Technology Infrastructure Design Guide

June 1, 2022

Approved by: _____

OIT Infrastructure Services — Date
Eddie Sorensen, Sr. Director

Approved by: _____

OIT/Digital Transformation — Date
Troy Martin, AVP/CTO

Approved by: _____

Facilities / Engineering — Date
Frank Young, AVP

Prepared by:

Utah Valley University
Information Technology Services

and

SUMMIT
Engineering & Consulting P.S.
www.summiteng.com

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1 Preface

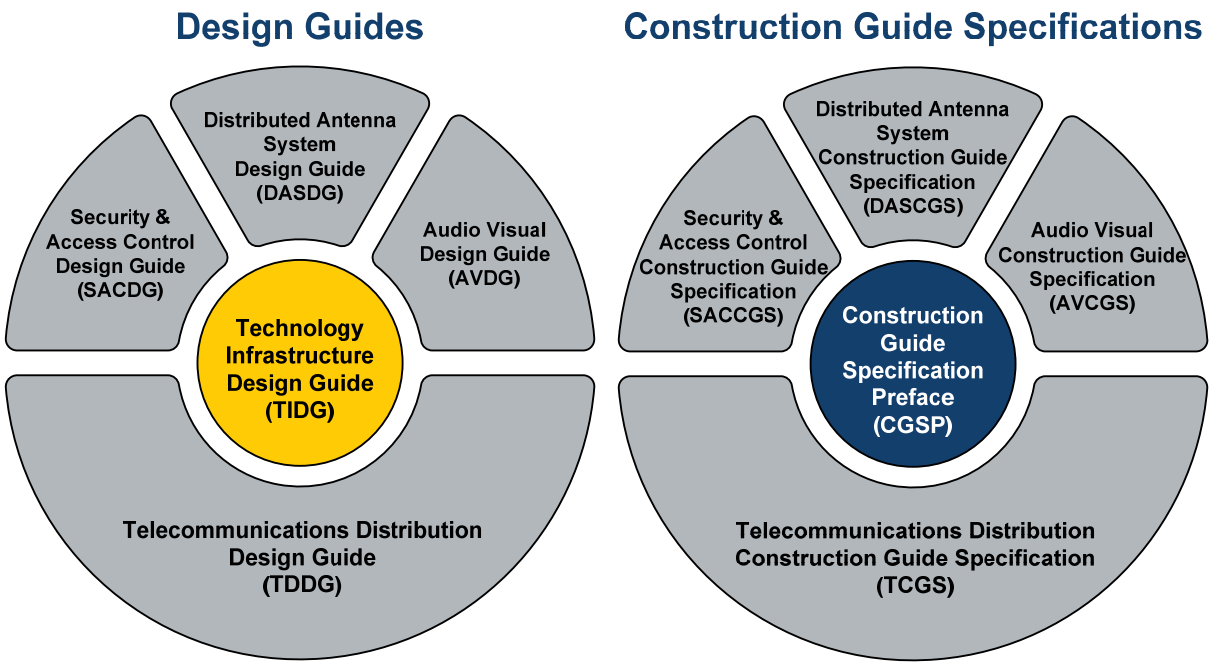
1.1 Introduction

A. The Technology Infrastructure Design Guide (TIDG) is written to communicate the requirements of Utah Valley University (UVU) for the design and installation of technology infrastructure and systems at UVU facilities.

- The TIDG is written for an audience of Architects, Engineers and Designers who are responsible for the design of new or remodeled facilities for UVU where telecommunications distribution systems currently exist or will be installed.
- It is also intended for other low voltage telecommunications Contractors and subcontractors installing telecommunications distribution systems at UVU facilities.
- This document also applies to infrastructure designed and installed by UVU staff, when a formal design is not developed.

B. The TIDG belongs to a set of documents (depicted below) that comprise the standard design and installation practices for all facets of technology infrastructure and systems at UVU's facilities. This document forms the core of the Design Guides document set.

Technology Infrastructure Standards Document Set



C. The Technology Infrastructure Design Guide (TIDG) contains information common to all of UVU's Design Guides.

D. The Construction Guide Specification Preface (CGSP) is a key companion to the TIDG.
- Designers shall adapt the various Construction Guide Specification sections "as written" for creating specifications for a particular project according to the instructions in the TIDG. In other words, Designers shall use the electronic specification section documents (provided by UVU in MSWord format) and then shall make any project-specific edits to the specifications in those documents. All changes to the specifications shall be done using the "Revision Tracking" features in MSWord.
- Rewriting sections in the Construction Guide Specification or modifying the format structure or requirements will not be accepted.

E. It is the responsibility of the Designer of technology infrastructure for UVU to coordinate with the other designers on a project (architectural, electrical, mechanical, etc.) to determine that other systems are both compatible with and complementary to the technology infrastructure. It is critical to coordinate between disciplines during the design phase of a project, rather than making adjustments in the field during construction.

F. This document was prepared by the Information Technology Services department at Utah Valley University and by Summit Engineering & Consulting, P.S. As technology and needs evolve, the document will be periodically updated.

- May 1, 2013 – Originally published
- January 4, 2016 – First Revision
- June 1, 2022 – Second Revision

1.2 Low Voltage Systems

Wherever practical, telecommunications pathway and cabling systems designed for UVU facilities are expected to support and integrate the complete set of building automation systems and other low voltage systems that convey information and operate facilities, and provide capacity for future growth. Telecommunications infrastructure shall be designed in accordance with the requirements in ANSI/TIA/EIA 862 – Building Automation Systems Cabling Standard for Commercial Buildings, and the requirements in this document, to support the Ethernet telecommunications channels on low-voltage devices. Throughout this document, references to "low voltage systems" shall include those referenced in ANSI/TIA/EIA 862, and shall be subject to specific requirements in that standard and as discussed below.

1.2.1 SHARED OSP MEDIA AND PATHWAY

A. The common outside plant (OSP) telecommunications media (cabling) shall be singlemode fiber optic cable and 24 AWG unshielded twisted pair (UTP) copper cable. The common OSP telecommunications media is intended for shared use by the following low-voltage systems, in addition to voice and data systems. The OSP telecommunications pathway infrastructure and media are intended for shared use by all low-voltage systems (not just voice and data systems).

B. Multimode fiber optic cabling shall not be installed at UVU facilities.

1.2.2 SHARED ISP MEDIA AND PATHWAY

A. The common inside plant (ISP) telecommunications ***pathway*** is intended for ***shared*** use by all low-voltage systems (not just voice and data systems).

B. The common inside plant telecommunications media shall be singlemode fiber optic backbone cabling, Category 6A-rated 24 AWG UTP copper cable for data and Category 3/5/5E-rated 24 AWG UTP copper cable for voice. ***Backbone*** cabling is permitted to be ***shared*** by all low-voltage systems (not just voice and data systems). ***Horizontal*** cabling serving these systems shall be dedicated (***not shared***) to each system.

C. Multimode fiber optic cabling shall not be installed at UVU facilities.

D. Inside plant telecommunications infrastructure intended to support Ethernet telecommunications (or other similar protocols for security, building automation/environmental and fire alarm systems) shall be designed in accordance with the inside plant telecommunications infrastructure requirements in this document and coordinated with the OIT Project Manager. However, due to the critical nature of these systems, inside plant pathway and cabling serving these systems shall typically homerun to a Mechanical Room or other Low Voltage Electronics Room rather than to a common shared telecommunications room.

E. Where low-voltage systems require different media (other than fiber optic cabling and 24 AWG UTP), the systems shall be designed to comply with the pathway and space requirements of this document. UVU anticipates the future convergence of most low voltage systems and requires the pathways and spaces to be designed now to support telecommunications cabling in the future.

F. The Designer shall design pathway and cabling to serve these systems, in cooperation with the other design disciplines on a project.

1.3 Standards and Guidelines

A. Generally speaking, UVU adopts most industry standards for technology infrastructure. ANSI/TIA/EIA, BICSI, Infocomm and other organizations are primary producers of industry standards and best practices. Refer to each Design Guide for the specific standards and guidelines associated with each subject.

B. It is mandatory to adhere to and comply with the listed codes, standards and industry practices, as well as the UVU requirements contained in the Technology Infrastructure Standards Document Set. Refer to each Design Guide for the specific codes, standards and guidelines associated with each subject.

C. The requirements contained in UVU's Technology Infrastructure Standards are considered to be in compliance with those required under contract with the State of Utah. Where the requirements differ, the issue shall be brought to the attention of the UVU Facilities Project Manager – otherwise, the more stringent requirement shall apply.

D. In some cases, the Designer may be required to use products from specific manufacturers in the design (unless otherwise directed by UVU) and to design systems that will be suitable for the use of products from these manufacturers. The construction documents shall require that the Contractor's installation workmanship fully comply with the current installation requirements from the manufacturers of these products.

E. Any request to deviate from the requirements of the National Electrical Code will not be accepted.

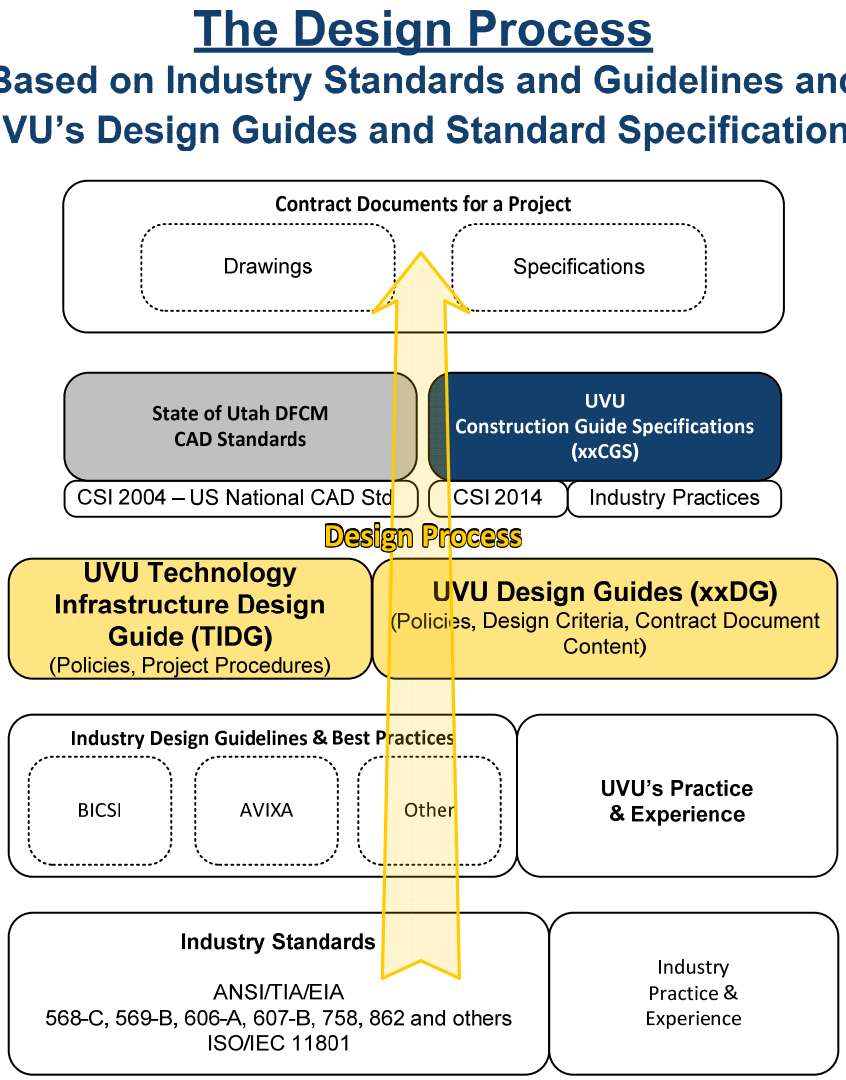
F. The Designer shall seek approval for designs that are not consistent with UVU's requirements. Requests to deviate from industry standards or UVU design solutions will be considered on a case-by-case basis by the applicable UVU Technology Project Manager (TechPM). Designers shall contact the TechPM to discuss proposed alternatives before spending significant time pursuing the option.

1.4 Document Intent

A. The Design Process diagram below depicts the relationships between industry standards, industry design guidelines/best practices, UVU's Design Guide, UVU's Construction Guide Specification documents and the project-specific Construction Documents.

B. UVU's Technology Infrastructure Standards provide directions for making standards-compliant design decisions that will, in due course, be reflected in Construction Documents for a project. The Construction Documents will be comprised of drawings and specifications that properly incorporate technology infrastructure and systems within a project. The Design Guides shall be used in conjunction with the Construction Guide

Specifications. Drawings shall conform to the guidelines contained in the Design Guide documents for content and completeness, and the specifications shall be based upon the Construction Guide Specifications.



1.5 Document Structure

The TIDG is organized in the following sections:

1. Preface
2. UVU Technology Infrastructure Procedures
3. Project Procedures
4. Appendices

A. The **Preface** (this section) describes this document, its intent and its relationship to industry standards, practices and the various audiences affected by the document. It also describes how to use this document.

B. The **Project Procedures** section describes the required qualifications for telecommunications Designers as well as the procedures that Designers must follow when working on telecommunications infrastructure projects at UVU facilities. It includes activities that are required throughout the project as well as phase-specific requirements.

C. The **Appendices** section provides standard forms and diagrams along with example forms and diagrams that are required for UVU telecommunications infrastructure.

1.6 Types of Buildings and Spaces

Many of UVU's buildings have multiple building-type spaces within the building. For example, an academic building will have academic spaces and office spaces, and may also have research spaces, public gathering spaces, etc.

Building/Space Type	Definition
• Academic Buildings	Classrooms, lecture halls, auditoriums, teaching labs
• Research Spaces	Research labs, freezer/refrigerated spaces, or other spaces containing specialized research equipment
• Office Spaces	Offices and conference rooms
• Public Gathering Spaces	Student lounges, lobbies for stand-up meetings or gatherings, outdoor meeting spaces
• Warehousing or Industrial Buildings	Storage buildings for materials or equipment, campus utility buildings
• Converted Residential Offices	Homes converted into office space
• Data Centers	Data centers or other spaces supporting critical network equipment
• Fine Arts Production	Spaces for instruction, production and performance of artistic events
• Student Life and Wellness Center	Athletic and recreational facilities

The Designer shall assume that adherence to BICSI guidelines, referenced industry standards, and UVU's standards are required (unless specifically indicated otherwise) for all facility types. Where exceptions are permitted, this document set will specifically highlight the construction type where UVU's requirements may differ from generally applicable practices and standards.

Adherence to applicable Code is always required.

1.7 Construction Types

For the purposes of this document set, construction projects are categorized by the extent of the construction work, as follows:

Construction Type	Definition
• New Construction	A new building
• Full Remodel	An existing building undergoing extensive remodeling, frequently including reallocation of internal spaces
• Minor Remodel (Workspace Remodel)	An existing building undergoing adjustments to office/work spaces. The project typically does not include changes to building systems (HVAC, electrical, etc.)
• Classroom Enhancement	An existing academic building undergoing updates to classrooms, including the technology features
• Tenant Improvement	An existing building undergoing adjustments to suit the purposes of a non-UVU tenant
• Technology Upgrade	Projects primarily focused on upgrading technology infrastructure or systems. These projects may involve minor remodeling
• Outside Plant	Projects involving the installation of or adjustment to cabling between buildings, including the in-building terminations

Some projects will qualify as multiple construction types, for example:

- Minor Remodel + Tenant Improvement

The Designer shall assume that adherence to BICSI guidelines, referenced industry standards, and the TIDG are required (unless specifically indicated otherwise) for all extents-of-construction. Where exceptions are permitted, this document will specifically highlight the construction type where UVU's requirements may differ from generally applicable practices and standards.

Adherence to applicable Code is always required.

1.8 UVU Personnel

A. There are several defined UVU personnel roles referenced in this document. The Designer shall interact with these individuals as direct points of contact:

- **Facilities Project Manager (FPM)** – responsible for project management, project oversight and project budget. There are two designated system project managers who report to the FPM:
  - **Access Control Project Manager (ACPM)** – responsible for access control systems and intrusion detection systems.
  - **Building Automation Project Manager (BAPM)** – responsible for building automation systems and environmental control systems.

- **Technology Project Managers (TechPM)** – responsible for oversight of an assigned subset of UVU's technology considerations, including interpretation of the requirements of this document. There are three designated technology project managers, who report to the Senior Director of OIT:
    - **Information Technology Project Manager (ITPM)** – responsible for fiber optic cabling, television distribution, telecommunications rooms, outside plant pathways and cabling and distributed antenna systems – see the TDDG.
    - **Telecommunications Project Manager (TPM)** – responsible for oversight of all technology considerations related to the telecommunications infrastructure. Specifically focused on horizontal cabling and pathways, riser/backbone copper cabling and pathways – see the TDDG.
    - **Audio Visual Project Manager (AVPM)** – responsible for oversight of all technology considerations related to the audio / visual infrastructure, video surveillance infrastructure and related systems, and digital signage – see the AVDG.

B. The UVU Technology Infrastructure Policy section of this document (Section 2) applies specifically to internal UVU personnel. In addition to the UVU Technology Infrastructure Policy section, UVU personnel should be aware of the instructions, requirements and guidelines for Designers contained in the other sections of this document. Also, the Construction Guide Specification contains additional requirements related to technology infrastructure materials and installation methods applicable at UVU facilities.

C. UVU personnel should be familiar with these requirements with respect to their application on both large-scale technology projects and small-scale "moves/adds/changes" projects. These requirements also apply to in-house operations and maintenance of existing systems.

1.9 Technology Infrastructure Designers

Technology infrastructure Designers shall be responsible to apply the guidelines, instructions and requirements in this document and adapt the Construction Guide Specification sections, in the course of designing technology infrastructure and systems at UVU facilities.

1.10 Contractors and Cabling Installers

Contractors and installers involved in projects without a formal engineering and design process shall be fluent with and adhere to the requirements of the Design Guide document set and also the requirements contained in the applicable Construction Guide Specification (xCGS) document set.

1.11 Required Manufacturers (Basis of Design)

A. This document set specifies certain manufacturers and materials comprising a Basis of Design.

B. Technology infrastructure shall be designed for construction using these materials and manufacturers.

C. UVU derives significant benefits from standardizing on specific materials for its technology infrastructure. To comply with applicable laws, UVU will also accept equal or better solutions comprised of manufacturers other than the ones required by UVU. However the following two conditions must be met:

- The Designer or Contractor proposing a different manufacturer or product line shall demonstrate that **all** of the properties of the alternative solution meet or exceed the performance characteristics of the manufacturers and products specified in these documents. The Designer or Contractor shall follow the Standards Variance Request process defined in the Technology Infrastructure Design Guide.
- Pre-approval of UVU TechPMs (in their sole judgment) must be sought and obtained prior to bidding or designing based on alternative manufacturers or product lines.

1.12 Copyright

Summit Engineering & Consulting retains the copyright for this document. Utah Valley University is authorized to edit and adapt the document.

Summit Engineering & Consulting has authored similar documents for many other organizations. The document is intended (in part) to describe best practices that are found in some segments of the industry. As a result, portions of this document are similar to comparable content in documents previously prepared by Summit Engineering & Consulting for other organizations. This document does not contain any information that is proprietary or confidential to other organizations.

3 Project Procedures

A. The Project Procedures section contains guidelines for architects, engineers and technology infrastructure designers regarding the procedures that UVU requires for projects that include technology infrastructure and systems. This applies both to projects that entail primarily technology infrastructure work (such as telecommunications upgrade projects) as well as to architectural projects and other work (such as a new building) that involve technology as part of the building.

B. This section is not intended to supersede the State of Utah contract requirements, but rather to complement them, providing additional requirements that apply specifically to technology design in projects at UVU facilities.

C. It is intended that the requirements in this section be considered contractually binding for professional design firms providing technology design services.

3.1 Designer Qualifications

A. For the purposes of this document set, the term “Designer” shall be a person with specific technical expertise as defined in each individual Design Guide. There are unique qualification requirements for the designer of each technology subject.

B. The services of a professional engineer (PE) shall be required to design the following aspects of a complete technology infrastructure.

- Grounding and bonding
- Firestopping
- Electrical power distribution in telecommunications spaces
- Standby generator and associated other backup power systems
- Telecommunications room cooling systems

C. The services of a licensed fire protection engineer shall be required to design fire protection and life safety systems.

3.2 Architect/Engineer Teams

It is imperative that the technology infrastructure design be incorporated during the preliminary architectural design phase. To accomplish this, the architects and engineers on the design team shall work closely with the Designer, the UVU FPM, and the UVU TechPM beginning with the Pre-Design phase of the project.

3.2.1 CROSS-DISCIPLINE COORDINATION

Successful projects involving technology infrastructure require frequent, thorough design coordination between the disciplines involved in the project. The Designer shall be

primarily responsible to coordinate the technology requirements and design features with the designs produced by the other Designers on the project.

At a minimum, the following aspects of the design shall be coordinated:

3.2.1.1 OUTSIDE PLANT INFRASTRUCTURE

- Ductbank routing around obstacles (trees, tunnels, buildings, existing ductbanks, etc.)
- Coordinate the locations of maintenance holes and hand holes to determine that they are not located in areas of water concentration. Site requirements, drainage, traffic, joint usage, utility requirements, etc.
- Proximity of ductbanks to sources of EMI, including power distribution feeders
- Proximity of ductbanks to steam piping
- Routing of entrance conduits through buildings
- Backbone cabling requirements of other disciplines (fire alarm, HVAC, security, CATV, etc.)

3.2.1.2 INDOOR UTILITIES AND FUNCTIONS

- HVAC cooling requirements for telecommunications rooms (TR) and A/V equipment rooms
- HVAC ductwork routing (avoiding TR ceiling spaces and A/V equipment room spaces, and allocating space to access cable trays)
- Routing of wire basket cable trays through ceiling spaces in congested areas (HVAC ductwork, plumbing, electrical, etc.)
- Plumbing routing (avoiding TR spaces and A/V equipment room spaces)
- Lighting requirements for TRs, A/V equipment rooms, classrooms and conference rooms
- Power requirements for TRs and A/V equipment rooms
- Power requirements for work areas (receptacle locations near telecommunications outlet locations and other devices)
- Proximity of cabling to sources of EMI
- Routing of conduits through and location of pullboxes in congested areas (HVAC ductwork, plumbing, electrical, etc.)
- Walls, paint, doors and floors in TRs and A/V equipment rooms
- Proximity of microphone and speaker wiring to sources of EMI
- Acoustic treatments for Classrooms, Auditoriums and Conference Rooms

More information regarding the above requirements is available in the Design Criteria section in each individual Design Guide.

3.3 Design Review Process

As noted in Section 3.5 titled “Procedures Related to Project Phases”, the project documents will pass through the design review process at the end of each design phase plus follow-up reviews when necessary. These requirements are in addition to the State of Utah contract requirements.

On some projects, UVU may hire an Independent Review Consultant to provide technical project oversight to UVU. The Independent Review Consultant will be responsible to review the overall design, paying particular attention to areas of the design that are related to the current or future operation and maintenance of the technical systems, including low voltage systems other than voice and data. The Independent Review Consultant will identify issues that do not appear to be compliant with the requirements in UVU's Technology Infrastructure Standards.

The following steps correspond to the numbered activities shown on the Design Review Process diagram below:

① Each time a review is required, the Architect / Engineer shall provide copies of the complete project documents set (drawings and specifications for all disciplines involved in the project) for the following people:

- UVU Facilities Project Manager (FPM) (one set)
- Each UVU Technology Project Manager (xxPM) (one set)
- Independent Review Consultant (one set)

ⒶⒷ The Independent Review Consultant will have 3, 5, or 10 days (depending on the project phase) to review the design documents and provide written Independent Review Comments to the UVU FPM and the UVU TechPM.

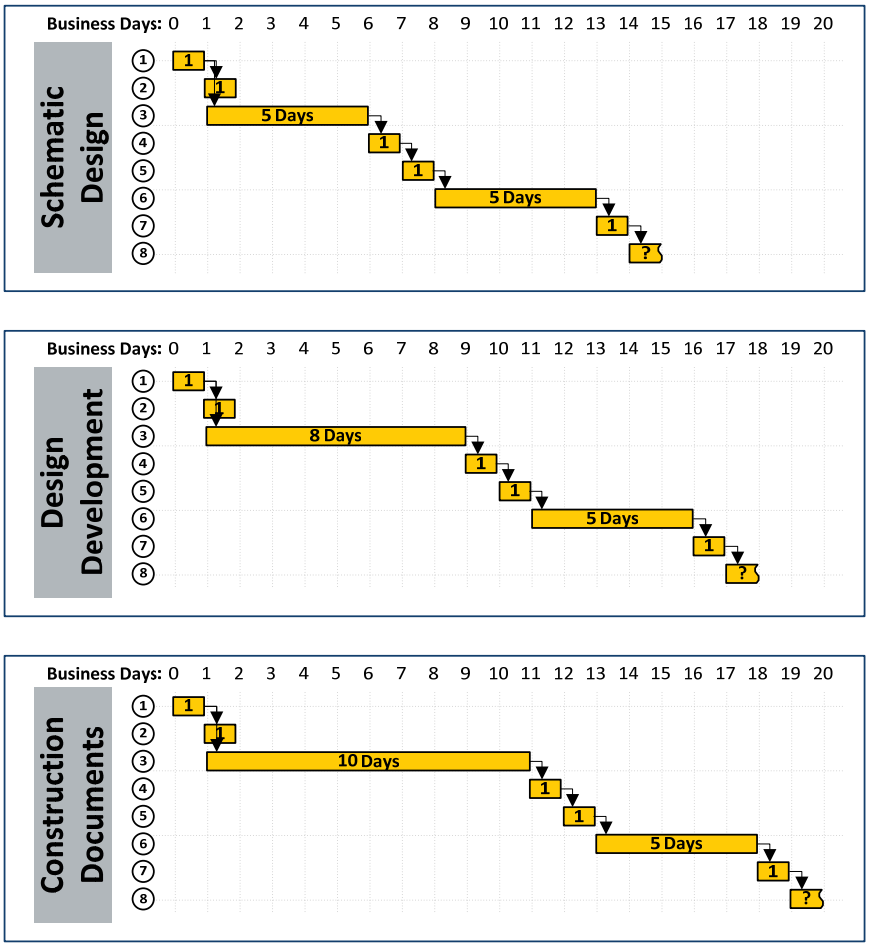
②③④ The UVU FPM and the UVU TechPM will have 5, 8, or 10 days (depending on the project phase) to review the design documents and the Independent Review Consultant's comments. The UVU TechPM will incorporate the Independent Review Comments into the TechPM's report. Following their review, they will distribute the complete set of comments to the Independent Review Consultant (if present on the project) and hold brief discussions about the comments. The UVU Technology Review Comments will then be sent to the UVU FPM for review.

⑤⑥ The UVU FPM will submit the Technology Review Comments to the Designer. The Designer will then be given five days to review the comments and respond to them in writing. Negative responses to any comment shall include a discussion of the reasons for non-compliance.

⑦⑧ Finally, a meeting or teleconference will be held with the UVU FPM, the UVU TechPM, the Independent Review Consultant and the Designer to discuss the review comments and the Designer's responses. Following the meeting, the Designer shall revise the design in accordance with UVU's resolution for each comment.

The following diagram depicts a typical technology design review process when an Independent Review Consultant is not involved in the review process. The number of days listed for #3 and #6 may need to be adjusted based on the scope or depth of the technology infrastructure and systems in a project.

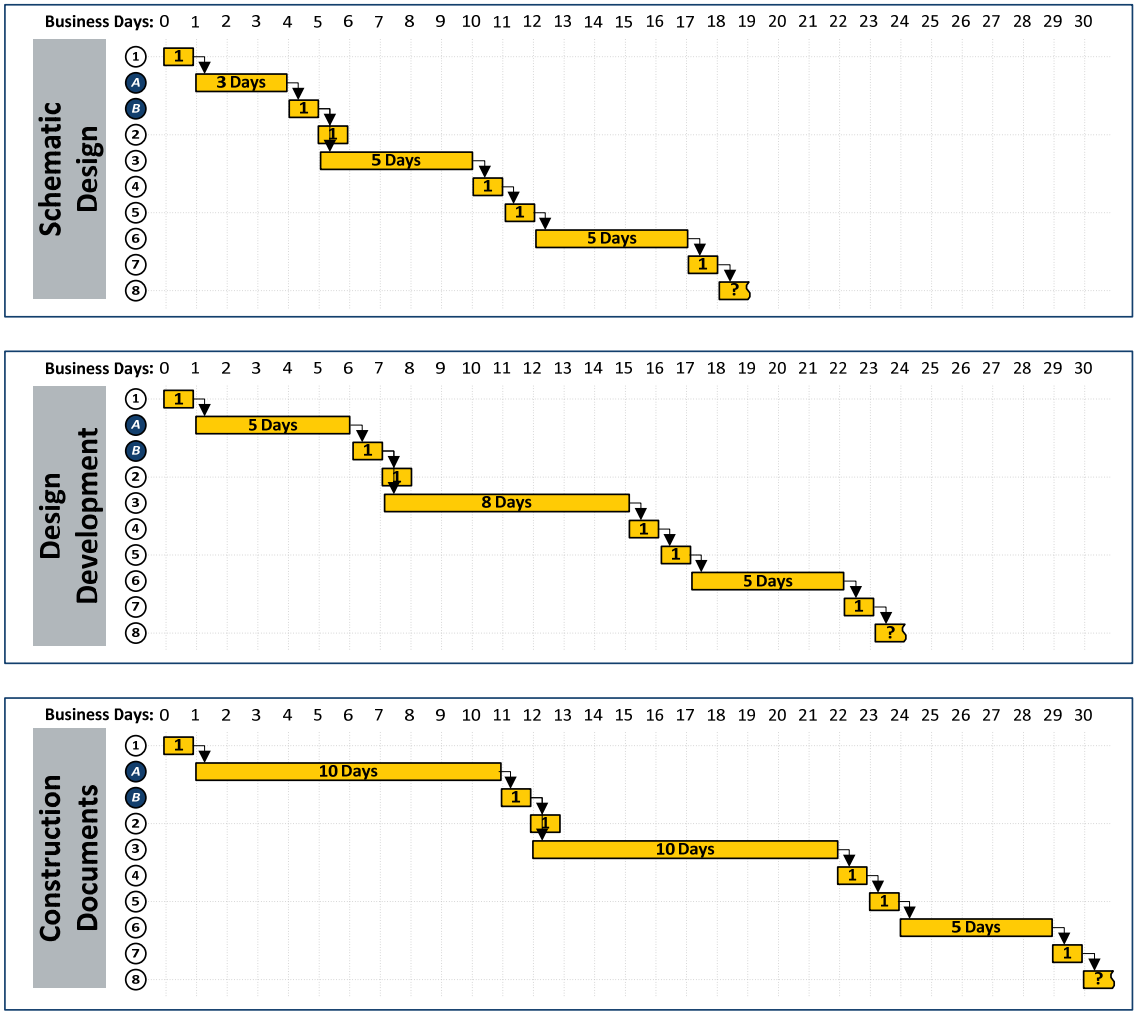
Design Review Process Without an Independent Review Consultant



1. Designer sends hard copy printed Drawings and Specifications to UVU Technology Project Manager and UVU Facilities Project Manager.
2. UVU FPM reviews the drawings and specifications.
3. UVU TechPM reviews the drawings and specifications and then produces Review Comments.
4. UVU FPM and UVU TechPM meet to discuss and finalize the Review Comments.
5. UVU FPM issues the Technology Review Comments to the Designer for response.
6. Designer provides a written response for each Review Comment and returns the Review Comments to UVU FPM.
7. UVU FPM and UVU TechPM meet to discuss the Designer's responses to the Review Comments and determine a course of action for each item.
8. Designer shall revise the design per the direction given in Step 7 (above). Designer shall then submit a second written response indicating how each Review Comment was resolved.

The following diagram depicts a typical technology design review process, including the Independent Review Consultant's role in the review process. The number of days listed for #A, #3 and #6 may need to be adjusted based on the scope or depth of the telecommunications systems on a project.

Design Review Process Involving an Independent Review Consultant



1. Designer sends hard copy printed Drawings and Specifications to Independent Review Consultant, UVU Technology Project Manager, and UVU Facilities Project Manager.

   A. Independent Review Consultant reviews the drawings and specifications and produces Review Comments.

   B. Independent Review Consultant delivers the Review Comments to UVU TechPM and UVU FPM.

2. UVU FPM reviews the Review Comments, drawings and specifications.

3. UVU TechPM reviews the Review Comments, drawings and specifications, and then adds additional Review Comments.

4. UVU FPM, UVU TechPM and Independent Review Consultant meet to discuss and finalize the Review Comments.

5. UVU FPM issues the complete set of Technology Review Comments to Designer for response.

6. Designer provides a written response for each Review Comment and returns the Review Comments to UVU FPM.

7. UVU FPM, UVU TechPM and Independent Review Consultant meet to discuss the Designer's responses to the Review Comments and determine a course of action for each item.

8. Designer shall revise the design per the direction given in Step 7 (above). Designer shall then submit a second written response indicating how each Review Comment was resolved.

A. The Designer shall require UVU to review the documents and respond with written review comments to the Designer at each phase of the design. The Designer shall not proceed with the next phase of design without receipt of written comments from UVU.

B. The Prime Consultant (typically the Architect) shall be responsible to determine that the review process is conducted in accordance with UVU's requirements, and shall participate in the review process to determine that the review comments are satisfactorily addressed.

3.3.1 INDEPENDENT REVIEW CONSULTANT

For projects where UVU hires an Independent Review Consultant, the prime consultant (Designer or A/E) shall provide one additional set of the drawings and specifications (from all disciplines involved in the project) for the Independent Review Consultant. The Independent Review Consultant will not perform any design services. The Independent Review Consultant could be asked to do the following:

3.3.1.1 TYPICAL DOCUMENT REVIEW SCOPE

1. Review telecommunications system design:

    - For compliance with UVU and industry standards
    - To identify apparent conflicts (routing, electromagnetic interference (EMI), etc.) with other disciplines' designs
    - For indications of coordination with television service providers or other utilities
    - For general document clarity

2. Review the completed needs analysis report.

3. Review the cutover plans.

The Independent Review Consultant shall review the documents according to UVU's requested review scope and then produce a report consistent with the format shown in the Appendix that addresses at a minimum the following items:

	Components to be Reviewed	Issues to be Considered
Pathways	Horizontal Conduit	Sizing, Sweep Radius
	Cable Tray	Sizing, Type
	Riser Conduit	Sizing, Sweep Radius
	Riser Sleeves	Sizing
	Firestopping	Locations, Type
	OSP Ductbank	Routes, Sizing, Sweep Radius

Spaces	Data Centers	Location, Sizing, Racks, Cable Protection and Termination, Grounding & Bonding
	Telecommunications Rooms and A/V Equipment Rooms	Location, Sizing, Racks, Cable Protection and Termination, Space for Wall-mounted Systems, Grounding & Bonding
	Application Spaces	Appropriate Arrangement of Conference Rooms and Classrooms
	Riser Shafts	Sizing, Vertical Stacking
	Maintenance Holes	Sizing, Location, Type

Cable Plant	Horizontal	CAT6A Copper (data), CAT5E Copper (voice), SM Fiber Optic
	Riser	UTP Copper, SM Fiber Optic
	Testing & Administration	Copper, SM Fiber Optic, Labeling Plan
Devices	Audio / Visual	Appropriate locations and quantities of A/V equipment, video surveillance devices and corresponding cabling
	Television	Appropriate locations and quantities of televisions and digital signage equipment and corresponding cabling

3.3.1.2 OTHER SERVICES (UPON SPECIFIC UVU REQUEST)

On some projects, UVU may also use an Independent Review Consultant to provide services during the construction phase. These services may include submittal review and "big-picture" construction observation services. In these situations however, the Designer always remains responsible for submittal review, construction observation, punchlist management, and other standard services as required under contract with the State of Utah.

In these situations, the Independent Review Consultant shall provide written comments to UVU. In turn, UVU will decide how to act on the written comments, and then direct the A/E, Designer or Contractor accordingly. The Independent Review Consultant shall not, under any circumstances, give direction to the A/E, Designer or Contractor.

3.4 General Procedures

3.4.1 PROCUREMENT AND INSTALLATION

A. The Designer shall inquire which procurement method will be used for a particular project. The construction documents prepared by the Designer shall be suited for the procurement method designated for the project. Some examples of procurement methods used at UVU include:

- Design-Bid-Build
- Design-Build
- General Contractor/Construction Manager (GC/CM)
- Blanket Purchase Agreement
- State Master Contract
- Direct to Contractor
- Request for Bid / Request for Proposal
- Job Order Contracting
- Owner Provided & Integrated

3.4.2 CAD FILES

The Designer shall coordinate with the Prime Consultant (typically the Architect) to determine that the electronic CAD files used for backgrounds for the technology infrastructure and systems design are consistent with the CAD file backgrounds used by the other disciplines on the project.

3.4.3 STANDARDS VARIANCE REQUEST (SVR)

A. It is not the intent of UVU to rigidly impose standards on every aspect of a design. Each design is unique and special requirements may lead to situations in which deviations from the standards are warranted.

B. UVU's Technology Infrastructure Standards document set identifies specific design solutions that are intended to meet the technical requirements at most

UVU facilities. Design issues that are not consistent with the requirements in this document shall require prior approval through the UVU Standards Variance Requests (SVR) process. Requests to deviate from industry standards or UVU design solutions will be considered on a case-by-case basis. Any request to deviate from applicable code requirements or from manufacturer's warranty requirements will not be approved.

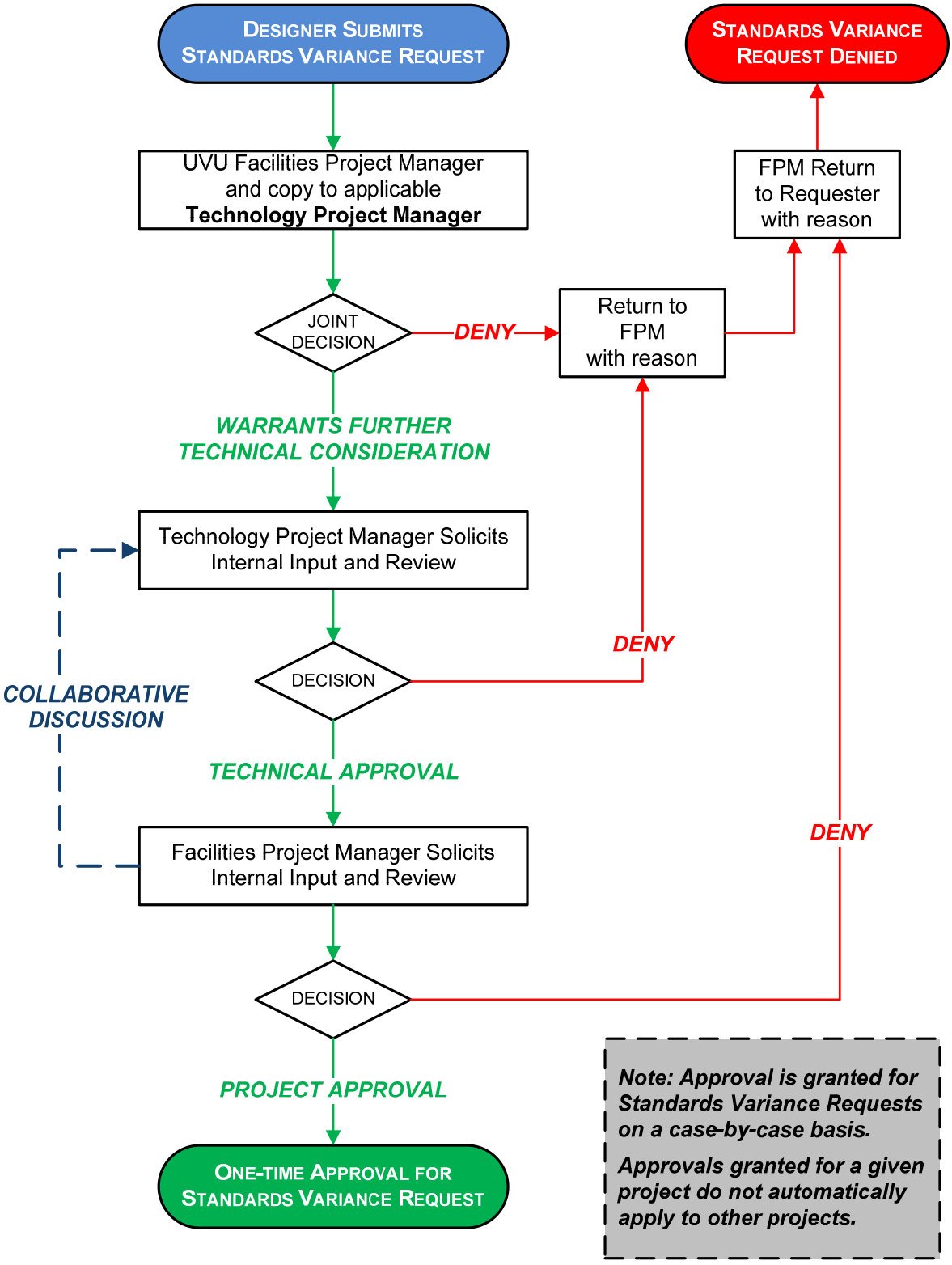
C. If the Designer feels that a solution is warranted which differs from a given standard, the Designer shall submit a written Standards Variance Request to UVU. The Designer may, upon written approval from UVU, incorporate the design deviation into the overall design. UVU approval is required on a project-by-project basis, and applies only to the designated instance(s) within that project. The Designer shall not assume that an approval for one project or one instance means that the practice is approved for use throughout that project, or that it will necessarily be approved for a subsequent project.

The request shall include a complete description of the proposed alternative design identifying:

1. The type of facility;
2. The conditions at the facility;
3. The approved design solution as described in this document or as described in the standards referenced in this document;
4. The proposed alternative design;
5. A list of the guidelines and standards referenced in this document with which the alternative design will not be in compliance, and the effect of non-compliance, both short and long term;
6. The reason for wishing to use the alternative design;
7. The Contractor or personnel performing the construction;
8. A written statement indicating that the proposed alternative design will meet the applicable UVU system performance requirements, and identifying any performance limitations, drawbacks and benefits from using the alternative design.

D. Both the Designer and the Prime Consultant (typically the Architect) on the project shall be jointly responsible to determine that the SVR process is properly conducted, and shall participate in the process (review, acknowledge and address issues) to determine that UVU's requirements are met.

Approval Process for Standards Variance Requests (SVR)



3.5 Procedures Related to Project Phases

In addition to the State of Utah contract requirements, Designers of technology infrastructure and systems for UVU facilities have the following responsibilities during each project phase:

3.5.1 PRE-DESIGN

A. During Pre-Design, the architect shall involve the Designer to incorporate the following considerations:

- Location and capacity of existing technologies and infrastructure that might be used to support the project.
- Identify any existing underground infrastructure that might conflict with the footprint of new work.
- Telecommunications room sizes and centralized locations.
- Audio/Visual equipment room sizes and desirable locations.

3.5.2 SCHEMATIC DESIGN AND FIELDWORK

A. Some projects at UVU campuses may require the Designer to conduct preliminary fieldwork to document the existing equipment, cabling and applications into which new technology will integrate. UVU believes that this information is vital to a successful project.

B. For projects that involve modifications to existing buildings, the Designer shall visit the project site during the Schematic Design phase to perform preliminary field investigation of the horizontal and intra-building backbone telecommunications infrastructure. The Designer shall create the following types of documentation based on information gathered while on site:

- Take digital photographs of existing pathways, spaces, equipment and cabling that affect or are affected by the new project work.
- Verify existing or create a new backbone schematic diagram showing the existing outside plant cabling in the area associated with the new project and the existing equipment connection strategy.

C. The Designer shall also conduct a needs analysis (involving UVU personnel) to identify and describe the required features and functionality of the new applications.

D. The information gathered during the fieldwork, combined with the results of the needs analysis, shall be the starting point for Schematic Design of the proposed new work.

E. The Designer shall discuss pathway type and size options with the UVU TechPM.

F. Schematic Design drawings shall show the following information:

- Building and OSP distribution
- Telecommunications Room sizes and locations
- Major distribution pathways inside the building, including cable trays
- Audio/Visual Equipment Room sizes and locations

G. Upon completion of the Schematic Design documents, the standard Design Review Process shall be conducted prior to progressing to the Design Development phase.

3.5.3 DESIGN DEVELOPMENT

A. The Designer shall modify the design documents to address the review comments received during the Schematic Design Phase.

B. In addition to the content shown on the Schematic Design documents, the Design Development documents shall show the following information:
- Schematic diagrams
- Device box locations and port (jack) counts for each box
- Equipment/Device types and locations
- Draft of specifications based on the Construction Guide Specifications

C. Upon completion of the Design Development documents, the standard Design Review Process shall be conducted prior to progressing to the Construction Document phase.

3.5.4 CONSTRUCTION DOCUMENTS

A. The Designer shall modify the design documents to reflect the accepted review comments received during the Design Development Phase.

B. It is expected that the Designer will expend considerable effort coordinating details between different disciplines during the design process. Non-coordinated pathway/raceway is not acceptable to UVU.

- In particular, accessible cable tray is crucial to UVU's operations. The Designer shall work with the mechanical designers to coordinate ductwork such that it does not obstruct access to the cable tray.

C. During the Construction Documents phase, the Designer shall obtain the assistance of manufacturer product representatives to review the CGS-based project specifications to determine that the correct part numbers have been included for each product in the specification. The specifications shall be adapted by the Designer from the UVU Construction Guide Specification.

D. Upon completion of the Construction Documents, the standard Design Review Process shall be conducted. The Designer shall then modify the documents to

reflect the accepted review comments associated with the Construction Documents prior to the Bidding Phase.

E. The Construction Documents are expected to contain the items discussed in the ***Construction Document Content*** of each Design Guide.

F. Upon completion of the Final Construction Documents, the standard Design Review Process shall be again conducted as described above. The Designer shall modify the documents to address the review comments associated with the Final Bid Documents prior to the bidding phase rather than "by addendum."

3.5.5 BIDDING

A. On projects where a pre-bid walkthrough is held, the Designer shall attend the walkthrough and shall discuss any materials and practice requirements that the bidders might find peculiar or which might affect the bids if such requirements were overlooked. Noteworthy items would typically be requirements that are more restrictive than practices considered acceptable for other commercial projects. The Designer shall consider the following items for inclusion on such a list, as well as any other items applicable to the project:

- The fact that most of the materials specified for use in UVU's technology applications are not designated as "or equal, according to the judgment of the contractor." Any material substitutions must be approved in advance by the Designer in counsel with the UVU TechPM.
- The requirement that the technology subcontractors must be pre-approved, prior to the bid, and that bids from subcontractors who have not been pre-approved will be considered to be non-responsive.
- The fact that UVU's technology infrastructure standards and specifications are more stringent than typical electrical installation requirements or the specifications on many other projects.
- The use of flex-conduit is prohibited.
- The installation of conduit under-slab or in-slab is prohibited for on-grade slabs, except where specifically noted.
- The requirement for no more than two 90 degree bends in any conduit run.

B. The Designer shall pay close attention to the addendums produced by other disciplines on the design team, noting any changes that conflict with technology infrastructure. The Designer shall promptly address any such conflicts, bringing them to the TechPM's attention in each case.

C. Approximately ten days prior to the date that bids are due, the Designer shall issue an addendum reiterating the requirement for technology subcontractors to have been preapproved. The addendum should also list the name and contact information for any subcontractors who have been preapproved. The objective is that the bidders should receive this finalized list of preapproved subcontractors not less than one week before the bids are due.

- The Designer, in cooperation with the UVU ITPM and AVPM shall together review the pre-qualification request, and make a unified decision to approve or reject the request.

D. On projects where a contractor will design and install the work, the Contractor shall submit the following documentation with the bid, depicting what will be installed by the Contractor:

- Material cut-sheets
- Plan drawings of new devices, outlets and cable routing
- Drawings of the grounding/bonding plan (as appropriate, when required)

All drawings shall be prepared using professional design software. Drawings that are hand-drawn sketches or produced using bitmap graphics editors shall not be accepted.

3.5.6 CONSTRUCTION OBSERVATION

A. The Designer shall review the Contractor's submittals that are required by the Construction Documents. When the Contractor's submittals include materials or methods that deviate from UVU standards, the Designer shall either:
   - Reject the specific materials and methods that do not comply, when the Designer believes that they constitute undesirable solutions.
   - Pursue the SVR process to seek separate approval for each specific material and/or method that the Designer believes would constitute a better solution.

B. The Designer shall visit the construction site frequently to observe the construction quality and status. The Designer shall confer with the UVU FPM prior to proposing services for the project to determine an appropriate site-visit frequency for the project. The site-visit frequency will likely fluctuate during the construction phase as the technology-related activity increases and decreases.

   - In particular, the Designer shall observe any rough-in work that will be concealed in walls or pathways that will be buried or concrete-encased.

C. The Designer shall invite the ITPM to attend a construction observation meeting prior to the pouring of concrete to allow UVU OIT to check the pathways that will then become concealed.

D. During all site visits, the Designer shall take digital photographs of existing and new pathways, spaces and cabling, both intra-building and outside plant, that are related to the project. In particular, the Designer shall photograph infrastructure that will later be concealed during the course of construction.

E. It is the responsibility of the Designer to verify that the Contractor properly

labels all cabling in a manner consistent with UVU standard labeling practices (both inside plant and outside plant) during construction. Inadequate or incomplete labeling is not acceptable.

F. Accurate as-built drawings are considered critical for the efficient long-term operation of UVU facilities. During construction observation visits, the Designer shall observe and report on the Contractor's progress toward staying current with the as-built drawing notations.

G. After each construction observation visit, the Designer shall submit a written report describing the observed construction progress. Observations shall be documented in the report with annotated digital photographs and a written description of any problems, a description of the requirements in the Construction Documents and the resolution to the issues. For each item requiring corrective attention, the report shall describe the following:

- A description of the issue
- Applicable requirements in the Construction Documents
- Applicable UVU standards, industry standards and codes
- Corrective options available to UVU
- Designer's recommendation

H. The Designer shall submit the construction observation reports via email to the UVU FPM and the UVU TechPM as soon as possible following each site visit. The reports shall also be reviewed at the next construction meeting. A timely report submission will aid the Designer and UVU in identifying potential problems early in the construction process.

I. The Designer shall alert the Contractor that cable testing shall be performed after electrical systems have been powered on and after building operational conditions become similar to normal operations. Also, any dust-producing construction activities shall be completed prior to any cable testing. The intent is that testing not be done until normal operating conditions exist (and the associated electromagnetic interference is being generated by electrical systems in the building).

3.5.7 POST-CONSTRUCTION

A. The Designer shall review the Operation and Maintenance information provided by the Contractor for the telecommunications distribution system. The Designer shall verify that information is included for each component in the system. Upon approval of the content in the Operation and Maintenance information, the Designer shall submit the information to the designated UVU TechPM with written documentation indicating that the Designer has reviewed the information and that it appears to meet the requirements in the Construction Documents.

B. The Designer shall provide record drawings and record documentation to UVU (based on as-built documents that have been "red-lined" by the

Contractor). Record documents shall be provided in electronic CAD format where applicable, in addition to requirements put forth by the Designer's contract with UVU.

- A separate full-size printed copy of any record drawings depicting technology infrastructure shall be furnished to the applicable TechPM.

C. The Designer shall review the test reports produced by the Contractor during the project. The Designer shall verify that the test reports are complete, properly performed and indicate passing results.

D. The Designer shall verify that the contractor provides the appropriate manufacturer warranty certification documentation to UVU.

3.6 Designing for Demolition

Some projects may involve existing buildings that require the demolition of existing telecommunications cabling and components. In these situations, the following activities are required:

3.6.1 Site-Specific Code Requirements

The Designer shall clearly understand the site-specific, Code-based requirements for demolishing cabling and components that are no longer in use, and shall communicate these requirements to UVU.

- Generally, this means that all abandoned cabling shall be removed during demolition or after cutover.

3.6.2 Preservation Objectives

UVU may wish to preserve some existing cables in operational condition. Such existing cables may not be used immediately following the completion of the work, but UVU may have plans for future use of those cables. It may be required in the Code that such cables be physically tagged for future use, or otherwise be subject to demolition.

The Designer shall inquire with UVU on a project-by-project basis about cabling, equipment and other materials that should be preserved in an operational condition during the course of a project.

3.6.3 Salvage Objectives

The Designer shall inquire with UVU on a project-by-project basis about cabling, equipment and other materials that should be removed and salvaged to the Owner, and also to determine how and where the salvaged materials will be delivered to the Owner.

4 Appendices

4.1 Sample Review Comment Report

The table below depicts an example Review Comment Report form that UVU may use.

Review comments from UVU would be entered on the left half of the page.

Responses from the Design Team (including architects, engineers and Technology Infrastructure Designers) shall be provided on the right half of the page.

DESIGN REVIEW COMMENTS

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Project Title: Utah Valley University Project Title | Contract No.: UVU # | Architect: Architect Name

DWG. NO./ PAR. NO.	*ITEM NO.*	*Reviewer Initials*	*REVIEWER COMMENTS*	Initials / Firm	*DESIGN TEAM RESPONSE*
Sheet #	1	ES	Drawing Comment		
Sheet #	2	TT	Drawing Comment		
Sheet #	3	KO	Drawing Comment		Design Team Responses (Architects, Engineers, Designers)
Section # Para. #	4	KD	Specification Comment		
Section # Para. #	5	TB	Specification Comment		

4.2 Acronym Glossary

ACPM	Access Control Project Manager
AVCGS	Audio/Visual Construction Guide Specification
AVDG	Audio/Visual Design Guide
AVPM	Audio/Visual Project Manager
BAPM	Building Automation Project Manager
CGS	Construction Guide Specification
CGSP	Construction Guide Specification Preface
EMI	Electromagnetic interference
FPM	Facilities Project Manager
GC/CM	General Contractor/Construction Manager
ISP	Inside Plant
ITPM	Information Technology Project Manager
MAC	Moves/Adds/Changes
OSP	Outside Plant
SVR	Standards Variance Request
TCGS	Telecommunications Construction Guide Specification
TDDG	Telecommunications Distribution Design Guide
TIDG	Technology Infrastructure Design Guide
TechPM	Technology Project Manager(s), *also*
TPM	Telecommunications Project Manager
TR	Telecommunications room(s)
UTP	Unshielded twisted pair