The format, except for Exhibits A and B, may be modified only with the Project Manager's approval.

**3. Building Areas**

The Project Architect/Engineer shall submit an estimate with the Schematic Design Phase submission and shall submit calculations with the Design Development Phase and the Construction Document Phase submissions for the project GROSS AREA and ASSIGNABLE AREA in accordance with the criteria shown in Appendix A. The Project Architect/Engineer shall design the project so that the *assignable square foot to gross square foot* ratio for the project exceeds 60% to the maximum extent possible.

See APPENDIX A, Definitions of Building Areas.

#### **4. Civil Engineering Criteria**

The Project Architect/Engineer shall design UT System projects to comply with the UTH Civil Engineering Criteria.

See **APPENDIX B**, Civil Engineering Criteria

#### **5. Codes and Standards**

UTH has adopted codes and standards that the Project Architect/Engineer shall observe in the design and construction of UT System construction projects. UTH will review the project for compliance.

See **APPENDIX C**, Codes and Standards.

#### **6. Computer Aided Design and Drafting (CADD) Guidelines**

The Agreement requires the Project Architect to produce Construction Documents on a CADD system as a part of Basic Services. The Project Architect/Engineer shall comply with the CADD layer guidelines as provided by the Institution. (See the Agreement)

#### **7. Constructability**

The Agreement requires the Project Architect to employ a General Contractor or Construction Manager acceptable to the Owner to provide outside construction expertise through the Schematic Design, Design Development and Construction Document Phases. The General Contractor or Construction Manager will provide review input related to Project Objectives, methods and concepts of “constructability.” In addition, the General Contractor or Construction Manager will submit for review a “constructability report” and Cost Quantity Survey to coincide with the Project Architect’s Basic Services submission requirements. (See the Agreement).

#### **8. Construction Cost Limitation**

The Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer, sets forth the Construction Cost Limitation (CCL) for the project. The Project Architect/Engineer is responsible for managing the design to stay within the CCL. (See the Agreement, Article 1.3.5).

#### **9. Construction Phase Criteria**

Upon the issuance of the Notice to Proceed to the construction contractor, the UTH Project Manager (PM) assumes management responsibility for the Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer, and the construction contract.

See **APPENDIX D**, Construction Phase Criteria

## **10. Consultants**

The Project Architect/Engineer shall provide UTH a list of its proposed consultants. The Owner reserves the right to reject any person or firm which the Owner may deem to be not qualified or competent to render the Project Architect/Engineer's Basic Services. (See the Agreement, Article 1)

## **11. Consultant Agreements**

Provide UTH with a copy of each contract or agreement, which the Project Architect/Engineer enters into with any consultant. (See the Agreement)

## **12. Cost Quantity Surveys**

The Agreement requires the Project Architect/Engineer to provide a full scope and detailed Cost Quantity Survey of the project in a form acceptable to the Owner for the Design Development and Construction Document Phases. See **APPENDIX L**, Submittal Requirements for Design Documents, for an example of a form for a Cost Quantity Survey acceptable to the Owner.

## **13. Easements**

The University of Texas System Board of Regents grants, receives and modifies easements for UT System and its institutions. THE GRANTING, RECEIVING AND MODIFICATION OF EASEMENTS SHALL BE COMPLETED BEFORE THE START OF CONSTRUCTION. The Project Architect/Engineer shall notify the UTH Project Manager of the need for UT System to grant, receive or modify an easement as soon as the need is identified. The Project Manager will obtain from a registered professional land surveyor (RPLS) the field notes and drawing for the easement requirements, and the UT System Office of General Counsel will administer the work necessary for UT System to grant, receive or modify an existing easement.

In addition, the UT Board of Regents Minutes, item 5, dated December 7, 1973, states:

All utility easements shall be put underground; in case it is absolutely necessary to have an overhead line, the easement will contain a provision that upon the University's request the grantee will relocate the line underground.

## **14. Electrical Criteria**

The Project Architect/Engineer shall design UT System projects to comply with UTH Electrical Criteria, including the UTH Guideline Specifications for Electrical Criteria. The Guideline Specifications are available on the UT System UTH website. The UTH Project Manager will provide the Project Architect/Engineer the diskettes by separate correspondence. The Guideline Specifications may be supplemented by exhibits which illustrate preferred design details.

See **APPENDIX E**, Electrical Criteria.

## **15. Energy Conservation Design**

The Project Architect/Engineer shall design UT System new construction and major renovation projects to comply with the Energy Conservation Design Standard for New State Buildings as issued by the State Energy Conservation Office. The Project Architect/Engineer shall submit certifications and the project to the UTH Project Manager for submission to the State Energy Conservation Office as required.

The Energy Conservation Design Standard for New State Buildings may be obtained from the following address:

State Energy Conservation Office  
111 East 17th Street  
Austin, TX 78701  
Telephone 512/463-1931

## **16. Texas Commission on Environmental Quality (TCEQ) - TPDES General Permit Requirements**

UTH will provide the Project Architect/Engineer with UTH Guidelines regarding the preparation of a Storm Water Pollution Prevention Plan in accordance with TCEQ TPDES regulations. A SWPPP is required on all projects where construction activity is 1 acre or greater. The SWPPP shall follow all UTH requirements and shall be submitted to UTH for review and comment. Once approved, UTH will submit all necessary forms and/or applications to the TCEQ for UT System and the Contractor.

## **17. Facility Program**

Normally the Chancellor of The University of Texas System appoints the Project Architect/Engineer to prepare a Facility Program with an option to continue into Basic Design services. The Project Architect/Engineer so appointed shall prepare the Facility Program following the UTH Facilities Programming Guidelines. The Owner will approve the Facility Program following its completion, and may exercise its option to continue into Basic Design Services. The UTH Project Manager will issue the UTH Facilities Programming Guidelines to the Project Architect/Engineer by separate correspondence. (See the Agreement, Article 14)

## **18. Geotechnical Services**

UTH will furnish the services of geotechnical consultants when UTH agrees that such services are necessary. In order to assist UTH in providing the most constructive information from the geotechnical consultant, the Project Manager will request the Project Architect/Engineer to recommend the scope of work for the geotechnical services by separate correspondence. (See the Agreement, Article 2.)



## **19. Internet Communications**

The Project Architect/Engineer may communicate with individuals at UTH using the individual's Internet e-mail address. The address follows the convention *username@utsystem.edu* with *username* the individual's first initial followed by the last name without spaces, e.g. John Doe will be *jdoe@utsystem.edu*. Also, the Project Architect/Engineer will find additional UT System, Institution and UTH information located on the UTH World Wide Web page found at <http://www.utsystem.edu>

## **20. Land Survey**

UTH will furnish a land survey of the site. In order to assist UTH in providing the most comprehensive information from the registered professional land surveyor (RPLS) firm, the Project Manager will request the Project Architect/Engineer to recommend the scope of work for the land survey by separate correspondence. (See the Agreement, Article 2.)

## **21. Landscape Architecture - Site Development Criteria**

The Project Architect/Engineer shall design UT System projects to comply with the UTH Landscape - Site Development Criteria. The A/E will be required to submit to the UTH Project Manager a letter with the design development documents stating compliance with the Texas Facilities Commission's guidelines for the required use of xeriscape.

See **APPENDIX F**, Landscape Architecture - Site Development Criteria.

## **22. Mechanical Criteria**

The Project Architect/Engineer shall design UT System projects to comply with UTH Mechanical Criteria, including the UTH Guideline Specifications for Mechanical Criteria. The Guideline Specifications are available in Microsoft Word format from the UT System UTH web site at <http://www.utsystem.edu/fpc>. If requested, the Project Manager will provide the Project Architect/Engineer the diskettes by separate correspondence. The Guideline Specifications may be supplemented by exhibits that illustrate preferred design details.

See **APPENDIX G**, Mechanical Criteria.

## **23. Meetings/Workshops**

The UTH Project Manager will schedule meetings among the Design Team (sometimes referred to as "workshops") about every two weeks throughout the Schematic Design, Design Development and Construction Document Phases, although they may be scheduled more or less frequently depending upon project requirements. The purpose is to provide a regularly scheduled forum for the design team to communicate on a regular basis and to proactively manage the project scope, schedule and budget.

The Project Architect/Engineer shall prepare and submit written minutes of each meeting as explained under Meeting Minutes, below.

#### **24. Meeting Minutes (Including Pending Issues Report)**

UTH has determined that a written record of major decisions and minutes for each meeting attended by the Project Architect/Engineer is necessary for recording the progress of the project. The Project Architect/Engineer is requested to provide UTH with minutes within ten calendar days of any event where minutes are advised. All project related communications between the Project Architect/Engineer including consultants, if any, and the Owner's representatives shall be transmitted via the UTH Project Manager.

Also, the Project Architect/Engineer shall maintain a Pending Issues Report for the project to record outstanding decisions for the design team. An example is located in **APPENDIX L, Submittal Requirements for Design Documents**. The example indicates data that should be maintained and documented for pending issues.

#### **25. Interior Finishes & Furniture, Furnishings and Equipment**

The Project Architect/Engineer shall design UT System projects to comply with the UTH Interior Group's criteria for movable furnishings.

See **APPENDIX H, Interior Finishes & Furniture, Furnishings and Equipment**.

#### **26. Owner's Representatives**

The Associate Vice Chancellor for Facilities Planning and Construction is the Owner's representative for administration of the Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer (See the Agreement, Article 2.3). The Associate Vice Chancellor for Facilities Planning and Construction will designate as his representatives a Project Manager during the design and construction phases. The Project Architect/Engineer shall direct all project related communications to the Project Manager during design and construction.

The Chief Administrative Officer of each Institution will appoint an Ad Hoc Project Building Committee to represent the Institution and the departments or divisions that will occupy the building. The Institution may also designate a representative to act on its behalf in consultation with the Ad Hoc Project Building Committee.

#### **27. Partnering**

UTH may conduct partnering sessions during design (for Owner and Project Architect/Engineer representatives) and during construction (for Owner, Project Architect/Engineer, and Construction Contractor representatives). UTH expects the Project Architect/Engineer to participate in all partnering exercises for UT System construction projects.

## **28. Prevailing Wage Rates**

UTH will provide the UT System prevailing wage rates to be used for the project. The Project Architect/Engineer shall include the prevailing wage rates in the Project Manual where instructed in **Appendix J**, Guidelines for Architects/Engineers - Preparation of Project Manuals.

## **29. Professional Liability Insurance**

The Project Architect/Engineer shall provide UTH with professional liability and errors and omissions (malpractice) insurance, covering the services provided by the Project Architect/Engineer and any and all consultants, as is acceptable to and approved by the Owner. (See the Agreement, Article 1.)

## **30. Project Value Analyses**

The Project Architect/Engineer and the Owner's representatives will participate in project value analyses during design and construction for constructability, construction cost estimating, life cycle costs, and value engineering. The analyses will be emphasized during scheduled reviews upon completion of the schematic design and design development phases, during periodic construction document reviews, and upon completion of the 95% complete construction documents. (See "Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer" and "Project Planning Schedule")

The project value analyses will emphasize:

- Constructability through consultation with a Constructability Consultant
- Construction cost estimating for cost control
- Life cycle costs of operation, maintenance and repair
- Value engineering to minimize cost and maximize performance without reducing quality below required levels.

## **31. Project Directory**

The Project Architect/Engineer shall provide UTH with the names of its representatives, the names of its consultants, the names of its consultants' representatives, and the names of the Owner's representatives, in the form of a project directory. Include titles for the various representatives and/or their project responsibility, with mailing addresses, telephone and FAX numbers, and e-mail addresses.

## **32. Project Information Form - Project Schedule**

The Project Manager will develop and maintain a Project Schedule establishing certain milestones in consultation with the Project Architect/Engineer and the Institution. The Project

Architect/Engineer shall maintain a detailed project schedule following the Project Manager's Project Schedule using computerized scheduling software.

See **APPENDIX I**, Project Information Form - Project Schedule

### **33. Project Manuals**

The Architect/Engineer shall prepare the Project Manual(s) for the project in accordance with the current edition of the manual titled The University of Texas System, Guidelines for Architects/Engineers, Preparation of Project Manuals.

Due to the statutory nature of its content, the document is subject to revision at any time. Therefore, the Project Architect/Engineer shall request a current edition of the document from UTH immediately before advertising for bids and include the current statutory documents in the bidding documents.

See **APPENDIX J**, Guidelines for Architect/Engineer Services - Preparation of Project Manuals.

### **34. Project Name and Number**

The Owner's approved project name and number shall be included on the Project Architect/Engineer's correspondence, reports, specification covers and drawings, and all correspondence.

The names for construction documents, which are also the names used for construction contracts, have two components: 1.) The PROJECT NAME, as authorized by the Board of Regents, and 2.) The STAGE NAME, as placed on the construction documents with the project manager's approval.

Normally the PROJECT NAME and the STAGE NAME are the same, except when a project is constructed in stages using multiple construction contracts, under one project number. Then, the STAGE NAME to be placed on each set of construction documents is different from and in addition to the PROJECT NAME. An example of a name for staged construction placed on construction documents, under the project number, is:

(Project Name)	Better Building
(Stage Name)	Site Adaptation
(Institution Name)	UT Institution
(Project Number)	Project No. 000-000

### **35. Proprietary Equipment**

Proprietary equipment may be specified for UT System projects when appropriately justified. The Office of General Counsel has requested that UTH obtain the institution's written request and justification when an institution asks that proprietary equipment be specified.

The following text shall be included in the specifications for each justified proprietary item in capitalized letters:

***NO SUBSTITUTIONS ALLOWED. THE UNIFORM GENERAL CONDITIONS FOR UNIVERSITY OF TEXAS SYSTEM BUILDING CONSTRUCTION CONTRACTS ARTICLE 8.3.5 IS NOT APPLICABLE.***

### **36. Purchase of Additional Sets of Plans and Specifications**

UTH has a procedure for the purchase of additional sets of plans and specifications that permits UTH to purchase reimbursable expense products directly from a reprographics vendor without sacrifice of the Owner's sales tax exemption. However, the Project Architect/Engineer may request payment as a reimbursable expense under the Agreement, excluding sales tax. Either procedure is applicable under the Agreement, Article 5 for "Expense of reproductions, postage and handling of Drawings, Specifications and other documents, over and above those required under Basic Services" a part of Article 5, Paragraph 5.1 Reimbursable Expenses.

The UTH Project Manager will provide the procedure for UTH's purchase of additional sets of plans and specifications directly from a reprographics vendor by separate correspondence.

### **37. Software Compatibility**

UTH uses Microsoft Office software.

### **38. Alternative Energy Feasibility**

The A/E will be required to submit to the UTH Project Manager a letter with the design development documents a detailed written evaluation stating the economic feasibility of incorporating alternative energy devices into the building's design.

As defined in Government Code, Section 2166.403, Building Construction and Acquisition:

(a) This section applies to the construction of a new state building, including a building construction project otherwise exempt from this chapter under Section 2166.003.

(c-1) For a project constructed by and for a state institution of higher education, the institution shall, during the planning phase of the proposed construction for the project, verify the economic feasibility of incorporating into the building's design and proposed energy system alternative energy devices for space heating and cooling functions, water heating functions, electrical load functions, and interior lighting functions. The institution shall determine the economic feasibility of each function listed in this subsection by comparing the estimated cost of providing energy for the function, based on the use of conventional design practices and energy systems, with the estimated cost of providing energy for the function, based on the use of alternative energy devices, during the economic life of the building.

(c-2) If the use of alternative energy devices for a specific function is determined to be economically feasible under Subsection (c-1), the governing body shall include the use of alternative energy devices for that function in the construction plans for the project.

(d) In this section:

- (1) “Alternative energy” means a renewable energy resource. The term includes solar energy, biomass energy, and wind energy.
- (2) “Alternative energy collector” means an assembly, structure, or design, including passive elements, used to absorb, concentrate, convert, reflect, or otherwise capture or redirect alternative energy for later use as thermal, mechanical, or electrical energy.
- (3) “Alternative energy device” means an alternative energy collector or alternative energy storage mechanism that collects, stores, or distributes alternative energy.
- (4) “Alternative energy storage mechanism” means equipment, components, or elements designed and used to store for later use alternative energy captured by an alternative energy collector in the form in which the energy will eventually be used or in an intermediate form. The term includes thermal, electrochemical, chemical, electrical, and mechanical storage mechanisms.
- (5) “Biomass energy” means energy that is created in living plants through photosynthesis.
- (6) “Solar energy” means energy from the sun that may be collected and converted into useful thermal, mechanical, or electrical energy.

### **39. Structural Criteria**

The Project Architect/Engineer shall design UT System projects to comply with the UTH Structural Criteria.

See **APPENDIX K**, Structural Criteria.

### **40. Submittal Requirements for Design Documents**

UTH has certain minimum requirements for the submission of the Schematic Design Documents, Design Development Documents and Construction Documents for review. The Project Architect/Engineer shall comply with the submittal requirements unless the Project Manager approves modifications for specific project requirements.

Appendix L also includes the format for the Cost Quantity Survey that the Project Architect/Engineer shall provide during the Design Development and Construction Document Phases.

See **APPENDIX L**, Submittal Requirements for Design Documents.

#### **41. Texas Accessibility Standards**

The Project Architect/Engineer shall comply with the Texas Accessibility Standards as adopted by the Texas Commission on Licensing and Regulation for purposes of administering the state Architectural Barriers Act, Government Code, Section 469.

The Project Architect/Engineer may request the Project Manager to reimburse the Project Architect/Engineer for fees required by the Texas Department of Licensing and Regulation in administration of Section 469 as a reimbursable expense under the Agreement Between the Board of Regents, The University of Texas System, Owner, and the Project Architect/Engineer.

#### **42. Appendix M and N not used 43. Audio/Visual Technologies**

Institutional learning spaces should support diverse learning styles, be versatile and configurable, comfortable, attractive and provide appropriate audio/visual and learning technology. The use of institutional standard AV technology should be balanced with a faculty-friendly control system that is consistently deployed throughout the institution.

See **APPENDIX O**, Recommended Guidelines for Audio/Visual Technologies (AV Technology).

**44. APPENDIX P** is not used.

#### **45. Life Cycle Cost Analysis**

Cost effectiveness is a key component of a building design, and Life Cycle Cost Analysis (LCCA) is an essential design process for controlling the initial and future cost of building ownership.

See **APPENDIX Q**, Guidelines for Life Cycle Cost Analysis (LCCA).

#### **46. Rainwater Harvesting Feasibility**

For projects entering design development after September 1, 2009, the Architect/Engineer will design into the project on-site reclaimed system technologies or submit to the Owner a written determination as to the impracticality of installing on-site reclaimed system technologies as defined in Government Code Section 447.004 paragraph c-1 & c-2 Design Standards. The A/E will be required to submit to the UTH Project Manager a letter with the design development documents stating any impracticality determinations along with supporting economic calculations or site impracticality rational. The Owner will notify the state energy conservation office of any impracticality determinations and provide to the office the A/E's documentation supporting the determination.

Government Code Section 447.004 paragraph c-1 & c-2:

(c-1) The procedural standards adopted under this section must require that on-site reclaimed system technologies, including rainwater harvesting, condensate collection, or cooling tower blow down, or a combination of those system technologies, for non-potable indoor use and landscape watering, be incorporated into the design and construction of:

- (1) Each new state building with a roof measuring at least 10,000 square feet; and (2)
- Any other new state building for which the incorporation of such system is feasible.

(c-2) The procedural standards required by Subsection (c-1) do not apply to buildings if the state agency or institution of higher education constructing the building:

- (1) determines that compliance with those standards is impractical; and
- (2) notifies the state energy conservation office of the determination and provides to the office documentation supporting the determination.

**47. Security Systems Criteria (*UT Health Standard*)**

The Project Architect/Engineer shall design UT System projects to comply with UTH /UT Health Security Systems Criteria. See **APPENDIX S**, Security Systems Criteria



## APPENDIX A

### DEFINITIONS OF BUILDING AREAS

#### A. GENERAL REQUIREMENTS

1. The Project Architect/Engineer shall submit an estimate with the Schematic Design Phase submission, and shall submit calculations with the Design Development Phase and the Construction Document Phase submissions for the project GROSS AREA and ASSIGNABLE AREA in accordance with the following criteria. The Project Architect/Engineer shall design the project so that the assignable to gross square foot ratio for the project exceeds 60% to the maximum extent possible. Refer to FIGURE 1: Conceptual Framework for Analyzing Building Space.

#### B. GROSS AREA

1. Definition: The sum of all square feet of floor areas within the outside faces of a building's exterior walls. This includes the areas, finished and unfinished, on all floors of an enclosed structure, i.e., within the environmentally controlled envelope, for all stories or areas which have floor surfaces.
2. Basis for Measurement: Gross area is measured from the outside faces of exterior walls, disregarding cornices, pilasters, buttresses, etc., which extend beyond the wall faces. Exclude areas having less than a 6'-6" clear ceiling height.

Measured in terms of gross square feet (GSF),

$$\underline{\text{Gross Area} = \text{Net Usable Area} + \text{Structural Space.}}$$

3. Description: In addition to all the internal floored spaces obviously covered above, gross area should include the following, provided they have greater than 6'-6" clear ceiling height and potential usability: excavated basement areas; mezzanines, penthouses and attics; garages; enclosed porches, inner or outer balconies whether walled or not, if they are utilized for operational functions; and corridors whether walled or not, provided they are within the outside face lines of the building, to the extent of the roof drip line. The footprints of stairways, elevator shafts and ducts (examples of building infrastructure) are to be counted as gross area on each floor through which they pass.
4. Limitations: Exclude open areas such as parking lots, playing fields, courts, atriums and light wells, or portions of upper floors eliminated by rooms or lobbies that rise above single-floor ceiling height.

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5. Exception: Include top, unroofed floor of parking structures where parking is available. See Source (2) named at the end of this document for additional information about parking structures.

### C. ASSIGNABLE AREA (ASSIGNABLE SQUARE FEET - ASF)

1. Definition: The sum of all areas within the interior walls of rooms on all floors of a building assigned to, or available for assignment to, an occupant or use, excluding unassigned areas. ASF includes auxiliary space and E&G space.

#### a. Education and General (E&G)

- i. Definition: Space used for teaching, research, or the preservation of knowledge, including the proportional share used for those activities in any building or facility used jointly with auxiliary enterprise, or space that is permanently unassigned. E&G space is supported by state appropriations.

2. Basis for Measurement: Assignable area is measured from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than a 6'-6" clear ceiling height.

Measured in terms of assignable square feet (ASF),

$$\begin{aligned} \text{Assignable Area} &= \text{Sum of Area Designated by the Ten Assignable Major} \\ &\text{Room Use Categories, OR} \\ &= \text{Gross Area} - \text{Non-assignable Area} - \text{Structural Area.} \end{aligned}$$

3. Description: Included should be space subdivisions of the ten major room use categories for assignable space - classrooms, labs, offices, study facilities, special use, general use, support, health care, residential and unclassified - that are used to accomplish the institution's mission.
4. Limitations: Deductions should not be made for necessary building columns and projections. Areas defined below under E. Building Service Area, F. Circulation Area, G. Mechanical Area, and I. Structural Areas should not be included.

### D. NON-ASSIGNABLE AREA (INCLUDES ITEMS E. BUILDING SERVICE AREA, F. CIRCULATION AREA AND G. MECHANICAL AREA.)

1. Definition: The sum of all areas on all floors of a building not available for assignment to an occupant or for specific use, but necessary for the general operation of a building.

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2. Basis for Measurement: Non-assignable Area is measured from the inside faces of surfaces that form the boundaries of the designated areas, and excludes areas having less than 6'-6" clear ceiling height.

Measured in terms of area,

Non-assignable Area = Sum of the Area Designated by Three Nonassignable Room Use Categories.

3. Description: Included should be space subdivisions of the three non-assignable room use categories - building service, circulation and mechanical - that are used to support the building's general operation.
4. Limitations: Deductions should not be made for necessary building columns and projections. Areas defined as assignable should not be included.

### E. BUILDING SERVICE AREA

1. Definition: The sum of all areas on all floors of a building used for custodial supplies, sink rooms, janitorial closets and for public rest rooms. Building Service Area does not include assignable areas.
2. Basis for Measurement: Building service area is computed by measuring from the inside faces of surfaces that form boundaries of the designated areas. Exclude areas having less than 6'-6" clear ceiling height.
3. Description: Included should be janitor closets or similarly small cleanup spaces, maintenance material storage areas, trash rooms exclusively devoted to the storage of nonhazardous waste created by the building occupants as a whole, and public toilets.
4. Limitations: Deductions should not be made for necessary building columns and minor projections. Areas defined as central physical plant shop areas, or special purpose storage or maintenance rooms, such as linen closets and housekeeping rooms in residence halls, are Assignable Areas and should not be included. It does not include private toilets.

### F. CIRCULATION AREA

1. Definition: The sum of all areas on all floors of a building required for physical access to some subdivision of space, whether physically bounded by partitions or not.

## APPENDIX A

2. Basis for Measurement: Circulation area is computed by measuring from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than 6'-6" clear ceiling height.
3. Description: Included should be, but is not limited to, public corridors, fire towers, elevator lobbies, tunnels, bridges and each floor's footprint of elevator shafts, escalators, and stairways. receiving areas, such as loading docks, should be treated as circulation space. Any part of a loading dock that is not covered is to be excluded from both circulation area and the gross building area. A loading dock which is also used for central storage should be regarded as assignable area. Also included are corridors, whether walled or not, provided they are within the outside face-lines of the buildings to the extent of the roof drop line.
4. Limitations: Deductions should not be made for necessary building columns and minor projections. When determining corridor areas, only spaces required for public access should be included. Restricted access private circulation aisles used only for circulation within an organizational unit's suite of rooms, auditoria or other working areas should not be included.

### G. MECHANICAL AREA

1. Definition: The sum of all areas on all floors of a building designed to house mechanical equipment, utility services and shaft areas.
2. Basis for Measurement: Mechanical area is measured from the inside faces of surfaces that form the boundaries of the designated areas. Exclude areas having less than 6'-6" clear ceiling height.
3. Description: Included should be mechanical areas such as central utility plants, boiler rooms, mechanical and electrical equipment rooms, fuel rooms, meter and communications closets and each floor's footprint of air ducts, pipe shafts, mechanical service shafts, service chutes and stacks.
4. Limitations: Deductions should not be made for necessary building columns and projections. Areas designated as private toilets are not included.

### H. NET USABLE AREA

1. Definition: The sum of all areas on all floors of a building either assigned to, or available for assignment to, an occupant or specific use, or necessary for the general operation of a building.

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2. Basis for Measurement: Net usable area is computed by summing the assignable area and the non-assignable area.

Measured in terms of net usable square feet (NUSF),

$$\underline{\text{Net Usable Area} = \text{Assignable Area} + \text{Non-assignable Area.}}$$

3. Description: Included should be space subdivisions of the ten assignable major room use categories and the three non-assignable space categories.
4. Limitations: Deductions should not be made for necessary building columns and projections. Areas defined as structural should not be included.

### I. STRUCTURAL AREA

1. Definition: The sum of all areas on all floors of a building that cannot be occupied or put to use because of structural building features.
2. Basis for Measurement: Structural area should be construed to mean that portion of the gross area which cannot be occupied or put to use because of the presence of structural features of the building. It is determined by calculating the difference between the measured gross area and the measured net usable area.

Measured in Terms of area,

$$\text{Structural Area} = \text{Gross Area} - \text{Net Usable Area.}$$

3. Description: Examples of building features normally classified as structural areas include exterior walls, fire walls, permanent partitions, unusable areas in attics or basements, or comparable portions of a building with ceiling height restrictions, as well as unexcavated basement areas.

Sources:

- (1) Texas Administrative Code  
Title 19: Education  
Part 1: Texas Higher Education Coordinating Board  
Chapter 17: Resource Planning  
Subchapter A: General Provisions  
Rule: §17.3 Definitions

## APPENDIX A

- (2) Postsecondary Education Facilities Inventory and Classification Manual, U. S. Department of Education, Office of Educational Research and Improvement, NCES 92165, November 1992.
- (3) Texas Higher Education Facilities Inventory Procedures Manual 1983, Coordinating Board, Texas College and University System.



### 3. Standard Functional Codes

<b>Instruction</b>	<b>Research</b>	<b>Public Service</b>	<b>Academic Support</b>	<b>Student Services</b>	<b>Institutional Support</b>	<b>Physical Plant O&amp;M</b>	<b>Auxiliary Enterprise</b>	<b>Independent Operations</b>	<b>Hospitals</b>		
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The University Of Texas System  
UT Health Science Center at Houston  
OWNER'S DESIGN GUIDELINES

**Revision Log**  
**APPENDIX A**

<b>Rev. Date</b>	<b>Remarks</b>
	Revisions prior to 3/1/11 are not recorded in this log

## APPENDIX B

### CIVIL ENGINEERING CRITERIA

#### A. GENERAL REQUIREMENTS

1. UTH will participate in the project from its beginning and will review all work performed by the A/E and Civil Engineering Consultant at each review period.
2. Civil Engineering Design shall consist of, but not be limited to, the following considerations:
  - a. Preparation of a Storm Water Pollution Prevention Plan according to the UTH Guidelines for this process. See Section G
  - b. The demolition, protection, salvaging, recycling and disposal of existing site components
  - c. Layout and design of streets, bridges and parking areas/structures, sidewalks and pavements
  - d. Site utilities
  - e. Outdoor lighting if applicable and within assigned scope of services
  - f. Drainage and site grading if applicable and within assigned scope of services
  - g. Special outdoor features such as ramps, walls, fences, shelters and/or other engineered elements
  - h. Proper recognition and utilization of desirable existing features such as water, tree groupings, geological formations, etc.

#### B. DESIGN REVIEW SUBMITTAL REQUIREMENTS

1. The A/E will be required to submit the plans, specifications, and calculations (UTS requested) for review to UTH at the intervals outlined in Appendix L of these Guidelines. Intermediate reviews may be required if the scope of the project has been changed or if an earlier review found the plans and specifications unacceptable either as a whole or part. All items submitted shall be in compliance with the Texas Engineering Practice Act, Rule 138.138(8) regarding signatures and engineer's seal.

## APPENDIX B

2. The Civil Engineering Consultant(s) will participate in all reviews, work sessions and presentations where this discipline is involved. Items to be included for review at each phase or stage of completion are outlined below:
3. Schematic Design Phase
  - a. Civil Engineer's name(s), registration number(s), address (es), telephone and FAX number(s).
  - b. Brief narrative of the scope of civil work involved and description of proposed hardscape including discussion of storm water collection, detention and disposal.
  - c. Cost estimate of site work based on generalized quantities and/or square feet.
  - d. Drawings:
    - (1) Site Plan/s at a scale consistent with Architectural Site Plan.
    - (2) Scale, graphic scale, and north arrow.
    - (3) Show and identify required site utilities.
    - (4) Show major civil engineering elements such as to convey overall site design concept.
    - (5) Show major vehicular and pedestrian circulation layout at least diagrammatically.
    - (6) Show relationships of all proposed work to existing site survey. Scale and sheet orientation of survey should be consistent with that of site plans.
4. Design Development Phase
  - a. Drawings:
    - (1) Further refine all plans incorporating Schematic Design review comments from UTH and Users. The number of drawing sheets

## APPENDIX B

required for the entire civil design package should be determined at this stage. The erosion control drawing and details for the project should be incorporated into the documents at this stage. Depending on the scope and complexity of the project, UTH shall determine how many categories, if any, can be combined on any individual drawing sheet.

- (2) Site plan should illustrate complete scope of hardscape/engineered features.
  - (3) Show outdoor lighting if within Consultant's scope of work.
  - (4) Show proposed grading contours with applicable spot elevations, drain inlets, manholes and other related structures.
  - (5) Identify all hardscape materials within scope of civil work.
  - (6) Show temporary storm water runoff and containment to meet applicable standards.
- b. Further refine cost estimate for site work based on further refinement of drawings, more specific quantities, volumes, lengths, square feet, etc.
  - c. Submit outline specifications for each category of proposed work.

### 5. Construction Documents

- a. Include updated cost estimate with each stage (50%, 75%, etc.) of construction documents submitted.
- b. Drawings and specifications to the appropriate stage of completion with each stage of construction documents submitted. The construction documents shall address the complete scope of work with regard to construction methods and details, quantities, materials and performance.
- c. Dated signature and seal of State of Texas licensed Civil Engineer, including date of expiration of current license. Specifications and plans shall be sealed.

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- d. At 50% CDs, submit SWPPP to UTH engineer for review/comment and approval. See item G for SWPPP format and requirements.
6. All civil review drawings shall bear the responsible engineer's name and registration number, but not necessarily his seal, at all stages of the design. Please refer to The Texas Engineering Practice Act (Article 3271a, Vernon's Annotated Texas Statutes), Section 15(b) and (c) as amended. The intent of this section is clarified in the Rule adopted by the Board, as follows:

Rule 131.138(8). "The registrant shall affix his seal, sign his name, and place the date of execution, only on engineering documents that have been issued by the registrant as completed work. Such documents should be accepted by clients for their purposes and/or by public authorities for final approval or issuance of a permit. Documents considered as incomplete by the registrant may be released temporarily for interim review and do not need to have the registrant's seal or signature affixed, but shall be dated; bear the responsible engineer's name, registration number, and professional engineer designation; and be clearly stamped to indicate the documents are for interim review and not intended for construction, bidding, or permit purposes. The use of signature reproductions, such as rubber stamps, or computer generated or other facsimiles shall not be permitted in lieu of actual signatures."

### C. CIVIL ENGINEERING ELEMENTS TO AVOID

1. Avoid storm water systems that assume outfall capacity in the collector system for the design storm event. The storm water collection, detention and disposal system shall address required redundancy and alternate function in severe storm events to the extent possible in the design phase.

### D. DESIGNING TO THE 100 YEAR STORM EVENT

1. Rainfall run-off storm drainage systems shall be designed to a minimum of the 100 year hourly rainfall rate indicated on rainfall intensity figures found in the latest version of the International Plumbing Code (IPC), or based on information provided by local municipal records.
2. As a minimum, buildings and facilities shall be designed to an elevation above the 100 year – 24 hour rainfall rate flood FEMA map. Where FEMA mapping is not available, rainfall rates are as published by the National Weather Service, National Oceanic and Atmosphere Administration.

## APPENDIX B

3. A/E shall discuss with UTH the effects of any rain event flooding of basements, garages, elevator shafts and other parts of a building or facility designed below the 100 year storm event elevation.
4. The limits of the 100 year – 24 hour storm event shall be indicated on the site topography drawing when in the proximity of the building site.

### E. SITE GRADING

1. The site grading for buildings and facilities shall be designed to best engineering practices by a registered Civil Engineer.
2. Slopes for cuts and fills shall not be steeper than 1 unit vertical in 2 units horizontal unless approved by the Owner.
3. Compaction of soil for regular grading or landscaping will be to a minimum of 90% of maximum density.
4. Avoid final grade elevations above the building weep holes unless specifically approved by the Owner.

### F. SURVEYING

1. See Exhibit “A” for topographic surveying drawing parameters.

### G. STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

UTH A/E Guidelines for Preparation of a Storm Water Pollution Prevention Plan (SWPPP) for all sites of one (1) acre or more.

#### 1. GENERAL REQUIREMENTS

- a. This A/E Guideline is intended for use at all UT institutional facilities.
- b. The A/E Civil Engineer (CE) is required to visit the site, in person, to evaluate the existing conditions before preparation of the SWPPP. The Engineer shall notify the UTH project manager at least ten (10) business days in advance of site visit. The Owner may choose to participate in the site review. After visiting the site, the CE shall prepare the SWPPP book to include the sections listed below.
- c. The SWPPP is more than just a SWPPP drawing; a SWPPP book containing all the relevant SWPPP information for that project is to be maintained at the project site.
- d. This A/E guideline must be used in conjunction with UTH **Specification Section 01 57 23**, Temporary Storm Water Pollution Control.

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### 2. SWPPP BOOK FORMAT

- a. As a minimum, two copies of the SWPPP book (one for UTH office, and one for jobsite) shall be prepared in the following format: 8-1/2" x 11" size paper bound in a **3-ring binder, 1 1/2" minimum**, with table of contents, tabbed sections as described below, and with plan drawings (size and scale may vary depending on nature of project) folded and inserted. The binder is to include a cover page and spine insert on the outside of the binder indicating the title Storm Water Pollution Prevention Plan, the institution name, the UTH project name and number, the consultant's name and date prepared (month and year).

### 3. TITLE PAGE, ENGINEER'S SEAL, SIGNATURE AND DATE

- a. First page of SWPPP book shall identify the title Storm Water Pollution Prevention Plan, the institution name, the UTH project name and number, the consultant's name and date (month and year) of preparation of SWPPP. Following identification of the project shall be the project engineer's seal, signature and date.

### 4. TABLE OF CONTENTS

- a. Include a table of contents in the SWPPP listing all ten (10) of the following Sections.

### 5. SECTION 1 - NOTICES OF INTENT (NOIs) AND PERMITS OR CONSTRUCTION SITE NOTICES (CSNs) FOR OWNER AND CONTRACTOR

- a. Draft versions of the SWPPP book shall include the incomplete unsigned NOI or CSN forms following the Table of Contents. After filing NOIs for Owner and Contractor, Owner shall distribute both completed and signed NOIs or CSNs for each copy of the SWPPP book, along with both copies of TCEQ TPEDES Construction Discharge Permits.

### 6. SECTION 2 –POSTING NOTICE/CONTACTS AND DELEGATION LETTERS

- a. For large construction sites of five (5) acres or larger include two (2) incomplete copies of the UTH Posting Notice/Primary Points of Contacts

## APPENDIX B

form. Both forms will be completed later and posted at the entrance of the facility.

- b. A copy of the Owner's and Contractor's delegation of authority letters are to be kept in this section.
- c. Shared SWPPP Acceptance Certification

### 7. SECTION 3 – SITE DESCRIPTION

This section of the SWPPP shall include a written description of the following items or map when appropriate:

- a. A description of the project site, followed by an 8-1/2" x 11" vicinity map. The vicinity map shall be of sufficient scale to show the project site location and the major streets and highways in and around the project location.
- b. A description of the nature of the project.
- c. Latitude and longitude of the site.
- d. A description of the intended sequence of major activities that disturb soils for major portions of the site (e.g., on-site mobilization, demolition, clearing, grubbing, excavation, grading, utilities and infrastructure installation.). Include timing of activities when it becomes available.
- e. Estimates of the total number of acres of the campus (see Exhibit "B") and the total area of the site that is expected to be disturbed by excavation, grading, or other activities including off-site borrow and fill areas.
- f. An estimate of the runoff coefficient of the site for both the preconstruction and post-construction conditions and data describing the soil or the quality of any discharge from the site.
- g. A statement that the site is not located over the Edwards Aquifer Contributing Zone or Recharge Zone and is not located on Indian Country Lands.
- h. The name of receiving waters and extent of wetlands.
- i. Identify any industrial activities such as concrete or asphalt batch plants associated with the construction of the project. If none, state so.
- j. A general location map or vicinity map (e.g. a portion of a city or county map), which locates the site within the overall drainage pattern of the city and/or county and shows the receiving waters and surface waters. The preference for the general location map is a color US Geological Survey Quadrangle map or equal. An 8 1/2" x 11" general location map should be kept in this section or a larger quad map in the back of the 3 ring binder with other SWPPP drawings in the section titled exhibits.



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### 8. SECTION 4 – GENERAL PERMIT REQUIREMENTS

- a. Copy of the permit requirements. Include copy of TCEQ TPDES General Permit TXR150000, March 5, 2013 containing the general permit requirements.

### 9. SECTION 5 – EROSION AND SEDIMENTATION CONTROLS

- a. Each SWPPP shall include a written description of appropriate control measures (i.e. Best Management Practices - BMPs) that will be implemented as part of the construction activity to control pollutants in storm water discharges. The written description must clearly describe for each major activity, appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented.
- b. Include an Erosion and Sediment Control Drawing and any control detail drawings illustrating the BMPs as exhibits in Section 10. Ensure the proposed locations of stabilized construction entrances and exits are shown on the Erosion and Sediment Control Drawing (see Section 10 of the A/E Guideline for additional contents of the drawing).
- c. Include a statement identifying which permittee is responsible for implementation.
- d. Include statements for Erosion and Sediment Controls - Short and Long Term Goals and Criteria that include the following:
  - (1) The construction-phase erosion and sediment controls should be designed to retain sediment on site to the extent practicable.
  - (2) All control measures must be properly selected, installed and maintained in accordance with the manufacturer's specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately, or incorrectly, the permittee must replace or modify the control for site situations.
  - (3) If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts. (i.e. sediment accumulation in streets and curbs)
  - (4) Sediment must be removed from sediment traps or sedimentation ponds when the design capacity has been reduced by 50%.
  - (5) Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from becoming a pollutant source for storm water discharges (i.e. screening outfalls, picked up daily)

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- e. Stabilization Practices – include a description of interim and permanent stabilization practices for the project site, including a schedule of when the practices will be implemented. Site plans should ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized. Use of impervious surfaces for stabilization should be avoided. Stabilization practices may include, but are not limited to:
  - (1) Establishment of temporary vegetation
  - (2) Establishment of permanent vegetation
  - (3) Mulching
  - (4) Geotextiles
  - (5) Sod stabilization
  - (6) Vegetative buffer strips
  - (7) Protection of trees
  - (8) Preservation of mature vegetation
  
- f. Structural Practices – include a description of structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site to the degree attainable. Structural practices may include, but are not limited to:
  - (1) Silt fences
  - (2) Earth dikes
  - (3) Drainage swales
  - (4) Sediment traps
  - (5) Check dams
  - (6) Subsurface drains
  - (7) Pipe slope drains
  - (8) Level spreaders
  - (9) Storm drain inlet protection
  - (10) Rock outlet protection
  - (11) Reinforced soil retaining systems
  - (12) Gabions
  - (13) Temporary and permanent sediment basins (detention ponds)
  - (14) Stabilized construction exit
  - (15) Rock berms

### 10. SECTION 6 – MAINTENANCE

- a. As a minimum, include a statement indicating that if site inspections identify BMPs that are not operating effectively, maintenance shall be

## APPENDIX B

performed before the next anticipated storm event or as necessary to maintain the continued effectiveness of storm water controls.

### 11. SECTION 7 – SPILL PREVENTION

- a. List and describe the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff. The general construction site superintendent is responsible for cleaning up and disposition of spills.
- b. Include a statement that spills and releases of hazardous material shall be reported to the Environmental Health and Safety Director for the site specific campus and UTH, as soon as there is knowledge of the spill. The EHS Director will determine if the spill is a reportable quantity and determine who must be notified. Include a statement that the contractor shall contain the spill until such time the campus EHS office can give direction or clean up.
- c. Include a statement that the SWPPP must be modified within 14 days of the spill to show any BMP modifications for spill prevention.

### 12. SECTION 8 – INSPECTIONS

- a. Include in the SWPPP a written description of all steps to be taken, by a qualified person, to perform inspections of site controls. Steps include, but are not necessarily limited to items b. through h. below.
- b. Include statements that the owner and contractor's construction inspector shall be responsible for a routine inspection of on-site controls, once every seven (7) days, on Tuesday. One standard UTH form shall be used for routine inspections. An after-rain event inspection will not be required if the 7 day inspection is followed.
- c. Include instructions to perform site inspections, at specified intervals and using UTH inspection forms. Verify that all implemented site controls are functioning properly to prevent erosion and sedimentation. Note any and all deficiencies in site controls on inspection form. Inspection report forms are to be signed in accordance with the General Permit by a person qualified to make such inspections and by the individual designated as having certification authority.
- d. Include instructions to provide a copy of inspection report to party responsible for maintenance and repair of site controls. Keep copies of all inspection reports filed with SWPPP on site for review by EPA, TCEQ, MS4 operator officials, or Owner's representatives.

## APPENDIX B

- e. Include instructions requiring when controls are found to be ineffective, or require modification to adequately prevent erosion and sedimentation, revise on-site copy of SWPPP to reflect changes made. Describe and illustrate change and note date of change.
- f. Direct Contractor to perform regular inspections at beginning of workweek (Tuesday) to allow sufficient time for maintenance and repair of site controls during same workweek.
- g. Include instructions that all inspection reports, along with noted revisions to the SWPPP, shall be retained for a period of at least three years from the date the site is finally stabilized.
- h. Include copy of UT UTH SWPPP Inspection Report Form. These forms are to be duplicated and used for inspection purposes.

### 13. SECTION 9 – NON-STORM WATER DISCHARGES

- a. Include an inventory of the non-storm water substances expected to be present onsite during construction. Examples are:
  - discharges from fire fighting
  - fire hydrant flushing
  - vehicle, building and pavement wash water
  - water used for dust control
- a. If no non-storm water substances are expected, then include a statement indicating there are none.

### 14. SECTION 10 - EXHIBITS

- a. Erosion and Sediment Control Drawing (SWPPP drawing) – plan drawing(s) and detailed drawing of controls, with plan sheet showing proposed improvements (building, paving, etc.) and indicating the following:
  - (1) Existing drainage patterns indicated with post construction arrows to show direction of flow on site with destinations of flow described (both on-site and off-site destinations)
  - (2) Approximate slopes anticipated after major grading activities (steeper slopes shall require additional control measures until final stabilization)
  - (3) Areas of soil disturbance (limit disturbance as much as possible and protect as much of existing vegetation in place as possible)

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- (4) Areas which will not be disturbed (indicate intent to protect or preserve existing vegetation)
- (5) Show limits of construction.
- (6) Locations of major structural and non-structural controls identified in SWPPP (silt fences, berms, swales, dikes, inlet protection, etc)
- (7) Locations where stabilization practices are expected to occur (exposed embankments during excavations, etc.)
- (8) Locations of off-site material, waste, borrow or equipment storage areas (concrete wash pits, lay-down areas, soil stockpile areas, etc.)
- (9) Surface waters (including wetlands or low areas, drainage channels, creeks, lakes, etc.)
- (10) Locations where storm water discharges to surface water
- (11) Location and description of any discharge associated with industrial activity other than construction, including storm water discharges from dedicated asphalt plants and dedicated concrete plants, which is covered by this permit.
- (12) Offsite material storage areas (also including overburden and stockpiles of dirt, borrow areas, etc.) used solely by the permitted project are considered a part of the project and shall be addressed in the SWPPP

### b. General Location Map (Quadrangle Map or equal)

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### EXHIBIT "A"

#### TOPOGRAPHIC SURVEY DRAWING PARAMETERS

1. Overall drawing sheets shall be prepared at a scale of 1"=50' - enlargements at 1"=20'.
2. Sheet size shall be 30 x 42, with a border on the (left) binder edge of 3-1/2", and a right edge border of 1".
3. Show plan and magnetic north and graphic scale on each sheet.
4. Include legend of symbols and abbreviations on the drawing/s.
5. Include spot elevations to the nearest .01 foot on paved or hard surfaces, and to the nearest .10 foot on non-paved surfaces (i.e. grass, base of existing trees).
6. Boundary and topographical information shall be on the same drawing sheet/s.
7. State elevation datum on each drawing sheet.
8. Locate and give elevations, size, depth and alignment (including invert elevations to the nearest .01 foot) of all drainage structures, manholes, storm sewer lines, gas lines, water lines, chilled water and/or steam lines.
9. Locate fire hydrants with size of main serving each.
10. Locate all power, cable television, street lighting and communication systems above and below grade. Contact University of Texas Campus Facilities Services for available record information on existing utilities.
11. Locate all easements and rights-of-way, and identify owners.
12. Show driveways that intersect with adjacent street across from the site to be surveyed.
13. Provide spot elevations every 10 feet along adjacent street curbs and along all edges of adjacent parking lots and driveways unless otherwise approved by the Owner.
14. Locate all other physical features on the site, including but not limited to trees, sign poles, ditches (arroyo), culverts, sidewalks, retaining walls, fences, traffic signal poles, disabled access ramps, light poles/fixtures, and driveways.
15. Note planned street widenings.
16. Show contours at one foot intervals, with a minimum of one permanent bench mark for each four acres.
17. Give total acreage of site, identify total watershed onto property, and note floodplain information as applicable.
18. Submit survey drawings in both electronic form (Auto Cad 14 on CD) and (hard copy) prints.

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**EXHIBIT “B”**

**U. T. SYSTEM CAMPUS LAND HOLDINGS BY ACREAGE**

**TOTAL NUMBER OF ACRES OF ENTIRE PROPERTY  
(FOR TCEQ TPDES SWPPP PURPOSE ON ACREAGE)**

<b>COMPONENT</b>	<b>ACRES</b>
<b>UT SYSTEM</b>	<b>35</b>
<b>UT ARLINGTON</b>	<b>393</b>
<b>UT AUSTIN</b>	<b>424</b>
<b>UT BROWNSVILLE *</b>	<b>*0</b>
<b>UT DALLAS</b>	<b>339</b>
<b>UT EL PASO</b>	<b>447</b>
<b>UT PAN AMERICAN</b>	<b>238</b>
<b>UT PERMIAN BASIN</b>	<b>588</b>
<b>UT SAN ANTONIO</b>	<b>629</b>
<b>UT TYLER</b>	<b>278</b>
<b>UT MEDICAL BRANCH AT GALVESTON</b>	<b>85</b>
<b>UT HEALTH SCIENCE CENTER AT HOUSTON</b>	<b>172</b>
<b>UT HEALTH SCIENCE CENTER AT SAN ANTONIO</b>	<b>224</b>
<b>UT M. D. ANDERSON CANCER CENTER</b>	<b>91</b>
<b>UT SWMC DALLAS</b>	<b>221</b>
<b>UT HEALTH CENTER AT TYLER</b>	<b>655</b>

\* The U. T. Board of Regents leases land from Texas Southwest College for UT Brownsville. Use project site acres.

## APPENDIX C

### CODES AND STANDARDS

#### A. GENERAL REQUIREMENTS

1. The Project Architect/Engineer shall design UT System construction projects to comply with the current University of Texas Health Science Center at Houston (UTH) approved editions of the following codes and standards and advise the Owner of code revisions having impact on the project design.

2. The State Fire Marshal is the code authority having jurisdiction (AHJ) for all issues pertaining to NFPA 101 Life Safety Codes and NFPA 1 Fire Code

For all UT System Capital Improvement Program (CIP) design and construction projects directly managed by UTH and for all building-related codes other than NFPA 101 Life Safety Codes and NFPA 1, the UT Health Science Center at Houston (UTH) is the authority having jurisdiction (AHJ) and/or the responsible party for coordination with other governing agencies having jurisdiction. When conflicts arise, UTH will facilitate resolution and confirm interpretations after a thorough and joint review with the institution(s).

Refer to the UTH Risk Mitigation & Monitoring Plan for confirmation of additional authorities having jurisdiction and for additional clarification on state and federal regulatory requirements

3. The Project Architect/Engineer shall prepare a written codes and standards analysis, "Building Code Analysis," for each project for review by UTH. This analysis shall provide a side-by-side comparison of the requirements of the below listed codes and standards for each code issue and an indication of which code requirement is being applied to the project (see sample analysis Exhibit 2). In the absence of a careful and thorough discussion by the design team of a specific conflict between the codes, the default is to design to the more restrictive or more protective code. These code discussions are project-specific and on a point-by-point basis within the codes. The final approved Building Code Analysis shall be placed in the project construction document drawings for future reference by the Owner. See Appendix L for submittal requirements.

4. If deemed necessary for local authority to review any aspect of the project, such review shall be arranged to allow an UTH or institutional representative to attend with the Project Architect/Engineer.

5. In the event of the need for interpretation among the codes and standards, the Project Architect/Engineer shall inform UTH of the need for an interpretation and UTH will establish the requirements for compliance.



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6. UTH also requires the Project Architect/Engineer to comply with certain provisions of the local fire department that provides fire protection services for the institution. These provisions may include locations and dimensions for fire fighting access, including fire lanes; locations and specifications for stand pipes, fire hose cabinets, fire control room, and fire hose connections; elevator requirements; and other similar matters.
7. The Project Architect/Engineer shall be required to provide an affirmation statement that the project is designed in compliance with applicable codes and standards. The following statement shall be located on the drawing index page or adjacent the project building code summary:

“Life Safety Code Compliance: The Project Architect/Engineer acknowledges that construction projects for the University of Texas System must, at a minimum, be designed in accordance with the requirements of National Fire Protection Association (NFPA) 101 Life Safety Code and NFPA 1 Fire Code as currently adopted by the State Fire Marshal, Texas Government Code sec. 417.008(e). Therefore, the Project Architect/Engineer affirms that, to the best of his/her professional judgment, knowledge, and belief, the design of this project satisfies the requirements of NFPA 101 Life Safety Code and NFPA 1 Fire Code as well as any other codes or standards made applicable to the project by the professional services agreement.”

### B. DESIGN BASIS

1. National Fire Protection Association National Fire Code NFPA 101 - 2015 Edition Life Safety Codes (LSC), including the indicated edition date of all referenced standards (effective May 1, 2016)
2. National Fire Protection Association National Fire Code NFPA 1 Fire Code – 2015 Edition including the indicated edition date of all referenced standards (effective February 1, 2017); **see Exhibit 1 for additional details and exceptions to NFPA 1**
3. International Building Code 2015 Edition (effective May 1, 2016)

### C. ARCHITECTURAL DESIGN

1. NFPA 45 Edition Standard on Fire Protection for Laboratories Using Chemicals as applicable
2. Texas Department of Licensing and Regulation (TDLR)

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- a. Elimination of Architectural Barriers Texas Government Code Chapter 469, Texas Administrative Code 16 TAC part 4 chapter 68 and Texas Accessibility Standards (TAS)

**NOTE: If commencement of construction begins on or after March 15, 2012, then new construction or alterations shall comply with the 2012 TAS.**

- b. Elevators and Escalators, Health & Safety Code chapter 754 and 16TAC § 74 (see 16TAC § 74.100 for effective dates of ASME standards) (see 754.014(k) for date of installation definition)
  - c. Boilers, Health & Safety Code chapter 755 and 16TAC § 65
3. Americans with Disabilities Act, 28 CFR Part 35 Nondiscrimination on the Basis of Disability in State and Local Government Services, Final Rule, as published in the Federal Register Friday, July 26, 1991
    - a. **NOTE: If physical construction or alterations commence on or after September 15, 2010 and before March 15, 2012, then new construction and alterations may comply with one of the following: the 2010 ADA Standards, or the 1991 ADA Standard. Physical construction or alterations commence when the General Construction agreement is signed.**
    - b. **If physical construction or alterations commence on or after March 15, 2012, then new construction and alterations shall comply with the 2010 ADA Standards**

### D. CIVIL/STRUCTURAL DESIGN

1. ACI – 318 current edition, Building Code Requirements for Structural Concrete
2. AISC current edition, for Steel Construction Manual
3. Texas Department of Insurance Windstorm Inspection Program
4. FEMA 100-year flood plain
5. UTH Guideline Specifications for Division 7

### E. MECHANICAL & PLUMBING DESIGN

1. International Mechanical Code 2015 Edition
2. International Plumbing Code 2015 Edition

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3. International Fuel Gas Code 2015 Edition
4. UTH Guideline Specifications for Divisions 11, 21, 22 and 23

### F. ELECTRICAL DESIGN

Based upon the February 2017 Memorandum of Understanding (MOU) between the State Fire Marshal's Office (SFMO), Texas Department of Licensing and Regulation (TDLR), and U.T. System (UTS), the effective date of compliance with the latest adopted edition of NFPA 70 National Electrical Code (NEC) was established such that every three (3) years in September when the latest NEC is published and released by NFPA, TDLR announces on its website that the new version of the NEC will become effective in one year. The SFMO will allow the use of, and UTS will require compliance with, the latest edition of the NEC as adopted by the TDLR based upon the start of electrical work. Currently, the following effective dates are in effect:

1. National Electrical Code 2014 Edition for electrical construction beginning before September 1, 2017.
2. National Electrical Code 2017 Edition for electrical construction beginning on or after September 1, 2017.
3. Ongoing adoption will occur on a three-year cycle as indicated above.

**NOTE: TDLR defines the start of electrical work as the day an electrician begins installing electrical materials or equipment within the building structure. Start of work includes the installation of temporary power for construction.**

3. UTH Guideline Specifications for Divisions 26, 28 and 33

### G. ENERGY & WATER CONSERVATION DESIGN

1. Energy Conservation Design Standard for New State Buildings (including major renovation projects), current edition, State Comptroller's Office, Government Code sec. 447.004 and 34 TAC § 19.32
2. ASHRAE / IESNA 90.1 2013 Edition (effective June 1, 2016) or International Energy Conservation Code (IECC) 2015 Edition (effective June 1, 2016)
3. SECO's Water Conservation Design Standards for State Buildings and Institutions of Higher Education Facilities dated April 2016 (effective June 1, 2016)

## APPENDIX C

### H. CODE COMPLIANCE CONFIRMATION REVIEWS

1. An independent project design “Code Compliance Confirmation Review” will be performed, documented and submitted to the Owner at DD and 75% CD submission to ensure compliance with the following codes as they apply to a specific project. The Owner’s Project Manager will direct the A/E to obtain this code confirmation review or will direct the Owner’s Code Consultant to perform this code confirmation review. (non-inclusive code review list, editions as listed in sections above):
  - International Building Code (IBC)
  - International Fuel Gas Code (IFGC)
  - International Mechanical Code (IMC)
  - International Plumbing Code (IPC)
  - National Electrical Code (NEC) NFPA 70
  - NFPA 101 Life Safety Code
  - NFPA 1 Fire Code
  - NFPA Codes as applicable, with emphasis on the following:
    - NFPA 101 Referenced Required Codes
    - NFPA 1 Referenced Required Codes
    - NFPA 12A
    - NFPA 20
    - NFPA 22
    - NFPA 54 As adopted by TX Railroad Commission
    - NFPA 58 As adopted by TX Railroad Commission
    - NFPA 92A
    - NFPA 92B
    - NFPA 203
    - NFPA 204
    - NFPA 2001
  - FEMA 100-year flood plain verification
  - Texas Department of Insurance (TDI) First Tier Coastal Counties wind load criteria
2. This Code Compliance Confirmation Review does not relieve the A/E firm from complying with the approved codes and standards for the project. See Exhibit 3 for sample code review template.

### I. ACOUSTICAL DESIGN - BACKGROUND NOISE DESIGN CRITERIA FOR TYPICAL OCCUPANCIES

## APPENDIX C

1. Design in accordance with good practice to achieve conventional ambient noise levels qualified in Noise Criteria (NC) defined in current ASHRAE Applications Volume, Chapter 42 and ANSI S1.8 Reference Quantities for Acoustical Levels – ASA 84.
2. The ambient sound level of an occupied space is not to exceed the following NC listed for its respective typical occupancy unless specifically directed otherwise by the involved institution’s statement of project program requirements. Spatial forms, materials, assemblies, systems and equipment selections are to be designed as required to achieve a standard quality of specified level of maximum background noise.

<u>a. Typical Occupancy</u>	<u>Max. Noise Criteria</u>
	<u>NC</u>
(1) Apartments/Dorms:	
(a) Individual rooms/suites	35
(b) Meeting/banquet rooms	35
(c) Halls, corridors, lobbies	40
(d) Service/support areas	45
(2) Offices:	
(a) Executive	30
(b) Conference rooms	30
(c) Private	35
(d) Open-plan areas	40
(e) Computer/Business machine areas	45
(f) Public circulation	45
(3) Research, Hospital, and Clinics:	
(a) Private rooms	30
(b) Wards	35
(c) Operating rooms	25
(d) Laboratories:	
Research & General	35
Teaching	30
At Hoods: 4’ AFF, 3’ in front	
0-50% sash position	55
(e) Corridors	35
(f) Public areas	40

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(4)	Schools:	
	(a) Lecture and classrooms	30
	(b) Open-plan classrooms	35
	(c) Lecture theaters	30
(5)	Libraries	35
(6)	Performing Arts:	
	(a) Theater	25
	(b) Stagehouse	25
	(c) Trap room	25
	(d) Orchestra pit	25
	(e) Rehearsal rooms	25
	(f) Teaching studios	30
	(g) Practice rooms	30
	(h) Ensemble rooms	30
	(i) Shop	45
(7)	Recording studios:	
	(a) Recording room	20
	(b) Sound control room	25
	(c) Other control rooms	25

3. These conventional standards of the level of ambient noise in a space are independent of and prior to the installation of any Owner-furnished equipment, furniture and furnishings unless specified otherwise. Other resource material describing conventional ambient noise criteria is available in the current edition of Ramsey/Sleeper Architectural Graphic Standards.

## EXHIBIT 1

Excerpts from:

### **4015**

Title 28. Insurance Adopted Section  
Part 1. Texas Department of Insurance  
Chapter 34. State Fire Marshal

#### **SUBCHAPTER C. STANDARDS AND FEES FOR STATE FIRE MARSHAL INSPECTIONS 28 TAC §34.303**

Beginning with page 7 of 12 - **4015...**

With respect to rehabilitation or remodeling, the State Fire Marshal can assist property owners and operators with finding reasonable equivalencies, alternatives, and modifications to achieve rehabilitation and meet the requirements and intent of the adopted code. Where there are practical difficulties that prevent the university's facilities management from carrying out the provisions of the NFPA 1 Fire Code during rehabilitation or remodeling, the state fire marshal can provide information to allow for flexibility while still providing reasonable protections. The state fire marshal is committed to working closely with staff at the state's universities to ensure safe conditions by applying adopted standards in a reasonable manner.

With respect to other occupancies, the State Fire Marshal intends to interpret provisions of the NFPA 1 Fire Code as adopted, while also allowing for equivalencies, alternatives, and modifications as necessary.

*Business Occupancies* – New and existing business occupancies, which constitute the majority of university academic buildings, must comply with NFPA 1 Fire Code, Chapter 20.13 and NFPA 101 Life Safety Code. NFPA 101 Life Safety Code, Chapter 38/39.3.2.1 refers to 8.7 and NFPA 45, Standard on Laboratories Using Chemicals.

*Health Care Occupancies* – New and existing health care occupancies must comply with NFPA 1 Fire Code, Chapter 20.4.1; NFPA 101 Life Safety Code; and NFPA 99, Health Care Facilities Code. NFPA 101 Life Safety Code, Chapter 18/19.3.2.2 refers to the NFPA 99, Health Care Facilities Code.

*Chapter 16, Safeguarding Construction, Alteration and Demolition* – NFPA 101 Life Safety Code, Chapter 4.6.10 provides for equivalent safeguards in comparison to the NFPA 1 Fire Code for buildings undergoing construction and alterations.

*Chapter 18, Fire Department Access and Water Supply* – The intent is for universities to reach out to local fire officials and work together to determine any particular requirements for fire department access and water supply, and that they find mutual solutions to resolve any specific issues.

*Chapter 21, Airports and Heliports* – Refers compliance to the NFPA 101 Life Safety Code and applicable sections of Chapter 40 and Chapter 42.

*Chapter 23, Cleanrooms* – Refers compliance to NFPA 318 Standard for the Protection of Semiconductor Fabrication Facilities with exceptions.

*Chapter 25, Grandstands, Bleachers, Tents and Membrane Structures* – Refers compliance to the NFPA 101 Life Safety Code. Specific provisions are referenced in Chapter 11, Chapter 12 and Chapter 13.

*Chapter 28, Marinas, Boatyards, Marine Terminals, Piers, Wharves* – Compliance prescribed per occupancy chapter, NFPA 101 Life Safety Code. Chapter 11 has provisions related to piers.

*Chapter 29, Parking Garages* – Refers compliance to NFPA 101 Life Safety Code, Section 42.8 and NFPA 88-A Standard for Parking Structures.

*Chapter 30, Motor Fuel Dispensing Facilities and Repair Garages* – Compliance is within scope of the NFPA 30 Flammable and Combustible Liquids Code and NFPA 30-A Code for Motor Fuel Dispensing Facilities and Repair Garages as adopted by State Fire Marshal rules under Health and Safety Code Chapter 753.

*Chapter 32, Motion Picture and Television Production Studios, Soundstages, and Approved Production Facilities* – Compliance prescribed per occupancy chapter and reference to the NFPA 140 Standard On Motion Picture And Television Production Studio Soundstages, Approved Production Facilities, and Production Locations as applicable.

*Chapter 34, General Storage* – Compliance prescribed per occupancy chapter. Typical university storage occupancies do not contain the type of commodities referenced in this chapter and in most cases already meet compliance with NFPA 101 Life Safety Code, Chapter 42.

*Chapter 35, Animal Housing Facilities* – Compliance is prescribed per reference to the NFPA 150 Standard on Fire and Life Safety in Animal Housing Facilities as applicable for existing buildings.



*NFPA 150 Standard on Fire and Life Safety in Animal Housing Facilities, Chapter 1.3.3* – This standard also applies to existing facilities in which any one of the following conditions exists: (1) a change of use or occupancy classification occurs where animals are introduced; (2) a change is made in the sub-classification or category of the animals housed; (3) a renovation, modification, reconstruction, or addition is made; (4) a building or structure with an animal housing facility is relocated; (5) a building with an animal housing facility is considered damaged, unsafe, or a fire hazard; (6) a property line that affects compliance with any provision of this standard is created or relocated.

*NFPA 150 Standard on Fire and Life Safety in Animal Housing Facilities, Chapter 1.4.1* – Unless otherwise specified, the provisions of this standard do not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard are retroactive.

*Chapter 36, Telecommunication Facilities and Information Technology Equipment* – Compliance prescribed per occupancy chapter and reference to the NFPA 75 Standard for the Fire Protection of Information Technology Equipment as applicable.

The State Fire Marshal recognizes that cases may arise that can present unusual or extraordinary circumstances and challenges for compliance with certain provisions of the code. In these cases, it is the intent the state fire marshal to determine an acceptable solution that offers a reasonable but equivalent method of compliance for the particular condition

### **§34.303. Adopted Standards.**

(a) The commissioner adopts by reference:

(1) NFPA 1-2015 Fire Code, except for

(A) Chapter 1 Administration, to the extent that subsections 1.6 Enforcement, 1.7 Authority, 1.8 Duties and Powers of the Incident Commander, 1.9 Liability, 1.10 Fire Code Board of Appeals, 1.11 Records and Reports, 1.12 Permits and Approvals, 1.13 Certificates of Fitness, 1.14 Plan Review, and 1.16 Notice of

Violations and Penalties do not apply to State Fire Marshal inspections;

(B) Chapter 30 Motor Fuel Dispensing Facilities and Repair Garages, to the extent it conflicts with standards adopted in Subchapter A of this chapter and Health and Safety Code Chapter 753;

(C) Chapter 60 Hazardous Materials, to the extent it will not be applied to laboratories and laboratories in health care occupancies; and

(D) Chapter 65 Explosives, Fireworks, and Model Rocketry, to

the extent it conflicts with subchapter H of this chapter and Occupations Code Chapter 2154;

(2) NFPA Life Safety Code 101-2015;

(b) These copyrighted standards and recommendations are adopted for inspections performed under Government Code §417.008, except to the extent they are in conflict with sections of this chapter or any Texas statutes or federal law. The standards are published by and are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269. A copy of the standards is available for public inspection in the State Fire Marshal's Office.

EXHIBIT 2  
BUILDING CODE ANALYSIS [TEMPLATE]

Project Name:

Institution:

Project No.

Code/Standards Analysis Date:

Project Phase:

Applicable Codes

1. NFPA 101 Life Safety – 2015 Edition
2. NFPA 1 Fire Code – 2015 Edition
3. International Building Code – 2015 Edition 4. Texas Accessibility Standard – 2012 Edition
5. etc.

Note: The code requirements selected as the basis for design are bolded.

<u>Code Issue</u>	<u>NFPA 101</u>	<u>IBC</u>
Occupancy Classification		
1. Offices and college classrooms less than 50 occupants	<b>Business 6.1.2.2</b>	Group B With 304.
Construction Classification		
1. Main Building	Not addressed	<b>Type IIA 403.3.1</b>
Stair Pressurization	Not Required	<b>1005.3.2.5</b>
Distance between exits	<b>250 ft. if sprinkled</b>	250 ft. if sprinkled
Etc.		

## EXHIBIT 3

### CODE COMPLIANCE CONFIRMATION REVIEW [TEMPLATE]

[Date]

[Project Manager]

UT Health Science Center at Houston

Reference: Review Comments on [100%DD or 75% CD]  
[Project name]  
[Institution]  
UTH Project No. XXX-XXX

Dear [Project Manager]:

[Code Consulting Firm (CCF)] has complete its Code Compliance Confirmation review and has prepared review comments on the documents for the [DD or 75% Construction Documents] package for the referenced project.

In performing this current service, [CCF] reviewed the following documents, furnished by A/E.

- DD or 75% Construction Documents Drawings dated [month dd, yyyy].
- DD or 75% Construction Documents Project Manual, Architectural Volume I Divisions 1-14, dated [month dd, yyyy].
- DD or 75% Construction Documents Project Manual, M.E.P. Volume II Divisions 21 - 33, dated [month dd, yyyy].

The principal codes used in this review are as follows:

- International Building Code, 2015 Edition (IBC)
- NFPA 101, *Life Safety Code*, 2015 Edition (LSC)
- NFPA 1, *Fire Code*, 2015 Edition

Other applicable codes, standards, and regulations are listed in the Project Data shown on the Building Code Analysis Drawing 1.1 and in the Project Information Manual. Additionally, FEMA 100-year flood plain verification and TDI First Tier Coastal County wind load criteria were reviewed where applicable.

#### Description of Project

The [Project] consists of ...

*Note: The follow major headings in this Code Compliance Confirmation Review Template are for reference only to demonstrate process.*

**Building Code Issues Comments:**

[Drawing 5.1, Drawing 10.21, Drawing 11.41 indicates there are accessible dwelling units. There is no table that indicates the discrete Apartment ID and Building ID for each accessible dwelling unit so that a user of the plans can see in one place the summary of accessible units.]

Requirements for Hazardous Materials and Laboratories Insert

comments as necessary.

Means of Exit Access

Insert comments as necessary.

Emergency and Standby Power Insert

comments as necessary.

Fire Water Supply

Insert comments as necessary.

FEMA 100-year Flood Plain Insert

comments as necessary.

TDI Windstorm Inspection Program Insert

comments as necessary.

Other Major Code Headings as Necessary Insert

comments as necessary.

Summary

Compliance with the comments stated in this letter does not relieve the A/E from complying with the Owners Design Guidelines, Owner's insurance/underwriting requirements, applicable NFPA Standards and State requirements.

Sincerely,

Project Manager

Texas License No. xxxxxx

cc: UT System Office of Risk Management  
UTH Director of Strategic Design and Initiatives  
UTH Staff Engineering Manager

Revision Log  
Appendix C

Rev. Date	Remarks
3/1/06	Adopt use of Master Format for specs. (change Div 15 & 16 to Div 1-33)
10/1/06	Adopt 2006 NFPA 101 LSC and 2006 IBC
1/1/09	Add Revision Log
	Adopt ASHRAE 90.1 – 2007 edition effective 1/1/09 per SECO
	Add effective date language to TDLR Elevator requirements
	Add language to use current edition of ACI 318 & AISC
10/12/09	Adopt 2009 NFPA 101 LSC and 2009 IBC effective 10-15-09
10/1/10	Changed more stringent to more restrictive or more protective, added 2010 ADA Standard effective date
3/1/11	Updated International Energy Conservation Code Edition to 2009 effective 4/1/11
9/1/11	Adopt International Energy Conservation Code 2009 Edition effective 6/1/11, adopt ASHRAE 90.1 – 2010 edition effective 9-1-11, adopt Water Efficiency Standard for State Buildings and Institutions of Higher Edu. effective 9/1/11
3/1/12	Adopt 2012 TAS effective 3/15/12
11/1/12	Adopt 2012 NFPA 101 LSC and 2012 IBC effective 10-19-12
7/13/15	Adopt 2012 NFPA 1 Fire Code effective 7-6-15
6/3/16	Adopt 2015 NFPA 101 LSC and 2015 IBC, IMC, IPC, IFGC, IECC effective 5-1-16 Adopt ASHRAE 90.1 – 2013 edition and Water Conservation Design Standard effective 6-1-16
8/4/16	Add Adopt 2015 IBC effective 5-1-16 omitted from text B3 on 6/3/16
7/20/17	Adopt 2015 NFPA 1 Fire Code effective 2-1-17
7/20/17	Adopt 2017 NEC effective 9.1.17 and SFMO/TDLR 3-yr NEC update process
7/20/17	Clarify addition of IECC 2015 for energy code compliance
4/17/18	Clarify UTH's AHJ role for UTH projects
6/13/18	Clarify that TX Railroad Commission has amended NFPA 54 & 58

## APPENDIX D

### CONSTRUCTION PHASE CRITERIA

#### A. GENERAL REQUIREMENTS

For the Construction Phase of the Project, the Architect/Engineer (A/E) is responsible for providing project administration for the Owner in accordance with established procedures, for observing the Work placement and confirming intended operation and compliance, and for representing the Owner in achieving project goals.

#### B. OWNER REPRESENTATIVES

Upon award of the contract, the UTH Resident Construction Manager (RCM) assumes the management responsibilities and Owner authority for the Construction Contract. During the time from receipt of bids until formal award of the Contract, the A/E works with both the RCM for coordination of the start of Work and with the UTH Design Project Manager (PM) to complete the award process. During construction, the A/E works directly with the RCM, who may be stationed either in the area of the project or at UT System (UTS) Headquarters in Austin, and his Construction Inspector(s) (CI) who are based at or near the project. The A/E also works with Owner consultants for testing of materials, balance and adjustment of systems, commissioning, and other special services as directed by the RCM.

#### C. INVOICES FOR CONSTRUCTION SERVICES

The A/E is to resolve final design and bid phase billings with the PM, which will establish the basic services fees for the construction phase. Beginning with the first invoice to include construction phase services, the A/E is to direct all invoices to the RCM for approval and processing. The invoice format, numbering, and HUB reporting is to remain as established during the design phase.

#### D. PRECONSTRUCTION ACTIVITIES

Upon UTH's determination to recommend award of the Contract, the RCM and/or the PM will contact the A/E to request that they begin preparations for construction start. Such activities will include:

1. Assist the RCM in scheduling, coordinating, and administrating a pre-mobilization meeting with the Contractor(s) and the Campus representatives when necessary for mobilization of the site in advance of a formal Notice to Proceed. Distribute notes.
2. Assist the RCM in scheduling and making arrangements for a Preconstruction Conference and a Partnering Workshop to be held prior to actual start of work at the site. Coordinate A/E and GC activities related to the Conference and the Workshop.

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3. Prepare a handout brochure for the Preconstruction Conference. An example brochure with general instructions will be provided to the A/E by the RCM or PM. In general, the A/E's responsibility for the brochure includes providing:

- \* Cover page with Project Title & Number, Conference Title, and Date.
- \* Project Directory including key members of all construction phase teams.
- \* Photocopy of Special Conditions from Bid Documents
- \* Photocopy of Specification Section 01 31 00 from Bid Documents
- \* A/E Administrative Plan for the Construction Phase of the project.
- \* A/E sample forms for Contractor's submission of Project Submittals, RFIs, etc. \*
- \* A/E sample logs for tracking of submittals, RFIs, changes, etc.
- \* A/E list of anticipated submittals.

and arranging, duplicating, and binding those with the following items provided by UTH, to make approximately 30 brochure copies:

- \* The "Table of Contents" to be used for the brochure.
- \* The "Agenda" for the Conference, to be included in the brochure.
- \* Supplemental text regarding "Partnering".
- \* Supplemental text regarding "Project Meetings".
- \* Supplemental text regarding "Inspections and System start-up".
- \* Supplemental text regarding the "HUB" Program.
- \* UTH Brochure Enclosures (*sample forms and flow diagrams*) with list identifying each \*
- \* Other items which may be provided or requested.

### E. PROJECT ADMINISTRATION

During the life of the construction contract, the A/E is responsible for project administration duties including, primarily, those listed herein. Unless otherwise stated, these services are covered by the percentages allowed for basic service fees in the A/E Agreement. Additional construction phase fees, other than those related to an increase in scope of the Work as outlined hereinafter, must be authorized by the RCM. All fee payments during construction phase are subject to approval by the RCM.

1. Establish and maintain a numbering and tracking system for all project records, including all change proposals, requests for information, submittals, supplementary instructions and informational clarifications, etc., and distribute updated copies of tracking logs to all parties at each monthly meeting and otherwise when requested.
2. Attend and administer all meetings with the Contractor, including periodic job meetings as well as the regularly recurring progress meetings scheduled by the RCM which normally occur monthly or bi-weekly. Some Component Institutions and/or some project conditions may require more frequent meetings which the A/E will be expected to attend and

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document. Provide summary notes of all meetings in a format acceptable to the RCM and distribute notes promptly to all parties.

3. Review Contractor's Project Schedule, Schedule of Values, Submittal Schedule, and Equipment Matrix carefully with Owner and Contractor to establish appropriate basis for construction monitoring, payment processing, and system commissioning. Provide detailed written comments to Contractor for revisions and recommend acceptance to Owner when appropriate. Review the Project Schedule to determine realistic feasibility and inclusion of contract requirements, including close-out.
4. Provide professionally competent review of all shop drawings and submittals promptly and in accordance with contract requirements, so as not to delay progress. The Contract indicates that the submittal process should be accomplished within thirty (30) days but goals developed at "Partnering" workshops will likely include faster processing. A/E's are reminded that no scope changes are to be made during shop drawing review that could cause the contractor to increase the contract price without prior RCM agreement and issuance (by A/E) of change pricing documents.
5. Provide professional, prompt replies to requests for information on interpretation of drawings or specifications or resolution of conflicts in the documents. Such response must not impact the construction cost or time without prior RCM agreement and issuance (by A/E) of change pricing documents to the Contractor.
6. Assist the Owner in obtaining consents, waivers, releases, HUB reports, and other documentation required in association with payments. Refer to UTH Specification Sections 10 31 00 Project Administration, and 01 77 00 Project Close-out Procedures.
7. Monitor and review construction materials testing to provide professional opinions on results of tests and any appropriate corrective measures as may be necessary.
8. Perform design, redesign, revisions to drawings, new drawings and changed specifications, as required or requested or authorized by the RCM, to describe necessary or desired changes in a clear professional manner suitable for competent pricing by the Contractor. Submit such change documents to the RCM & CI for review and then to the Contractor for its cost and time proposal response.
9. Prepare independent cost estimates and time extension estimates on all change proposals for use in comparing with those prepared by the Contractor. Copies of independent estimates and other pertinent data shall be furnished for the Owner's review concurrent with submission of change documents to Owner for review.
10. Evaluate Contractor cost and time proposals for changes, including compliance with contract pricing terms and required format as well as appropriate cost of the Work, and



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provide written recommendations to the Owner to accept or identify in writing to the Contractor any revisions necessary for acceptance. Assist the RCM & CI in negotiation of costs/credits and time extensions.

11. Perform services similar to 9. and 10. above for the Owner in evaluation of Contractor claims, and all other issues impacting construction costs and/or time.
12. Upon RCM approval of the price and/or time for a proposed change, prepare and issue change orders using the standard UTS Change Order form. See additional comments which follow under "F" for change orders and related fees.
13. Assist CI in checking as-built drawings before certifying each progress payment to insure that they are being kept up-to-date in an appropriate format in compliance with contract requirements and established administrative procedures.
14. Receive from Contractor, review, require necessary revisions, and, ultimately recommend acceptance of all close-out documentation, including as-builts, warranties, product literature, operating manuals, etc. Accumulate, catalogue, and when acceptable, transmit close-out items to Owner. See Specification 01 77 00.

### F. OBSERVATION OF THE WORK

1. The A/E is to make periodic visits to the jobsite to observe and inspect the work.  
The Owner-A/E Agreement requires that a principal of the A/E (Architect and Consultants) visit the site at least twice per month, but the A/E's project personnel should expect to be at the site much more frequently as needed to clarify and resolve issues, respond to questions, and administer the work. In addition, site visits are required for general review of work placement and for specific reviews related to certification of progress payments and formal inspections. Provide written field reports for all site visits. Assist the RCM & CI in matters of interpretation of design intent and other consultation as requested.
2. All critical phases of the work are to be observed by the A/E including the start of all significant work activities as well as tests of sewer, water, gas and electrical lines and equipment, concrete pours and foundation excavation, piers and pile driving, start-up and commissioning of mechanical and other systems, etc.
3. Review Contractor's periodic payment estimates with Contractor and CI at the jobsite, along with verifying stored materials either on the site or in off-site storage. Assist in resolution of payment request amounts to enable certification of payment.
4. Make a detailed list of all outstanding work items and/or deficiencies in the Work in association with Overhead or "in wall" Inspections, System(s) Start-up Inspections,

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Substantial Completion or Prefinal Inspection, and Final Inspection. Assemble lists from all parties participating in the inspections and furnish the official consolidated punch list(s) to all parties. Assist in verification of correction of punch list items.

### G. CHANGE ORDERS & CHANGE ORDER FEES

1. UTH Change Orders can be issued either for singular change actions, or for accumulated multiple change actions, and are issued only upon direction from the RCM, normally once a month. The A/E is to draft the Change Order form, using the standard UTS document, along with a brief "change order summary" describing the reasons for making each change. Upon concurrence by the RCM, the A/E is to make eight (8) copies for original signatures. Note that all eight (8) copies must have the "change order summary" attached, and three (3) of those eight copies must have all backup documentation, which includes the issued change and cost response.
2. Change Order fees are to be based on a maximum of the percentage established in the A/E Agreement, but are negotiated with the RCM depending on the extent of additional A/E involvement. For changes likely to result in minimal or no cost, the A/E may submit a "Not-to-Exceed" proposal for consideration by the RCM. Such proposal shall be provided on a form similar to the UTH "A/E Additional Service Request and Authorization Form." Hourly rates are as stated in the A/E Agreement.
3. The A/E will not be paid fees for services related to any change resulting from errors and/or omissions under any circumstances. Further, UTH may expect the A/E to participate in paying for "gross" errors and omissions. UTH has found that change orders historically cost UTS 15%-20% more than competitive bid prices. Therefore, the A/E could be held financially responsible for some change order pricing if the number or cost of change orders resulting from errors and/or omissions is considered excessive or the errors/omissions are considered blatant.

### H. HISTORICALLY UNDERUTILIZED BUSINESSES (HUB)

State law and UT System policy require a good faith effort to award certain percentages of the total value of each construction contract, as well as A/E agreements, to certified HUB firms. To that end, the A/E must provide at least one set of plans and specifications to the various HUB Offices, minority business affairs offices, and/or economic development offices as determined at the time of bid. The A/E is to assist in verifying that the construction contractor is following his HUB plan and is submitting the appropriate documentation with construction progress payments.

### I. WAGE RATE COMPLIANCE

## APPENDIX D

The Contract Documents include both a minimum Prevailing Wage Rate for various work classifications and a Prevailing Wage Guideline for administration of wage rate compliance. The A/E is to assist in accumulation of documentation and evaluation of contractor compliance with contract wage rate provisions.

### J. PROJECT PARTNERING

1. UTH encourages the use of “Partnering” for all projects and has found that the time and effort expended on Partnering results in benefits to each of the parties.
2. The A/E is expected to take a leadership role in the Partnering Process, as it can significantly impact both project administration and Work placement. Principals and project staff of all design consultants are expected to attend and participate in Partnering Workshops and follow-up evaluations, and are expected to embrace the goals of the Team toward success of the project.

The University Of Texas System  
UT Health Science Center at Houston  
OWNER'S DESIGN GUIDELINES

**Revision Log**  
**APPENDIX D**

<b>Rev. Date</b>	<b>Remarks</b>
	Revisions prior to 3/1/11 are not recorded in this log

APPENDIX E

**ELECTRICAL CRITERIA**

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## APPENDIX E

### A. GENERAL REQUIREMENTS

#### 1. Materials

- a. All current carrying conductors shall be 95% conductivity copper. This includes primary cable, building wire, signal, communication and control wire, panel buses, switchgear and switchboard buses, and bus duct.
- b. Primary cable 5 KV and 15 KV shall be ethylene propylene insulated to 133% voltage level. Systems are to be grounded neutral with the extra thickness as a safety factor. Primary cable shall have copper conductors and copper shielding.
- c. The characteristics of the primary power service shall be determined specifically for the campus involved and for the particular location on the campus.
- d. In general, each major building shall have two underground primary feeders terminating in a double ended sub-station. This does not apply to all campuses.

#### 2. Transformers

- a. Each transformer in a double ended sub-station shall be sized to serve 75% of the maximum demand on the sub-station. In critical loads such as hospitals and research facilities or where determined to be necessary by the University and design team, this may be increased to 100%.
- b. Where feeders are arranged in a looped system, full capacity feed-through capability will be required.
- c. Generally the first transformation shall be to 277/480 volts, 3 phase, 4 wire. 4160 volts, 3 phase, 3 wire may be required for large motors.
- d. Three phase dry type transformers shall be installed at strategic locations to provide 120/208 volt, 3 phase, 4 wire service to incandescent and task lighting, convenience outlets, specific equipment loads and small motors. One of the determining factors of the transformer locations shall be the cost of the increased length of branch circuits versus the addition of transformers/panels.

#### 3. Metering

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- a. Minimally, watt hour and demand meters shall be provided to meter all energy usage. Consideration of the use of intelligent metering for power and energy tracking and reporting, power quality monitoring, reporting and alarms shall be made following discussion and coordination with the University and determining compatibility with existing campus metering systems.
  - b. Meters shall be equipped with the pulse initiators so they can be monitored remotely. Compatibility with existing campus metering systems shall be considered.
4. Utilization voltages generally shall be as follows, unless determined differently by design team with University approval:
- a. 4160 volts, 3 phase for motors 300 HP and larger.
  - b. 480 volts, 3 phase for motors 5 HP and larger.
  - c. 208 volts or 480 volts, 3 phase for motors 1 ½ - 5 HP.
  - d. 208 volts, 1 phase, for motors 1 ½ HP and smaller.
  - e. 120 volts for motors ½ HP and smaller.
  - f. 277 volts, 1 phase, for fluorescent lighting.
  - g. 120 volts, 1 phase, for incandescent and individual task lighting, convenience outlets and specific equipment loads.
  - h. 277 or 480 volts, 1 phase for high intensity discharge lighting, smaller space heating applications, and as required for special purpose outlets.
5. Services Outages – the following requirements shall be included in construction drawings and/or specifications:
- a. Any total or partial building service outage required to complete the installation shall be coordinated with and shall not proceed without written permission from the University.
  - b. A written request for service outage shall be forwarded to the Construction Inspector a minimum of 10 business days prior to desired outage. The

## APPENDIX E

Contractor shall include in his letter a schedule of work and an estimate of the time to accomplish the work.

- c. The University reserves the right to require the Contractor to perform this work during non-normally occupied hours at no increase in contract price.

### 6. Protection of Apparatus

- a. Contractor shall arrange not to bring electrical apparatus on job site, or place within the building until construction has progressed to the point where full protection from damage by weather, submersion by flooding, or other potentially destructive causes is assured.
- b. Extreme care shall be exercised at all times to keep the ends of primary service conductors sealed, air and water tight, until connections are made.

### 7. Energization of Primary Conductors

- a. When the primary service conductors have been initially energized, they shall not be de-energized except for emergency reasons, equipment failures, and like causes. Reasons for unscheduled de-energizations shall be immediately reported verbally and subsequently in writing to the Construction Manager.
- b. Should de-energization be required for cause, such de-energization shall not continue for a period exceeding three hours. The necessity and reason for one or more operations of scheduled de-energization shall be submitted to the Construction Manager, and subsequently confirmed and approved in writing prior to proceeding.

### 8. Adequate Space

- a. Provide adequate space for all electrical apparatus allowing ample room for access and servicing, removal and replacement of parts, etc., as required.
- b. Provide adequate space for telecommunication system equipment on a per floor basis as required. Allow ample wall space for termination of equipment and multi-conductor cables from all telecommunication locations on floors. Terminal boards and cabinets must not be installed in janitor closets or storerooms.
- c. A clear statement shall be made concerning construction power: where, and at what voltage and phase, who makes the installation, and who is responsible for the cost.



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### 9. Material Quality

- a. Electrical materials shall comply with the standards of the Underwriters Laboratories, Inc., where that body has established test procedures for a class of material. Evidence of such compliance shall be the U. L. label, or “listing” under Re-examination Service.

- (1) In general, specify top-of-the-line products of proven reliability. Although we are required to encourage competition, in the exceptional case where there is no equal to a product which it would be to our advantage to use, justification must be documented.

### 10. Lighting

- a. The lighting level required and the type of luminary to be used in each area, interior and exterior, shall be submitted. The calculated lighting level based upon the lighting system designed shall also be submitted by the DD stage or early CD to prevent redesign. Floor or site plans with lighting software generated photometrics are strongly encouraged and may be required by the University depending on the application, for normal lighting and separately for emergency lighting. Catalog cut sheets on each lighting fixture shall be submitted for review.

### 11. Lightning Protection

- a. In general, all buildings shall have an Underwriters Laboratories, Inc. approved, Master Label lightning protection system. Where such a system is not provided, complete justification for its elimination shall be made a part of the record.

### 12. Provision for the Handicapped

- a. New buildings shall be constructed to comply with current Texas Accessibility Standards. Remodeled buildings shall be brought into compliance as required. This shall include, but not necessarily be limited to:
  - (1) Height of wall mounted devices, receptacles, light switches, card readers, etc., above finished floor.

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- (2) Type and location of audible and visible fire alarms and other distress signals.

### B. DESIGN REVIEW SUBMITTAL REQUIREMENTS

1. The A/E will be required to present the plans and specifications for review to UTH at the intervals outlined in the A/E Agreement. Intermediate reviews may be required if the scope of the project has been changed or if an earlier review found the plans and specifications unacceptable either as a whole or in part.
2. The Electrical Engineering consultant(s) will participate in all reviews, work sessions and presentations where this discipline is involved. Items outlined below are to be included for review at each phase or stage of completion.
3. UTH Project Name and Number, north arrows, and graphic scales on drawings.
4. Engineered drawings are required to include the engineering firm's Texas Registration number and the engineer of record's Texas PE number.
5. Schematic Design – Refer to Appendix L
6. Design Development – Refer to Appendix L
7. Construction Documents:
  - a. Interim - 50% CD stage presentation:
    - (1) Review of specifications using tracked changes for any modifications made to UTH base specifications.
    - (2) Overall progress made to DD documents prior to those listed for 75% CD.
  - b. Interim - 75% CD stage presentation:
    - (1) All electrical distribution equipment located.
    - (2) Complete lighting and light switching layouts.
    - (3) Lights, receptacles and equipment requiring electric power circuited, but circuit numbering may not be complete.
    - (4) Fixture schedule complete.
    - (5) Electrical symbols schedule complete.

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- (6) Site plan, all services detailed.
  - (7) Panel schedules nearly complete.
  - (8) Separate grounding system design complete.
  - (9) Electrical details nearly complete.
  - (10) One-line or riser diagram complete, except final sizing of protection, transformers and feeders depending upon final mechanical equipment selections.
  - (11) Updated load analysis accurate to 75% CDs.
  - (12) Reflected ceiling plans to match architecture's.
  - (13) Specifications complete.
- c. Final - 100% Submittal:
- (1) Design complete. Corrections required from Final Review Comments to be included on either another final submittal or as addenda, depending upon the extent and severity of comments.
  - (2) Engineer of Record's seal shall be on all drawings.

### C. ENERGY CONSERVATION

1. Electrical systems design shall comply with The Energy Conservation Design Standard for State Buildings except Low-Rise Residential Buildings, based on ASHRAE Standard 90.1 for Nonresidential Buildings. See Appendix C for current edition.
2. Consideration shall be given to efficiency, lamp life, and ease of maintenance of light source:
  - a. In general, use fluorescent, HID or LED sources in lieu of incandescent or quartz lamps.
  - b. Use incandescent or quartz only where aesthetics or the specific function requirement outweighs economic considerations.

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- c. Where incandescent or quartz sources are used, consider methods for increasing lamp life and reducing energy consumption, such as limit the use and quantity, use dimmer control, etc.
  - d. Coordinate with each University campus for preferred lamp and fixture types.
  - e. Design illumination levels shall be as set forth in IESNA Lighting Handbook, latest edition.
  - f. Consider maximum flexibility for switching and circuiting for lighting control as natural illumination levels, and/or task change:
    - (1) Automatic occupancy sensing may be used in areas where this may be applicable to save energy, even where not required by ASHRAE 90.1.
  - g. Switch rows of fixtures nearest natural illumination (windows) separate from other fixtures where applicable.
  - h. Provide multiple circuits for outside lighting, such that lighting can be reduced, yet uniform coverage retained, in times of critical energy shortage or as applicable for scheduling.
  - i. Control outside lighting with photo-electric cells in conjunction with a time-of-year adjustable time switch capable of one "off" and one "on" operation during the hours of darkness.
  - j. Designate security fixtures that are to remain on all night as controlled with photocell only.
3. Use task lighting techniques with lower room ambient lighting levels where applicable and where task areas can be defined to achieve energy conservation.

### D. COORDINATION OF DESIGN

- 1. The A/E shall prepare Reflected Ceiling Plans that coordinate and accurately locate ceiling panels, lighting fixtures, A/C supply and return grilles, sound system speakers, automatic sprinkler heads, fire and smoke detectors, access doors, and any other ceiling located items.

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2. The A/E shall make every effort to coordinate the design between disciplines. The final drawings shall as a minimum be checked for the following:
  - a. Physical space above ceiling for duct work, lighting fixtures, piping, etc.
  - b. Compatibility of lighting fixtures to ceiling types and the environment in which they are installed.
  - c. Compatibility of all equipment to the environment in which they are installed.

### Revision Log Appendix E

Rev. Date	Remarks
10/1/10	Various technical clarifications throughout document and deliverable requirements

## APPENDIX F

### **LANDSCAPE ARCHITECTURE - SITE DEVELOPMENT CRITERIA**

#### A. GENERAL REQUIREMENTS

1. The U. T. System Design Guidelines and this Landscaping and Irrigation criteria shall be utilized by the Project Architect/Engineer in preparation of the construction documents. Any applicable campus standards and specifications for Landscaping and Irrigation will be provided to the A/E by the UTH Project Manager as a supplement to these guidelines.
2. The UTH Landscape Architect will participate in the project from its beginning and will review all work performed by the A/E and Landscape Architectural and Irrigation Consultant's at each review period.
3. Site development and landscape architectural design shall consist of but not be limited to the following considerations:
  - a. Grading and drainage.
  - b. Relationships of exterior/interior functions.
  - c. Automatic irrigation system.
  - d. Exterior lighting and landscape illumination.
  - e. Plant material selections and locations.
  - f. Special outdoor amenities such as courtyards, sculpture, plazas, fountains, furnishings, etc.
  - g. Pedestrian and vehicular circulation including walks, roads, parking, ramps, bike compounds, service lanes, etc.
  - h. Proper utilization of desirable existing features such as water, tree groupings, geological formations, etc.
4. The A/E will be required to submit to the UTH Project Manager a letter with the design development documents stating compliance with the Texas Facilities Commission's guidelines for the required use of xeriscape on state property new construction, Government Code 2166.404.

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### B. DESIGN REVIEW REQUIREMENTS

1. The A/E will be required to present the plans and specifications for review to UTH at the intervals outlined in A/E Agreement. Intermediate reviews might be required if the scope of the project has been changed or if an earlier review found the plans and specifications unacceptable either as a whole or in part.
2. The Landscape Architectural and Irrigation consultant(s) will participate in all reviews, work sessions and presentations where this discipline is involved. Items to be included for review at each phase or stage of completion are outlined below:
  - a. Schematic Design
    - (1) Landscape Architectural and Irrigation Consultant(s) name(s), mailing address(es), email address(es) telephone and FAX number(s).
    - (2) Brief narrative of the scope and character of landscape development - both hardscape and softscape, including proposed special features such as fountains, sculpture, etc.
    - (3) Cost estimate of site work based on generalized quantities and/or square feet.
    - (4) Drawings:
      - (a) Plan/s of proposed areas to be planted and irrigated at a scale consistent with Architectural Site Plan.
      - (b) Scale, graphic scale. and north arrow.
      - (c) Show location of water source for irrigation.
      - (d) Show major space defining elements such as trees, walls, fences, etc. to convey overall site design concept.
      - (e) Show major vehicular and pedestrian circulation patterns.
    - (5) Design Development
      - (a) Drawings:

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- 1) Further refine site plan incorporating Schematic Design review comments from UTH and Users.
  - 2) Site plan should evolve into a separate plan sheet at this phase with complete hierarchy of proposed plant materials shown and identified.
  - 3) Show proposed landscape accessories such as seating, litter receptacles, tables, tree grates, drinking fountains, etc.
  - 4) Show landscape lighting if applicable.
  - 5) Show proposed grading.
  - 6) Identify hardscape materials.
  - 7) Show irrigation diagrammatically in terms of number of zones and type of components (sprays on risers, pop-up sprays, rotary heads, drip, etc.).
- (b) Further refine cost estimate for site work based on further refinement of drawings, more specific quantities and square feet.
  - (c) Submit outline specifications for planting, irrigation and accessories.
6. Construction Documents
    - (a) Include updated cost estimate with each stage (50%, 75%, etc.) of construction documents submitted.
    - (b) Drawings and specifications to the appropriate stage of completion with each stage of construction documents submitted.
    - (c) Dated signature and seal of licensed landscape architect and licensed irrigator, including date of expiration of license/s to be included on all applicable drawings and specifications.
3. Plant Material



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- a. Generally, plant material should repeat the existing campus palette. Use of native plant material where possible is encouraged.
  - b. AVOID THE USE OF PLANT MATERIAL WITH EXCESSIVE MAINTENANCE REQUIREMENTS.
4. Landscape Irrigation
- a. The automatic irrigation system shall be designed by a Texas Licensed Irrigator.
  - b. Applicable campus irrigation standards and specifications will be provided to the A/E by the UTH Project Manager.
  - c. Potable water protection shall be as per local code requirements.

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Revision Log  
Appendix F

Rev. Date	Remarks
10/1/10	Add A/E requirement for xeriscape compliance letter

APPENDIX G

**MECHANICAL CRITERIA**

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## APPENDIX G

### A. GENERAL REQUIREMENTS

1. The UT System Design Guidelines and Guideline Specifications for mechanical services shall be utilized by the Architect/Engineer in preparation of the contract documents. The specifications shall be edited to conform to the particular project, systems, and campus.
2. The criteria for a particular mechanical system will vary somewhat from campus to campus which may change certain parameters of initial design considerations. Design engineer is responsible for acquiring a local campus standard, if one exists, and adjusting design to standard as appropriate and as approved by the UTH Project Manager.
3. Do not assume the Owner will provide, connect, or otherwise perform any services without specific prior agreement.
4. Room names and numbers shall appear on all mechanical, plumbing, and fire protection floor and partial floor plans. Column lines or designations shall appear on all Mechanical, Electrical and Plumbing (MEP) floor plan sheets, sections, and partial floor plan drawings (e.g., vaults and mechanical rooms) as they appear on Architectural sheets; such drawings shall also have graphic scales and north arrows as applicable. All MEP drawing sheets shall have the UTH project name and number shown in the title block.
5. Systems shall be designed to comply with ANSI standards, including supplements.
6. Flow diagrams shall be drawn for each piping system including but not limited to steam, heating water, chilled water, domestic hot and cold water, distilled water, fire standpipe, oxygen, compressed air, condenser water, gas, vacuum, and refrigerant systems. Mains and major branches shall show quantities of flow with size. All valve sizes shall be indicated.
7. Plumbing and air conditioning systems shall be drawn as separate drawings. These systems may be combined on common drawings only by written permission of UTH. A complete roof plan shall be included both for air conditioning plans and plumbing plans; one plan may serve for both.
8. Where piping systems are to be installed underfloor, these shall be shown on an underfloor plan and not on the plan prepared for the space above. Floor plans for mechanical systems shall be drawn to show pipes, ducts, etc., on the floor in which they are installed.

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9. Fume hoods, kitchen hoods, and all other specialized mechanical equipment shall be included in the mechanical sections under the responsibility of a Professional Engineer.
10. UT standard details will be furnished in both AutoCAD and hard copy and shall be used as part of the contract documents. The standard details shall be carefully reviewed and redrawn on the construction drawings and revised as required to suit the project.
11. All construction details shall be shown on the drawings and shall not be bound in the specifications.
12. All equipment and material specifications shall be bound in the specifications and shall not be shown on the drawings.
13. Performance data schedules for all equipment shall be shown in schedules on the drawings.
14. All MEP review drawings shall bear the responsible engineer's name and registration number, but not necessarily his seal, at all stages of the design. Please refer to The Texas Engineering Practice Act , Occupation Code Title 6, Subtitle A, Chapter 1001 Engineers. The intent of this section is clarified as follows:  
  
Sealing Requirements: The registrant shall affix his seal, sign his name, and place the date of execution, only on engineering documents that have been issued by the registrant as completed work. Such documents should be accepted by clients for their purposes and/or by public authorities for final approval or issuance of a permit. Documents considered as incomplete by the registrant may be released temporarily for interim review and do not need to have the registrant's seal or signature affixed, but shall be dated; bear the responsible engineer's name, registration number, and professional engineer designation; and be clearly stamped to indicate the documents are for interim review and not intended for construction, bidding, or permit purposes. The use of signature reproductions, such as rubber stamps, or computer generated or other facsimiles shall not be permitted in lieu of actual signatures.
15. Variable Frequency Drives (VFD's): Shall be provided on all air moving fans and pumps of two horsepower and above. This does not apply to constant volume fans and pumps. The designer shall use care in the provision of VFD's and shall not arbitrarily provide for VFD's where not appropriate.
16. Provide complete flashing and trim details for all thermal and moisture protection systems to include assemblies, system transitions, and termination points.

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### B. DESIGN REVIEW SUBMITTAL REQUIREMENTS

1. The A/E will be required to present the plans and specifications for review to UTH at the intervals outlined in the A/E Agreement. Intermediate reviews may be required if the scope of the project has been changed or if an earlier review found the plans and specifications unacceptable either as a whole or in part.
2. The Mechanical, Electrical, Plumbing and Fire Protection Engineering consultant(s) will participate in all reviews, work sessions and presentations where this discipline is involved. Items to be included for review at each phase or stage of completion are outlined below.
3. Schematic Design: Refer to Appendix L.
4. Design Development: Refer to Appendix L.
5. Construction Documents:
  - a. Contract bid documents for plumbing systems shall as a minimum include: (1) all plumbing fixtures shown and identified by a number; (2) isometric riser diagrams for all plumbing risers in the building (each main stack identified by a number on both the plans and the riser diagram); (3) flow diagrams for all pressure systems including heating and cooling, water, steam, gas, oxygen, air, vacuum, fire protection, etc.; (4) all spaces identified by name and room numbers; (5) column numbers; (6) sections where space is limited; (7) details such as fire hose cabinet, lavatory connection, pump connection, hot water generator, water softener, acid dilution basin, sewer manholes, backflow prevention, water header, etc., (8) specifications complete in final mark-up form (final typing can be delayed until bid document issued); (9) schedule all major equipment on drawings. Plumbing fixtures may be scheduled but must also be described in detail in the specifications as guidelines to invite competition; (10) if project requires fire sprinklers, the drawings will include main piping sizes and head locations in architecturally sensitive areas. (11) MEP plans shall have all fire and smoke walls and partitions (and their ratings) clearly indicated.
  - b. Contract bid documents for HVAC systems shall as a minimum include: (1) all air conditioning systems drawn to scale including all ductwork in two lines with all fittings to scale; (2) sections through mechanical rooms to adequately describe the construction requirements; (3) schedule of all major

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items of equipment to indicate performance characteristics; (4) all piping systems complete with necessary sections to clarify routing; (5) applicable details from UTH Standard Details set modified to suit project; (6) all columns numbered; (7) all rooms numbered; (8) flow diagrams for each piping system except drains - show quantities in each major branch take-off and the base of each main; (9) north arrows and graphic scales shown; and (10) specifications complete in final mark-up form (final typing can be delayed until bid documents issued).

- c. Final update of "BASIC DATA" form.

### C. ENERGY CONSERVATION

1. Initial Design Requirements for new building construction
  - a. Every project of new construction and major remodel/renovation is required to meet the energy performance standards established by the State Energy Conservation Office. It will be the design engineer's responsibility to submit the appropriate documents to verify compliance.
2. Mechanical System
  - a. The following criteria shall govern for the design of mechanical systems in remodeled buildings and in new buildings regardless of whether or not the features are required to meet the Design Energy Budget:
    - (1) Except where potential funding sources may be put at risk due to higher ventilation rate requirements, it is recommended that one (1) CFM of air be exhausted from each square foot of laboratory floor area. This does not preclude higher rates necessary to offset exhausts from equipment located within the laboratory, or higher rates necessary to maintain acceptable space temperature. A laboratory is defined as a workspace where chemicals are used and/or stored.
    - (2) The number of air handling units in a building shall be as few as feasible to serve the building. Each system shall be provided with a return air fan or relief fan to discharge air to the outside in direct ratio to the outside air being introduced into the system. The system shall be capable of exhausting 100% of the building return air when the system is on a controlled ventilation cycle.

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- (3) On projects where generation of steam or chilled water for heating and cooling is part of the design of the building, provide life-cycle cost analysis to determine the most economical primary fuel to use, with consideration given for the anticipated availability of fuel during the life expectancy of the generating equipment.
- (4) All new and remodeled building projects shall conform to ASHRAE Standard 90.1.
- (5) The mechanical systems within the building shall be designed in accordance with this section and sections of the Design Guidelines unless more stringent requirements are indicated in the standards of the State Energy Conservation Office.
- (6) All projects utilizing campus chilled water, heating hot water, and/or steam shall be specified to have BTU meters, or flow meters and supply and return temperature sensors, depending on campus preference.

### D. CONTROLS

1. Controls air flow diagrams, indicating air handler configuration and equipment arrangement shall be provided with location of all control devices shown. Dampers and control valves shall have their normal (fail) position indicated on the diagram. These diagrams will be used by the controls contractor to develop the system graphics.
2. Chilled water and hot water piping controls diagrams, indicating pump and equipment configuration, shall be provided with location of all control devices shown. Control valves shall have their normal (fail) position indicated on the diagram.
3. A complete controls input/output points list shall be provided on the drawings.
4. A detailed sequence of operation shall be provided on the drawings, on the same sheet as the diagram for each system.
  - a. Provide AHU system description, including all components such as supply fans, return or relief fans, coils, dampers, filter sections and terminal devices.
  - b. Provide pumping system description, including all components such as pumps, heat exchangers, control valves, and bypass valves.



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- c. Provide normal start-up sequence for each system and start-up sequence after power failure restoration. State normal position of all control dampers and valves when system commanded OFF and when system trips off due to safety or power failure. Detail equipment system response for each potential equipment alarm and failure.
  - d. Indicate percent of full load that pumps/fans are sized and if they operate in lead/lag or both operate simultaneously.
  - e. Provide CO2 demand ventilation sequence for high occupancy areas.
  - f. Provide economizer cycle sequence when applicable.
  - g. Detail all alarms, alarm limits, and identify critical alarms.
  - h. List initial settings for all operator modifiable control parameters, such as, but not limited to, set-point, dead-band, offset, and equipment start/restart delay.
5. Show temperature sensor locations for all terminal boxes with dashed line from each sensor to respective VAV box.
  6. Show dashed line at each VAV to indicate 3 feet maintenance access required for controls. Locate VAVs so that maintenance access area is not above fixed furniture or lab casework, preferably above door entry for the room.
  7. Show location of VFDs and control cabinets on mechanical plan. Provide VFD schedule for pumps and fans.

### E. UTILITIES

1. The Engineer shall be specific and show all points of connection and flow rates precisely for utilities. The utilities shall be connected to a campus distribution system or a combination of campus distribution and public services. Inverts when applicable shall be determined and indicated.
2. Direct burial of chilled water, hot water, or steam pipe is not generally acceptable. Any circumstances requiring an exception must be approved by UTH.
3. Sanitary and storm sewers shall show invert elevations at manholes and other critical points.

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4. Buildings shall be designed to permit gravity drainage of sanitary sewage. The pumping of sanitary sewage is prohibited unless there is absolutely no other alternative. Where sewage ejector or sump pumps are to be provided, these shall be so located that there is sufficient head room to pull the pump shafts straight up through the floor plate. Lifting eyes shall be included in or near the ceiling to facilitate this operation. Rail mounted pumps should be considered.
5. Buildings shall be designed to permit gravity drainage of storm water. The pumping of rainwater is discouraged and, where it becomes necessary, an assignable area could be flooded on pump failure. An emergency generator shall be provided with adequate room for ventilation, a fuel supply, exhaust to roof, and radiator cooling duct. Submersible type heavy duty pumps with extraction rails shall be used in lieu of vertical type sump pumps.
6. In general, storm and sanitary distribution systems outside the building are civil engineering projects. If distribution is complex, such consultant shall be retained to do this work.

### F. PLUMBING

1. All toilet rooms shall be equipped with at least one floor drain. Drains shall be furnished with trap primers. (Check requirement of particular UT component institution.)
2. All janitors' closets shall be arranged with the sink near the door and a floor drain in the room.
3. All mechanical rooms containing air conditioning equipment shall have a floor drain. Do not locate floor drains under machinery. Floor drains shall be 4" minimum size, with a deep seal.
4. Pipes penetrating exterior walls below grade must be installed so as to prevent breakage due to building settlement and to maintain a watertight seal.
5. Easy access shall be provided to all working parts of all plumbing devices. Items of plumbing requiring periodic maintenance or repair shall not be permanently sealed in masonry walls.
6. Drinking fountains shall be electric, wall type, surface mounted into a wall recess 30" wide x 14" deep except where ADA requirements dictate a different configuration. Do not construct fountains into the walls so that a building alteration is required in the event an exact duplicate is not available.

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7. Gas lines shall be of a welded black steel construction up to emergency shut-off valves within reach of occupants. Gas lines from emergency shut-off valves to lab tables or appliances may be screwed if not larger than 3/4" and if they are exposed. Gas lines shall be installed exposed below ceilings throughout a building.
8. Waste lines from lavatories or any other fixtures shall not be on arms. The wastes shall discharge directly into a stack directly behind the fixture. Back to back lavatories are permitted if connected to sanitary tapped crosses. Straight taped crosses will not be permitted.
9. Plumbing riser diagrams must be drawn with one for each riser on the project. The risers must show all piping from the underfloor through the roof.
10. Floor drains shall be 4" in size serving 80 or larger square foot area. Smaller area shall contain 3" or 2" floor drains as required. Mechanical room floor drains shall be 4" size, minimum and shall be connected with trap primers.
11. Cleanouts shall be shown on plans and on riser diagrams.
12. Vent pipes shall be carried up adjoining soil and waste pipe, and they shall be connected into the main stack at top and bottom. Vents may be one size smaller than the traps they serve, except that no vent shall be less than 1-1/2". The size of vent lines accommodating more than one fixture shall be sized in accordance with the International Plumbing Code.
13. Roof drains shall be run separately from all other storm water sources to a manhole outside the building. Downstream from this manhole, the piping shall be sized sufficiently large to prevent roof drain water from impeding the proper flow from area drains. All piping dropping more than 50' shall be welded construction.
14. Specified fixtures shall conform to the requirements of the Texas Department of Health water saving performance standards.
15. Provide automatic flush valves for water closets and urinals.

### G. HEATING, VENTILATING, AIR CONDITIONING

1. General Planning Criteria
  - a. Do not use mechanical rooms or air handling unit equipment rooms as return air plenums. No pumps, panel boxes, etc. can be installed in a plenum. Each component of an air handling system shall be spaced in the unit so that

## APPENDIX G

there is ample room on all sides for inspection and maintenance and man size hinged access doors shall be provided for ready access to these spaces.

- b. Ventilate mechanical rooms.
- c. All mechanical rooms shall have locks and a common key system not accessible to building personnel.
- d. Provide lifting eyes or trolley rails for heavy equipment.
- e. Combinations of mechanical rooms and janitor closets, or mechanical room with storage spaces, are not acceptable. Main electrical switch gear shall be in a separate room and avoid liquid conveying pipes above the gear. Where such an arrangement is not possible, consult UTH.

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- f. Access shall be provided to mechanical room spaces without going through any assigned area such as a janitor closet.
- g. Walkways shall be provided for roof-mounted machinery so that equipment may be serviced without traffic directly on roof. Roof mounted equipment shall be accessible by a stair. Hatches without stairs or use of external ladders are not acceptable.
- h. Equipment rooms shall be large enough to provide access to all equipment for maintenance and a means to remove and replace equipment. Adequate “pull spaces” shall be provided for coils, shafts, filters, etc.
- i. The standard HVAC system preferred by the owner is the double duct VAV terminal unit (“mixing box”) that performs to the owner’s satisfaction. If for some reason double duct systems are not appropriate for the project, then the designer shall design a single duct system with hot water coils for temperature control. This exception will only be allowed via written permission from the owner’s Mechanical Engineer.
- j. When the air conditioning system is operating on the refrigerated water cycle, the outside air shall be dehumidified by a separate air unit before releasing into the return air plenum of the main unit. This requirement is mandatory in the coastal areas and may be required on other campuses, depending on the building usage and the dewpoint of the design outside air conditions.
- k. All coils shall be ARI rated. Fins shall be no more than 8 per inch. Cooling coils shall have copper fins; if spiral wound, they shall be solder dipped. Maximum number of rows in a single bank shall not exceed six.
- l. All strainers shall have blow-down valves with 3/4” hose end connections.
- m. All preheat steam coils should be vertical tube “non-freeze” type.
- n. Cooling coils shall be sized for a maximum face velocity of 450 feet per minute.
- o. All air handling equipment shall be installed so that bearings can be replaced without equipment demolition and be serviced through hinged access doors.

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- p. Electric motor speeds 1800 RPM and less are preferred for fans. Pumps may be directly coupled to motors with speeds as high as 3600 provided the highest efficiency of the pump is attained.
- q. Equipment located above finished ceiling shall have adequate ceiling access panels or other means of access to equipment for maintenance and removal. Except for lift out ceiling installation all access panels shall be hinged. Equipment using water shall have auxiliary drain pans.
- r. All storage spaces shall be ventilated and should preferably be served with building exhaust air or a treated air supply.
- s. Toilet rooms shall have supply air, exhaust and transfer air. Janitor's closets shall have exhaust.
- t. Exhausts from adjacent toilet rooms shall be arranged to prevent sound transmission between men's and women's areas.
- u. Transformer vaults shall have separate ventilating fan or fans connected to emergency power supply. Vault shall be vented to outside in accordance with the National Electric Code.
- v. All connections between dissimilar materials in the piping system shall be made with dielectric unions or couplings.
- w. Pressure piping, including gas piping, shall not be located under slabs within buildings. Where such placement is unavoidable, the piping must be run in a sleeve and vented at each end so that leakage can be channeled off without pressurizing the underside of the slab.
- x. Piping shall not be run in concrete floors. Piping shall not be buried beneath the lowest floor level with the exception of soil pipe.
- y. At every point where piping and ductwork penetrate a floor slab, except slabs on grade, a cast-in sleeve or other waterproof curbing at least 2" high shall be provided.
- z. All air conditioning unit chilled water coils shall be provided with control valves, either of the 3-way or 2-way type as required by the system. No wild coils will be permitted. 2-way valves are preferred except as required at the end of a main to maintain flow through the system and/or pumps.

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- aa. Fire dampers shall be installed in all duct penetrations of rated walls or enclosures in conformance with the International Building Code and NFPA code requirements.
  - ab. All condensate piping shall be designed to flow by gravity back to condensate receiver. Traps are not to kick or lift condensate up.
  - ac. All ductwork shown on plans shall be indicated as clear air stream size. Ducts shall be shown in two dimensions to scale with fittings, dampers, splitters, outlets and offsets clearly illustrated. Include large scale details of duct fabrication where necessary to show construction methods. (On final plans single line ductwork is prohibited except where specific prior approval is given by UTH.)
2. Ductwork: When ductwork is drawn, keep in mind the following additional requirements:
- a. There must be a minimum of three diameters of straight rigid ductwork entering terminal units. A detail will be required to emphasize this requirement to the Contractor.
  - b. Ductwork taps to supply diffusers shall be made using bellmouth or “boot” connections. Boot connections shall be from the side of the duct, not the bottom. This will allow for a better location for the volume dampers. Also, flexible duct shall be limited to 5 foot lengths or less. All other ducts shall be rigid.
  - c. All volume dampers shall be shown in the plans.
  - d. No more than 3 rooms of similar size, orientation, and function should be on the same zone. Director’s offices, corner rooms, conference rooms, and other special purpose rooms should be on an individual zone. Note that a small corridor area or storeroom may be added to almost any small zone. Zones requiring large amounts of air (such as auditoriums or laboratories) may require more than one terminal unit, and may be controlled by a single thermostat. Terminal units are limited to 2,000 cfm maximum.
  - e. Use short radius vaned elbows in lieu of square 90° fittings with turning vanes. It is preferred that long radius sweeps be employed where space permits.

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- f. Show all ductwork on the same plan for each floor: high pressure, low pressure, exhaust, etc.
  - g. Lab exhaust ductwork material shall be 304 stainless steel from fume hoods to main branch exhaust duct and galvanized sheet metal on main ducts to fans.
3. Testing and Balance: The owner will contract for TAB (HVAC Testing and Balancing) services separately from the construction contract. The design professional shall provide only for the contractor coordination required in Section 23 05 93.A. Representatives of the TAB agency will participate in the progress reviews and will be provided appropriate review documents.
  4. Controls: The controls for all projects shall be interfaced with the campus FCMS computer. Specific instructions for the specification of controls will be customized for the specific project.

### H. FIRE SPRINKLER SYSTEMS

1. It is the strong desire of UT System to provide fire sprinklers for all buildings, whether or not required by code. Most buildings where fire sprinkler systems are considered by code to be optional may contain cost “trade offs” in building construction which may help to justify the use of fire sprinkler systems. Smaller buildings with severely limited budgets may not be able to afford sprinkler systems, and will be addressed individually. When the engineer is assembling plans, there shall be a separate set of drawings for fire sprinkler system and with UTH Project Name and Number, north arrows, and graphic scales.
2. The engineer shall, in the plans, indicate the general piping arrangement. Head locations are required to be shown in critical or architecturally sensitive areas of the building. In addition, main piping shall be sized to assure the owner that the A/E team has investigated possible conflicts involved in the fire sprinkler systems, and coordinated the piping, HVAC, electrical, and structural systems throughout the project. (Conflicts are most frequent where the fire sprinkler systems are located.) A note shall also be added to the plans which states:

“The fire sprinkler piping shown is intended to indicate the locations of the main supply piping, and larger runouts, as well as the areas intended for fire sprinklers. The inclusion of this information in the drawings shall in no way diminish the responsibility of the Contractor to provide a fully designed, sized, and installed fire



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sprinkler system, as required by the project specifications and the laws of the State of Texas.”

3. Applicable national fire codes, as published yearly by the National Fire Protection Association, shall be used as guidelines for fire-fighting equipment. There are variations in requirements between campuses -- check before designing. In general, at least a Class II standpipe system shall be designed for the building occupants' use and a dry standpipe system in the fire stairs for the fire department's use.

### I. COORDINATION OF DESIGN

1. The A/E shall make every effort to coordinate the design between disciplines. The final drawings shall, as a minimum, be checked for the following:
  - a. To assist in the coordination the reflected ceiling plan shall show all electrical lighting fixtures, including exit lights, air diffusers, ceiling grilles, ceiling type speakers, ceiling grid, etc. Sprinkler heads need to be shown only in architecturally sensitive areas.
  - b. Duct work shall be checked for clearance between ceiling construction and underside of beams, recessed lighting fixtures and other interferences where space is limited.
  - c. Large mechanical system piping shall be coordinated with building construction, beams, etc., to assure clearances and accessibility for maintenance. Piping and electrical switchgear locations are to be coordinated.
  - d. Coordinate requirements for louvers, equipment supports and other devices serving mechanical systems but furnished under the general construction section of the project.
2. Coordinate special types of equipment for correct rough-in requirements.

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Revision Log  
Appendix G

Rev. Date	Remarks
10/1/10	Added building controls section

## APPENDIX H

### FURNITURE, FURNISHINGS, AND EQUIPMENT CRITERIA

#### 1. RESPONSIBILITIES OF UTH INTERIORS GROUP

a. Projects in which UTH Interiors acts as Project Designer and Where Furnishings Production Work Is Performed In-house.

- (1) Where the furnishings production work is performed inhouse by UTH Interiors, the UTH Interior Designer assigned to the project is responsible for the selection, specification and bidding process for all movable furnishings from programming through recommendation for contract award. That Designer serves as the main contact in UTH with the Institution.
- (2) The UTH Interior Designer, in conjunction with the Senior Interiors Coordinator, shall handle all contract administration activities. The UTH Interior Designer shall lead the installation oversight, inspection, punchlist follow through and acceptance of furnishings. The Senior Interiors Coordinator shall handle the issuance of purchase orders, and the processing of payments to furniture contractors.
- (3) The Senior Interiors Coordinator will help determine building readiness for the start of furniture installation and set the schedule for the installation of furnishings in conjunction with the Resident Construction Manager, the Construction Contractor Project Manager, and the Head of the Building and Furnishings Committees.

b. Outsourced Interior Design Firm with Management by UTH Interiors Project Manager

- (1) Where the furnishings design work for a project is outsourced to an outside Interior Design Professional, that firm shall be responsible for the furnishings selections, presentations, specifications and bid documents. This work shall be managed by the UTH Interior Designer, acting as UTH Interiors Project Manager. The Interior Design Professional will further be responsible for the primary contract administration tasks including installation and inspection, and acceptance of the furniture under the

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guidance of the UTH Interiors Project Designer and the Senior Interiors Coordinator.

- (2) The UTH Interior Designer/ Project Manager, in conjunction with the UTH Interiors Senior Interiors Coordinator shall oversee all other facets of the Interior Design Professional's contract administration activities including the installation, inspection and acceptance of furnishings. The Senior Interiors Coordinator shall process payments to furniture contractors.

c. In all projects

- (1) The UTH Interior Designer shall participate in the building design and construction, Programming and A/E document review processes for the purpose of providing consultation and advice to the Design Team on matters related to interior furnishings, A/E layouts, System and campus standards, a building's interior finishes and materials, and ADA compliance.

## 2. RESPONSIBILITIES OF THE A/E, OR CM@R TEAM

*The A/E or Construction Manager at Risk (CM@R) Team shall prepare Furniture Layouts to demonstrate that Programming requirements have been met.*

a. Preliminary Furniture Layouts

The A/E or CM@R Team shall provide preliminary furniture layouts for the entire building during the Design Development stage to substantiate and verify that program space requirements are being met, and to confirm electrical, telecommunication, and audio/visual locations. While the A/E's or CM@R Team's furniture layouts may be further refined during the design and production process, the A/E or CM@R Team's preliminary furniture layouts shall be both well resolved and workable, and must conform to ADA standards.

Layouts shall be based on Owner input via either the furniture committee, if one is in place during this phase, or from

## APPENDIX H

representation of the various User groups through the Ad Hoc building committee and the building program.

Planning by the A/E must be provided for furniture items as they relate to doorways, circulation, windows, electrical outlets, communications system outlets, mechanical and plumbing coordination and ADA clearances.

### b. Final Furniture Layouts

Requests for revisions to the Preliminary Furniture Layouts, which are specifically identified by the User groups or UTH Interiors Group during the Design Development review period, shall be incorporated into the layouts as part of the Design Development effort. The resulting furniture layouts developed by the A/E or CM@R Team shall receive the approval and sign-off of the Owner. Construction documents shall not be required to show furniture layouts. However, the A/E or CM@R Team shall convey its Final Furniture Layouts to all of its trades so that all work is coordinated.

These layouts prepared by the architectural design team may be further refined when the Furnishings design team or UTH Interior Designer meets with the Ad Hoc furniture committee. UTH Interiors shall make these revised layouts available to the architectural design team for coordination purposes. If the Interior Design Professional and Ad Hoc committee is in place, Interiors Programming shall be completed and final floor plans presented to the architectural design team early on for coordination purposes.

When final revised layouts have been completed, a clean set of floor plans for both base bid and alternates that includes walls, windows, doors, room numbers, built-in cabinetry, and equipment shall be sent to UTH Interiors. If transmitted electronically, the A/E shall advise the designer of software type and version used prior to sending (dwg format is preferred). This set of layouts shall include a site/project location map as well as electrical/data layers for each floor.

### c. Revisions to Floor Plans During Construction

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The A/E, CMR, or CM@R Team shall immediately notify the UTH Interiors group of any revisions made to the floor plans during construction through the Resident Construction Manger.

### 3. **FIXED OR BUILT-IN FURNISHINGS AND ACCESSORIES THAT ARE THE RESPONSIBILITY OF THE A/E OR CM@R TEAM**

*Items that are built-in or affixed to the structural, mechanical or plumbing members of a building fall under the design and specification responsibility of the A/E or CM@R Team and are to be procured through the Construction Contract. Those items include but are not limited to:*

- Built-in dishwashers, refrigerators, and icemakers
- Exterior benches and waste receptacles
- Fixed auditorium, lecture hall, and gymnasium seating
- Fixed classroom seating and tables
- Fixed laboratory casework and equipment
- Food service equipment
- High density files, shelving and floor tracks (motorized or manual)
- Utility-type shelving attached to wall by brackets in standards
- Laboratory Benches and Tables
- Lecterns tied-in to building's A/V data and/or electrical systems
- Lockers
- Mailboxes and mail centers
- Projection screens
- Wall clocks
- Building finishes and items as noted in Appendix I

### 4. **ADHERENCE TO FURNITURE STANDARDS:**

#### a. Maximizing Space and Following Requirements

Space Planning shall reflect both UTH's and the Institution's requirements. The A/E or CM@R Team shall be sensitive to UTH's need to maximize space and shall assist in that regard wherever possible.

#### b. Following Standards in Design

The following typical UTH standards for furniture dimensions are outlined for the benefit and coordination of the A/E or CM@R Team in space planning. Wherever an item under consideration is not covered by the minimum standards outlined below, the latest editions of the *Texas Accessibility Standards (TAS)*, *ADA*, and *IBC*, shall be used in setting forth minimum standards.

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### 5. BUILT-IN CABINETS:

- a. Shall meet ADA accessibility requirements. Where knee spaces occur, it is suggested the counter height be further dropped to 30" (with a knee space height clearance of 27 inches) so that a standard task chair may also be used. Attention shall be paid to the depth of aprons or pencil drawers in order to allow maximum leg space for occupant.

### 6. CLASSROOM RECOMMENDATIONS

- a. Teaching space at the front of classrooms shall be not less than 8'-0". If an Integrated Teaching Station is to be provided, allow 5' minimum behind unit to wall and 3 feet in front of unit to the first row of students. Where demonstration tables are to be used, clear space shall be increased to 11'-0" minimum.
- b. No person should be further from the screen than 7 times the height of the screen, nor closer than 2 times the height of the screen.
- c. Classrooms with tablet arms: Allow a minimum of 18 sq. ft. per student **in addition to the teaching space in front of the room.**
- d. Classrooms with tables and chairs: Allow a minimum of 20 sq. ft. per student **in addition to the teaching space in front of the room.**
- e. Computer classrooms with tables and chairs: Allow a minimum of 30 sq. ft. per student **in addition to the teaching space in front of the room.**
- f. Computer classrooms shall have a minimum work surface of 36 inches wide (42 inches preferred) x 30 inches deep, where a regular sized PC is used. A lap top will require a 24" minimum deep work surface. Table depth may be achieved by using an UTH Interiors approved attached adjustable keyboard platform. **In rooms where a keyboard platform is used, row space shall be increased to 42 inches.** Provide the appropriate number of circuits for each power entry, with a maximum of 3 full size computer stations sharing one circuit. Coordinate and provide telecommunications/networking cable directly next to the power entry as required.
- g. Faculty typically prefer wide over deep classrooms. It keeps the teacher closer to the furthest student and there is more presentation space in the front of the room.
- i. In classrooms or auditoriums with swinging with tablet arms, minimum back-to-back spacing: 42" when the tablet arm is in a raised position. In classrooms or auditoriums without tablet arms: 36" minimum back-to-back spacing, 42" ideal.
- j. Minimum clearance between top back of chair and rear wall: 6"

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- k. If screens are to be recessed in a ceiling pocket, width of pocket shall be 30% wider to accommodate future wide screen technology. Rear screen projections shall also be sized for this wider technology.
- l. Whiteboards or chalkboards shall be mounted with bottom at 34" AFF. Screens shall be mounted with bottom at 48" AFF. If the whiteboard is to double as a screen, the bottom should be mounted at 34" AFF and the whiteboard made taller.
- m. Provide ceiling mounted video/data projectors.
- n. Curved rows (over straight) with no teacher's platform is typically preferred.
- o. Create a minimum of 3 lighting zones in medium/large classrooms: 1) back row, 2) center seating area, 3) front presentation area. Large classrooms and auditoriums provide dimmers. Label or engrave switch cover plates to identify lighting zones.
- p. Provide display surface for faculty to post announcements or room changes outside door. Provide an "Occupied" sign or vision panel to check whether a classroom is in use.

### 7. RESPONSIBILITIES OF THE INSTITUTION

- a. The project's Ad Hoc Building Committee shall provide the A/E or CM@R Team with information regarding general room furniture requirements for inclusion in Design Development documents.
- b. The Institution's Furniture Committee shall provide the UTH Interior Designer with specific detailed and refined information relating to the furnishing needs for each space in the project.
- c. The Institution shall procure and arrange for the installation of all specialized audio-visual, office, lab, janitorial, laundry, medical, kitchen and gymnastic equipment as well as pianos and other musical instruments, computers and copier machines. Institutional funds separate from the UTH Interiors' Moveable Furnishings budget shall be used to procure these items.
- d. The Institution shall provide for the hard-wiring of locations that are need to support any furnishings with electrical systems requiring connection to the building power source. Adjacent network connections shall also be provided if a network connection is required. The Institution shall arrange for telecommunications/network cabling of any furnishings to the building power source.
- e. The Institution shall arrange for a staff member to oversee building access on an as needed basis during the course of the UTH managed



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furnishings installation, lock up the building if the contractor is no longer on the job site, and generally assist the UTH Interiors Contract Manager during this phase of the project.

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### **INTERIOR FINISHES CRITERIA**

#### **A. GENERAL REQUIREMENTS**

1. The following information and specification details are designed to aid the A/E for a Competitive Sealed Proposal or Design/ Bid/ Build project or Construction Manager-at- Risk (CMR) project in understanding what falls into its scope of responsibility. The categories listed below define those key areas of responsibility.
  - a. For building projects delivered through a Competitive Sealed Proposal or Design/ Bid/ Build method, Preliminary Interior Building Finishes and Materials shall be presented to and approved by owner prior to 95% Construction Documents.
  - b. For building projects delivered through a CM@R method, Preliminary Interior Building Finishes and Materials shall be presented to and approved by owner concurrent with the GMP development process and finalized prior to 95% Construction Documents. This finalization shall ensure accurate budgeting for building finishes and materials in the GMP and shall therefore be considered final.
  - c. Regardless of project delivery method, UTH Interiors shall have the opportunity to comment on the appropriateness of finishes.
  - d. Final Finish and Materials Submittals NO LATER THAN 12-14 months prior to Substantial Completion.
  - e. The selection and presentation of all interior finishes including carpet and flooring selections are the responsibility of the AE.
  - f. The selection and presentation of building directories, graphics, signage and way-finding are the responsibility of the AE.
2. Moveable Furnishings budgets identified as “UTH-Managed” are the responsibility of the UTH Interiors group or its outsourced Interior Design Professional Firm contractually acting on its behalf.
3. Moveable Furnishings budgets identified as “Institutionally-Managed” are the responsibility of the Component Institution.
4. Note section Appendix H, 1 sets forth the responsibility of the A/E or CMR team to prepare Preliminary Furniture Layouts during Design Development.

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### **B. A/E OR CM@R TEAM'S RESPONSIBILITIES:**

#### 1. INTERIOR BUILDING FINISHES AND MATERIALS

*The A/E shall design the interior colors, finishes, materials, and design details for the building.*

- a. **Preliminary Finish and Material Submittals Presented/Approved Prior to 95% Construction Documents for Competitive Sealed Proposal (CSP) Projects and Prior to GMP in case of Construction Manager-at-Risk (CMR) Projects.**

The A/E shall prepare a presentation of proposed interior colors, finishes, materials and design details, and securing the Owner's approval of same, incorporate any changes required. The A/E shall provide the UTH Interiors Group with a finish schedule and **Preliminary Finish and Material samples** following this approval. Receipt of the schedule and material samples by UTH Interiors shall immediately follow approval by the institution and inclusion in the GMP in the case of (CMR) projects or prior to 95% completion of the construction documents in the case of Competitive Sealed Proposal projects.

- b. **Final Finish and Material Submittals**

Regardless of the delivery method for the project, the A/E shall prepare the final finish color/materials board(s) and schedule and present it for approval to UTH and the Institution a minimum of one year prior to construction completion (14 months preferred).

*A minimum of 3 sets of finish boards shall be produced by the A/E. One set will be for use at the construction site, one set for the component institution, and one set for use by the UTH Interiors Group. Additionally, if the Project Manager requires a set, a fourth set shall be prepared. Boards shall be accompanied by a complete list identifying each of the materials and finishes on those boards.*

**NOTE: The A/E shall immediately notify UTH Interiors Group of any changes (including those resulting from value-engineering) by providing the authorization record and revised finish and material samples to the Resident Construction Manager.**

- c. **Built-in Equipment, Materials and Accessories That Are the Responsibility of the A/E or CMR Team**

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Items that are built-in or affixed to the structural, mechanical, plumbing members of a building, or A/V systems, fall under the design and specification responsibility of the A/E or CMR Team and are to be procured through the Construction Contract. **Finishes for these items shall be presented and approved along with the rest of the building interior finishes.** Those items include but are not limited to:

- Building directories, graphics, and way-finding
- Bulletin boards in public areas
- Carpet and carpet base
- Chalkboards and liquid writing boards in public areas
- Cubicle curtain and tracks
- Draperies on electrified tracks or that fit into wall or ceiling pockets
- Exterior and interior signage
- Fixed lighting fixtures
- Floor to ceiling and accordion room dividers
- Stage rigging and draperies
- Projection Screens
- Window blinds, drapery, shutters, and shades whether interior or exterior
- Fixed furniture and furnishings as noted in Appendix H
- Utility-type shelving attached to wall by standards/ brackets.

### 2. CARPET SELECTIONS

#### a. Carpet Selection Requirements for Projects Using the Design/Build Delivery Method

In CM@R projects, **ALL interior finishes and materials, including flooring products that are recommended to and approved by the Owner shall be the exact selections on which the Guaranteed Maximum Price (GMP) is based. These same finishes, materials and items shall be provided through the construction contract unless the Owner requests or agrees to changes following the establishment of the GMP.**

Additionally, all fixed furnishings, built-in casegoods and equipment as listed in B.1.c above that are recommended to and approved by the Owner, on which the GMP is based, shall be provided through the Construction Contract unless otherwise directed by the Owner.

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### b. Presentation of the Recommended Carpet Selections to the Owner

As noted above, carpet recommendations, along with all other finish and materials selections, shall be shown to and approved by the Owner at the Preliminary Finish Submittal Presentation preceding 95% construction documents in the case of projects with a Competitive Sealed Proposal, Design/ Bid/ Build or Construction Management at Risk delivery methods. Carpet recommendations shall be shown to and approved by the Owner prior to the presentation of the GMP projects and the GMP budgeting shall be based on those approved recommendations.

### c. Carpet Selection Specification Concerning Submittals:

In construction projects using all delivery methods, the following paragraphs shall be written into the Construction Bid Specifications section 09680, paragraph 1.3, Submittals:

1. In Competitive Sealed Proposal projects, the following paragraphs shall be incorporated into the Construction Document's Project Manual, Bid Specifications section 09680 for Carpet or 09685 for Carpet Tiles, under the submittals paragraph. The Submittals Section of the Construction Document's Project Manual shall also contain the information outlined in these paragraphs.

“In preparing his bid, the Contractor shall specifically identify the exact carpet(s) manufacturer, style name, number and color-way on which his bid is based and which will be provided by that Contractor. If the successful Contractor is basing his bid on a product not previously approved through the specifications or addenda, a strike-off shall be submitted by Contractor and approved by A/E, with the concurrence of Institution, no later than **60 days** after notification of contract award.

**If the 60 day deadline is not met, that Contractor shall be required to provide the carpet originally specified as the “Base Selection” in the specifications for each carpet type identified for the project at no additional cost to the Owner.”**

2. In Construction Manager-at-Risk projects, the following paragraphs shall be incorporated into the Construction Document's Project Manual, Bid Specifications section 09680 for Carpet or

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09685 for Carpet Tiles, under the submittals paragraph. The Submittals Section of the Construction Document's Project Manual shall also contain the information outlined in these paragraphs.

“In preparing his bid, the Carpet Sub-Contractor shall specifically identify the exact carpet(s) manufacturer, style name, number and color-way on which his bid is based and which will be provided by that Carpet Sub-Contractor. If the successful Carpet Sub-Contractor is basing his bid on a product not previously approved through the specifications or addenda, a strike-off shall be submitted by Carpet SubContractor and approved by A/E, with the concurrence of the Institution, no later than **60 days** after acceptance of bid.

**If the 60 day deadline is not met, that Carpet SubContractor shall be required to provide the carpet originally specified as the “Base Selection” in the specifications for each carpet type identified for the project at no additional cost to the Owner.”**

### d. Minimum Carpet Specifications

The selection of carpet type(s) to be recommended by the A/E shall be made and guided by an informed understanding of the amount of traffic a given area will experience, the anticipated degree of spilling and staining that will occur in that area and the amount of direct sunlight exposure on the carpet(s). Following are the categories from which the A/E shall base his selection(s) using those criteria.

#### (1) TYPE 1 BROADLOOM CARPET:

##### Generic Carpet Performance Specification for High Traffic, Health Care, & Food Service Areas

*This generic carpet performance specification is intended for areas of heavy traffic, where frequent spills and stains are expected. These may also be areas where significant direct sunlight would be experienced and where colorfastness is a primary concern. Following are the minimum specifications required:*

##### Construction:

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The carpet shall be either tufted or woven, level or multilevel loop pile with maximum height variation of 1/32 inch. It shall either be 12-foot broadloom, six foot or carpet tile.

(See paragraph 4 for detailed specification on Carpet Tile)

(Cut Pile and Cut/Loop construction shall be used for borders only unless specifically approved for the given application.)

### Carpet Yarn:

The minimum carpet yarn type specification shall be

### **EITHER:**

100% DuPont Antron Lumena, or 100% Solutia Ultron SDN, first quality, solution dyed, bulk continuous filament nylon type 6,6, cationic polymer, offering a construction and performance standards testing program by fiber producer. Fiber shape shall have a Modification Ratio range of 1.5 to 2.2 for soil release capabilities. Fiber identification to AATCC 20. Soil resistant topical treatment Duratech applied, 3 M Commercial Carpet Protector or equivalent, applied.

### **OR**

100% DuPont Antron Legacy with Duracolor® by Lees Permanent Stain Resistant System or 100% Solutia Ultron ColorShield, nylon 6,6, cationic polymer with inherent stain resistant properties.

### Static Control:

Static shall be controlled by permanent means (i.e. antistatic filaments) and without chemical treatment. The static generation shall be below 3.5 kilovolts under standard conditions of 65 degrees F and 20% relative humidity.

Electrostatic Propensity (Static delayed signal):  
AATCC 134.

Pile Weight: Minimum of 20 oz/yd<sup>2</sup>

Pile Height: Maximum of .22 inches high

Gauge/Stitch count:

## APPENDIX I

In order to provide balanced construction, the gauge and stitch count minimums shall be as follows:

- 1/8 shall require a minimum of 26 oz. weight
- 1/10 shall require a minimum of 24 oz. weight
- 5/64 shall require a minimum of 20 oz. weight

Primary Backing: Woven polypropylene

Secondary Backing: Hot Melt Thermoplastic, Polyolefin Composite, Urethane, or Vinyl (NO Latex Accepted)

Resistance to Delamination: ASTM D3936 with minimum lifetime delamination warranty

Tuft Bind:

ASTM D1335 with minimum lifetime tuft bind warranty

Pile density:

Density =  $36 \times \text{pile weight (oz/yd}^2\text{)} / \text{finished pile height (inches)}$

Flammability:

ASTM 648 - 0.22 watts/cm<sup>2</sup> critical radiant flux and/or federal, state or local requirements. Smoke Density: ASTM E662 Rating to be less than 450 in flaming mode (or to State Code). Must meet Federal Flammability standard DOC FF 1-70 (Methenamine Pill test ASTM D2859).

Colorfastness to Light:

AATCC 16E, 200 AFU, International Gray Scale for Color Change rating, minimum 3-4.

Colorfastness to atmospheric contaminants:

AATCC 164 (ozone) & AATCC 129 (oxides of nitrogen) for 2 cycles, International Gray Scale for Color Change rating, minimum 3-4.

Stain Resistance: AATCC 138 for 5 washings to simulate removal of topical treatments by hot water extraction, followed by: AATCC 175, minimum level 8.

Soil Resistance:

An average of 3 fluorine analyses (AATCC 189, formerly CRI TM 102) of a single composite sample to be a



## APPENDIX I

minimum of 500 ppm fluorine by weight when new and 400 ppm fluorine by weight after 2 AATCC 171 (HWE) cleanings.

### Coloration:

Minimum 4 color hues, and hue values to be in optimum light reflectance rating for soil hiding enhancement

### Appearance Retention:

Vetterman Drum Test ASTM D5417 for 22,000 cycles. A minimum rating of 3.0 using CRI TM-101 Reference Scale. Testing without underpad or brushing.

### Indoor Air Quality:

Maximum 0.5 mg/m<sup>2</sup>hr total VOC emission, ASTM D5116

## (2) TYPE 2 BROADLOOM CARPET:

Generic carpet performance specification for heavy traffic, where dry soiling is the primary maintenance concern.

*This generic carpet performance specification is intended for areas of heavy traffic where dry soiling is expected. Following are the minimum specifications required for carpet in this type of area.*

### Construction:

The carpet shall be tufted or woven, level or multi-level loop pile with maximum height variation of 1/32 inch. It shall be either 12-foot broadloom, six foot or carpet tile.

(Cut Pile and Cut/Loop construction shall be used for borders only unless specifically approved for application.)

### Carpet Yarn:

The minimum carpet yarn specification shall be: 100% DuPont Antron Legacy, or 100% Solutia Ultron, first quality, bulk continuous filament nylon type 6,6 offering a construction and performance standards testing program by fiber producer. Fiber shape shall have a Modification Ratio range of 1.5 to 2.2 for soil release capabilities. Fiber identification to AATCC 20. Soil resistant topical

## APPENDIX I

treatment Duratech, 3M Commercial Carpet Protector or equivalent applied.

### Static Control:

Static control shall be achieved by permanent means (i.e. antistatic filaments) and without chemical treatment, static generation below 3.5 kilovolts under standard conditions of 65 degrees F and 20% relative humidity. Electrostatic Propensity (Static delayed signal): to AATCC 134.

Dye Method: 100 % yarn dyed or a combination of yarn and solution dyed. Duracolor® by Lees acceptable.

Pile Weight: Minimum 20 oz/yd<sup>2</sup>

Pile Height: .22 inches maximum

### Gauge/Stitch Count:

In order to provide balanced construction, the gauge and stitch count minimums shall be as follows:

- ③ 1/8 shall require a minimum of 26 oz. weight
- ③ 1/10 shall require a minimum of 24 oz. weight
- ③ 5/64 shall require a minimum of 20 oz. weight

Primary Backing: Polypropylene

### Secondary Backing:

Hot Melt Thermoplastic, Polyolefin Composite, Urethane, or Vinyl; (NO Latex Accepted)

### Resistance to Delamination:

ASTM D3936 with a minimum lifetime delamination warranty

Tuft Bind: ASTM TM D1335 (minimum lifetime tuft bind warranty)

Pile density: Density = 36 x pile weight (oz/ yd<sup>2</sup>) / finished pile height (inches)

### Flammability:

ASTM 648 - 0.22 watts/cm<sup>2</sup> critical radiant flux and/or federal, state or local requirements. Smoke Density: ASTM E662 Rating to be less than 450 in flaming mode (or to

## APPENDIX I

State Code). Must meet Federal Flammability standard DOC FF 1-70 (Methenamine Pill test ASTM D2859).

### Colorfastness to Light:

AATCC 16E, 80 AFU, International Gray Scale for Color Change rating, minimum 3.

### Colorfastness to atmospheric contaminants:

AATCC 164 & AATCC 129 for 2 cycles, International Gray Scale for Color Change rating, minimum 3-4.

### Soil Resistance:

An average of 3 fluorine analyses (AATCC 189 formerly CRI TM 102) of a single composite sample to be a minimum of 500 ppm fluorine by weight when new and 400 ppm fluorine by weight after 2 AATCC 171 (HWE) cleanings.

### Coloration:

Minimum 4 color hues, and hue values to be in optimum light reflectance rating for soil hiding enhancement

### Appearance Retention:

Vetterman Drum Test ASTM D5417 for 22,000 cycles. A minimum rating of 3.0 using CRI TM-101 Reference Scale. Testing without underpad or brushing.

### Indoor Air Quality:

Maximum 0.5 mg/m<sup>2</sup>hr total VOC emission, ASTM D5116

### (3) TYPE 3 BROADLOOM CARPET:

Generic carpet performance specification for areas of low traffic, where frequent spills and stains are expected, and where significant direct sunlight, colorfastness and budget are primary concerns.

*This generic carpet performance specification is intended for areas of low traffic, where frequent spills and stains are expected, that receive significant direct sunlight, where therefore colorfastness is a primary concern and where budget considerations are an issue. Such areas may include low traffic health care or food service areas. Following are the minimum specifications for carpet for this type of area.*

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### Construction:

The carpet shall be tufted, level, multi-level or textured loop pile with maximum height variation of 1/16". It shall either be 12-foot broadloom, six foot or carpet tile.

(Cut Pile and Cut/Loop construction to be used for borders only unless specifically approved by Owner for application. MUST be solution dyed where stains and colorfastness are primary concerns.)

### Carpet Yarn

Carpet yarn shall be 100% DuPont DSDN, or 100% Solutia Ultron SDN, first quality, bulk continuous filament nylon type 6,6 offering a construction standards testing program by a fiber producer. Dye method shall be solution dyed. Fiber shape shall have a Modification Ratio range of 2.1 to 2.5 for soil release capabilities. Fiber identification to AATCC 20.

### Static Control:

Static shall be controlled by permanent means (i.e. antistatic filaments) and without chemical treatment, static generation below 3.5 kilovolts under standard conditions of 65 degrees F and 20% relative humidity. Electrostatic Propensity (Static delayed signal): to AATCC 134.

Dye Method: Solution dyed

Pile Weight: 20 oz/yd<sup>2</sup> minimum

Pile Height: .22 inch maximum

### Gauge/Stitch Count:

In order to provide balanced construction, the gauge and stitch count minimums shall be as follows:

- ③ 1/8 shall require a minimum of 26 oz. weight
- ③ 1/10 shall require a minimum of 24 oz. weight
- ③ 5/64 shall require a minimum of 20 oz. weight

Primary Backing: Woven polypropylene

Secondary Backing:

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Hot Melt Thermoplastic, Polyolefin Composite, Urethane, or Vinyl; (NO Latex Accepted)

Resistance to Delamination of Secondary Backing:

ASTM D3936 lifetime delamination warranty

Tuft Bind: ASTM D1335, lifetime tuft bind warranty

Pile Density:

Density =  $36 \times \text{pile weight (oz/ yd}^2 \text{) / finished pile height (inches)}$

Flammability:

ASTM 648 - 0.22 watts/cm<sup>2</sup> critical radiant flux and/or federal, state or local requirements. Smoke Density: ASTM E662 Rating to be less than 450 in flaming mode (or to State Code). Must meet Federal Flammability standard DOC FF 1-70 (Methenamine Pill test ASTM D2859)

Colorfastness to Light: AATCC 16E, 160 AFUs, International Gray Scale for Color Change rating, minimum 3-4.

Colorfastness to Atmospheric Contaminants:

AATCC 164 (ozone) & AATCC 129 (oxides of nitrogen) for 2 cycles, International Gray Scale for Color Change rating, minimum 3.

Stain Resistance:

AATCC 138 for 5 washings to simulate removal of topical treatments by hot water extraction, followed by: AATCC 175, level 6

Soil Resistance:

Protective, anti-soil treatment heat shall be applied by carpet manufacturer.

Coloration:

Minimum 3 color hues, and hue values to be in optimum light reflectance ratings for soil-hiding enhancement.

Appearance Retention:

Vetterman Drum ASTM D5417 for 22,000 cycles.

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Requires a minimum rating of 3.0 using CRI TM-101 Reference Scale. Testing without underpad or brushing.

Indoor Air Quality:

Maximum 0.5 mg/m<sup>2</sup>hr total VOC emission, ASTM D5116

(4) CARPET TILE OR SIX FOOT VINYL CUSHION BACK ROLLED GOODS:

Construction:

Textured or level loop tufted graphics.

Face Fiber:

100% Dupont Antron Lumena or Antron Legacy, Antron Blend . Type 6.6 nylon - continuous filament with anti soil, anti stain protection.

Pile Height

.117 ≥ ≤ .187:

Yarn Weight:

(varies depending on tuft gauge and pile height)

Dye Method:

100% solution dye or a solution dye yarn dye blend

Stitches per inch:

12 minimum

Tuft Gauge:

1/13", 1/12" (minimum)

Primary Backing:

Sealant vinyl or Synthetic (no latex coating)

Secondary Backing:

Vinyl 5/32" closed cell cushion. Backing must be fusion bonded into face and primary to create integrated product. Poly vinyl composition - closed cell, fusion bonded construction. Must pass Test ASTM D 3936 delamination of secondary back.

Test ASTM D 1667 w/25% deflection @ 710 PSI. Must be full 100% chemical weld at seam site to ensure moisture barrier + monolithic installation.

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### Total Backing Weight:

35.5 oz. minimum (cushion)

### Density:

4500 minimum Electrostatic Propensity 3.5 KV or Less

### Pill Test:

Doc FF1-70 must pass

### Radiant Panel (Direct Glue):

ASTM E-648 must be Class 1

### NBS Smoke Density:

ASTM E-662 Flaming Mode must be < 450

Non-flaming Mode must be < 450

### Static:

AATCC-134 must be < 3.5 KV Permanent Conductive  
Fiber

### Electric Resistance:

Must pass NFPA 99, Burroughs Method: NFPA 99

### Warranty:

20 years, non-prorated warranty against delamination, edge  
ravel, zippering, moisture penetration, wear

### Carpet Adhesive:

Shall be non wet adhesive, micro-encapsulated tackifier  
impregnated into vinyl cushion backing. Solvent free  
adhesive as recommended by carpet manufacturer for  
interior installation of vinyl backed carpet. Acrylic based  
adhesive shall be non-flammable, water and alkali resistant,  
mildew-resistant, freeze-thaw stable. Adhesive shall release  
from substrate without leaving residue.

### Adhesive Seam Sealer:

As required, provide adhesive seam sealer certified in  
writing by the manufacturer to be compatible with carpet  
backing. Seam sealer to have minimum 5 year  
manufacturer's guarantee. Sealer must be completely  
chemical weld/fuse backing together at the seam site.

Carpet Edge Guard: A/E to specific either aluminum or vinyl  
edge guard or transition in color suitable for particular

## APPENDIX I

installation. Edge guard attachment to be by mechanical fasteners or glued down.

### INSTALLATION CONDITIONS FOR BROADLOOM OR CARPET TILES

- a. All subfloors must be level, clean, dry, free of dust, dirt, wax, paint, grease, cut back adhesive or any material that might interfere with the overall bond strength of the adhesive. All concrete floors must be fully cured and free of excessive moisture and alkalinity. No condensation within 48 hours on underside of 4 foot by 4 foot polyethylene sheet, fully taped at perimeter to substrate. Conduct moisture test maximum allowable amount of moisture emitted from floor shall be 3.0 pounds per 1,000 square feet in 24 hour period.
- b. Store floor covering and adhesive at a temperature of 70 degrees F. for 48 hours prior to installation and maintain for 48 hours during and after completion.
- c. Do not expose adhesive to ultraviolet light. It is photosensitive and will lose its tack.
- d. Double cut edges tight to form seams without gaps using carpet manufacturer's recommended seam sealer.

When carpet is scheduled for installation on risers and treads, as in auditoriums, and the carpet product as specified with a vinyl cushion back will not install properly over risers and treads, the installer of the carpet product shall be required to provide and install rubber tread edge strips along the front edge of all treads including treads located within the seating areas.

- e. Experience of installer shall be at least five years. Installer shall be certified by Manufacturer of carpet submitted.



## APPENDIX J

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- PART 1. Introduction
  
- PART 2. Organization of Project Manual
  
- PART 3. Bidding Requirements, Contract Forms and Conditions of the Contract
  
- PART 4. Specifications - Divisions 1 - 33

## APPENDIX J

### PART 1 - INTRODUCTION

The Project Architect/Engineer (A/E) shall prepare the Project Manual in accordance with the current edition of The Construction Specification Institute (CSI) Manual of Practice and MASTERFORMAT 2007 - Master List of Titles and Numbers for the Construction Industry.

The preparation of Project Manuals for The University of Texas System (U. T. System) projects requires certain modifications to the format given in the CSI Manual of Practice and MASTERFORMAT 2007. The modifications are described in Parts 2, 3 and 4 of these Guidelines.

Part 2 - Organization of Project Manual describes the preferred Table of Contents for U. T. System projects.

Part 3 - Bidding Requirements, Contract Forms and Conditions of the Contract transmits certain U. T. System documents and provides instructions to the Project Architect/Engineer for completing these documents.

Part 4 - Specifications Divisions 1 - 33 transmits certain U. T. System specifications sections and provides instructions to the Project Architect/Engineer for completing the specifications Divisions 1-33.

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### PART 2 - ORGANIZATION OF PROJECT MANUAL

The Project Architect/Engineer shall organize the Project Manual in accordance with The Construction Specification Institute (CSI) Manual of Practice and MASTERFORMAT 2007-Master List of Tables and Numbers for the Construction Industry. See the example:

	TITLE	PAGES
INTRODUCTORY INFORMATION		
00001	Title Page*	XX
00002	Certifications Page*	XX
00003	Table of Contents	XX
00004	List of Drawings, Tables and Schedules**	XX
BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT		
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	Attachment "C" - Weather Days	
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	Project Administration	01 31 00
	Project Planning and Scheduling	01 32 00
	Project Safety	01 35 23
	Quality Control	01 45 00
	Temporary Storm Water Pollution Control	01 57 23
	Project Close Out Requirements	01 77 00

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Project Commissioning	01 91 00
<i>(Optional UT Austin Only) Storm Water Management</i>	
Cast Bronze Dedicatory Plaque	10 14 16.11

### SPECIFICATIONS

Division 1 - General Requirements

Section 01 11 00 Summary of Work    xx etc.

\*Title Page and Certifications Page may be combined. See Exhibit - Part 2, Title Page

\*\*List of Drawings, Tables and Schedules may be incorporated in a specifications section.

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EXHIBIT - PART 2

TITLE PAGE

(A/E may combine Title Page with Certifications Page)

PROJECT MANUAL

OWNER: The University of Texas System  
Austin, Texas

PROJECT: (Official name of project)

PROJECT NUMBERS: (U. T. System Project No.)  
(A/E Project No.)

DATE: (Date of bid documents)

OWNER'S REPRESENTATIVES: UT Health Science Center at Houston  
7000 Fannin St. Suite 820  
Houston, Tx 77030

(Name of Institution,  
mailing address, and telephone and fax numbers)

PROJECT ARCHITECT/ENGINEER: (Name of principal in charge, firm name, mailing  
address, and telephone and fax numbers)

PROJECT ARCHITECT/ENGINEER'S (Name of principal in charge, firm name,  
/CONSULTANTS: mailing address, and telephone and fax numbers)  
(Identify individually by discipline)

PART 3 - BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE  
CONTRACT

I. Introduction

- A. The Project Architect/Engineer shall include the documents furnished herein in the Project Manual for U. T. System construction projects. Some documents need completion or modification to suit the individual project; others are to be reproduced from the copy herein, without alterations of any kind, and are so identified in these instructions.

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- B. The Bidding Requirements, Contract Forms and Conditions of the Contract are subject to revision at any time. Therefore, the Project Architect/Engineer shall verify the accuracy of the documents with the UTH Project Manager before advertising for bids.
  - C. Many documents furnished herein are available upon request on electronically from UTH in Microsoft Word or Adobe Acrobat formats.
- II. Bidding Requirements, Contract Forms and Conditions of the Contract to be included in the Specifications of U. T. System construction projects - See Exhibits - Part 3, U. T. System Bidding Requirements, Contract Forms and Conditions of the Contract for:
- A. Notice to Respondents
  - B. Information to Respondents
  - C. Supplemental Information to Respondents
  - D. Policy On Utilization, Historically Underutilized Businesses, Exhibit H
  - E. Proposal
  - F. Agreement
  - G. Performance Bond
  - H. Payment Bond
  - I. Uniform General Conditions and Supplementary General Conditions
  - J. Owner's Special Conditions
  - K. Attachment "A" - Prevailing Wage Rate Determination
  - L. Attachment "B" - Project Sign Layout
  - M. Attachment "C" - Weather Days
- III. Instructions for Project Architect/Engineer to Complete Exhibits - Part 3, U. T. System Bidding Requirements, Contract Forms and Conditions of the Contract:
- A. Notice to Respondents

## APPENDIX J

UTH to furnish A/E the information for the first paragraph  
A/E to complete the last paragraph

### B. Information to Respondents

A/E, under Plans and Specifications, to complete blanks for Deposits (the amount shall reflect actual costs) and Documents on File  
A/E to review with UTH the information for Partnering  
UTH to furnish A/E the information for Pre-Bid Conference

### C. Notice to Respondents

### D. Policy on Utilization, Historically Underutilized Businesses, Exhibit H

No completion required; do not alter.

### E. Proposal

A/E to complete blanks for the official name of the Project and the Institution  
A/E to complete the first paragraph for the Project Architect/Engineer's name and address  
UTH to furnish A/E the information for Construction Contingency Allowance  
A/E to recommend to UTH any Special Cash Allowances  
A/E and UTH to agree upon any Alternate Bids  
A/E to recommend to UTH any unit prices other than those shown in the Exhibit  
A/E to recommend to UTH calendar days to complete all work  
UTH to furnish A/E the amount of liquidated damages

### F. Agreement

UTH to furnish A/E the information to complete Article 1 Scope of Work, first paragraph; Article 2 Time of Completion; and Article 5 Liquidated Damages. All other blanks are to remain.

### G. Performance Bond

No completion required; do not alter.

### H. Payment Bond

No completion required; do not alter.

### I. Uniform General Conditions and Supplementary General Conditions

## APPENDIX J

No completion required; do not alter.

The Uniform General and Supplementary General Conditions for University of Texas System Building Construction Contracts have been integrated into a single document.

### J. Owner's Special Conditions

The Project Architect/Engineer shall customize the Owner's Special Conditions for the project. The Project Architect/Engineer shall review the Owner's Special Conditions with UTH and recommend Owner's Special Conditions items to retain, modify, add and delete.

### K. Attachment "A" - Prevailing Wage Rate Determination (No completion required; do not alter.)

UTH to furnish A/E the rates of wages to include in the specifications immediately following Attachment "A".

### L. Attachment "B" - Project Sign Layout (No completion required; do not alter.)

### M. Attachment "C" - Weather Days (do not alter)

## EXHIBITS - PART 3

## U. T. SYSTEM BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTACT

Notice to Respondents

Information to Respondents

Supplemental Information to Respondents

Policy on Utilization, Historically Underutilized Businesses, Exhibit H

Proposal

Agreement

Performance Bond

Payment Bond

Appendix J



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Uniform General Conditions and Supplementary General Conditions

Owner's Special Conditions

Attachment "A" - Prevailing Wage Rate Determination

Attachment "B" - Project Sign Layout

Attachment "C" - Weather Days

### PART 4 - SPECIFICATIONS DIVISIONS 1 -33

- I. The Project Architect/Engineer (A/E) shall prepare the Project Manual in accordance with the current edition of The Construction Specification Institute (CSI) Manual of Practice and MASTERFORMAT 2007 - Master List of Titles and Numbers for the Construction Industry.
  
- II. The Project Architect/Engineer shall include the documents furnished herein for specifications Divisions 1-33 in the Project Manual for U. T. System construction projects. Some documents need modification and completion to suit the individual project; others are to be reproduced from the copy herein, without alterations of any kind, and are so identified in these instructions. See Exhibits - Part 4, U. T. System Specifications Divisions 1-33 for:

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- A. Section 00 73 16 – Project Insurance (OCIP) (Optional for OCIP projects. No completion required, do not alter)
  - B. Section 01 31 00 - Project Administration (No completion required; do not alter)
  - C. Section 01 32 00 – Project Planning and Scheduling (No completion required; do not alter)
  - D. Section 01 45 00 – Project Quality Control (No completion required; do not alter)
  - E. Section 01 57 23 – Temporary Storm Water Pollution Control (No completion required; do not alter)
  - F. Section 01 77 00 - Project Closeout (No completion required; do not alter)
  - G. Section 01 91 00 - Project Commissioning (No completion required; do not alter)
  - H. Section 10 14 16.11 - Cast Bronze Dedicatory Building Plaque (Remove the instructional note in the box at the top of the first page).
- III. Formatting
- A. The documents were word processed in Word. They are formatted for 8 1/2" x 11" paper as follows: Font = Courier 10 point, 1" top margin with .5" bottom margin, 1" left margin with .75" right margin, left justification and footers for section and page numbers.
  - B. The fonts, page layout, and any "footers" must be modified to match the other Sections within the particular Division of the Project Manual.
- IV. See the Guidelines for Architect/Engineer Services for instructions concerning U. T. System specifications Divisions 11 thru 33.
- A. UTH maintains Division 11, 13 and 21-33 Guideline Specifications for Mechanical/Electrical Services for U. T. System projects, which UTH will furnish to the Project Architect/Engineer. The Project Architect/Engineer shall review, modify and complete the Guideline Specifications for Mechanical/Electrical Services and roofing in detail as may be required for specific project requirements. The Project Architect and/or Project Engineer shall be responsible for content of the entire Project Manual as issued for bids, and the professional's seal shall be applicable to all of the contract documents, including those specification sections based on an UTH standard.

EXHIBITS - PART 4

U. T. SYSTEM SPECIFICATIONS DIVISIONS 1 - 33

Section 00 73 16 – Project Insurance (OCIP) - If Applicable

Section 01 31 00 - Project Administration

Section 01 32 00 – Project Planning and Scheduling

Section 01 35 23 - Project Safety

Section 01 45 00 – Project Quality Control

Section 01 57 23 – Temporary Storm Water Pollution Control

Section 01 77 00 - Project Closeout

Section 01 91 00 - Project Commissioning

Section 10 14 16.11 - Cast Bronze Dedicatory Building Plaque

The University Of Texas System  
UT Health Science Center at Houston  
OWNER'S DESIGN GUIDELINES

**Revision Log**  
**APPENDIX J**

<b>Rev. Date</b>	<b>Remarks</b>
	Revisions prior to 3/1/11 are not recorded in this log
3/1/2011	Miscellaneous minor changes throughout
3/1/2011	Updated references to MasterFormat 2007

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**STRUCTURAL CRITERIA**

A. COORDINATION OF DESIGN:

1. The consulting Structural Engineer shall coordinate his work with the Architect and the Mechanical, Plumbing and Electrical Engineers to avoid conflicts in dimensions and space requirements. See Item D under “Structural Elements.”
2. Close attention should be given to mechanical requirements for construction clearances, openings, penetration of structural members, inertia pads, equipment weights, vibrations and special framing. The Engineer shall show any support or

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reinforcing conditions on the Construction Documents with plan references to specific details.

3. The consulting Structural Engineer shall review architectural details to verify that all architectural elements (storefronts, overhead doors, finishes, life safety anchors, etc.) are supported. The Engineer shall verify that all lintels, shelf angles, handrail anchors, miscellaneous framing members, clip angles, anchors, bolts and welds have been properly sized and spaced for their required carrying capacity. The Engineer shall also evaluate the details for simplicity, economy, ease of erection and flexibility to meet construction tolerances. The Engineer shall show any support or reinforcing conditions on the Construction Documents with plan references to specific details. This review should be continuous as required during the preparation of Construction Contract Documents.
4. For cost estimating purposes, connections that are part of a delegated design and are not the responsibility of the Structural Engineer of Record may be required to be indicated on the Construction Documents for scope and coordination. The Basis of Design for the element to be supported shall be used to establish a reasonable baseline condition for sizing and detailing the connections that are to be shown on the Construction Documents. These connections are to be resolved through the submittal process. If the connection is proposed to be substantially changed by the Contractor, the Engineer of Record shall be consulted when determining the appropriate cost and performance for the connection.
5. The architectural elevations shall clearly indicate the locations of all vertical and horizontal joints in all masonry. These joints shall be reviewed by the Structural Engineer.
6. Any new openings or penetrations through existing structures shall be well coordinated with all other design disciplines and shall be clearly shown in the Structural drawings. Dimensions for openings shall be shown on the Structural Drawings.
7. All elevations noted on the Structural drawings shall match the Architectural sign convention and referenced datum.
8. The Structural Engineer review all structural submittals including concrete mix designs.
9. It is expected that the Structural Engineer performs field observations during construction especially at critical stages of the work such as rebar observations and during steel framing erection.
10. The Engineer shall include the following language in the Structural Steel Notes and the Concrete Reinforcing Notes:

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Domestic Iron and Steel Certification. Pursuant to Sections 2252.201-2252.205 of the Government Code, the Contractor certifies that it is in compliance with the requirement that any iron or steel product produced through a manufacturing process and used in the Project is produced in the United States.

### B. DESIGN REVIEW SUBMITTAL REQUIREMENTS

The following outlines submittal requirements for Design Documents. The entire architectural and engineering team shall confirm that the Design Documents meet all the requirements of both this appendix and Appendix L.

The submittal requirements are not limited to the items listed below but are shown to be a minimum list. As the project warrants, the Architect and Engineer shall provide drawings, sections, calculations or other information as required to define a particular portion of the work as agreed upon by the Owner.

All Structural drawings and specifications issued for construction shall meet the requirements of TEXAS ENGINEERING PRACTICE ACT AND RULES CONCERNING THE PRACTICE OF ENGINEERING AND PROFESSIONAL ENGINEERING LICENSURE

Preliminary drawings and specifications issued for review shall meet Rule 137.33(e). “Preliminary documents released from a license holder’s control shall identify the purpose of the document, the Engineer(s) of record and the Engineer’s license number(s), and the release date by placing the following text or similar wording instead of a seal: “This document is released for the purpose of (Examples: interim review, mark-up, drafting) under the authority of (Example: Leslie H. Doe, P.E. 0112) on (date). It is not to be used for (Examples: construction, bidding, permit) purposes.”

#### 1. Schematic Review

- a. Provide an Outline of Structural Criteria. The purpose of the Outline of Structural Design Criteria is to establish early agreement between the Structural Design Engineer and The University of Texas Health Science Center at Houston (UTH) Engineer as to overall design approach and detailed design assumptions.
- b. The Outline of Structural Design Criteria shall include the following:
  - 1). Project, title, UTH project number, location
  - 2). Architect, firm name, address, phone
  - 3). Structural Engineer, firm name, address, phone
  - 4). Brief Description of Structure:



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- a). Building functions
  - b). Number of floors, basement
  - c). Exterior walls, interior partitions
  - d). Overall building dimensions and frequency of expansion joints including those at exposed exterior building components
  - e). Unusual design features
- 5). Structural System Selected:
- a). Describe the floor and roof structural systems.
  - b). Discuss reasons for selection of System chosen. This should include comments on the economics of the system as opposed to others, unusual spans and loads, fireproofing and any other factors governing selection of structural system. The Engineer shall be prepared to provide typical framing plans (i.e. one to two (1-2) bays) for pricing and determination of the most cost effective system.
  - c). See section D for additional requirements/information.
- 6). Stress Distribution in Frame:
- a). Give a brief statement of method of distributing loads and moments throughout frame. Except for complex structures, any recognized method will be satisfactory.
  - b). Discuss method of distributing wind loads. Wind loads must be taken to the integral parts of the structure.
- 7). Structural Analysis and Proportioning Members:
- a). State method of stress analysis i.e. working stress, ultimate strength.
  - b). List Codes, Standards and pertinent references to be used as criteria for sizing members.
  - c). Give class and strength of structural materials to be used.
  - d). Major analysis and design assumptions shall be briefly described in the “Structural Notes” on the design drawings.
- 8). Design Loads:
- a). The Structural Engineer should review Architectural drawings and determine the appropriate loads using the IBC and the Unit Live Loads listed in this guide. The Engineer shall use the increased Live Loads listed in this guide. The loads have been increased above the usual Code requirements in order to satisfy future loading possibilities often encountered in The University of Texas System buildings.
  - b). If the Architect or Engineer feels that the project is of a nature where there could be changes in function and therefore increases in future applied loads, then the Engineer should alert

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the UTH Project Manager. A live load schedule can then be determined to fit the specific requirements of the structure.

- c). List unit loads.
- d). List wind loads.
- e). List the seismic load factors.
- f). Live load maps are required for the Design Development Documents but are not required for Schematic Design Development review.

### 9). Foundation Design:

- a). As soon as soils investigations have been completed, give detailed description of foundation type and soils capacities actually used in sizing foundation members. State anticipated settlements if known.
  - b). Basement and Ground floor foundations shall be designed in accordance with the Geotechnical Recommendations given in the Geotechnical Report. Considerations should be given to having a crawl space if required by the Institution or if soil conditions warrant. The Structural Engineer shall confirm requirements as soon as possible through the UTH Project Manager. If crawl spaces are included, use of mud slabs are encouraged but not required unless they are required by the Institution. In addition, the design team needs to consider crawl space ventilation as required by the IBC by using a vapor barrier, cross ventilation, forced ventilation or other waterproofing methods for the floor above the crawl space.
  - c). Discuss below grade waterproofing and method of removing water at exterior walls, under slab or in crawl space.
  - d). Discuss lateral load assumptions at below grade locations.
- c. Discuss unusual foundation and shoring problems due to nature of soils, proximity of adjacent structures, etc.
  - d. Provide a detailed discussion of why the particular framing and foundation system was chosen.
  - e. Provide schematic layout drawings and framing plans.
  - f. Provide sample calculations proposed for use on project - computer input, program utilized, etc. if requested by UTH.

## 2. Design Development Criteria

- a. *The A/E team should understand the project delivery method. A GMP (guaranteed maximum price) is required for CMR (Construction Manager at Risk) or DB (Design Build) projects at the end of the DD phase. All typical*

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*structural systems and representative details and any other details necessary to reach a GMP by the CMR/DB Contractor shall be included so that the CMR/DB Contractor can make a reasonable take-off and cost estimate for the GMP. This requires more plan work and detail that is normally not included at the DD phase. Early construction packages may be required. The Engineer shall prepare and provide appropriate drawings to facilitate early construction packages.*

b. Design Development Structural Drawings and Specification sections:

- 1). Foundation, floor and roof plans shall show all major structural members and preliminary sizes along with approximate reinforcing quantities to assist in the preliminary pricing of the structure.
- 2). The plans shall show all major structural members along with approximate reinforcing quantities to assist in the preliminary pricing of the structure.
- 3). Indicate recessed areas in slabs, major openings, elevator and sump pits.
- 4). Indicate subsurface drainage system if required. This system should be coordinated with the Architectural Drawings and the Civil and Plumbing Engineers.
- 5). Provide typical details including; pier layout, lateral bracing and framing details to assist in the preliminary pricing of the structure.
- 6). Show locations and heights of soil retentions systems.
- 7). Provide preliminary structural demolition drawings if demolition is required for the project.
- 8). Provide preliminary specifications sections.
- 9). Provide preliminary Live Load maps. Floor Live Load maps shall have an Architectural Background in lieu of a Structural Background as these maps will be used for future renovation projects. Backgrounds shall include appropriate grid lines and callouts and any dimensioning that is required. Provide Floor Live Load maps after the Structural Notes but before the framing plans.
- 10). Provide Roof Uplift Load map showing gross uplift loads for all roof areas, including canopies and other architectural features that may be subject to wind uplift forces. Coordinate roof uplift map with Architectural Drawings and Specifications including roofing

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specifications. Backgrounds shall include appropriate grid lines and callouts and any dimensioning that is required. Provide Wind Load maps after the Structural Notes but before the framing plans.

### 3. Construction Documents

- a. UTH may request one copy of complete structural calculations. Because complete calculations are often bulky and repetitious in standard design operations, calculations for representative parts of the building usually will be acceptable. Calculations and design assumptions shall be presented in a manner that can readily be followed. Members shall be cross-referenced to plans and (rough) details with any number system that permits easy identification of the member and its location in the structure. If requested, calculations at minimum will show:
  - 1). Unit dead loads with partitions load assumptions.
  - 2). Unit live loads with sustained load assumptions and reduction factors.
  - 3). Deflections. Show justification for long, slender members.
  - 4). Ponding.
  - 5). Vibration considerations where applicable.
- b. Drawings and specification sections will be required at each construction document review.
- c. Drawings shall be as complete as possible at each CD phase. The preferred progression would be: Design structural frame including lateral design, add details as necessary to define the plan work at each phase, complete the detailing after frame is designed.
- d. Design drawings shall include plan Live Load maps for all floors including the foundation. The maps shall indicate live loads and dead loads requiring special consideration. The floor load maps shall have an Architectural Background in lieu of a Structural Background as these maps will be used for future renovation projects. Backgrounds shall include appropriate grid lines and callouts.
- e. Design drawings shall include Roof Uplift Load maps showing gross uplift loads. Coordinate roof uplift map with Architectural Drawings and Specifications. Backgrounds shall include appropriate grid lines and callouts and any dimensioning that is required.
- f. Design documents (drawings and/or specifications) shall include general postconstruction penetration guidelines including:
  - 1). Where penetrations are allowed (with noted restrictions).
  - 2). Where penetrations may be allowed with the review and approval of a Structural Engineer.
  - 3). Where penetrations will never be allowed.
- g. Review the possibility of special loads due to specialized equipment with the A/E team and the UTH Project Manager.

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### C. LOADING AND DEFLECTION STANDARDS

#### 1. Minimum Live Loads – Per the IBC with the following modifications

<u>OCCUPANCY OR USE</u>	<u>LBS. PER SQ.FT.</u>
Auditoriums, Theaters, Assembly Areas	
Fixed Seats	80
Movable Seats	100
Seated Balconies	80
Stages	150
Assembly areas, Lobbies	100
Classrooms	80
Corridors Above 1 <sup>st</sup> Floor	80
Exterior Balconies	100
Garages- If story heights and level floors permit conversion to some function other than storage of private cars, contact the Project Manager about the appropriate design live loads.	
Hospitals- Patient Rooms/Operating Rooms	80
Laboratories - Standard Equipment	80
Heavy Equipment	100
Libraries Reading Room	80
Stack Room	150
Mechanical/MEP Rooms	150
Multipurpose Rooms	100
Offices	80
Public Areas/Lobbies/Assembly Areas	100
Rest Rooms	80
Roof Loads Flat or rise less than 7” per foot	30
Rise 7” per foot and greater	20
Stairways	100
Stores Retail (all floors)	100

#### Additional Notes

- a. For items not specifically covered in the list above- the live load shall be approved by UTH Engineer.
- b. Design shall provide for maximum wheel loads.

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- c. All roofs shall be designed with sufficient slope or camber to assure adequate drainage after long-time deflection from dead load or shall be designed to support maximum loads including possible ponding due to deflection.
- d. Provisions for Partitions - The above live loads for classrooms and office spaces include the IBC 15 psf for partitions. The Structural Engineer shall consult with the UTH Engineer for inclusion of the partition loading provision in areas not noted by the above or by the IBC.
- e. Concentrated Loads - In the design of floors, probable concentrated loads shall be considered as described in the IBC. Where such loads may occur, the supporting beams, girders and slabs shall be designed to carry either the concentrated loads or the live load described in the IBC or above, whichever produces the greater stresses.
- f. Structural systems and members shall be designed and detailed to accommodate the specific mechanical, electrical, and other equipment as specified by the Architect. Minimum Design Live Load for MEP areas/rooms shall be 150 psf. All substitutions resulting in changes in the magnitude or location of these loads, or in the revision in the number, location, or size of penetrations through structural elements shall be coordinated by the Contractor at Contractor expense including providing design calculations by a registered Professional Engineer addressing the proposed substitution.

### 2. Reduction of Live Loads

- a. No reduction shall be applied to the roof live load.
- b. No reduction of the floor live load shall be allowed in the design of any slabs or joists (concrete or steel).
- c. Beams, girders, trusses, columns, walls, pier or foundation elements shall be designed to support the full dead and live loads with allowable Code reductions with the following restrictions:
  - 1). Maximum allowable live load reduction is 20%. Live load reductions shall follow the IBC live load reductions formulas (both basic and alternate) up to a maximum amount of 20%. Per Code, live load reductions are not allowed for members supporting less than 150 SF.
  - 2). For parking garages, a reduction in live load is not permitted except that the live loads for members supporting two or more floors may be reduced by a maximum of 20 percent (20%).

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- 3). For warehouses and storage facilities, no reduction in live load is permitted.

### 3. Wind Loads

- a. Buildings and structures shall be designed to withstand the minimum horizontal and uplift pressures set forth in the International Building Code (IBC). The IBC wind design parameters shall be clearly indicated on the design drawings. All Institutional Buildings shall be classified as Category III (per ASCE-7) unless determined by the Design Team and the UTH Engineer to be Category IV. If determined by the Design Team that a special wind category/classification is required for the Project, written notification shall be sent to the UTH Engineer for approval.
- b. Provide a wind uplift load map showing gross uplifts and clearly note coordination with Architectural Drawings and Specifications, including roofing specifications.
- c. Projects in Tier-1 counties (i.e. Galveston, Cameron or Nueces) shall also be designed to meet TDI (Texas Department of Insurance) Windstorm requirements. It is required that the Building shall be able to obtain Texas Windstorm Insurance Association (TWIA) insurance coverage. The Structural Engineer of Record shall assist/take the necessary steps to understand his/her project responsibility with the structural, architectural and construction inspection requirements of TDI to insure that the Windstorm Insurance can be obtained.

The Structural Engineer of Record shall file any and all paper work with TDI to ensure that the WPI-8 certificate will be obtained at the end of the project. The Structural Engineer of Record shall forward the WPI-8 Certificate (once obtained from TDI) to the UTH Engineer as soon as possible at the end of the project.

- d. In design for Wind, the integral structural parts shall be designed to resist the total lateral loads. Non-structure elements shall be sufficiently attached to the structural framing system to prevent shedding of components in a design loading event.
  - e. If the building components are in a location considered by the consulting Structural Engineer, or the UTH Engineer, to be unusually exposed, higher wind loads may be specified. Written notification shall be sent to the UTH Engineer for approval.
4. Seismic and Geologic Factors - Notify the UTH Engineer in writing (email is acceptable) if seismic or unusual geologic conditions occur affecting the design of the structure.

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5. Ice Sensitive Structures- The Engineer shall evaluate ice sensitive structures or architectural features for proper support and detailing.

### 6. Control of Deflection - Steel

- a. Structural steel members shall be designed in accordance with A.I.S.C. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest edition with the following exceptions:

<u>Roof and Floor Load</u>	<u>Maximum Deflection</u>
Live Load Only	L/360
Dead Load and Live Load	L/240

CMU support masonry cladding (lat. deflection)\* L/600\*  
Light gauge metal studs for the lateral load resisting system for masonry cladding \* L/700\*

\* CMU is the preferred lateral load back-up system for masonry veneer. Cold-formed metal studs may only be used upon written authorization (email notification is preferred) by UTH's Engineer. Requests shall be sent through the UTH Project Manager.

- b. It is preferred that flexural members be selected with sufficient depth and stiffness to deflect approximately L/360 maximum under dead load plus live load conditions. If in the Engineer's judgment this requirement creates unreasonable cost or aesthetic problems, L/240 may be used with written consent from the UTH Engineer.

7. Ponding and Vibration - Use A.I.S.C. Manual of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest edition. Consulting Structural Engineers shall use due regard in proportioning to resist vibration to avoid occupancy discomfort due to transient live load vibrations.

### 8. Control of Deflection - Concrete

- a. Design documents shall include FF/FL testing guidelines for deflection requirements for structural slabs.
- b. Reinforced concrete members subject to bending shall be designed with adequate stiffness to limit deflections or any deformations as set forth in building Code Requirements for Reinforced Concrete (ACI 318 - latest edition), except that the following Allowable Deflection Table shall govern.

Deflection to

Deflection



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<u>Type of Member</u>	<u>be Considered</u>	<u>Limitation</u>
Flat roofs not supporting or attached to non-structural elements likely to be damaged by large deflections.	Immediate deflection due to live load, L	L/240**
Floors not supporting or attached to nonstructural elements likely to be damaged by large deflections.	Immediate deflection due to live load, L	L/360
Roof or floor construction supporting or attached to nonstructural elements likely to be damaged by large deflections.	That part of the total deflection which occurs after attachment of the nonstructural elements, the sum of the long-time deflection due to all sustained loads and the immediate deflection due to any additional live load.*	L/480***
Roof or floor construction supporting or attached to nonstructural elements not likely to be damaged by large deflections.		L/360****

\* Total long-time deflection may be reduced by the amount of deflection which occurs before attachment of the nonstructural elements. This amount shall be determined on the basis of accepted engineering data relating to the time-deflection characteristics of members similar to those being considered.

\*\* This limit is not intended to safeguard against ponding. Ponding should be checked by suitable calculations of deflection, including the added deflections due to pond water, and considering long-time effects of all sustained loads, camber, construction tolerances and reliability of provisions for drainage.

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\*\*\* This limit may be exceeded if adequate measures are taken to prevent damage to supported or attached elements.

\*\*\*\* But not greater than the tolerance provided for the nonstructural elements. This limit may be exceeded if camber is provided so that the total deflection minus the camber does not exceed the limitation.

c. Assume a minimum 50% of live load as acting with sustained load.

9. Architectural Detailing for Deflections - The Structural Engineer shall inform the Architect of anticipated deflections so connections of nonstructural walls, partitions, shelves, laboratory equipment, etc. may be detailed with sufficient tolerance and flexibility to allow for frame movement. This includes recommendations for CMU, brick and stucco joint details and locations.

### D. STRUCTURAL ELEMENTS

This section consists of various systems and details which UTH prefers to use or avoid, as stated. It is not the intent that these items must be included or excluded from consideration; they are to be listed and discussed to assure special attention be given to them in order to eliminate recurrent problems. A thorough discussion of the merits of possible structural systems should be held early in the design process. Many of these requirements are based on historic “challenges” that UT System has faced in the design and maintenance of their structures.

#### 1. Foundation:

- a. Avoid precast-pre-stressed piling
- b. Avoid slab-on-fill in areas of expansive soils. If a slab-on-fill is approved then it shall include a 10-mil vapor barrier which meets ASTM E1745 standards.
- c. Avoid the use of waxed cardboard carton forms to form a void space for isolation purposes at active soils. Carton Forms shall not be used without written authorization from the UTH Engineer. A 12” minimum void shall be used when approved. Email requests shall be sent through the UTH Project Manager.

#### 2. Concrete Systems:

- a. Avoid structural suspended slabs less than 5 inches thick. This includes pan formed slabs.
- b. Strive to use standard depth for girders and joists and obtain a “flush” bottom structure, i.e., joists and beams are the same depth throughout the structure.

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The savings in formwork usually more than offset the expense of extra concrete.

- c. Avoid sprayed-on fireproofing requiring a monolithic finish on thin slab, panjoist or waffle-joist systems.
- d. Avoid pan-joist and/or particularly waffle-joist systems where extensive penetration of floors will occur. Skip-joists with clear rib dimensions of at least 48" are preferred.
- e. Post-tensioning
  - 1). Post Tensioning (PT) is an appropriate choice for many applications such as parking garages with typical 20' x 60' bays which lend themselves to a post-tensioned beam and slab system supported on cast in place columns.
  - 2). Another highly appropriate usage for post-tensioning would be in a girder supporting skip-joist ribbed slab. In many cases, the overall building systems work best when the girders supporting the skip-joists are maintained at a depth no greater than the skip-joist ribs. For longer spans, post-tensioning is helpful in controlling the deflections of the girder without deepening it past the pan rib depth.
  - 3). Provide detailed sections at column/PT beam intersections that show typical reinforcing and post tension anchors. Include all typical reinforcing that is typically designed by the PT designer. The intent is to highlight congestion at column/PT beam intersections and to confirm all reinforcing is correctly positioned prior to concrete placement. It is preferred that realistic representations of rebar sizes and posttensioned anchors and cables are shown (do not use single line weight/type representations of rebar/cables).
  - 4). Avoid two-way post-tensioned systems such as banded flat plates. These highly optimized systems do not lend themselves to future penetrations and live load changes and will be used only with written authorization from the UTH Engineer.
- f. The consulting Structural Engineer shall present various options for consideration at the Schematic and Design Development stages which consider various approaches in lieu of girders deeper than the pan ribs. A preference hierarchy would go something like this: 1) Post tensioning 2) Deep girders 3) Cambered formwork 4) Haunch Girders. Combinations of these four approaches shall not be used without specific written approval by the UTH Engineer.
- g. Two-way flat slab systems are not allowed without written approval by the UTH Engineer.

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- h. Avoid precast-pre-stressed double-tees. Use only with written authorization from the UTH Engineer. The decision for use of precast double tees in lieu of CIP framing shall be made based on cost-benefit analysis for life cycle costing for a 50-year life cycle. (exception – parking garages.)
- i. Avoid excessive Span/Depth ratios to minimize deflections and keep the system rigid.
- j. Pan joists or ribbed slabs shall not be designed as “tee beams” to save (slightly) in the cost of the reinforcing bars in the pan ribs because this practice compromises future flexibility of the structure in terms of slab penetrations between the ribs. Future renovations may require openings in the pan slab. Do not locate pan joist top steel in the slab area. Consider/detail slab steel placement to be above joist top steel whenever possible.
- k. Avoid the assignment of large bending moments to columns for the sake of beam design and then neglecting these beam moments when designing the columns.

### 3. Structural Steel Framing:

- a. Avoid light steel structures with long-span joists without a positive shear diaphragm, i.e. metal decking.
- b. Avoid columns without seat angles for beam and girder connections.
- c. Avoid full penetration field welding (in both the shop and field) without strict specification to welder qualifications, welding procedures, inspection and testing, including X-ray testing or Ultrasonic testing. Specify ultrasonic testing when possible. When specifying on the Contract Documents clearly indicate on plan where moment connections are required. It is best to call out on plan rather than use a small symbol that is defined in the Structural Notes or the Plan Notes.
- d. Avoid all “weathering” steel including “weathering” sheet metal.
- e. Avoid higher strength steels other than ASTM A992 Grade 50 for W-shaped members, ASTM A500, Grade B, 46 ksi steel for tube shaped members and A36 steel for miscellaneous plates and members.
- f. Avoid ASTM A-490 bolts.
- g. Avoid high-strength bolted connections without investigating and specifying latest state of the art methods of bolt tightening, inspection, and documentation.

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- h. Avoid use of touching dissimilar metals conditions in all structural situations. Use compatible metals or provide isolation devices.

Clearly identify Architecturally Exposed Structural Steel (AESS) on the Construction Documents. Show on plan with shading, labels or other means to indicate AESS. Provide appropriate specifications and details. Minimize its use due to probably additional associated costs associated with its usage.

### 4. Precast Concrete:

- a. Avoid extra-long span floor members or very large wall panels without thorough research as to transport route from various supply sources, traffic congestion on campus, availability of local machines capable of handling, etc.
- b. Avoid the use of systems not commonly used to the local construction trades.
- c. Avoid systems that flimsy or difficult to support and attach.
- d. Avoid lightweight concrete (weight less than 145 pcf) without written authorization from the UTH Engineer.
- e. Avoid the use of epoxy-coated rebar without written authorization from the UTH Engineer. Email requests shall be sent through the UTH Project Manager.

### 5. Cast in Place Concrete:

- a. Avoid the use of grade 80 rebar, full penetration weld splices and bar spacing which provides less than 1-1/2" clear separation. Should this prove unavoidable, specify 3/4" maximum aggregate and 1" clear separation. Use lap splices on column bars or use cad-weld or acceptable mechanical devices where possible.
- b. Avoid lightweight structural concrete with monolithic finish, particularly in Austin. In general, Austin has exceptional hard rock aggregates available making lightweight concrete (less than 125 pcf) cost a premium. UT-Austin sites typically have shallow rock strata for low-cost high-strength foundations, thus reducing the potential benefit of using lightweight concrete.
- c. Avoid the use of several concrete strengths for structural elements. Limit upper working stress to 6,000 psi for major construction areas (Houston, Dallas, San Antonio and Austin) unless approved in writing by the UTH Engineer. Limit upper working stress to 5,000 psi for other construction areas (Tyler, El Paso, South Texas and Permian Basin) unless approved in writing

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by the UTH Engineer. The individual institution's UTH construction inspectors and RCMs should be asked for input to problems encountered with concrete mixes, strengths, placement issues, finish issues, supply issues, etc.

- d. Avoid architectural cast-in-place concrete with conventional reinforcement cover. Use 2" minimum cover typically, in addition to rustications. Provide 4-1/2" minimum clearance for vibrators. Tie wires must not have long free ends and must be bent away from concrete faces. Clipped ends must be removed from forms prior to concrete placement.
- e. Avoid the use of sandblasted concrete without written approval by UTH Engineer. Email requests shall be sent through the UTH Project Manager. If approved, use stainless steel or plastic bolsters.
- f. Avoid the repair of cracks in architectural concrete with conventional caulking compounds. Repairs shall be made by low-pressure epoxy material.
- g. Fly ash in structural concrete is to be used only with the written permission of the UTH Engineer for architecturally exposed concrete. For all other concrete, a maximum of 25% (by weight) of type C or F fly ash may be used. Higher amounts of fly ash may be used with written approval from the UTH Engineer. The fly ash shall come from a TxDOT approved source and shall include monthly mill certificates confirming the adequacy of the ash.
- h. Avoid dapped beam and corbels in lieu of double columns at expansion joints.
- i. Minimum rebar size for slabs are #4 bars. (Note: #3 bars do not support the weight of the concrete placement personnel with typical #3 bar support spacing.) Do not use WWF except in steel deck supported slabs.

### 6. Masonry:

- a. Horizontal control joints with corresponding masonry support shelf angles for exterior masonry veneer shall be located at each elevated floor, including twostory buildings. A horizontal control joint is not needed between the top floor and the roof parapet. Vertical control joints shall be located at a maximum of approximately 30 feet on center on continuous planar exterior walls. Masonry shall have control joints at each side of masonry openings, (doors, windows, etc.) The exact locations of the horizontal and vertical control joints shall be clearly shown on the architectural elevation drawings. The Structural Engineer and the Architect should coordinate the location of these control joints.
- b. Requirements for shelf angle supports for masonry veneer:

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- 1). The Structural Engineer shall design the support angles for the full weight of the masonry which it supports. This includes the lintels above all wall openings.
  - 2). Angles shall be discontinuous at building expansion joints.
  - 3). Angles shall be discontinuous at masonry inside and outside corners.
  - 4). Breaks in the angles shall only be located at corresponding building expansion joints or masonry control joints. However, breaks in the angles need not occur at each control joint. Coordinate breaks with Architectural Drawings.
  - 5). Continuous spans of shelf angles shall not exceed approximately 30 feet.
  - 6). Shelf angles shall be protected from corrosion.
  - 7). Provide a loose lintel and/or a lintel schedule in the Documents.
- c. Avoid light gauge metal stud backup for exposed masonry veneer (especially brick). CMU is the preferred masonry backup. Use light gauge metal stud backup only with written authorization from the UTH Engineer. Email requests shall be sent through the UTH Project Manager. When allowed, the light gauge framing shall limit deflections under service wind loads to  $L/700$ .
- d. The use of masonry cement is not allowed. Use Portland cement only for mortar.
- e. Use stainless steel masonry wall anchors for all Institution locations except Permian Basin and El Paso. UT Permian Basin and UT El Paso locations may use galvanized masonry wall anchors.
- f. Type "N" mortar is preferred. Type "S" mortar should only be used when absolutely necessary since it is less durable than type "N" mortar. Use of type S mortar should not be used without written notification by the UTH Engineer.
- g. Mortar cube testing and prism testing are not reliable indications of the in-place strength of the masonry. They shall not be prescribed unless specific project requirements warrant. Confirm with UTH Engineer prior to specifying.

### E. GENERAL REQUIREMENTS & COMMENTS

#### 1. Geotechnical Report

- a. UTH maintains two to four geotechnical firms under contract for each of our eight Institution areas on a rotating basis. UTH will request a new geotechnical study for virtually all UTH-managed projects. The A/E consulting team will be asked by the UTH Project Manager to provide a plan of proposed boring locations and a written description of the project to be

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attached to the RFP to assist the Geotechnical Engineer in understanding the geotechnical requirements. Representative information to be included in this attachment:

- 1). Anticipated live and dead column loads
  - 2). Number of stories
  - 3). Cladding type
  - 4). General size of retaining walls
  - 5). Specific PVR guidelines
  - 6). Vehicle traffic loads
  - 7). Request sidewalk/paving design recommendations 8). Request percolation test.
  - 9). Preliminary building elevation of lowest level. Final building elevation of lowest level should be reviewed with Geotechnical Engineer at 50% CD.
  - 10). Describe any freestanding structures that require special foundations.
  - 11). Request lateral load design recommendations such as “L-Pile” values.
- b. The UTH Project Manager will submit a request to the UTH Contract Manager for a geotechnical RFP. Hard copies of the geotechnical report will be distributed to the A/E team, the Project Manager, the UTH Engineer and the Institution. In addition UTH requires an electronic copy of the Geotechnical Report be sent to the UTH Engineer.
- c. The A/E team is encouraged to communicate directly with the Geotechnical Engineer during all phases of the design process for clarifications; however, copies of all substantive communications and discussions should be sent to the UTH Project Manager and the UTH Engineer. UTH Engineering department maintains a library of geotechnical reports for all UTH-managed projects. Copies of these reports may be obtained to assist in early design assumptions. Geotechnical reports may be used for the final design of only the specific project for which they were prepared.

### 2. Renovation Work

- a. Structural demolition drawings are to be included.
- b. All penetrations of existing structural components shall be shown in the structural drawings. Reinforcement of these structural components shall be designed and detailed as required. Drawings shall show all original framing in the areas near the new penetrations.
- c. Drawings shall show all original structural framing with new framing superimposed. Clearly show original framing to remain in place.
- d. Where portions of an existing structure are required to be completely demolished, drawings shall show all original structural framing and provide



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adequate details clarifying location of concrete saw cuts and details of any reinforcement required.

- e. Small penetrations of existing concrete slabs (cores for pipes, saw cut openings for ductwork, etc.) shall require the contractor to drill pilot holes to verify that these penetrations will not cut beams or joists. Use of Ferroskan or ground penetrating radar is recommended as a precaution to help identify conduit which may be embedded in the concrete. Note: Neither Ferroskan nor radar can differentiate between metal rebar and conduit.
  - f. When possible, provide existing drawings in the construction document set for Contractor use. Add any disclaimer as necessary to convey that the existing drawings are for Contractor information only.
3. Future Loads - Structures built for The University of Texas System must be designed to accept future loads large enough to permit wide flexibility in their functions. Therefore, the loads listed in part C may be larger than those specified in building codes.
  4. Load Reductions - These structures are subject to increased loads and high sustained live loads. Loads are often applied to large areas of usable floor space (thereby making liberal live load reduction factors undesirable).
  5. Deflections - Live loads and deflection limitations must be assumed to accommodate these conditions of design. Care must be exercised in control of immediate and longtime deflections to prevent immediate and future damage to non-structural elements attached to the structure.
  6. Building Codes – The more stringent design requirements between the applicable building codes and the guidelines within this appendix shall be used. The code edition of the International Building Code (IBC) listed in Appendix C of these guidelines shall be used unless otherwise directed in writing by the UTH Project Manager and the UTH Engineer.
  7. Document Review Schedule - The A/E will be required to present the plans and specifications for review to UTH at the intervals outlined in Appendix L of these Guidelines. Intermediate reviews may be required if the scope of the project has been changed or if an earlier review found the plans and specifications unacceptable, either as a whole or in part.
  8. Review Meetings - The Structural Engineering Consultant(s) will participate in all reviews, work sessions and presentations where this discipline is involved. UTH Engineer will review the documents for compliance with Code, UTH Guidelines, Institutional requirements, consistency of design, efficiency of design and any other items unique to the Project. The Structural Engineer of Record, along with the

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Architect, shall be prepared to discuss any concerns or unique design requirements at the meetings or in a separate meeting with the UTH Engineer.

9. Consistency of Design Assumptions - Design assumptions made for efficiency in analysis must be carried through the design and proportioning of the actual members. The design assumptions must be consistent with the institutional goals as stated in the preceding paragraphs. For example, the practice of designing pan joists or ribbed slabs as “tee beams” may save slightly in the cost of the reinforcing bars in the pan ribs. However, this practice compromises future flexibility of the structure in terms of slab penetrations between the ribs. Another example would be the assignment of large bending moments to columns for the sake of beam design, and then neglecting these beam moments when designing the columns.
10. Structural Integrity - The structural system selected should be adequately described and detailed such that all parts of the facility are incorporated and connected with the structure to allow the facility to function as a unit under extreme service conditions. An example would be in the cases for exterior cladding and roofing systems, which must be adequately fastened to the structure to resist the worst case loading conditions, but which also must be detailed to avoid distress under more typical thermal and moisture exposures. It makes little sense to design a roof system capable of resisting Code wind loads unless the connections to the structure and the structure itself are substantial enough to resist the loads to be transferred.

### F. ENGINEERING TESTING:

1. During the design stage of a construction project, it will be necessary for The University of Texas System to provide the Architect/Engineer with “Pre-Design Engineering Information.” Requests for these services as deemed necessary by the Architect/Engineer should be made to The University of Texas System. The University of Texas System will select a qualified engineering testing firm to provide the Architect/Engineer with information when required.
2. It is the practice of The University of Texas System to assign its own personnel to both “represent the Owner” and provide for inspection during the construction of a project. An independent, commercial testing agency will be selected by and paid for by The University of Texas System to provide the engineering testing and materials inspection during the construction of the project. These services provide the Owner, Architect/Engineer and the Contractor unbiased, third party, technical information and also augment The University of Texas System personnel in specific technical inspections.
  - a. Pre-Design Testing:
    - 1). Sub-Surface Investigations for Foundations: The primary purpose of a sub-surface investigation for foundation design is to accomplish an efficient use of natural, in place materials for the support of imposed

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structural loads. Soil and rock formations have specific engineering properties of shearing strength, stress deformation, consolidation, volume change and grain size. These engineering properties affect the supporting value and stability of the founding media and are influenced by the geological history of the formation.

- 2). Sub-surface exploration for foundation design should delineate the horizontal and vertical limits of the deposition and establish the engineering properties that will affect the foundation design. The location and depth of the borings are selected to accomplish this purpose. Test borings are normally spaced geometrically to provide one boring for each 6,000 to 10,000 square feet of area. Inconsistencies or non-uniform conditions require a much closer spacing. The depths of borings are influenced by several factors such as the depth to a primary or non-yielding formation, the strength, stability and uniformity of the soil strata, the magnitude of column loads, the water table and the swelling potential of the upper surface soil. The borings should be of adequate depth to determine the proper foundation for the structure.
- 3). The spacing of borings, the establishment of boring depth and the selection of engineering tests are the responsibility of an experienced Soil Engineer with consultation of the Architect and his Structural Engineer and UTH to obtain the necessary information at a minimum of cost.
- 4). Procedure:
  - a). On or before the Pre-Design Conference, the UTH Project Manager will forward the results of any sub-surface investigations performed at or near the site for A/E study.
  - b). The A/E and his consultants will study preliminary information, and with the UTH Project Manager and UTH Engineer will determine whether additional exploratory testing will be required, and to what extent. If so, the A/E will proceed to acquire testing information through a testing lab approved by UTH. UTH will pay for testing information not to exceed the agreed estimated cost.
  - c). Embankments and Fill Areas: The use of soil for engineering purposes such as compacted fill for the support of structural load, levees and berms, and slope improvement should be accomplished by using soil mechanics technology. Soils compacted to arbitrarily selected degrees of compaction rarely perform in relation to actual requirements. Over-compaction

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results in increased costs and creates a potential for excessive swelling. Under-compaction lowers the shear strength and increases the potential for detrimental settlement. The compaction of the soil should accomplish an improvement in the ability of the soil to withstand shearing stresses, prevent excessive settlement and minimize volume changes in the soil. The degree of compaction that more nearly satisfies the majority of these considerations shall be determined by an approved soils laboratory. The optimum degree of compaction that will accomplish the intended purpose is selected from the resulting test data.

- d). **Pavement Design:** The soil investigation for pavement design includes shallow undisturbed core borings spaced approximately every 200 feet along the proposed street or at approximately every 10,000 square feet for a parking area. Intermediate borings are drilled in those instances where inconsistencies are encountered. The engineering design of the pavement section utilizes the soil investigation data provided by the soils laboratory, an analysis of the available construction materials, and a study to determine the types of vehicles that will utilize the pavement and a projection of the number of wheel load applications anticipated during the design period. The A/E and his consultants are expected to design a pavement which will meet the desired performance level with a minimum of maintenance expenditure.
- e). **Concrete Materials:** Concrete construction in remote areas or unusual applications of concrete construction can be assisted by a pre-design material investigation. Some areas do not have facilities available for producing concrete aggregates that meet recognized standards or quality. The durability and concrete making properties of local sources should be investigated prior to establishing an acceptable specification for material quality. Unusual concrete application problems should also be studied prior to design in order to resolve problems that are created by the uniqueness of design. Pre-design testing is extremely helpful in eliminating unnecessary expenses and potential construction problems.

### G. CONSTRUCTION TESTING:

1. Provide Construction Testing requirements that are reasonable for the Project. Do not specify testing that will give little or no value to the Project. For example, do not require test cylinders to be tested at 56 days when the 28-day tests are acceptable. If the 28-day test do not pass, then it is reasonable to test at 56 days. In addition,

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coordinate testing requirements with the Contractor that provide the desired construction Quality Assurance that is also beneficial to the construction process/schedule. It does not make sense to have concrete tests at 7 days that are required by the Construction Documents only to have the Contractor request to have concrete tests at 3 days and 5 days. Testing should be beneficial to both the Owner and the Contractor.

If there is a specific test that is required that is not common, discuss the test with the UTH Engineer regarding all aspects of the proposed test.

### 2. Concrete:

All concrete tests performed in the laboratory and on the job site, the design of mixes, and the inspection of concrete production should be performed in accordance with the applicable ASTM and ACI standards. The technician should be properly trained and completely familiar with the standards for the work he is performing. These standard methods have been proven to be satisfactory when conscientiously applied by the testing agency and cooperatively accepted by all parties concerned with the concrete construction work. The prime purpose of concrete testing and inspection is to provide all parties with the pertinent information required for successfully accomplishing the work. The testing agency must meet and comply with the requirements of ASTM E-329.

### 3. Soil/Subgrade

#### a. Compaction Testing (Roadway Embankments, Roadway Base, Structural Fill, Utility or Wall Backfill and Subgrades):

1). The testing for soil compaction during construction is accomplished by frequent tests of the moisture and field density (ASTM D2922) of the compacted material. The minimum frequency of field density tests is as follows:

a). Roadway subgrade, roadway embankment or roadway base- one for each 6,000 to 10,000 square feet in each lift or one for each 1000 linear feet per traffic lane of street.

b). Structural fill- one test per 4000 to 8000 square feet per lift of fill with a minimum of two tests per lift.

c). Utility or wall backfill- one test per 200 to 500 linear feet of fill with a minimum of two tests per lift.

2). Fill areas with limited access to compaction equipment should be tested more frequently. A laboratory moisture-density curve is

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required for each of the materials to allow comparison with the field density in order to determine the percent of compaction obtained. Mixing of different materials during the excavation of fill material will also necessitate a moisture-density curve. Blends of materials should be frequently checked with a single compacted specimen to obtain the compacted weight of material for comparison with the available moisture-density curves. Each of the soils encountered in the project should be identified by liquid limit, plastic index and minus 200 mesh sieve tests. These identification test correlations should be accompanied by a description of the materials with respect to color, texture and soil type. The common method of identification and description is found in the Unified System of Soil Classification (ASTM D 2487). The degree of compaction required in the specifications should be established by a pre-design analysis of the soil. The field density tests are made to confirm compliance with the specification requirements. To be of value, the test results must be representative of an area that has been uniformly prepared.

### b. Acceptance Testing (Roadway embankments, roadway base, structural fill):

1). Prior to stockpiling or delivery of materials to the project site, the Contractor should be required to make submittals of the soil or base properties. The acceptance tests may be duplicated during the progress of the work when deemed necessary by the job inspector. The minimum properties tested may vary between projects and regions of the State, but are generally summarized below:

a). Roadway base material- Acceptance tests for the pavement sub-base and base materials normally include the Los Angeles abrasion or the Wet Ball Mill of the aggregate, the gradation of the material and the plasticity index of the fines. The gradation of the material and the plasticity of the fines should be checked at frequent intervals during the construction to maintain the specified quality. The selection of quality standards for specifying materials should be done carefully to prevent the use of requirements that are uncommon in the area or that specify a quality which cannot be obtained within an economical distance. Texas Department of Transportation (TxDOT) standards may prevail in one portion of the state and federal specifications might be the controlling factor in other parts of the state. A quality pavement can be obtained with either of the two standards, but the familiarity to the suppliers in the area is important in specifying a material that would be easily recognized. If neither TxDOT nor federal standard quality materials are available, a modification of the design and specifications should be considered. These determinations

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should be made prior to the completion of the Construction Contract Documents and Specifications.

- b). Roadway embankments and structural fill: Acceptance testing of these materials is normally defined by the project design team and will include the gradation of the material and the plasticity index. Other required tests may include organics content, pH, and/or resistivity of soluble sulfate content.

### 4. Structural Metals

- a. Provide an outline or guideline for inspection/observation of Structural Metals and connections.
- b. Welded connections: Provide connections that are common. All welds shall conform to ANSI/AWS D1.1. Request that all welders (both shop and field) shall be certified to make desired welds and that the welder has been certified to perform the desired welds within the past 6 months.
- c. Perform Non-Destructive Testing (NDT) (ultrasonic or radiographic) on all full penetration field welds in accordance with ANSI/AWS D1.1. See D.3.c.
- d. Bolted Connections - connections shall be snug tight unless noted otherwise on plans or specifications. Test ten percent (10%) of all bolts with at least two (2) bolts tested per connection, per AISC Chapter 5.

### 5. Other Building Materials:

- a. There are other building materials that may require testing on a Project. There shall be a discussion during the design reviews for the appropriateness of each test or inspection requirement.

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**SUBMITTAL REQUIREMENTS FOR DESIGN DOCUMENTS**

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**SUBMITTAL REQUIREMENT FOR DESIGN DOCUMENTS**

A. PENDING ISSUES REPORT

The Project Architect/Engineer shall prepare and maintain a Pending Issues Report throughout the Schematic Design, Design Development and Construction Document Phases to record outstanding decisions for the Design Team. An example may be seen as **Attachment A**,



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**Pending Issues Report.** The example indicates the kinds of data that should be maintained and documented for pending issues.

### B. CONSTRUCTION COST ESTIMATE

The Project Architect/Engineer shall provide a Construction Cost Estimate by an independent estimating company, acceptable to the Owner, throughout the entire design process at the end of each design phase (or as necessary to meet the Owner's identified Construction Cost Limitation) until 100% completion of the Construction Documents. An example may be seen as **Attachment C**.

### C. SCHEMATIC DESIGN DOCUMENTS

The preliminary phase of design services to produce a diagrammatic representation of the project, including sketches of building exterior and selected interior spaces, outline-level specification of materials and finishes to be incorporated, general floor plans, and a narrative assessment (for the non-professional Owner) of proposed building systems. The design shall be generated from the approved Facility Program, and resulting conceptual studies and alternative schemes developed in conference with the Owner.

Schematic documents shall be considered "complete" when all areas of design (i.e. Civil, Architectural, Structural, and MEP) are 100% schematic in nature as defined below and agreed upon by the Owner.

- The submittal requirements noted in this appendix do not exclude elements which may be unique to a particular project required for the facility design, that are not specifically identified/mentioned herein or in any of the referenced appendices in the Design Guidelines. It is the Architect/Engineer's responsibility to incorporate any necessary plans, sections or details in the design documents of each submittal package for review.
- Complete schematic design documents are a result of a completed product and are not a function of time/duration of work.
- Documents that are "on average" 100% schematic will not be considered "complete" schematic documents.

#### 1. Civil

See Appendix B for Civil submittal requirements.

#### 2. Architectural

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- a. A copy of the approved Facility Program.
- b. Building Code Analysis: Including, but not limited to, IBC, NFPA-101; Texas Department of Licensing and Regulation, and A.D.A. Refer to Appendix C.
- c. Site description and conditions.
- d. Renovation projects shall include plans of the existing building, building structural system, and areas requiring demolition.
- e. Drawings (small scale and schematic in nature):
  - (1) Site Plan: schematic project location, building footprint, adjacent structures, access and proposed site improvements.
  - (2) For renovation projects, provide schematic demolition plan.
  - (3) Floor Plans (final agreed scheme) showing room layout, room titles, gross areas.
  - (4) Selected critical areas (identified by the Owner) to larger scale.
  - (5) At least two exterior elevations (final agreed scheme), building profile section showing floor to floor dimensions, ground floor elevation to mean sea level (MSL), and primary elevation and other significant façades (street-facing, loading dock area, adjacent to recognized neighbor).
  - (6) At least two perspective renderings in color or a model if authorized.
- f. Descriptive Specifications: Brief narrative description of the proposed component systems, materials and equipment in the Construction Specification Institute (CSI) Master Format, current edition.
- g. Construction Cost Estimate based upon (at a minimum) square footage costs for building systems (i.e. foundation, structure, exterior closure, roof, interior construction, specialties, conveying, MEP systems, etc.) typical for the building type and location.

### 3. Structural

See Appendix K for Structural submittal requirements.

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### 4. Mechanical

- a. Describe briefly the proposed HVAC system, gross design loads, supply and return air system, principal piping materials, and fire protection system.
- b. Drawings: (small scale, 1/8" = 1'- 0" minimum, and schematic in nature).
  - (1) Site Plan, showing location of existing utility sources and characteristics, and proposed routing of new utilities to building.
  - (2) For renovation projects, provide schematic HVAC system ductwork and air devices and Plumbing domestic water and sanitary waste piping demolition plans.
  - (3) HVAC Floor Plans showing equipment layout in mechanical rooms; building floor plans indicating ductwork in single line format for Supply Air (SA), Return Air (RA) and Exhaust Systems; indicate estimated SA, RA and Exhaust airflow rates; piping mains.
  - (4) Plumbing fixtures and equipment may be shown on Architectural Floor Plans.
- c. Submit completed preliminary copy of **Attachment B, Basic Data**.
- d. HVAC Controls
  - (1) Describe the proposed controls sequence of operation for each system.
  - (2) For systems with multiple fans or pumps, indicate size of each relative to full load capacity, and how many operate at a time.
  - (3) For AHU controls, indicate if economizer cycle and CO2 demand ventilation sequences will be included.
  - (4) Describe any required network integration of packaged controls systems for equipment such as chillers, boilers, computer room AHUs, etc.

### 5. Electrical

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- a. Briefly, describe the proposed normal and emergency electrical power distribution systems, preliminary design loads, interior and exterior lighting, fire detection/alarm, telecommunication, audio visual, central clock and CCTV and security systems. Include any other items relevant to the project, such as lightning protection, special grounding requirements, UPS, power quality, hazardous locations, etc.
- b. Drawings:
  - (1) Site Plan, showing location of existing or new utility source, characteristics and proposed routing of new electrical service to building. Indicate the provider of the power, utility company, campus generated, etc.
  - (2) Typical lighting and power layouts and main distribution gear locations.

### 6. Landscape Architectural

- a. Describe briefly the scope and character of landscape development, both hardscape and softscape, including proposed special features such as fountains, sculpture, etc.
- b. Cost estimate of site work.
- c. Drawings: Reflect Campus Master Plan and/or Facility Program requirements.
  - (1) Show areas (in plan) proposed to be planted and irrigated at a scale consistent with the Architectural Site Plan.
  - (2) These may be included on the Architectural Site Plan itself unless degree of complexity requires separate plan sheet.
  - (3) Show location of water source for irrigation.
  - (4) Include major space defining elements such as trees, walls, fences, etc. to convey overall site design concept.
  - (5) Include major vehicular and pedestrian circulation patterns.

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### D. DESIGN DEVELOPMENT DOCUMENTS

The continued development of the project design and detailing, refinement and confirmation of program requirements and schematic design efforts, and the expansion of outline specifications that fully describe the nature and intent of the project. The design is a continuation the Schematic Design documents, and resulting studies, and alternative schemes developed in conference with the Owner.

Design Documents shall be considered “complete” when all areas of design (i.e. Civil, Architectural, Structural, and MEP) are 100% design development documents as defined below and agreed upon by the Owner.

- The submittal requirements noted in this appendix do not exclude elements which may be unique to a particular project required for the facility design, that are not specifically identified/mentioned herein or in any of the referenced appendices in the Design Guidelines. It is the Architect/Engineer’s responsibility to incorporate any necessary plans, sections or details in the design documents of each submittal package for review.
- Complete design development documents are a result of a completed product and are not a function of time/duration of work.
- Documents that are “on average” 100% design development documents will not be considered “complete” design development documents.

#### 1. Civil

See Appendix B for Civil submittal requirements.

#### 2. Architectural

- a. A complete code review of the entire scope of the project. Code review drawings would include Building Code Analysis and Fire Life Safety drawings. The Fire Life Safety drawings would include as a minimum, construction type, fire exposure analysis, occupancy type and loads, required egress capacity and means of egress, transportation systems (elevators, moving walks, escalators, etc.), required fire and smoke barriers, fire suppression, emergency notification, smoke control, stair

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pressurization, vertical openings , emergency lighting, etc. Provide technical documentation support with any proposed equivalencies.

- (1) Code review shall include, as a minimum, the following codes: NFPA 101, IBC, IMC, IPC, NEC, TDLR-TAS, and other codes as warranted. Refer to Appendix C for latest edition.
  - (2) The Energy Conservation Design Standard for State Buildings except Low-Rise Residential Buildings is based on ASHRAE Standard 90.1 for Nonresidential Buildings. Refer to Appendix C for latest edition. Provide worksheets addressing the Building Envelope compliance. The completed SECO compliance documentation, based upon the final design, will be submitted by UTH to SECO to certify the building design is in conformance with the Standard. UTH is to review SECO compliance documentation prior to submittal to SECO.
  - (3) The State Energy Conservation Office (SECO) adopted the International Energy Conservation Code for Low-Rise Residential Buildings. See Appendix C for current edition. Provide document results from *REScheck* software analysis indicating compliance. The completed SECO compliance documentation, based upon the final design, will be submitted by UTH to SECO to certify the building design is in conformance with the Standard. UTH is to review SECO compliance documentation prior to submittal to SECO.
- b. Site conditions and constraints, survey, sub-surface conditions, existing structures and improvements, demolition.
  - c. For renovation projects: existing building plans, elevations, structural and architectural systems and elements.
  - d. All special design criteria, such as acoustics, environmental, transportation, security.
  - e. Complete drawings, to scale:
    - (1) All site plans including project location, adjacent structures, access, site improvements, topographical contour lines, landscaping scheme.
    - (2) Renovation projects: All demolition plans.

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- (3) All proposed floor plans showing overall dimensions, room titles and sizes, door swings, furniture layout, equipment layout, fire rated walls, gross area and net assignable area calculations.
  - (4) All major exterior elevations with exterior materials indicated, building sections, typical wall sections (exterior and interior).
  - (5) A preliminary room finish and door schedule.
  - (6) Cabinet/casework elevations and typical sections, dimensioned.
  - (7) All special equipment descriptions/schedule.
  - (8) Bid alternates.
  - (9) Assignable and gross floor areas calculated following Appendix A.
- f. Descriptive Specifications: A narrative description of the component systems, materials and equipment in the Construction Specification Institute (CSI) Master Format, current edition, in “non-specification” language.
  - g. Descriptive Literature: Catalogue cut-sheets of proposed systems, materials and equipment.
  - h. Construction Cost Estimate based upon detailed quantities and unit costs for all materials, labor, equipment, building systems, General Conditions, fees and contingencies in the CSI Master Format, current edition, and/or the Uniform at Assemblies format.
    - All estimates shall include all costs associated with completion of the documents through the Construction Document phase.

See **Attachment C**, Construction Cost Estimate, for an example of a Construction Cost Estimate in a form acceptable to the Owner.

### 3. Structural

See Appendix K for Structural submittal requirements.

### 4. Mechanical

- a. Describe design criteria:

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- (1) Code Review, UT Guidelines Review, Occupancy classification, Construction Envelope, International Mechanical Code, International Plumbing Code, International Fuel Gas Code, Texas Department of Licensing and Regulation. See Appendix C for current editions.
  - (2) Design loads for HVAC, Plumbing; and Plumbing Fixture requirements per code.
  - (3) The Energy Conservation Design Standard for State Buildings except Low-Rise Residential Buildings is based on ASHRAE Standard 90.1 for Nonresidential Buildings. See Appendix C for current edition. Provide worksheets addressing the Heating, Ventilating and Air Conditioning (HVAC), and Domestic Water Heating compliance. The completed SECO compliance documentation, based upon the final design, will be submitted by UTH to SECO to certify the building design is in conformance with the Standard. UTH is to review SECO compliance documentation prior to submittal to SECO.
  - (4) The State Energy Conservation Office (SECO) adopted the International Energy Conservation Code for Low-Rise Residential Buildings. See Appendix C for latest edition. Provide documentation from *REScheck* software analysis indicating air conditioning equipment efficiencies in compliance. . The completed SECO compliance documentation, based upon the final design, will be submitted by UTH to SECO to certify the building design is in conformance with the Standard. UTH is to review SECO compliance documentation prior to submittal to SECO.
  - (5) Provide a written evaluation of alternative energy applications in compliance with Texas Government Code. Also provide a letter statement regarding the results of the evaluation. Federal Renewable Energy Screening Assistant software (FRESA) may be used to assist in the evaluation. Include a copy of the analysis results with the evaluation report.
  - (6) Special environmental requirements (such as equipment, space pressurization, processes, animals, odors, sterility, etc.)
  - (7) Update and resubmit “Basic Data” form.
- b. Complete drawings, to scale  $\frac{1}{8}'' = 1'' - 0''$ :



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- (1) All site plans showing existing and proposed utilities, underground and overhead, with sizes shown, valves, boxes, cleanouts, access ways, manholes, fire protection Siamese and hydrant locations.
- (2) Material and equipment legends, symbols, abbreviations.
- (3) All HVAC floor plans shall include:

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- (a) Mechanical room plan (1/4" scale) laid out with HVAC and associated equipment (air handlers, pumps, compressors, etc.) shown to scale.
  - (b) Mechanical room plans to indicate service clearances for all equipment, including coil pull space for Air Handling Units (AHU).
  - (c) Plans shall indicate egress route for large equipment including height requirements. Remodel projects shall also indicate egress routes for major components.
  - (d) Medium pressure ductwork shown in double line format, placement of single/dual duct terminal units, thermostats. Show major taps and splits, duct sizes.
  - (e) Low pressure ductwork shown in single line format, not sized, diffusers, grilles and returns shown but not sized. Indicate SA, RA and Exhaust Device cfm from current Load Calculations.
  - (f) Routing of HVAC piping and pipe sizes shown.
  - (g) Show in special detail, cross-section or other appropriate manner above ceiling spaces dedicated to specific services, such as special laboratory services, conduit, piping, ductwork, fire protection piping, etc.
  - (h) Equipment schedules, but not necessarily complete.
- (4) HVAC Controls
- (a) Provide preliminary points list for all systems that is complete enough to allow accurate scope of work for pricing of controls work.
  - (b) Provide detailed sequence of operation for all systems.
- (5) Plumbing plans shall include:
- (a) All plumbing fixtures, floor and roof drains, special devices.
  - (b) All sanitary waste and vent piping; Roof/Overflow Storm Drain piping; and main water supply taps and piping, sized.

## APPENDIX L

- (c) Any special plumbing system requirements such as vacuum, compressed air, de-ionized water, medical or laboratory gases or laboratory waste.
  - (d) Typical Cold/Hot Water, Sanitary Waste and Vent riser diagrams.
  - (e) Equipment and fixture schedule showing major characteristics of each.
- (6) Fire protection plans shall include:
- (a) Location of incoming supply, valves, fire pump, etc.
  - (b) All piping routes, sprinkler head locations in architecturally sensitive areas only, fire department connections.
  - (c) Show sizes of risers and trunks.
- c. Descriptive Specifications - describe all systems, controls, equipment and materials in narrative form.
- d. Descriptive Literature - catalogue cut-sheets on all equipment, fixtures.

### 5. Electrical

- a. Complete drawings, to scale:
- (1) All site plans showing normal and emergency electrical service system equipment locations, routing and characteristics, including electric utility switches, power poles, sub-stations, vaults, ductbanks, manholes, exterior lighting, etc., as applicable.
  - (2) Updated estimate of total normal and emergency electrical loads with line item breakout of power, lighting, mechanical, receptacles, misc., etc.
  - (3) All floor plans showing typical light fixture layout and types, both interior and exterior, typical power layouts, all distribution equipment locations, electrical rooms/vaults, telecommunications rooms, etc. Unless permitted otherwise, provide separate sets of sheets as needed for power, lighting, fire alarm, telecommunications, audio-visual and security.

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- (4) Schedule of typical spaces, including exterior, with design footcandle levels and calculated lighting levels for the corresponding spaces. The Energy Conservation Design Standard for State Buildings except Low-Rise Residential Buildings is based on ASHRAE Standard 90.1 for Nonresidential Buildings. See Appendix C for current edition. Provide worksheets addressing the Interior and Exterior Lighting Budget compliance. The completed SECO compliance documentation, based upon the final design, will be submitted by UTH to SECO to certify the building design is in conformance with the Standard. UTH is to review SECO compliance documentation prior to submittal to SECO.
  - (5) One-line or riser diagram indicating electrical service supply (primary and secondary as applicable), switchgear, switchboards, MCC's, large individual mechanical equipment, distribution panel boards, branch circuit panel boards, generators, fire pumps, etc.
- b. Descriptive Specifications - for all systems and equipment, including electrical power and lighting, fire detection and alarm, telecommunications, security, audio visual, central clock control, CCTV, etc.
  - c. Description Literature - catalogue cut-sheets on all light fixtures and major distribution equipment.
6. Landscape Architectural
- a. Complete drawings, to scale: further refine site plan incorporating schematic comments from UTH and User.
    - (1) Site plan should evolve into a separate plan sheet at this phase with complete hierarchy of plant materials shown and identified.
    - (2) Include landscape accessories such as seating, litter receptacles, tables, tree grates, drinking fountains, etc.
    - (3) Include landscape lighting if applicable.
    - (4) Show proposed grading.
    - (5) Identify hardscape materials.

## APPENDIX L

- (6) Begin to show irrigation diagrammatically in terms of number of zones and type of components (sprays on risers, pop-up sprays, rotary heads, drip, etc.).
- b. Further refine cost estimate for site work based on further refinement of drawings.
- c. Submit outline specifications for planting, irrigation and accessories.

### E. CONSTRUCTION DOCUMENTS

The completion of Design Documents that incorporate and illustrate all aspects of the project in sufficient detail for purposes of accurately bidding/proposing by the construction community throughout the construction process.

- The submittal requirements noted in this appendix do not exclude elements which may be unique to a particular project required for the facility design, that are not specifically identified/mentioned herein or in any of the referenced appendices in the Design Guidelines. It is the Architect/Engineer's responsibility to incorporate any necessary plans, sections or details in the design documents of each submittal package for review.
- Complete Construction Documents are a result of a completed product and are not a function of time/duration of work.
- Construction Documents shall be considered "complete" when all areas of detail design (i.e. Civil, Architectural, Structural, and MEP) are satisfactory to the Owner as defined below.
  1. Additional requirements are identified in Appendices for each discipline.
    - a. Civil Engineering Criteria – Appendix B
    - b. Electrical Criteria – Appendix E
    - c. Landscape Architecture – Appendix F
    - d. Mechanical Criteria – Appendix G
    - e. Structural Criteria – Appendix K
  2. Color Selections: Include color selections for specified materials included in the construction documents. The Project Architect/Engineer's recommendations for color selections shall be reviewed with and approved by the Owner's representatives.
  3. Construction Cost Estimate: It shall be based upon itemized quantities of unit costs and components, overhead and profit, escalation, and administrative expenses. See Attachment C, Cost Quantity Survey, for an example of a Cost Quantity Survey in a form acceptable to the Owner.

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- Construction Cost Estimate shall be based upon detailed quantities and unit costs for all materials, labor, equipment, building systems, General Conditions, fees and contingencies in the CSI Master Format, current edition, and/or the Unifomat Assemblies format, and shall address and include cost values that reflect anticipated market conditions at time of defined procurement and construction durations.
4. Equipment Scheduling: Provide equipment scheduling for all equipment requiring a space allocation and/or architectural/mechanical/electrical service and/or a rough-in, including any future equipment if required in the construction documents. Equipment schedules shall be placed on the construction drawings which crossreferences the specification section (or description of the equipment, as required) with the specific location(s) of the equipment on the drawings. The equipment shall be grouped into at least three categories:
    - Contractor Furnished - Contractor Installed (CFCI)
    - Owner Furnished - Contractor Installed (OFCI)
    - Owner Furnished - Owner Installed (OFOI)
  5. Project Data Sheet: Include a project data sheet in each set of construction documents. The project data sheet shall include, at a minimum, the following information specific to the project design and the construction documents:
    - Abbreviations used
    - Alternate bid descriptions
    - Codes and standards analysis summary
    - Component Institution's name and address
    - Date of construction documents
    - Drawing symbols
    - Future provisions for expansion (all design disciplines)
    - List of Drawings, Tables and Schedules
    - Materials legend
    - Project Architect/Engineer's name and address
    - Project Architect/Engineer's consultants' names and addresses
    - Project name and UT System project number
    - Square footage per project level and the project total (gross and assignable square footage). See Appendix A, Definition of Building Areas.
    - Vicinity map
  6. Project Manuals: Prepare Project Manuals in accordance with Appendix J, Guidelines for Architects/Engineers - Preparation of Project Manuals.
  7. Prevailing Wage Rates: UTH will provide the UT System prevailing wage rates to be used for the project. The Project Architect/Engineer shall include the prevailing

## APPENDIX L

wage rates in the Project Manual where instructed in the material identified under "Project Manuals".

8. Title Block: Include certain minimum information on the title block for the drawings. Submit a mock-up of the title block to the Project Manager for review before reproduction on drawing sheets or use. The information to be included on the title block for the drawings shall include, at a minimum: □ Owner's approved project name and number
- Project Architect/Engineer's name and street address
  - Project Architect/Engineer's consultants' names and professional discipline(s)
  - Location for the date of issue of the plans with space for several revision dates
  - Location for professional seals
  - Location for the sheet title
  - Location for the sheet number and “ \_\_\_ of \_\_\_ Sheets”





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ATTACHMENT B

**BASIC DATA**

Project: \_\_\_\_\_ Date: \_\_\_\_\_  
Location: \_\_\_\_\_ UTH Project No.: \_\_\_\_\_

Areas:

Gross: \_\_\_\_\_

Assignable: \_\_\_\_\_

„U“ & „SC“ VALUES:

WALLS	Type 1	Type 2	Type 3	Type 4	Type 5
„U“					
Location					

GLASS	Type 1	Type 2	Type 3	Type 4	Type 5
„U“					
„SC“					
Location					

ROOF	Type 1	Type 2	Type 3	Type 4	Type 5
„U“					
Location					

FLOOR	Type 1	Type 2	Type 3	Type 4	Type 5
„U“					
Location					

SLAB EDGE	Type 1	Type 2	Type 3	Type 4	Type 5
„U“					
Location					

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ATTACHMENT B (Continued)

**BASIC DATA**

COOLING SYSTEM

Tons: \_\_\_\_\_ GPM: \_\_\_\_\_

Type: \_\_\_\_\_

Prime Energy Source: \_\_\_\_\_

If served by central plant, has plant capacity for this project been verified? Yes: \_\_\_ No: \_\_\_

Confirmed by: \_\_\_\_\_

HEATING SYSTEM

1000 BTU: \_\_\_\_\_ Lb/Hr Steam: \_\_\_\_\_ or GPM HW: \_\_\_\_\_

\_\_\_\_\_ Type: \_\_\_\_\_

Prime Energy Source: \_\_\_\_\_

If served by central plant, has plant capacity for this project been verified? Yes: \_\_\_ No: \_\_\_

Confirmed by: \_\_\_\_\_

AIR SYSTEM

Type: \_\_\_\_\_

No. of prime units: \_\_\_\_\_ Total CFM: \_\_\_\_\_

VENTILATION RATES

CFM/person: \_\_\_\_\_

or CFM/sq. ft.: \_\_\_\_\_

or Air Chg./Hr.: \_\_\_\_\_

Min. O. A. \_\_\_\_\_ Max. O. A. \_\_\_\_\_

Vent Cycle? \_\_\_\_\_

PLUMBING

San. load: \_\_\_\_\_ FU \_\_\_\_\_ GPM

Cold Water: \_\_\_\_\_ FU \_\_\_\_\_ GPM

Hot Water: \_\_\_\_\_ FU \_\_\_\_\_ GPM

Storm Water: \_\_\_\_\_ FU \_\_\_\_\_ GPM

ELECTRICAL LOADS

Lighting: \_\_\_\_\_ watts/sq. ft. \_\_\_\_\_ kw total

General Power: \_\_\_\_\_ watts/sq. ft. \_\_\_\_\_ kw total

Special Power: \_\_\_\_\_ watts/sq. ft. \_\_\_\_\_ kw total

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ATTACHMENT C

**COST QUANTITY SURVEY  
EXAMPLE**

PROJECT NAME INSTITUTION NAME UTH PROJECT NUMBER

TITLE (Design Development or Construction Document Estimate)

SUMMARY - BASE BID (Repeat For Each Alternate Bid) DATE OF ESTIMATE

	\$	\$/GSF (XX,XXX GSF)
DIVISION 01 - GENERAL REQUIREMENTS	XXX,XXX	X.XX
DIVISION 02 - EXISTING CONDITIONS	XXX,XXX	X.XX
DIVISION 03 - CONCRETE	XXX,XXX	X.XX
DIVISION 04 - MASONRY	XXX,XXX	X.XX
DIVISION 05 - METALS	XXX,XXX	X.XX
DIVISION 06 - WOOD, PLASTIC, AND COMPOSITIES	XXX,XXX	X.XX
DIVISION 07 - THERMAL AND MOISTURE PROTECTION	XXX,XXX	X.XX
DIVISION 08 - OPENINGS	XXX,XXX	X.XX
DIVISION 09 - FINISHES	XXX,XXX	X.XX
DIVISION 10 - SPECIALTIES	XXX,XXX	X.XX
DIVISION 11 - EQUIPMENT	XXX,XXX	X.XX
DIVISION 12 - FURNISHINGS	XXX,XXX	X.XX
DIVISION 13 - SPECIAL CONSTRUCTION	XXX,XXX	X.XX
DIVISION 14 - CONVEYING SYSTEMS	XXX,XXX	X.XX
DIVISION 21 - FIRE SUPPRESSION	XXX,XXX	X.XX
DIVISION 22 - PLUMBING	XXX,XXX	X.XX
DIVISION 23 - HVAC	XXX,XXX	X.XX
DIVISION 25 - INTEGRATED AUTOMATION	XXX,XXX	X.XX
DIVISION 26 - ELECTRICAL	XXX,XXX	X.XX
DIVISION 27 - COMMUNICATIONS	XXX,XXX	X.XX
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY	XXX,XXX	X.XX
DIVISION 31 - EARTHWORK	XXX,XXX	X.XX
DIVISION 32 - EXTERIOR IMPROVMENTS	XXX,XXX	X.XX
DIVISION 33 - UTILITIES	<u>XXX,XXX</u>	X.XX
SUBTOTAL:	<u>XXX,XXX</u>	

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	ADD FOR GENERAL	___	XXX,XXX	
CONDITIONS - % :	ADD FOR GENERAL	___	<u>XXX,XXX</u>	
	CONTRACTOR'S FEE -	% :		
		SUBTOTAL:	XXX,XXX	
	ADD FOR GENERAL CONTINGENCIES	- ___% :	<u>XXX,XXX</u>	
		SUBTOTAL:	XXX,XXX	X.XX
(Describe, if any)	SPECIAL CASH ALLOWANCE(S):		<u>XXX,XXX</u>	
	CONSTRUCTION CONTINGENCY ALLOWANCE:		<u>XXX,XXX</u>	
		TOTAL OF ESTIMATE:	<u>XXX,XXX</u>	

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**COST QUANTITY SURVEY  
EXAMPLE**

PROJECT NAME INSTITUTION NAME UTH PROJECT NUMBER

TITLE (Design Development Or Construction Document Estimate)

BASE BID (Repeat For Each Alternate Bid) DATE OF ESTIMATE

<u>REF.</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>	<u>UNIT</u>	<u>RATE</u>	<u>TOTAL</u>
<u>DIVISION 03 - CONCRETE</u>					
<u>03 30 00 - CAST-IN-PLACE CONCRETE</u>					
	200 Retaining wall 1"6" deep	X,XXX	SF	XX.XX	XX,XXX
	300 Concrete topping slab	X,XXX	SF	XX.XX	XX,XXX
	500 10"x 10" Housekeeping pad	X,XXX	EA	XX.XX	XX,XXX
	510 6" Housekeeping pad	X,XXX	EA	XX.XX	XX,XXX
				REFERENCE 03 30 00 - SUBTOTAL:	XX,XXX
<u>03 53 00 - CONCRETE TOPPING</u>					
	010 Broom finish concrete topping on waterproof membrane	X,XXX	SF	XX.XX	XX,XXX
	150 Concrete topping on waterproof membrane to east and west terraces	X,XXX	SF	XX.XX	XX,XXX
				REFERENCE 03 53 00 - SUBTOTAL:	XX,XXX
<u>03 35 00 - CONCRETE FINISHING</u>					
	100 Broom finish to concrete topping and sidewalk	X,XXX	SF	XX.XX	XX,XXX
				REFERENCE 03 35 00 - SUBTOTAL:	XX,XXX
<u>03 35 13 – HIGH-TOLERANCE CONCRETE FINISHES</u>					
	010 Trowel top of elevated slabs	X,XXX	SF	XX.XX	XX,XXX
	011 Deburr and patch bottom of slabs	X,XXX	SF	XX.XX	XX,XXX
	015 Trowel top of pier caps	X,XXX	SF	XX.XX	XX,XXX

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020 Rub finish round columns	X,XXX	SF	XX.XX	XX,XXX
------------------------------	-------	----	-------	--------

REFERENCE 03 35 13 - SUBTOTAL: XX,XXX

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Revision Log  
Appendix L

Rev. Date	Remarks
10/1/10	Added design of controls systems deliverables, added fire life safety drawing deliverables, clarification of electrical deliverables

**APPENDIX O**

**RECOMMENDED GUIDELINES FOR AUDIO/VISUAL TECHNOLOGIES (AV TECHNOLOGY)**

TABLE OF CONTENTS

A. GENERAL REQUIREMENTS.....1

B. MECHANICAL SYSTEM.....2

C. ACOUSTICAL SYSTEM .....3

D. ELECTRICAL SYSTEM.....6

E. CATV.....8

F. SECURITY SYSTEM.....8

G. LIGHTING SYSTEM .....8

H. NETWORKING AND TELECOMMUNICATIONS SYSTEM.....14

I. AUDIO VISUAL SYSTEM.....15

J. CLOCK/BELL SYSTEM .....16

**RECOMMENDED GUIDELINES FOR AUDIO/VISUAL TECHNOLOGIES**  
**(AV TECHNOLOGY)**

A. GENERAL REQUIREMENTS

1. Institutional learning spaces should support diverse learning styles, be versatile and configurable, comfortable, attractive and provide appropriate audio/visual and learning technology. This should be balanced with use of institutional standard AV technology with a faculty-friendly control system that is easy to use and consistently deployed throughout the institution.
2. In addition to these design guidelines, the A/E is responsible for smart classroom design and system components that meet the institution’s standards. Also, the A/E is responsible for coordinating location of all devices to accommodate furniture layout. These guidelines apply to classrooms, conference rooms or other similar spaces where presentations, seminars, instruction or conferencing are a required



## APPENDIX O

function. The intent is to establish a starting point for design that will meet with the institution's requirements; it is expected revisions to this guideline will be made to fit the project.

### B. MECHANICAL SYSTEM

Note: The mechanical system design shall meet the UTH Division 23 guideline specifications.

1. Design classroom zone HVAC air-handling components using low velocity ductwork systems.
2. Design HVAC systems with a minimal need to access systems via classroom for maintenance.
3. Resiliently caulk all fixtures at the penetration point. This includes pipes, ducts and conduit penetrating through walls, ceilings, and floors.
4. Design systems to reduce exterior noise from entering room. Classroom walls should extend above ceiling to deck.
5. Coordinate systems so that space is provided for classroom technology components that may require space above finished ceilings.
6. Isolate equipment mounted adjacent to and above a classroom from vibration.
7. Do not locate supply air or return air devices close to projection screens.
8. Select room air devices to meet the sound criteria in Section 2 of this guideline.
9. Design the classroom HVAC systems to operate as a separate zone with controls to operate independently from other spaces within building. Design equipment projection booths, rear projection rooms, and control rooms with separate HVAC zones independent of the classroom. Systems using Mylar rear projection system mirrors must be air-conditioned 7x24 to prevent the Mylar from sagging and wrinkling.
10. Maintain general building specifications regarding temperature and humidity. Rear projection room temperature should be maintained at 72-76 degrees with humidity of 45%-to-55%. Position air registers so that air does not blow directly onto the Mylar mirror. If a blackout curtain is used around the rear projection system, provide an even airflow and an adequate return air volume inside the blackout curtain space.

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11. Place air-conditioning registers along the perimeter of the room and the air returns in the center, front or rear of the room. Select air devices for low velocity air conditioning system to minimize airflow noise in the room. Provide return air transfer duct with an offset inlet/outlet configuration to isolate the room from the noise in the plenum air space. If the mechanical room is in close proximity to the classroom, evaluate the requirement for sound attenuators based upon the classroom NC criteria in Section 2, to reduce the mechanical system noise to meet these guidelines.
12. Install and maintain mechanical systems (ducts and piping) along sidewalls for horizontal air flow into the room, and to allow the front central area projection screens to be constructed as high as possible.
13. Integrate systems that serve classrooms with the central monitoring system or energy management system.
14. Do not use fan coil units or other fan powered elements of the mechanical system in the classroom ceiling space.

### C. ACOUSTICAL SYSTEM

1. Consider wall and ceiling treatments that improve intelligibility in the classroom and to keep noise outside and internal building noise from being audible inside the classroom. Specify flooring with IIC (Impact Isolation Class) that prevents sound transmission. Specify walls with sound transmission class minimum rating of 50. Provide sound rated doors with acoustical door seals. The surface of the ceiling must be designed to accommodate the required acoustical properties of the room. The area of the ceiling to be acoustical tile is a function of ceiling height. A 9' ceiling height typically requires that 40% - 50% of the total ceiling area to be acoustical tile. A ceiling height of 10' typically requires that 50% - 60% of the ceiling be acoustical tile and a ceiling height of 12' typically requires that 70% - 80% of the ceiling area be acoustical tile.

The acoustical tile shall be arranged in center of the room with a sheetrock ceiling enclosing the acoustical tile area.

Ceiling tiles with a Noise Reduction Coefficient (NRC) of .65-.85 and a minimum Sound Transmission Coefficient (STC) of 50 shall be used.

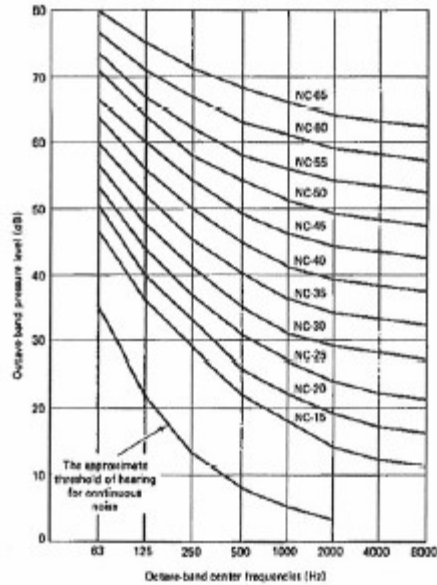
Access hatches must be installed in the ceiling wherever gypsum board or plaster is used to facilitate access to otherwise inaccessible areas of the ceiling cavity.

2. Separate classrooms from external and internal sources of noise such as loading docks, parking lots, streets, mechanical and equipment rooms, vending areas, elevator, locker rooms and dining facilities.

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3. Minimal acoustical requirements:
  - a. NC Ratings
    - General Classrooms: NC 35 or less
    - Auditorium/Lecture Hall: NC 25-30, or less
    - Distance Learning Classroom: NC 25-30, or less
  - b. Reverberation Time
    - General Classroom: RT60 of .4 seconds or less
    - Small Auditoriums: RT60 of .8 seconds or less
    - Large Auditoriums: RT60 of 1.5 seconds or less
4. Overall noise criterion of less than 30 dBA is required, with the maximum sound level not to exceed 35 dBA.
5. In all conference rooms, use acoustically absorbent materials with an NRC rating of .85 or greater.
6. Acoustical Standard Testing Procedures
  - a. Noise Criteria (NC)
    - (1) A reference level based on a chart of frequency vs. sound pressure (dB) curves that displays sound levels perceived by the human ear as equal in magnitude. The highest NC curve touched by a plot is the sound NC level. NC curves apply to sound pressure levels in an occupied space, not equipment sound power levels.

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- (2) Conditions: Windows and doors closed, with the HVAC on in the room and minimal external noise from adjacent locations.
  - (3) Acquire Data: With microphone at 48 inches, AFF located in middle of the instructor station location area at the front of the room.
  - (4) Standard: NC of 35 or less for classrooms. NC of 25-30 or less for auditoriums and distance learning classrooms.
- b. Reverb Time (RT60):
- (1) Reverberation time is the time required for the sound level in the room to decay 60 dB. In other words, it is the time needed for a loud sound to become inaudible after turning off the sound source.
  - (2) Conditions: Windows and doors closed, with the HVAC on in the room and minimal external noise from adjacent locations.
  - (3) Acquire Data: With microphone at 48 inches, AFF located in middle of the instructor station area at the front of the room.
  - (4) Standard: RT60 of 0.40 seconds or less for standard classrooms, RT60 of 0.80 for small auditoriums (100 to 200 seats) and RT60 of 1.50 seconds for large auditoriums (more than 200 seats).
- c. Equipment

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(1) As specified.

### D. ELECTRICAL SYSTEM

Note: The electrical system design shall meet the UTH Division 26 guideline specifications.

#### 1. General Power Requirements

- a. Audio-visual systems require clean, high quality AC power to operate correctly and reliably, as recommended by the equipment manufacturer. A conservative number of ac power circuits shall be dedicated exclusively to the audio-visual systems.
- b. Ensure that "Star" ground configuration is properly implemented by the Electrical Contractor. Ensure that ground wires from each outlet are isolated from conduit, neutrals, and each other, and are each "home-run" back to the dedicated breaker panel for AV systems.
- c. Provide isolated, insulated copper ground conductor, in a separate conduit, from the building ground at the transformer case to the room equipment electrical panel and from the panel ground bus to the equipment rack(s). All grounds will be connected to the main building ground and as required by National Electrical Code.
- d. All audio, video and control electrical circuits should be fed from "clean" legs of the power transformer free of high inductive loads. There shall be no elevator motors, compressor motors, blower motors, etc. on the secondary side of the power transformer that feeds the media equipment.
- e. In rooms where the data/video projector is to be ceiling mounted, a flush 120V duplex power outlet is required. Location of the outlet is to be determined during design.

#### 2. Convenience outlets and floor boxes

- a. Conference rooms are to have a minimum 3 data RJ-45 data outlets and 1 analog fax/audio conference telephone line outlet installed. These connections are to be installed in the floor box in new construction or mounted on the front wall below the projection screen in existing construction.
- b. Classrooms will have a minimum of 3 RJ-45 data outlets in each of the floor boxes and 1 analog fax/audio conference line in the floor box designated for

## APPENDIX O

the instructor station connections. For existing classrooms, the connections are to be installed in the wall box with the instructor station connections.

- c. Two additional data outlets are required for videoconference capable conference and classrooms. These additional RJ-45 data connections are to be located in the vicinity of the audiovisual support equipment racks.
  - d. The project manager should coordinate with institution to locate wireless access points.
  - e. Install 4 standard power outlets close to projector connection to serve additional equipment.
  - f. A/V floor boxes should include dedicated conduit for Data (1 inch), Security (1 inch), Power (1 inch) and A/V (1 1/2 inches). Box should be sized as small as possible to fit under table pedestals.
  - g. Install two additional data outlets close to projector location to provide network-connectivity to projector and network-connectivity for IP Surveillance Camera. The project manager should coordinate with institution to locate Network points.
  - h. Provide convenience outlets in the front of the room.
  - i. Coordinate special requirements for plasma display screens; ensure power and A/V connections are located behind display screen.
3. Dedicated distribution panels
    - a. All circuits for the system shall be taken from the same phase, with a dedicated distribution panel for all audio-visual classroom circuits.
  4. Conduits
    - a. Requirements for raceway system shall be per UTH Division 26 specifications.
    - b. Conduit from equipment rack location should include, at a minimum, Data (1 inch), Security (1 inch), Power (3/4 inch), Lighting control (1 inch), Screen control (1 inch), and three (3) A/V (1 1/2 inch). One A/V conduit will go to floor box and two (2) conduits to stub out above drop ceiling for speakers and projector.
  5. Conductors

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- a. Requirements for conductors shall be per UTH Division 26 specifications.
6. Provide scaled elevation dimensioned drawings for all controllers, phones, and other device locations.
- E. CATV
1. Provide a minimum of one CATV connection in all conference rooms and classrooms. In locations without access to CATV provide connections to local Cable-TV systems or satellite downlinks. In conference rooms the CATV connection should be on the wall below the projection screen. In classrooms there should be CATV connections at the instructor station location and audiovisual equipment support racks.
- F. SECURITY SYSTEM
1. Provide security alert on all equipment as required. Provide conduit from the room to the telecommunications closet for running fiber optic security line to monitor the installed equipment. Coordinate with institution police department.
- G. LIGHTING SYSTEM
1. General
    - a. Conference room non-videoconference capable. Measured at tabletop height 40 to 50 foot-candles horizontal all across the seating area of the room. Legible foot-candles on the projections screens.
    - b. Conference rooms videoconference capable.
      - (1) Measured at tabletop height: 40 to 50 foot-candles horizontal all across the seating area of the room.
      - (2) Measured at 40" above the finished floor: 50 to 70 foot-candles vertical all across the seating area, as measured looking toward the projection screen from the seating area.
      - (3) Measured from the presentation area looking toward the seating area: 40 to 50 foot-candles at instructor station height of approximately 40" to 75" above the finished floor and 60-80 footcandles vertical measured from 40" to 75" above the finished floor.

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- (4) Measured at projection screen: negligible foot-candles on the projections screens. Wall wash on all but the projection screen wall should have a wash of 50 to 70 foot-candles.
- c. Classroom non-videoconference.
- (1) Measured at tabletop height 40 to 50 foot-candles horizontal all across the seating area of the room. 0 foot-candles on the projection screens. Presentation area 40 to 50 foot-candles at instructor station height of approximately 40" above the finished floor.
- d. Classrooms videoconference capable.
- (1) Measured at tabletop: height 40 to 50 foot-candles horizontal all across the seating area of the room.
  - (2) Measured at 40" to 75" above the finished floor: 50 to 70 footcandles vertical all across the seating area. This would be looking toward the projection screen from the seating area. From the presentation area looking toward the seating area 40 to 50 footcandles at instructor station height of approximately 40" above the finished floor and 70 to 110 foot-candles vertical measured from 40" to 75" above the finished floor.
  - (3) Measured at project screens: Negligible foot-candles on the projections screens. Wall wash on all but the projection screen wall should have a wash of 50 to 70 foot-candles.
- e. The color temperature for all lighting fixtures should be the same. The color temperature target goal is 3200 degrees Kelvin. Color temperature in the range of 3000 to 3500 degrees Kelvin is acceptable as long as all the fixtures are the same.
- f. In non-videoconference capable conference rooms both general fluorescent and compact fluorescent down lighting should be provided. Sufficient compact fluorescent down lights should be provided to achieve an even 40-50 foot-candles of light across the seating area at tabletop height when the projection screen is used. Care should be given to select luminaries that will provide a minimum light spill on to the projection screen.
- g. In non-videoconference capable classrooms both general fluorescent and compact fluorescent down lighting should be provided. Sufficient compact fluorescent down lights should be provided to provide an even 40-50 foot-candles of light across the seating area at tabletop height when the projection



## APPENDIX O

screen is used. In the presentation area directional lighting fixtures should be used to provide 40-50 foot-candles of light on the instructor station and keep the light from spilling on to the screen. One or two compact fluorescent down lights should be used above the instructor station to light the workspace on the instructor station. Care should be given to select luminaries that will provide a minimum light spill on to the projection screen.

- h. In videoconference capable conference rooms asymmetrical fluorescent luminaries should be provided. Asymmetrical luminaries direct the light away from the projection screens and minimize glare from the ceiling for wide angle camera views that often include the ceiling and provide adequate down light for general meetings and videoconferences. A sufficient number of asymmetrical fluorescent luminaries shall be provided over the seating area to provide a range of 50-70 vertical footcandles looking toward the presentation area. Adjustable fixtures with pattern adjustment capabilities should be used to provide 60-80 vertical foot-candles as the presenter looks toward the seating area. One or two compact fluorescent down lights should be used above the instructor station to light the workspace on the instructor station. Use wall wash luminaries to light all but the presentation walls for videoconferences. Adjustable pattern wall wash fixtures shall be used to light the wall behind the presenter without spilling onto the projection screen. Use wall wash fixtures to light markerboards.
  - i. In videoconference capable classrooms asymmetrical fluorescent luminaries should be provided. Asymmetrical luminaries direct the light away from the projection screens and provide adequate down light for general meetings and videoconferences. A sufficient number of asymmetrical fluorescent luminaries shall be provided over the seating area to provide a range of 50-70 vertical foot-candles looking toward the presentation area. Adjustable fixtures with pattern adjustment capabilities should be used to provide 70-110 vertical foot-candles as the presenter looks toward the seating area. One or two compact fluorescent down lights should be used above the instructor station to light the workspace on the instructor station. Use wall wash luminaries to light all but the presentation walls for videoconferences. Adjustable pattern wall wash fixtures shall be used to light the wall behind the presenter without spilling onto the projection screen. Use barn doors or internal shutter to cut off the light above the bottom of the projection screen.
  - j. Placement of light fixtures should not obstruct sight lines to screens or projection throws.
2. Requirements for lighting control  
(Lighting control shall meet AHRAE 90.1 requirements)

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- a. Control system cover plates such as lighting switches and projection screen switches shall be labeled or permanently etched clearly in 3/16 inch high lettering.
- b. Light dimming capabilities shall be provided as an integral part of all conference rooms and classrooms.
- c. For non-videoconference capable conference rooms and classrooms provide wall mounted dimmers for at least 4 zones.
  - (1) Zone 1 shall be the fluorescent luminaries immediately in front and to the side of the projection screen.
  - (2) Zone 2 shall be the rest of the fluorescent luminaries in the room.
  - (3) Zone 3 shall be the compact fluorescent down lights above the seating area.
  - (4) Zone 4 shall be the compact fluorescent down light and adjustable pattern fixtures for the presentation area.
- d. For non-videoconference capable conference rooms provide an electronic controlled dimming system. Include an audiovisual control system interface. Provide a minimum of zones with one 5-button entry control panel and a multi-scene wall mounted master controller.
  - (1) Zone 1 shall be the fluorescent luminaries immediately in front and to the side of the projection screen.
  - (2) Zone 2-3 shall be the rest of the fluorescent luminaries in the room.
  - (3) Zone 4 shall be the lighting for the instructor station.
- e. For videoconference capable classrooms provide an electronic controlled dimming system. Include an audiovisual control system interface. Provide a minimum of 13 zones with one 5-button entry control panel and a multi-scene wall mounted master controller.
  - (1) Zone 1 shall be the fluorescent luminaries immediately in front and to the side of the projection screen.
  - (2) Zone 2-4 shall be the rest of the fluorescent luminaries in the room.

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- (3) Zone 5 shall be the compact fluorescent down light for the instructor station.
  - (4) Zone 5-6 adjustable pattern fixtures for the presentation area.
  - (5) Zone 7 shall be the wall wash fixtures behind the instructor station.
  - (6) Zone 8-10 shall be the wall wash fixtures on the rear and 2 side walls.
  - (7) Zone 11 shall be the lighting in any technician control area.
  - (8) Zone 12-13 shall be for rear projection equipment rooms.
- f. Basic classroom lighting controls shall be placed at all entrances in new construction. Controls for presentation writing surface lighting must be placed on both sides of the front wall. For new construction, lighting controls for the presentation writing surface shall be configured to allow the projection screen and instructor's writing surface to be used simultaneously. That is, the lights over the writing surface shall be controlled in separate sections to provide illumination of a portion of the presentation writing surface while a projection screen is in use.

### 3. Illumination Level Standards

Full capacity, overall even illumination - 60 foot-candles (Even illumination is defined as  $\pm 10$  foot-candles from mean and distributed uniformly)

Note-taking illumination – 5 foot-candles (Required)

Marker or Presentation Board – 75 foot-candles

### 4. Lighting Standard Testing Procedures

- a. Work Surface Lighting Levels: The level of light in foot-candles on the working surfaces of the room.
- b. Conditions: Lights on at full capacity. Room shades and blinds closed.
- c. Acquiring Data: Divide the floor area into a 3 by 3 grid pattern evenly dispersed across the student seating area. Measure levels at table height of 30 inches AFF.

Front of room looking down

1	2	3
4	5	6

## APPENDIX O

7	8	9
---	---	---

- d. Standards
    - (1) 60 foot-candles is the minimum design level required,  $\pm 15$  is acceptable. All readings shall be mean averaged and noted.
    - (2) Even lighting is defined as  $\pm 10$  foot-candles from mean. Deviation within a space in excess of 10 foot-candles shall be noted.
  - e. Equipment: as specified.
5. Reduced Note-taking Light Testing Procedures
- a. Conditions: Lights on at low volume. Room shades and blinds closed.
  - b. Acquiring Data: Dividing the floor area up into a 3 by 3 grid pattern evenly dispersed across the student seating area. Measure levels at table height of 30 inches AFF.
  - c. Standards: Five foot-candles is required.  $\pm 10$  is acceptable. All readings shall be mean averaged and noted.
  - d. Equipment: as specified.
6. Glare
- a. Glare in the field of view of the presentation surfaces shall be a contrast ratio of 3:1 or less.
7. Glare Contrast Measurement Testing Procedure
- a. Glare is defined as any brightness in the field of vision that causes discomfort, reduction in vision or eye fatigue. Glare is the result of excess light that is in the normal line of sight in the work area. Excess light can be emitted directly from the fixture, or be reflected from a glossy surface.
  - b. There can be actual intensity levels exceeding 1:250 within the space, but the ratio of highest intensity to that of background intensity is more crucial in determining glare conditions. A ratio of 2:1 or greater between the peak and the median begins to feel uncomfortable. Any ratio of 3:1 or greater positively produces a sensation of discomfort and should be avoided.
  - c. Conditions: Lights on at full capacity. Room shades and blinds closed.

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- d. Acquiring Data: Divide the students' field of view into a 5 by 2 grid pattern evenly dispersed across the field of view from the middle of the student seating area. Acquire data and note. Then look at the brightest point in the field of view, and note as the peak reading.

Looking at front presentation area

1	2	3	4	5
6	7	8	9	10

- e. Standards: A contrast ratio of 3:1 or less is acceptable. Average the light level in the field of view and note. Give the ratio to the peak measurement.
- f. Equipment: as specified.
8. Energy efficient fixtures shall be used. (Design shall meet ASHRAE 90.1 requirements.)
9. Emergency directional exit signage and emergency egress lighting (Design shall meet NFPA requirements.)
10. Motion detectors. (Design shall meet ASHRAE 90.1 requirements.)
11. Color and reflectance values
- a. Specify colors and finish materials with minimum reflectance values and to enhance A/V functionality of classrooms.

### H. NETWORKING AND TELECOMMUNICATIONS SYSTEM

1. Location for telephones
- a. A telephone outlet shall be installed in the presentation area of the classroom. When a classroom includes a booth, the booth also shall have a telephone outlet.
- b. Telephone outlets for wall-mounted phones shall meet ADA requirements.
- c. Classrooms shall have a minimum of four data connections in a singlegang box located in coordination with the A/V system requirements. When the classroom has a booth, the booth shall have a minimum of two data connections. If a storage room exists within the classroom space, it shall have a minimum of two data connections.
- d. Conference room table locations shall have provisions for speaker phone.

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- e. Coordinate with institution for location of wireless access.

### I. AUDIO VISUAL SYSTEM

1. Projection Capable Classroom: A classroom that has data/video projection capabilities, Internet connectivity at the instructor station, a VCR and/or other input device, a user-friendly laptop interface/control system, and capabilities for other add-on modular features. Projections-capable classrooms use standardized control/interface systems and employ a standardized operational protocol.
2. Instructor station
  - a. Connection of umbilical cable to instructor station.
  - b. Design to meet ADA requirements.
3. Projection
  - a. A 120V, 20-amp duplex outlet is required at the support for the projector mounting bracket structural ceiling.
  - b. Coordinate where the projector shall be placed with institution.
  - c. Locate projection screen writing area separate from projection surface so that the writing is not covered.
  - d. Provide electrically operated projection screens, unless noted otherwise. Controls shall be located at switch height next to lighting controls. Presentation lighting fixtures shall not be directly in contact with or interfere with the movement of the projection screen(s).
  - e. Ensure screens in lowered positions clear chalk/white board trays and do not obstruct control switches, exit signage, motion detector, A/V fire alarm devices, clocks etc.
  - f. Projector appropriate for room size, minimum 1024 x 768 native resolution.
  - g. Connections for the projector at the instructor station to be mounted on wall or in floor (as appropriate to room).
  - h. Connections on interface panel to include VGA connector, composite video connector, Component (S-video) connector, and audio connections for both computer and video models.

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4. Sound System
  - a. Input to follow the data projectors video input.
  - b. Speakers to be mounted in a location that allows stereo sound to be provided to the classroom.
  - c. Speakers must have enough power to provide comfortable listening level in the classroom (powered speakers or a separate powered amplifier as necessary).
  - d. Speaker system to have wireless mike capability and the “audio-out” can be captured on the presentation computer.
  - e. Provide ability to connect other equipment as required (document camera, whiteboard, smartboard etc.)
  - f. Design to meet ADA hearing assisted device requirements.

### J. CLOCK/BELL SYSTEM

1. Clocks shall be placed on a wall in each classroom (other than the front wall).
2. Clocks shall be self-correcting for accuracy. If DC-powered, the battery shall have an extended (multi-year) life expectancy.
3. Clocks shall be integrated into existing system.

## APPENDIX Q

### GUIDELINES FOR LIFE CYCLE COST ANALYSIS (LCCA)

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## APPENDIX Q

### **RECOMMENDED GUIDELINES FOR LIFE CYCLE COST ANALYSIS** **(LCCA)**

Note: For UT Austin capital projects, do **not** use this Appendix Q. UT Austin projects should adhere to the UT Austin Design & Construction Standards 4.02.00 *Project Design Evaluation and Approval Process* current edition.

#### A. PURPOSE

Cost effectiveness is a key component of a building design, and Life Cycle Cost Analysis (LCCA) is an essential design process for controlling the initial and future cost of building ownership. Life Cycle Cost (LCC) is defined by the National Institute of Standards and Technology (NIST) Handbook 135 as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time.

LCCA is based on the premise that multiple building design options can meet programmatic needs and achieve acceptable performance, and that these options have differing initial costs, operating costs, maintenance costs, as well as different life cycle costs. By comparing the life cycle costs, LCCA can show the trade-offs between low initial first cost and long-term cost savings. Thus, the most cost-effective system for a given use can be identified, and the length of time it will take to “pay back” the incremental cost for this system can also be determined.

In keeping with the Institution’s sustainability practices, LCCA can identify environmentally desirable solutions. Careful design choices that result in efficient use of energy and water often yield long-term cost savings. In addition, should environmentally friendly choices not save money over time, LCCA may reveal that their additional cost over time is minimal.

These guidelines define the LCCA process, and establish the standards and metrics to ensure accurate and consistent life cycle data collection and evaluation across projects.

#### B. GENERAL REQUIREMENTS

1. During the Schematic Design (SD) and Design Development (DD) phases of a project, the Project Architect/Engineer will be directed by the Owner and Project Team to perform up to five (5) LCCA comparative analyses from several building system categories. Each LCCA comparative analysis can have up to four (4), or more if deemed necessary, alternatives (one base case plus three alternate cases). Building system categories are as follows, but are not limited to:

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- a. Energy Systems
  - 1) Central plant vs. stand alone system (steam and chilled water)
  - 2) Equipment options (air cooled chillers vs. refrigerant-based direct expansion [DX] units)
  - 3) Alternative energy systems
- b. Mechanical Systems
  - 1) Air distribution systems (variable volume vs. constant volume, overhead vs. underfloor)
  - 2) Water distribution systems
- c. Electrical Systems
  - 1) Indoor lighting sources and controls
  - 2) Outdoor lighting sources and controls
  - 3) Power distribution (transformers, buss ducts, cable trays)
- d. Building Envelope Systems
  - 1) Skin and insulation options
  - 2) Roofing systems materials and insulation methods
  - 3) Glazing, daylight, and shading options
- e. Siting Systems
  - 1) Orientation, floor to floor height, and overall building height
  - 2) Landscape, irrigation, and hardscape options
- f. Structural Systems
  - 1) Systems/materials selection (wood vs. steel vs. concrete, cast-in-place vs. pre-cast)

### C. THE LCCA PROCESS

1. GENERAL: The LCCA process involves the Project Architect and Project Team establishing clear objectives, determining the criteria for evaluating alternatives, identifying and developing design alternatives, gathering cost information, and developing a life cycle cost for each alternative.
2. ESTABLISH CLEAR OBJECTIVES: The Project Architect and Project Team should establish clear objectives in evaluating alternatives. LCCA can capture dollar cost variations between alternatives and show which

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option has the overall lowest cost. However, LCCA cannot evaluate the improved comfort or occupant satisfaction with different glazing materials.

3. **DETERMINE LCCA METRICS:** The two metrics to be used and calculated in the LCCA are the Life Cycle Cost of each alternative and its Payback over an agreed upon study life. Consideration is given to total costs and the time it takes to recover an incremental initial investment incorporating the time value of money. As mentioned above, Life Cycle Cost is defined as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time.
4. **IDENTIFY BASE CASE AND ALTERNATIVE DESIGNS:** The Project Architect and Project Team should develop up to four alternative designs. The first alternative design is the “base case” and is the standard design or minimum requirement for a project. The base case is typically identified as having the lowest initial cost of all the alternatives. The remaining three alternative designs are developed to evaluate against the “base case.” The Project Team should use their experiences and judgment in selecting relevant building and system component alternative designs.
5. **GATHER COST INFORMATION:** For each alternative design, the Project Architect should gather cost information. Cost information should include, but not be limited to, the following:
  - a. Initial Costs
    - i. Construction costs (labor, materials, equipment, etc.)
    - ii. Soft costs (design fees, permit fees, etc.).
  - b. Annual Future Costs
    - i. Operating Costs (utility costs such as electricity, gas, water, steam, chilled water, etc. and service costs such as custodial, etc.)
    - ii. Maintenance Costs (preventative and reactive)
  - c. Non-Annual Future Costs
    - i. Replacement Costs (planned maintenance, renovation at a future date, etc.)
    - ii. Demolition Costs (if required)

Note: Residual Value default is set at zero (\$0) for all studies and not included in LCCA unless otherwise directed.

6. **PERFORM LIFE CYCLE COST ANALYSIS:** For each alternative, including the base case, the Project Architect should calculate the LCC and Payback

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metrics. Each alternative should be evaluated using these two metrics, and recommendations should be made as to which alternative design should be incorporated into the project.

Regarding the concept of “avoided capital,” some LCC analyses attempt to incorporate upfront cash savings (derived by a lower initial cost) into the LCC and Payback metrics of one particular design alternative. This practice circumvents true LCC analysis by treating “avoided capital” as an avoidance of initial costs only. In reality, “avoided capital” encompasses initial cost savings as well as performance savings produced by the design alternative over the life of the study period, as measured in present value terms. Put another way, “avoided capital” is the dollar amount difference between the LCCs of two design alternatives. It is an output of LCC analysis, not an input. Thus, “avoided capital” can only be accurately reflected by comparing two completed LCCs.

LCCA weighs money spent today versus money spent in the future. All costs are converted to constant dollars, and then summed to develop an LCC, or Present Value Cumulative Cost for each alternative. In general, the best alternative design is simply the alternate with the lowest LCC with an acceptable Payback period. Note: Do not confuse wanting “lowest present value” in an LCCA calculation with wanting the “highest present value” from a revenue-generating financial calculation.

### D. LCCA TERMINOLOGY

1. **Life Cycle Cost (LCC)** – the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or building system over a period of time. Also referred to as Present Value Cumulative Costs.
2. **Payback** – the time it takes to recover an incremental initial investment, incorporating the time value of money.
3. **Life Cycle Cost Analysis (LCCA)** – an economic evaluation technique that determines the total cost of owning and operating a building, building system or facility over a period of time.
4. **Initial Costs** – costs incurred prior to occupation of the facility including construction costs (labor, materials, equipment, etc.) and soft costs (design fees, permit fees, etc.).
5. **Annual Future Costs** – after occupation of the facility, costs that are incurred every year over the span of the study period (utilities maintenance, etc.).

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6. **Non-Annual Future Costs** – after occupation of the facility, costs that are not incurred every year over the span of the study period (replacement, renovation, demolition, etc.).
7. **Study Period** – the time period over which an LCCA is performed, or the period of time over which ownership and operations expenses are to be evaluated. The LCCA Model assumes the study period to be equivalent to the useful life of the project.
8. **Nominal Discount Rate** – generally reflects the cost of capital and is used to discount future nominal cash flows back to Current Dollars. The Nominal Discount Rate incorporates the rate of inflation.
9. **Real Discount Rate** – the Nominal Discount Rate adjusted to exclude the rate of inflation. By adjusting for inflation, the Real Discount Rate can be used to discount Constant Dollar cash flows. Real Discount Rate is expressed as:

$$\text{Real} = \frac{1 + \text{Nominal}}{1 + \text{Inflation}} - 1$$

10. **Escalation Rate** – the rate of change over time for established commodities such as materials, labor, and utilities.
  11. **Constant Dollars** – dollars of uniform purchasing power whose present value is tied to a reference year and is exclusive of general price inflation or deflation.
  12. **Current Dollars** – dollars of non-uniform purchasing power, including general price inflation or deflation, in which actual prices are stated. When inflation is 0%, Constant Dollars and Current Dollars are equivalent.
  13. **Present Value** – the time-equivalent value of past, present, or future cash flows as of the beginning of the base year.
- E. LCCA FORMULAS

1. The basic LCCA formula is:

$$\text{LCC} = I + \text{PV}_{\text{Annual Future}} + \text{PV}_{\text{Non-Annual Future}}$$

## APPENDIX Q

Where:

LCC = Life Cycle Cost

I = Initial Costs

PV<sub>Annual Future</sub> = Present Value of all Annual Future Costs

PV<sub>Non-Annual Future</sub> = Present Value of all Non-Annual Future Costs

2. To determine the Present Value of Annual Future Costs, the following formula is used:

$$PV_{\text{Annual Future}} = A \cdot (1 + e) \cdot \frac{(1 + d)^t - (1 + e)^t}{(d - e) \cdot (1 + d)^t}$$

Where:

PV<sub>Annual Future</sub> = Present Value of Annual Future Costs

A = Amount of Annual Future Cost

d = Real Discount Rate  
e = Escalation Rate

t = Time (expressed as number of years)

3. To determine the Present Value of Non-Annual Future Costs, the following formula is used:

$$PV_{\text{Non-Annual Future}} = \frac{A \cdot (1 + e)^t}{(1 + d)^t}$$

Where:

PV<sub>Non-Annual Future</sub> = Present Value of Non-Annual Future

Costs A = Amount of non-recurring Future Costs at a time t

d = Real Discount Rate  
e = Escalation Rate

t = Time (expressed as number of years)

### F. ECONOMIC PARAMETERS FOR LCCA

1. FINANCIAL CRITERIA: Financial criteria used to perform an LCCA study are established by the Owner in the Basis of Design (BoD) document during the “Pre-Design Phase.” These BoD financial criteria are campus- and project-specific, and are used for the selection of appropriate equipment and systems fit for project-specific purposes. The Project Architect should utilize the BoD financial criteria when calculating LCC. Financial criteria may include:

- a. Real Discount Rate
- b. Study Period

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- c. Payback
- d. Initial Costs
- e. Annual Future Costs
- f. Non-Annual Future Costs

### G. PROCESS FOR FINAL SELECTION AND DESIGN APPROVAL

1. Once the LCCs have been compiled, use a scoring system to determine the best solution for the Institution. The Design Team will work closely with the UT Project Team to develop an appropriate framework of evaluation for each project. Other factors within the scoring system might include aesthetics; land use, water, and ecosystem quality; social and programmatic factors; materials and waste; indoor environmental quality; energy and atmosphere; or adaptability for future use.

## APPENDIX S

### SECURITY SYSTEMS CRITERIA

*(UT Health Standard)*

The Project Architect/Engineer shall design UT System projects to comply with UTH/UT Health Security Systems Criteria including the UT Health Guideline Specification 28 00 00, Electronic Security System Design Construction and Commissioning Guide.

In addition to the guideline specification, the above referenced Security Systems Criteria include the following documents:

(1) **Building Security System Classification.** A description of the minimum standard security systems to be included in a facility based on its classification (A,B or C), which is determined by campus UTPD and ITS department using the Security Assessment Tool (SAT) which evaluates the threat assessment, vulnerability and function of each specific facility.

(2) **Chronology of Requirements for Security Systems.** A description of activities and responsible parties involved from OPR through planning, design and construction.

(3) **Critical Security Milestones.** This chart provides specific examples of prerequisite activities security contractor will need completed before they can do their work along with amount of time prior to substantial completion when these milestones must be completed.

(4) **Lessons Learned from Security System Installations.** 18 general principles gleaned from historical problems encountered while installing and testing security systems in facilities at UT Health, along with recommendations for process improvement to avoid repeating them.

(5) **Owner's Project Requirements.** Use "Owner's Project Requirements: Security Systems", as a tool to ensure comprehensive consideration of security systems during the OPR process.

(6) **Security Construction Schedule Narrative.** A description of security scheduling activities.

(7) **Security Consultant Scope.** This is an outline for baseline scope to establish the owner's expectations of level of service from the security consultant, and for the Design Professional to negotiate the scope of consultant's proposal. Ensure that the scope of the AE agreement includes sufficient time allocated for security consultant to perform critical observations of field installation and adequate inspections to ensure proper system functionality. UT Health Security Consultant Qualifications for CIP Projects. Establishes the minimum qualifications for Security Consultants, and lists those firms meeting these requirements.

Revised 3/11/14

(8) **UT Construction Schedule P6.** This is a PDF version of a generic sample schedule designed to show the level of detail needed for a typical project schedule incorporating critical security activities and predecessors affecting security system.



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THE UNIVERSITY OF TEXAS SYSTEM  
UT HEALTH SCIENCE CENTER AT HOUSTON  
7000 Fannin Street  
Houston, Texas 77030

## CONSTRUCTABILITY GUIDELINES



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## SECTION 1.0 - CONSTRUCTABILITY IMPLEMENTATION POLICY

**The International Trade and Technology Building** has endorsed the cost savings potential of constructability efforts, “the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.”

In view of our continuing efforts to provide the highest degree of quality and cost effectiveness to our projects, it is our policy to implement constructability to the fullest degree possible. This applies to all phases of project planning, design, and construction. We will ensure that we take full advantage of high potential of constructability to achieve savings during the earliest phases of project planning and prior to the start of design.

\_\_\_\_\_ is hereby designated as the Constructability Manager and will oversee the constructability program, ensure consistency with other continuous improvement processes, implement changes, and regularly report its effectiveness.

EXECUTIVE SPONSOR:

(OWNER)

(SPONSOR)

\_\_\_\_\_  
Signature

Date

SPONSORS:

(Architect's Name):

\_\_\_\_\_  
Signature

Date

(Contractor's Name):

\_\_\_\_\_  
Signature

Date

## SECTION 2.0 - PHILOSOPHY OF CONSTRUCTABILITY

The Message is: Be sure that construction considerations are incorporated into every phase of a project- Feasibility Studies, Conceptual Planning, Design, Procurement, as well as Construction.

- Constructability is the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.
- Maximum benefits occur when people with construction knowledge and experience become involved at the very beginning of a project.
- Only through the effective and timely integration of construction input into planning, design, and procurement as well as field installation will the potential benefits of constructability be achieved.
- Industry in the past tended to separate the individual functions involved in capital projects by finetuning each individual function to minimize its costs. Fine-tuning the individual functions, however, does not yield the most successful project. Constructability integrates these functions and by so doing is the most powerful tool that can be used on projects.
- Traditional separation of engineering and construction early in the project must be bridged if constructability is to work. This bridging requires merging engineering and construction cultures which have both commonalities and distinct differences. This merger must be made easily, automatically, and permanently.
- The principle of continuous commitment is important. The front-end constructability participants are most effective when they know that they are the ones who will have to make it happen in the field. This focuses attention and builds true commitment within the constructability team.
- The size of a project is no barrier to constructability. It is equally valuable to both large and small projects. Smaller projects may warrant to combine some constructability functions. The important point is to include all the essential elements so that a team assembled for a project will have ample common ground for effective joint action by all constructability participants.
- Long-term or complex bureaucracies are not needed to make constructability happen. Constructability, like any other broad program, works best when it is simply an accepted way of doing business with self-evident benefits. Like productivity improvement programs, constructability is too important to be left to chance and must be reexamined periodically.

## SECTION 3.0 - CONSTRUCTABILITY OBJECTIVES

- Zero accidents, incidents and injuries.
- Provide work quality that meets project needs and applicable regulatory requirements.
- Implement proven methods and techniques that maximize overall project performance.
- Provide a coordinated effort between engineering, procurement and construction that produces a schedule that meets the project's objectives.

- Continually improve project cost effectiveness through implementation of constructability concepts.

#### SECTION 4.0 - CONSTRUCTABILITY ORGANIZATION

- CONSTRUCTABILITY SPONSORS

OWNER - SPONSOR NAME:

ARCHITECT COMPANY - SPONSOR NAME:

CONSTRUCTION COMPANY - SPONSOR NAME:

The constructability sponsors' duties and responsibilities are to communicate to the companies' organizations and employees the high interest placed by top management on constructability and to remove any barriers encountered in implementing it.

- CONSTRUCTABILITY MANAGER

(NAME OF MANAGER):

The Constructability Manager's duties and responsibilities are as follows:

- Oversee the Constructability Program.
- Ensure consistency with other continuous improvement processes. - Implement changes and regularly report its effectiveness.

- CONSTRUCTABILITY COORDINATOR

(NAME OF COORDINATOR):

The Constructability Coordinator's duties and responsibilities are as follows:

- Functionally report to Constructability Manager.
- Act as Chairman of the Constructability Committee.  
Call for and participate in all constructability reviews and concepts evaluations.
- Report to the Constructability Committee any major feedback or development relevant to constructability.
- Distribute notes of meetings and other documents to the Constructability Committee members.

- CONSTRUCTABILITY COMMITTEE MEMBERS

The Constructability Committee member's duties and responsibilities are to attend and participate in all Constructability reviews and concepts evaluations.

- DATABASE CUSTODIAN

The Database Custodian's duties and responsibilities are to be responsible for the documentation, tracking, and distribution of constructability concepts and lessons learned.

## SECTION 5.0 - CONSTRUCTABILITY IMPLEMENTATION

Implementation of constructability concepts is essential to the success of the constructability process and shall provide a method to ensure all concepts are evaluated, that beneficial concepts are implemented and detrimental concepts are prevented from being implemented. Implementation shall also assure the means of documenting projected cost savings. Post auditing will generate lessons learned for future projects and determine the overall success of the program.

### DEFINITIONS

- CONSTRUCTABILITY CONCEPT

Constructability concepts are ideas or suggestions that may improve the performance of a project. These ideas can be generated from any discipline by anyone for any aspect of the project.

- LESSON LEARNED

Lessons learned are observations generated from post auditing current project experiences. These lessons learned will be filed and may become concepts for future projects.

- EVALUATION OF CONCEPTS GENERATED FROM CONSTRUCTABILITY CONCEPTS FILES

The Constructability Committee shall evaluate every concept in the Constructability Concept Files and shall categorize as follows:

(A) Accept The concept is agreed to by all committee members as a cost effective idea or method for executing the project. The concept is not standard practice but adds value to the project. Accepted concepts will not be cost-estimated but will be documented as project concepts guidelines.

(STD) Standard The concept represents the typical way the project would be executed and cost estimating is not required. The concept is documented in the project concepts guidelines.

(C) Consider The concept represents an idea whose merit requires analysis. The effect of the concept on all disciplines (i.e., Engineering, Procurement, and Construction) must be evaluated to determine its overall benefit to the project prior to acceptance and implementation. Once accepted, the concept is documented through constructability bulletins to be added to the project concepts guidelines.

(NA) Not Applicable for This Project The concept is documented as not applicable for this project.

(R) Rejected The concept is documented as adding no value for this project.

- CONSTRUCTABILITY CONCEPTS SUGGESTION FORM

The constructability concepts suggestion form, Attachment “A.” shall be used by all participants to submit constructability suggestions to the Constructability Committee through the Constructability Coordinator.

The constructability process shall allow committee evaluation of all constructability concepts and individuals will be informed of results.

- PROJECT CONSTRUCTABILITY CONCEPTS LOG

The project constructability concepts log, Attachment “B,” is used to track the status and record the cost savings of all constructability concepts. Concepts are generated from the “constructability concepts files” and from the “constructability concepts suggestion forms.” All suggested concepts are maintained and listed on the project constructability concepts log whether ultimately accepted or rejected.

- LESSONS LEARNED REPORTING FORM

The lessons learned reporting form, Attachment “C,” shall be used by all participants to submit lessons learned on this project to the Constructability Coordinator.

- PROJECT CONSTRUCTABILITY LESSONS LEARNED LOG

The Project Constructability Lessons Learned Log, Attachment “D,” is used to summarize lessons learned from this project to be used for future projects.

- CONSTRUCTABILITY BULLETINS

When the Constructability Committee accepts a concept, the Constructability Coordinator notifies the various project disciplines via constructability bulletins.

- CONCEPT ESTIMATING

Each constructability concept recorded on the project constructability concept log shall be reviewed by the committee for potential value added to the project. All concepts judged by the committee to be in excess of \$25,000 savings shall be estimated [not to exceed eight (8) man-hours per concept] by the Project Control Manager with support from the various departments and will include the following documented savings or cost breakdown:

- Engineering
- Procurement
- Construction
- Total installed cost savings

Concepts judged by the Committee to be valued at less than \$25,000 overall savings can be accepted in principle by the Committee without further estimating effort involved.

- REPORTING

The Constructability Coordinator shall formally report project constructability status monthly. The reports shall include the project constructability log and narratives as appropriate. The reports shall be part of the monthly project status review and distributed to committee members and sponsors as a minimum.



## SECTION 6.0 - CONSTRUCTABILITY GUIDELINES

Because the ability to influence the overall optimization of schedule and cost is very high during the early phases of a project (i.e., feasibility study, conceptual planning, design, and procurement activities) and becomes very low at construction and start-up phases, there is the need to orient the engineering, purchasing, and subcontracting activities through constructability guidelines.

### 6.A CONSTRUCTABILITY DURING FEASIBILITY STUDY

Utilize construction input to help evaluate “do-ability” and cost effectiveness of alternatives during idea generation and elimination.

### 6.B CONSTRUCTABILITY DURING CONCEPTUAL PLANNING

An overall project management plan detailing the interactions of the various sub-plans (i.e., engineering, procurement, and construction execution plans) must be developed in the conceptual planning phase utilizing construction input.

### 6.C CONSTRUCTABILITY DURING DESIGN

Many of the conflicts between the extent of engineering's details and construction efficiency can be resolved at this time. An open and questioning mind is essential. Now is the time for the project team to quiz traditional approaches and consider different methods.

### 6.D CONSTRUCTABILITY DURING PROCUREMENT

Utilizing the overall project schedule and a list of major process equipment, construction must develop a set of field need dates for input to the procurement effort.

Procurement packages detailing vendor requirements must be reviewed to confirm that construction needs are met. Ongoing procurement activities, especially bulk material deliveries, must be aware of construction's field needs.

### 6.E CONSTRUCTABILITY DURING CONSTRUCTION

Labor-saving techniques resulting from new, modified, or enhanced tools or equipment or unique application of methods are to be reported to the constructability team members on the concepts suggestion form.

Lessons learned during the execution of the project are also to be reported to the constructability team members on the lessons learned reporting form for use on future projects.

## SECTION 7.0 - RECOGNITION, INCENTIVES AND AWARENESS

- RECOGNITION

The Constructability Manager is responsible for recommending originators for recognition to be determined by the Constructability Committee.

Recognition may take any of the following forms:

Certificate of merit

Letter of commendation Incentive award

- INCENTIVES

The Constructability Committee shall determine the level of incentives to be awarded to individuals or groups. The level shall be funded based on constructability savings.

The savings/incentive progress is shown in Attachment “B.” Incentives will only be considered where reduced costs have been taken through reduction in budgets.

- AWARENESS

The Constructability Committee may elect to fund awareness campaigns designed to raise commitment to constructability. This may include but is not limited to:

Outside presentations

Team-building

## SECTION 8.0 - CONSTRUCTABILITY CONCEPTS

### **CONCEPTUAL PLANNING CONCEPT 1**

*Details of the constructability program should be an integral part of project execution plan.* If constructability is to be achieved on a project, it must be included in the project execution plan. In most cases, these plans are prepared by an owner project manager at a very early state of the owner’s project. The constructability program should become an integral part of the planning process. The constructability program can contribute to effective project execution in many ways, including:

- Helping to establish project goals and objectives
- Providing a logical and systematic manner for integrating design and construction
- Providing a mechanism for obtaining field construction experience as needed
- Improving the construction personnel understanding of the design intent

### **Notes**

- The Project Execution Plan (PEP) is a formal approach to early comprehensive planning.
- The PEP should address the constructability program.
- The PEP facilitates new player buy-in and imposes a planning discipline.

### **Application**

The A/E scope of services statement should outline in detail the owner’s expectations pertaining to constructability. The statement should cover such issues as level of effort, range of issues, interaction with other organizations, documentation, and results-tracking efforts.

## CONCEPTUAL PLANNING CONCEPT 2

*Project planning involves construction knowledge and experience.* This concept addresses achieving cost and schedule benefits by including construction personnel in the early planning teams. These teams are responsible for determining how best to satisfy a business need--for example: manufacturing a new product, increasing existing capacity, reducing costs, or improving quality. Construction knowledge and experience can be actively involved in:

- Establishing project objectives
- Selecting major construction methods
- Selecting project site
- Analyzing schedule feasibility
- Creating productivity assumptions
- Preparing estimates and budgets
- Identifying sources of materials and equipment

### Notes

- Many project planning issues would benefit from early construction input.
- One or more construction personnel should be involved in the early planning effort.

### Application

Early planning issues that can benefit from early construction input include project siting, budget feasibility, schedule feasibility, relative priorities, conceptual sequencing of major activities, and feasibility of manloading.

## CONCEPTUAL PLANNING CONCEPT 3

*Early construction involvement is considered in development of contracting strategy.* The contracting strategy will have a major influence on the availability of qualified construction personnel to serve on constructability teams. Owners must be particularly cognizant of strategies limiting the role of the constructor during early phases of the project. For example, if the project delivery system uses the tradition strategy of separate contracts for the designer and general contractor, the owner will have primary responsibility for coordinating early construction input. Special arrangements, such as reviewing conceptual designs by prospective contractors or using a constructability consultant, may be required to obtain the necessary constructability input during the conceptual and early design phases. Regardless of which approach is selected, the appropriate construction personnel must be involved and their qualifications must be clearly specified in the contract documents.

### Notes

- The contracting strategy often establishes the manner of acquiring construction input.

- It is critical to get the *right kind* of people.

## Applications

- Early construction involvement or input can come from one or more of the following seven sources:
  - Owner construction staff
  - A/E construction staff
  - *The* project constructor hired early on
  - A project constructor hired early on
  - An EPC or design-build contractor
  - A CM (professional construction manager)
  - An independent constructability consultant (specialist)
- Equipment vendors or material suppliers may also be a good source of constructability input.
- On large EPC contracts, many have found that specialty contractors are more effective for work such as stack construction, tanks, roofing, asbestos removal, piling, and site services, among others.

Some suggest that piping, insulation, and heat-tracing activities be consolidated into a single contractor work package in order to facilitate efficient sequencing and coordination.

## CONCEPTUAL CONCEPT 4

*Project schedules are construction-sensitive.* This concept establishes the principle that the project completion date and the requirements of the construction phase should be considered in optimizing the project cost and schedule. This concept addresses the overall project schedule, which balances and allocates durations of time among major project phases and activities. To reap the benefits of constructability, the “forward pass” technique of scheduling must be avoided by requiring a “backward pass” or constructiondriven approach to overall scheduling. While using this approach, a proper balance must be maintained among the times allocated for planning, design, procurement, and construction.

## Notes

- Base the conceptual design and procurement schedules on the conceptual construction schedule.
- The construction schedule should be totally integrated with the start-up schedule.
- Construction durations should be realistic; passive acceptance of an imposed schedule should be avoided.

## Applications

- The allocation of project time among the major project phases must reflect a balance, based on iterative analysis.
- Considerations in allocating time include procurement lead time, contract negotiation period, mobilization and training activities, and construction seasons.

Projects with multiple power units should take advantage of the efficiencies of repetitive activities through judicious sequencing.

## CONCEPTUAL PLANNING CONCEPT 5

*Basic design approaches consider major construction methods.* Major construction methods can be defined as the use of construction equipment, labor, and work sequencing in such a way that the methods become a major *design driver*. In this case, a *design driver* is a construction method, condition, or technique that design engineering must address, and which, if substituted later in the design or construction process, could significantly impact cost, time, or performance results. Major construction methods must be considered during conceptual planning. All members of the project team should interact and agree on the methodology that will quantitatively and qualitatively measure the output of the major construction methods as positive construction contribution to overall project objectives.

### Notes

- The focus is on selection of high-impact construction methods:
  - Scope of modularization
  - Major structural and foundation systems
  - Concrete forming systems
  - Excavation planning
  - Heavy-lift planning
- Heavy-lift planning issues:
  - Identification of lifts
  - Lifting equipment selection
  - Location and scheduling of lifts
  - Crane support/foundation
  - Job-site accessibility

### Applications

- Modularization applications include plant control rooms, pulverized coal delivery system, boiler boxes, boiler superheaters, boiler steam drums, turbine generators, exhaust stacks, scrubber additions, pipe racks, precast concrete manholes, and various skid-mounted equipment assemblies. Discussion of these matters should begin very early and involve vendors whenever appropriate.
- Equipment heavy-lift planning should be formalized and conducted early. Project schedulers, rigging consultants, and major vendors should play active roles in this planning.

## CONCEPTUAL PLANNING CONCEPT 6

*Site layouts promote efficient construction.* This concept addresses the principle that construction efficiency is an important criterion in the layout of both permanent and temporary facilities. Permanent facility layout should be reflective of construction concerns and well-coordinated with temporary facility plans. Construction concerns include:

- Adequate space for lay-down and fabrication yards
- Access available for construction equipment, materials, and personnel
- Avoidance of costly and problematic types of construction, such as underground and elevated work when alternatives exist
- Temporary construction uses of existing facilities
- Planning for adequate drainage during construction

### Notes

- The focus is on layout of both permanent and temporary facilities.
- Considerations include:
  - Accessibility
  - Construction efficiency/minimize problematic types of construction
  - Coordination of permanent facilities with temporary facilities

### Applications

- Compact plant designs reduce cable and piping run lengths; however, corresponding construction and operations congestion should be avoided.
- Minimize structure and scaffolding by supporting pipe runs on sleepers at grade.
- A GIS-based system for automatic layout of temporary construction facilities has been developed.
- Construction uses of permanent facilities may require design modifications and changes in design and/or construction sequence.
- Temporary facility layout should fully incorporate a site drainage plan.

### CONCEPTUAL PLANNING CONCEPT 7

*Project team participants responsible for constructability are identified early on.* This concept addresses the attributes of the key individuals on the project team who are responsible for constructability. These individuals should be identified as early as the contracting strategy allows and should continue throughout the project. Having prior involvement in a similar type of project, particularly during the construction phase, enhances the constructability. In addition to construction knowledge and experience, selection criteria should include:

- Teamwork skills
- Communication skills

- Ability to objectively evaluate design and construction trade-offs
- Receptiveness to new ideas

### **Notes**

- Constructability is a team effort!
- Proper timing of involvement of key personnel is the secret to success--usually, the earlier, the better
- Needed skills of constructability coordinator include construction knowledge and experience, teamwork skills, communication skills, awareness of trade-offs, and receptiveness to new ideas.

### **Applications**

- Include plant operations representatives on the project team from the start, but be aware that their influence may need “balancing.”
- Recognize the costly effects of not having continuity with key personnel; aggressively seek continuity in personnel.
- Conduct team-building sessions at the outset of every major project. Have the team collectively define constructability challenges, opportunities, and solutions.
- Another key to constructability success is having one or more team members with extensive start-up experience.

## **CONCEPTUAL PLANNING CONCEPT 8**

*Advanced information technologies are applied throughout project.* Constructability is enhanced by exploiting the capabilities and benefits of advanced information technologies. The use of advanced information has the potential to revolutionize the methods used by the construction industry. Some of the information technologies being applied to projects include the use of three-dimensional computer modeling, relational database systems, expert systems, computer simulation, electronic data interchange, bar coding, and field notebook computers. The emerging technologies provide opportunities to better apply construction knowledge and experience by improving the interface of project engineering, construction, and maintenance personnel.

### **Applications**

- Networked database of constructability ideas and lessons learned
- 3D solid modeling with physical interference detection and an integrated database for controls
- Bar-coding technology for materials management, tool control, document control, and worker training
- Electronic data interchange with suppliers to increase efficiency of the purchasing cycle

- Hand-held, user-friendly, durable pen-to-screen field notebook computers facilitate virtually all forms of field information management, including daily diary, materials management, progress tracking, and field inspections
- Graphical computer analysis and simulation of heavy lifts
- Expert systems as advisors on such issues as scoping of modularization/preassembly, selection of welding procedures, diagnosis of weld problems, diagnosis of pump problems, and diagnosis of rotating machinery vibration problems.

## **DESIGN AND PROCUREMENT CONCEPT 1**

*Design and procurement schedules are construction-sensitive.* Construction normally is the largest cost segment of a project and thus exerts great cost leverage on a backward-pass schedule through both procurement and design. Procurement, other than for lead times, has a moderate ability to conform to the needs of the construction segment of the overall schedule. Design is a complex and demanding process, but frequently it is the most fruitful area in optimizing the entire project schedule. Owners and their project managers should be sensitive to cost and schedule trade-offs over the entire period of project activity. Needed skills of constructability coordinator include construction knowledge and experience, teamwork skills, communication skills, awareness of trade-offs, and receptiveness to new ideas.

### **Notes**

- The focus is on definitive development of design and procurement schedules.
- The semi-detailed master construction schedule with major milestones must be established first.
- A non-conventional design sequence may be necessary.
- Details include:
  - Deliver plans and specs early enough to allow for job-site preplanning.
  - For large orders with multiple stages deliveries, specify the sequence of delivery.
  - Be aware of “area sterilization” effects (in which access to areas is limited for one reason or another).

## **DESIGN AND PROCUREMENT CONCEPT 2**

*Designs are configured to enable efficient construction.* The desired result is to facilitate the exchange of ideas between construction and design professionals before pencil-and-paper design activities occur. The following factors should be kept up front in constructability deliberations.

Simplicity is a desirable element of any constructable design, as is flexibility for the field construction forces to select alternative methods of innovative approaches. Sequencing of installation is as much a design consideration as it is a procurement or construction consideration. And designs that require special skills should be minimized, along with ones that are highly labor-intensive.

### **Notes: The “Simplified Design” Litmus Test**



- Could the design be accomplished with fewer components? [Value Engineering approach: Can the part be eliminated altogether?]
- Are the materials readily available? Have you used common sizes? Can the engineered equipment be purchased off the shelf?
- Have you minimized demands for extraordinarily skilled craftsmen?
- Can the task be accomplished without special environmental controls (shelter, HVAC, lighting, etc.)?
- Have you provided for a field capability for dimensional adjustment?
- Have you avoided making the task more sequential-dependent than necessary?
- Have you accommodated special handling, inspection, or testing requirements?
- Have you provided an incentive for the contractor to suggest a better design?

### **Applications: Lots!**

- Reduce scope of work by maximizing use of existing site utilities such as water/wastewater treatment, emergency generator, auxiliary steam, and start-up transformer and storage facilities.
- Increase the amount of life-cycle, cost-benefit analysis to contain “scope growth” for automated control systems.
- Consider reducing the number of pile caps by enlarging pile cap size.
- Consider elimination of transformer oil retention pits by routing drains to the plant drainage system for oil removal.
- Consider replacing concrete duct banks with direct burial cable or sand-encased PVC.
- Substitute lightweight flexible steel mesh for formwork for underground duct banks.
- Consider replacing elbow-plus-fittings or welded elbows with induction pipe bending technology. Benefits can be significant.
- In lieu of total replacement of underground pipelines, consider the slip-lining approach.

### **DESIGN AND PROCUREMENT CONCEPT 3**

*Design elements are standardized.* This concept addresses the achievement of cost and schedule benefits by using standardization--a process by which project elements are both regularly and widely used. Usually, the predominant trade-off is a cost reduction that results in time savings in construction and volume discounts in materials. Compare that to an increase in materials resulting from a more conservative design. Specific advantages of standardization include:

- Increased productivity from repetitive field operations
- Volume purchase discounts
- Simplified material procurement
- Reduced design time
- Greater interchangeability of spare parts during maintenance operations
- Reduced contingencies in estimates

### Notes

- Standardization offers many benefits.
- Many aspects of design and equipment selection can be standardized.
- Questions to ask:
  - Where do you suffer from excessive variation?
  - How should the standard be determined?
  - How can standardization analysis be made part of the design process?

### Applications

- Lack of standardization is often a problem for pipe valves, pumps, condensers, instrumentation (e.g., transmitters), switchgear, turbine accessory skids, and paints/coatings.

## DESIGN AND PROCUREMENT CONCEPT 4

*Construction efficiency is considered in specification development.* Construction knowledge and experience can contribute significantly to the generation of specifications that promote efficiency in field construction operations. Constructability can be enhanced by recognizing the following:

- The underlying corporate guide specifications should offer clear-cut options.
- Specification development within a project should be done as a distinct project activity with full and early involvement of personnel with appropriate construction knowledge and experience.
- Sufficient time should be allowed to develop complete, consistent, and error-free specifications.
- Clarity is sought as one of the prime characteristics of a good specification.
- A single construction specification should cover all appropriate aspects of a single subject or component.
- The cost saving potential of “or equal” specifications often is balanced against the risk involved.

- Specifications should be maintained in order to include the most current cost-effective, state-of-the-practice techniques and materials.
- “Gold-plated” specs should be avoided.
- Specifications should be conducive to “global” procurement.
- Where appropriate, consider the use of a performance-type spec to increase contractor/vendor flexibility and cost-effectiveness.

## Notes

- Both specification content and the manner of its communication can affect constructability.
- Why do such problems persist?
  - Spec development is often a rushed activity.
  - Constructability is often neglected in spec review.
  - Truly capable automated information systems are only now becoming available.

## Applications

- Project close-out reports should address specification-related problems and lessons learned should be documented and reviewed periodically.
- Specifications should facilitate the use of recent low-cost technological developments, such as:
  - Geotextiles for troublesome soils or slopes
  - Flowable fill (or “fill-crete”) in lieu of normal compacted fill
  - Concrete superplasticizer admixtures
  - Fly-ash as a cement substitute (that improves workability and reduces heat of hydration)
  - Epoxy-set anchor bolts
  - Lightweight high-strength fiberglass beams and gratings
- Consider using 50 KSI steel rather than 36 KSI steel for building structures. The higher-strength steel is more costly per pound, but cross sections may be reduced, reducing both steel tonnage and foundation sizes.

## DESIGN AND PROCUREMENT CONCEPT 5

*Module/preassembly designs are prepared to facilitate fabrication, transportation, and installation.* Once the decision has been made to use modularization, preassembly, and/or prefabrication, special factors must be addressed during design and procurement to ensure their successful implementation. Designers should first consider where the fabrication is to be performed. Module/preassembly designs add requirements for transporting and handling large assemblies. These activities form a revised scope for the project and introduce key physical or schedule restraints based on the availability of transportation and handling equipment. Finally, the installation method must be considered because it affects module design, overall plot layout, and design of underground services and foundations.

## Notes

- Design considerations include:
  - Design/procurement organization restructuring
  - Engineering criteria/specifications
  - Work packaging/technical documentation
  - Module scoping/sizing/orientation - Module transport/handling methods - Module weight/c.g.
  - Module-to-Module connections/QA-QC requirements
  - Module structural support
  - Module temporary support
  - Module fabricator selection/component procurement
  - Winterization/hazards minimization
  - Fabrication yard layout, staffing, and management

## Applications

- Each module should be treated as a mini-project unto itself for the purposes of scoping, engineering, drawing/specification production and work packaging, fabrication, and installation. Project organization and control systems should be modified accordingly.
- In general, modules should be designed as large as shipping constraints will allow.
- On-site boiler assembly will be facilitated with exceptionally tight control of boiler component fabrication tolerances.
- Precast concrete underground manholes and sumps often are subjected to settlement problems. Innovative foundation leveling and compaction methods are needed. Flowable fill (high-slump concrete) may offer an answer to this problem.

## DESIGN AND PROCUREMENT CONCEPT 6

*Designs promote construction accessibility of personnel, material, and equipment.* Difficult access for personnel, material, and equipment on the project can have a negative impact on the project's success. Difficult access for personnel can have a severe impact on productivity. In addition, difficult access routes frequently present unsafe working conditions. Similarly, difficult access routes for high volume commodity materials can adversely affect cost and schedule. Accessibility studies of major equipment pieces and temporary erection access openings are as important as those for personnel and commodities. Specific issues that should be considered include:

- Sequencing of work
- Delivery schedules for major pieces of equipment
- Laydown areas on congested sites
- Delivery routes
- Use of permanent elevators for personnel lifts

- Installation and location of underground work to be traversed later by heavy equipment
- Type, location, and required opening size for equipment

## Notes

- Poor accessibility can be costly.
- Accessibility problem tell-tales:
  - Remote sites
  - Tight sites/CBD sites
  - Road restrictions/limitations
  - Large loads
  - Steep grades
  - Elevated work/overhead work
  - Weak soils/muddy sites
  - Congested areas/concurrent scheduling
  - Security restrictions
  - Operating plant restrictions
  - Overhead obstructions/power lines
  - Sites with adjacent construction power lines
  - Add-ons and modifications to existing plants
  - Extreme weather
  - Strikes
- How can accessibility be enhanced?
  - Use effective activity planning/sequencing.
  - Use effective plant layout.

## Applications

- Accessibility is obviously critical for installation of large pieces of equipment and modules in general; this applies to the cranes needed for installation as well.
- Accessibility for modularization is greatly facilitated by having a port/shipping channel or a rail spur that allows for increased module sizes.
- Pipe rack designs should provide adequate space for insulation, coatings, and worker head room.
- Heavy haul roads should be designed such that their utilization is not diminished by cross-traffic, excessive rain, or inadequate bearing capacities.
- Enhance site accessibility by maintaining an effective site drainage system. Plan for ditch crossings with minibridges, temporary culverts, and cover plates. With a high water table, be prepared to use sump pumps.

## DESIGN AND PROCUREMENT CONCEPT 7

*Designs facilitate construction under adverse weather conditions.* It should be recognized that adverse weather conditions can have a significant impact on construction cost and schedule. In many cases, however, the effects of adverse weather can be alleviated with proper consideration in the design of the project. Typical activities that may reduce the effects of adverse weather are:

- Planning site layout that is accessible
- Selecting construction materials
- Use of off-site pre-assembly
- Scheduling of design
- Minimizing subsurface construction that involves de-watering
- Planning construction lighting
- Allowing for adequate site drainage
- Scheduling and controlling delivery of equipment and materials to avoid unnecessary protection requirements
- Providing adequate temporary protected storage areas.

### Notes

- To what extent will weather affect your project?
- What can you do about it?
  - Effective sequencing of activity
  - Modularization/preassembly - Proper selection of materials
  - Judicious project layout/design

### Applications

- Cut drainage ditches and place road bases as soon as possible to enable productive work during rainy weather.
- Minimize problems with dust or smoke by locating wind-borne material stockpiles down wind and away from easily affected construction activities.
- Hot weather concreting can be facilitated with the use of chilled water or ice.

## DESIGN AND PROCUREMENT CONCEPT 8

*Design and construction sequencing should facilitate system turnover and start-up.* This concept establishes that the overall project schedule for complex projects shall integrate turnover and start-up sequencing with design and construction sequencing. Recognizing that high penalties are paid to change construction sequences (with a possible corresponding change in design sequence), it is important that the overall start-up planning process begin early in the facility-delivery process. The sooner planning begins, the fewer start-up problems crop up that result in increased costs and delays. The longer the overlap between the start-up phase and the construction phase, the more important becomes early integration of start-up into the overall project plan. Of equal importance to integrated project planning is the need to identify start-up requirements that have a direct impact on design, such as special piping connections, environmental considerations, and electrical power requirements.

### **Notes/Applications**

- Facilitate start-up by converting from an area-based schedule to a systems-based schedule when approximately 75% of construction is complete.
- Start-up planning is critical for several reasons:
  - There is a significant amount of concurrent activity.
  - Design/vendor support is often required.
  - Hazardous operations require more attention to safety.
  - As the work force is downsizing, staffing may be a problem.
- Check out digital control systems and major equipment in the factory prior to shipment (substituting simulators for external interfaces).

### **FIELD OPERATIONS CONCEPT**

*Constructability is enhanced when innovative construction methods are used.* Obviously, there is also a need to apply construction knowledge and experience to improve the effectiveness of field operations. Construction method innovations are numerous and typically “small” advances. These should not be overlooked, however. Collectively, the potential benefit is substantial. Innovative construction methods may involve a variety of issues:

- Sequencing field tasks
- Use of temporary construction materials/systems
- Use of hand tools
- Use of construction equipment
- Constructor-optional preassembly
- Post-bid constructor preferences relevant to the layout, design, and selection of permanent materials

### **Notes**

- Some constructability benefits may still be available during field operations. To some extent, constructors can still reap constructability benefits from their actions alone.

- There is a need to share construction innovations within and across field organization boundaries.
- These innovations are often small in scope or scale, yet are numerous in quantity. Collectively, the effect can be very significant!

There are seven classes of innovative construction methods:

- Innovative, definitive sequencing of field tasks
  - Innovative uses of temporary construction materials and systems
  - Innovative development and uses of hand tools
  - Innovative uses of construction equipment
  - Constructor-optional preassembly - Innovative temporary facilities
  - Post-bid economical constructor preferences related to layout, design, and/or selection of permanent materials
- Two related topics:
    - Promotion of innovation; see *Tucker's Tidbits*, a newsletter for the exchange of craftsman ideas.
    - Awareness and application of advanced construction technologies.

## Applications

- Examples of innovative sequencing of field tasks:
  - Effective preplanning/sequencing of the setting of boiler boxes enhances crane usage and overall task productivity
  - Underground construction should be sequenced so as to minimize excavation (and compaction) efforts.
  - Install the permanent fire water system early for use in hydrotesting.
- Examples of innovative uses of temporary construction materials:
  - Flexible, easily erected, left-in-place, chicken-wire type mesh has been used in lieu of conventional formwork for underground duct banks and spread footings.
  - Demolition of large boulders and concrete structures (including foundations) is made easier and quieter with the use of expansive grouts placed within drilled holes.
  - Stack and large vessel fabricators should provide the foundation contractor with a template of the anchor bolt arrangement in order to facilitate proper alignment.
- Examples of innovative hand tools may be found in issues of *Tucker's Tidbits*.
- Innovative construction equipment developments include the following:
  - Automatic wire feeders for casing work
  - Automatic shoring adjusters
- Common examples of constructor preassembly include pipe fabrication and reinforcing steel cages.



ATTACHMENT A

**CONSTRUCTABILITY CONCEPTS  
SUGGESTION FORM**

**PROJECT TITLE:**

\_\_\_\_\_

**DISCIPLINE GROUP:**

\_\_\_\_\_

**CONCEPT DESCRIPTION:**

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**ORIGINATED BY:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

**OFFICE COMMENTS:**

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**REPLY:** \_\_\_\_\_

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<b>TOTAL</b>	\$	\$	
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<p><b>STATUS KEY:</b>  A = ACCEPTED  C = UNDER CONSIDERATION  NA = NOT APPLICABLE TO THIS PROJECT  R = REJECTED</p>	<p><b>TOTAL % COMPETITION</b>  DESIGN :  CONSTRUCTION:  PROGRAM COST TO DATE:</p>
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ATTACHMENT C

**CONSTRUCTABILITY “LESSONS LEARNED”  
REPORTING FORM**

**PROJECT TITLE:**

\_\_\_\_\_

**DISCIPLINE GROUP:**

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**LESSONS LEARNED:**

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**ORIGINATED BY:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

**OFFICE COMMENTS:**

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**REPLY:** \_\_\_\_\_

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ATTACHMENT E

**CONSTRUCTABILITY REPORT FOR  
MONTHLY ENGINEERING SUMMARY**

**PROJECT TITLE:**

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**DISCIPLINE GROUP:**

\_\_\_\_\_

**Constructability:**

Concepts: \_\_\_\_\_ (this month)

Concepts accepted: \_\_\_\_\_ (this month)

Total concepts accepted: \_\_\_\_\_

Total Program Cost: \_\_\_\_\_

Total Potentially Avoided Cost: \_\_\_\_\_

Total Value Added Cost: \_\_\_\_\_

**\*Optional\*** Describe any concepts that had a major affect on the project.

**CONCEPT**

**DESCRIPTION:** \_\_\_\_\_

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**ORIGINATED BY:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

## MEETING NOTES

### Attachment A

#### **0.0 PROGRAM OBJECTIVES**

- Implement a rigorous constructability program following The University of Texas System, UT Health Science Center at Houston Constructability Manual.
- Identify and document project cost and schedule savings (targeted costs are 5% of construction costs).

#### **1.0 PROGRAM IMPLEMENTATION 1.1      Project Team Meeting with Constructability Consultant**

(Initial meeting)

##### **1.1.1 Constructability Implementation**

- Review Constructability Manual for constructability program, implementation and documentation requirements.
- Establish constructability organization following the Constructability Manual.
- Identify preliminary constructability priorities and special challenges or concerns.

##### **1.2 Schematic Design Phase**

(On-going tasks during Schematic Design Phase and for final review of Schematic Design Documents)

##### **1.2.1 Constructability Consultant**

- Attend project team meetings, review documents, and develop constructability recommendations and documentation following the Constructability Manual.
- Provide construction cost estimates to coincide with the Project Architect's submissions. The Project Architect and Constructability Consultant shall consult and resolve any differences in their respective construction cost estimates.

##### **1.2.2 Project Team and Constructability Consultant**

- Review constructability recommendations, documentation and construction cost estimates for acceptance.

##### **1.3 Design Development Phase**

(On-going tasks during Design Development Phase and for final review of Design Development Documents)

### **1.3.1 Constructability Consultant**

- Attend project team meetings, review documents, and develop constructability recommendations and documentation following the Constructability Manual.
- Provide Cost Quantity Surveys to coincide with the Project Architect's submissions. The Project Architect and Constructability Consultant shall consult and resolve any differences in their respective Cost Quantity Surveys.

### **1.3.2 Project Team and Constructability Consultant**

- Review constructability recommendations, documentation and Cost Quantity Surveys for acceptance.

## **1.4 Construction Documents Phase**

(On-going tasks during Construction Documents Phase and for final review of Construction Documents)

### **1.4.1 Constructability Consultant**

- Attend project team meetings, review documents, and develop constructability recommendations and documentation following the Constructability Manual.
- Provide Cost Quantity Surveys to coincide with the Project Architect's submissions. The Project Architect and Constructability Consultant shall consult and resolve any differences in their respective Cost Quantity Surveys.

### **1.4.2 Project Team and Constructability Consultant**

- Review constructability recommendations, documentation and Cost Quantity Surveys for acceptance.

## **1.5 Close-out Documentation**

### **1.5.1 Constructability Consultant**

- Complete all documentation following the Constructability Manual.

### **1.5.2 Project Team and Constructability Consultant**

- Review documentation for acceptance.