



DIVISION 27 COMMUNICATIONS

IT@Sam
Communicate + Collaborate

Table of Contents

Part 1 - General	1
1.1..... Purpose	1
1.2..... Coordination	1
1.3..... Design Guidelines	1
1.4..... Scope and Deliverables	2
1.5..... Regulatory Requirements, Codes and Standards	2
1.5 Specific Equipment.....	3
1.5.1 Telecommunications.....	3
1.6 Certification Requirements and Documentation	5
1.7 Warranty.....	5
1.8 Performance Requirements.....	6
1.9 Grounding and Bonding.....	7
1.10 Administration (Labeling).....	7
Part 2 – Telecommunications and Equipment Room Guidelines	7
2.1 Definitions.....	7
2.2 Room Planning and Spacing.....	7
2.3 Construction.....	9
2.4 Fire Protection.....	9
Part 3 – Inside Plant Guidelines	9
3.1 Pathways and Room Penetrations	10
3.2 Station Wiring and Jacks.....	11
3.3 Inside Plant Wireless	11
3.4..... Inside Plant Telephone	11
3.5 Inside Plant Public Safety and Cellular Communications	11
3.5.1 Bidirectional Amplification for Public Safety Two-Way Radio and Cellular/Smart Phone	12
3.5.2 Roof Top Antenna Mounting Hard Points.....	12
Part 4 – Outside Plant Guidelines	13
4.1 Pathways.....	13
4.2 Maintenance Holes.....	13
4.2a Hand Holes.....	14
4.3 Splicing	14
4.4 KatSafe Emergency Telephones & Towers	15
4.5 Light Pole Camera Fixtures	15

Part 5 – Software, Licenses and Connectivity	15
Part 6 – Minimum Technology Enhanced Classroom Design Standards	16
6.1 Classroom Design Standards, Basic Technology Enhanced Classroom.....	16
6.2 Certification Requirements and Documentation.....	16
6.3 Warranty and Maintenance	17
6.4 Projection Screens, Basic Technology Enhanced Classroom	18
6.5 Ceiling Mounted Data Projector Mounting, Basic Technology Enhanced Classroom.....	18
6.6 Audio, Basic Technology Enhanced Classroom	19
6.7 Multimedia and Video, Basic Technology Enhanced Classroom	19
6.8 AV Control System, Conduit and Networking, Basic Technology Enhanced Classroom	21
6.9 Floor Boxes, Conduit and Networking, Basic Technology Enhanced Classroom	22
6.10 Lighting, Conduit and Networking, Basic Technology Enhanced Classroom	23
6.11 Storage and IDF, Conduit and Networking, Basic Technology Enhanced Classroom	23
6.12 Specific AV Equipment.....	23
Part 7 – Minimum Technology Conference Room Design Standards	25
7.1 Integrated Audio-Video Systems and Equipment for Conference Rooms	25
Part 8 – Typical Drawings	26
8.1 Typical Drawings.....	26

DIVISION 27 COMMUNICATIONS

Part 1 - General

1.1 Purpose

These guidelines identify and define Sam Houston State University requirements and policies for designing and installing telecommunications infrastructure and substructure at all Sam Houston State University facilities. Use of, and compliance with these guidelines is mandatory for Sam Houston State University personnel, and for architects, engineers, and installation contractors working on Sam Houston State University projects.

This General Information outlines the major codes, standards, and guidelines to be followed when planning and installing facilities telecommunications infrastructure (including, but not limited to, telecom/equipment rooms, cabling and pathways).

1.2 Coordination

- A. By default, work with IT@Sam must be scheduled at least 30 business days in advance. Deviation from normal business hours (8:00 a.m. – 5:00 p.m., Monday through Friday) may be possible by coordinating in advance with IT@Sam.
- B. General: Installation of voice/data/video system components shall be coordinated with IT@Sam Networking and Audio/Visual. Provisions requiring minor modifications shall be made at no cost.
- C. Building Service: Provisions for voice/data/video cable entry to the building shall be coordinated with IT@Sam Networking and Audio/Visual, prior to installation.

1.3 Design Guidelines

- A. The Sam Houston State University Communication Standards are based upon the code requirements and telecommunications industry standards contained in the following guidelines. These guidelines will not duplicate the information contained in those references, except where necessary to provide guidance, clarification or direction. It is imperative that Sam Houston State University personnel, architects, engineers, and installation contractors working on Sam Houston State University projects become familiar with these guidelines and the industry telecommunications standards referenced.
- B. In instances where several technical alternatives may be available to provide a design solution, these guidelines will identify the preferred solution to meet Sam Houston State University needs. However, each facility and project is unique. Design for new construction will differ from design for retrofit of existing facilities. These guidelines will differentiate certain design approaches and solutions to be applied to new construction versus existing facilities, and different types of Sam Houston State University facilities. However, designers and installers shall always use sound engineering judgment in order to comply with the requirements of the codes and standards identified in this section. Design or installation questions shall be referred to the Sam Houston State University IT@Sam Networking and Audio/Visual staff for resolution.

1.4 Scope and Deliverables

- A. The Division of Information Technology Services (IT@Sam) utilizes applicable codes, standards, and industry guidelines for the planning and design of telecommunications infrastructure. In the initial design phase of a building as well as with renovations or redesign, consideration shall be made to provide the space requirements for present telecommunications design needs and more importantly for maximum growth. Some of the guidelines herein may exceed industry standards and take precedence over those standards.
- B. IT@Sam requires that a complete set of blueprints and specification manuals be submitted for IT@Sam Networking and Audio/Visual review. Once the blueprints are finalized, a complete set of 15x22 size blueprints is required, plus the architectural sheets and e-sheets in electronic format (PDF and DWG).

1.5 Regulatory Requirements, Codes and Standards

- A. All designs shall be in compliance with the following codes, industry standards, and practices, as well as, IT@Sam specific requirements described in this document. It is the responsibility of the designer to know and comply with the most current version of each document, or its most recent successor document, referenced below:
 - ANSI/EIA/TIA-568-B, Commercial Building Telecommunications Cabling Standard or its most recent successor document
 - ANSI/EIA/TIA-570, Residential and Light Commercial Building Telecommunications Wiring Standard or its most recent successor document
 - ANSI/EIA/TIA-569, Commercial Building Telecommunications Pathways and Spaces or its most recent successor document
 - ANSI/EIA/TIA-606, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings or its most recent successor document
 - ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications or its most recent successor document
 - ANSI/NFPA-70, The National Electrical Code or its most recent successor document
 - BICSI (Building Industry Consulting Service International) Telecommunications Distribution Methods Manual or its most recent successor document
 - BICSI Outside Wireless Design Reference Manual or its most recent successor document
- B. Additional major codes and standards are specified by the current version of:
 - OSHA (Occupational Safety and Health Administration)
 - NEC (National Electrical Code)
 - NESC (National Electrical Safety Code)
 - IEEE (Institute of Electrical and Electronics Engineers)
- C. Testing Standards should follow:
 - Each Category 6 (CAT6) cable system shall be tested for compliance with requirements:
 - Termination Standards: ANSI/TIA/EIA-568-B.1-2000 T568A
 - Compliance Testing Standards: TIA/EIA-568-A
 - Each Fiber Optic cable shall be tested for compliance with requirements:
 - ANSI/TIA/EIA-455 ii. OFSTP-7

- OFSTP-14
- Corning EWP

1.5 Specific Equipment

In an effort to reduce maintenance inventory and to provide consistency across the campus, IT@Sam has standardized on specific brands and warranties for telecommunications systems. All designs and specifications shall be based on the following approved manufacturers without substitution:

1.5.1 Telecommunications

- Chatsworth 19" Universal Rack 7' with 2 post Black Freestanding Aluminum Rack
 - 46353-703
- Chatsworth Combination Cable Section (CCS) with 10" vertical wire managers for 7'
 - CCS-EFX-40099-703
- Siemon 24 or 48 Port Patch Panel
 - 48 Ports: HD6-48
- Siemon Horizontal Switch Wire Management
 - 2U WM-145-5
- Telecommunications Cable
 - CommScope Ultra Media 6
 - CAT 6 Teal Plenum CommScope Ultramedia
 - UN874036714/10
 - CAT 6 Yellow Plenum CommScope Ultramedia
 - UN874029514/10
 - Cat 6 Direct burial Plenum BLK
 - 874036404/10
- CAT 6 Yellow Plenum Arlington Industries The Loop Cable Hanger in 5" diameter
 - AI-TL50
- Siemon Assembly
 - Siemon Jumpers
 - 7ft Teal
 - MC6-07-07
 - 10ft Teal
 - MC6-10-07
 - 15ft Teal
 - MC6-15-07
 - Siemon Wall Phone Faceplate Analog Phone
 - MW-WP-K6-SS
 - Single Gang Faceplate
 - MX-FP-S-04-02
 - Double Gang Faceplate
 - MX-FP-D-06-02

- MX-FP-D-12-02
- Siemon Flat Module
 - MX6-F02
 - MX6-F02-D
- Siemon Surface Mount Box
 - CT4-BOX-02
 - CT8-BOX-02
 - MX-SM1
 - MX-SM2
- FSR Series 600 Floor Box with the FL-GRD Series Floor Pan
- Corning Ribbon OSP Fiber
 - 048EC5-141-01D53
 - 144EC5-141-01D53
 - 216EC5-141-01D53
- Corning Ribbon Plenum Fiber
 - 024EC8-14101-20
- Corning Housing with Pre-terminated Heads
 - PR148P24-A9-3RJ1D0 48 port
 - PR124P24-A9-3RJ1D0 24port
 - EDGE-01U-SP 144port Needs 12ea ECM-RM12-04-89G MODULES
- Circa 100 PAIR INDOOR BET 710/110
 - 1880ECA1-25
 - 1880ECA1-50
- Circa Semi-Conductor Unit
 - 3B1EW
- VERTIV Energy Sys Cross Connect Box 600 I/O
 - F1002233
- Ant Poison
 - Rainbow 4480 Fire Ant Control
- Emergency Talk-A-Phone
 - Phone: ETP-500V
Description: The ETP-500 is an outdoor-rated, ADA-compliant hands-free emergency phone.
 - Phone: ETP-500KV
Description: The ETP-500K is an outdoor-rated, ADA-compliant hands-free emergency/information phone with keypad.
 - Housing: ETP-SMH
Description: weather-protective stainless steel hooded mount for any 500-Series flush mounting emergency phone.

- Housing: MS-400
Description: The MS-600 is a mounting sleeve box for flush mounting 500 Series Talk-A-Phone emergency phones.
- Pedestal: WEBS-MT/R
Description: Vandal-resistant emergency/information tower system with emergency broadcast speaker. WEBS-MT/R 120V AC is to be painted International Orange (color code 05SF) with White (color code A7801R) Reflective lettering on each side. Lettering to say: EMERGENCY
- Pedestal: ETP-WM
Description: Wall-mount emergency/information station provides an integrated security solution.
- This link, <http://www.talkaphone.com/category.cfm?sct=1&sbs=2>, contains information on these products as well as E&G specs for each model.

1.6 Certification Requirements and Documentation

- Work will be performed by a telecommunications contractor who has a Registered Communications Distribution Designer (RCDD) on staff full-time and is participating in the Corning Extended Warranty Program (EWP). Hereinafter the telecommunications Contractor will be referred to as the Contractor. IT@Sam may waive the requirements for a contractor at its discretion.
- The Contractor, utilizing his Registered Communications Distribution Designer (RCDD), shall be responsible for designing the communications distribution within the scope of the project, including any underground conduit necessary to provide telecommunications service from existing point of service availability, distributing throughout the project area, and within the structures. Considerations for any adverse conditions shall also be accommodated per instance, advising IT@Sam of the necessary variances from the outlined specifications.
- The Contractor shall perform all work per the BICSI Cabling Installation Manual including NEC and ANSI Standards referenced therein, unless otherwise directed herein, meeting Category 6 wiring standards.
- All punch down of Category 6 cabling shall conform to T568A punch down method. A service loop of 10' is required in all data closets. The service loop shall be bundled neatly and ran over the cable ladder or along wall to keep it out of the work space. A service loop of 10' is required in all rooms. The service loop shall be secured and bundled neatly in the ceiling.
- The Contractor's proposal shall provide submittals to IT@Sam for all materials and equipment to be provided and installed by the Contractor on this project, to include but not to be limited by the following list: Telephone cable, Fiber Optic cable, Category 6 cable, telecommunications outlets and components, patch panels, telephone entrance terminals, protectors, hanger devices, conduit, and equipment cabinets or racks and all rack component parts.

1.7 Warranty

- The contractor shall provide IT@Sam a warranty for performance of the Structured Cabling System and against defects in materials and workmanship for a period of no less than seven

years after close of the project. All material, labor, and expenses to correct the problem(s) are to be included in the warranty.

- B. The Contractor shall enroll the installed Structured Cabling System into the cabling component manufactures' warranty program. They shall provide IT@Sam with a certificate of warranty from the manufacturer. All materials, labor, and expenses to correct the problem(s) shall be included in the warranty.
- C. The Contractor shall correct any problems reported within 5 business days.

1.8 Performance Requirements

- A. The Contractor, by submitting their RCDD number, certifies that he has a Registered Communications Distribution Designer on staff who will design the layout for this project, and that his cabling staff has the technical training and ability to install the cabling in a professional manner consistent with the best standards of the trade within BICSI guidelines. He further certifies that each cable system shall be tested fully to verify compliance with Category 6 standards and will be labeled consistently end to end meeting specifications given by IT@Sam Networking. IT@Sam Networking shall be notified prior to testing, and shall have the option to have a representative present during any or all testing. The Contractor shall complete the job within the expectations of Sam Houston State University's defined timeframe.
- B. The Contractor shall provide all the labor and scheduling coordination, as well as all materials and equipment, per IT@Sam specification as stated herein, which are required to render a BICSI Standard Category 6 compliant cabling system from each telecommunications port designated on the schematic floor plans to the patch panel termination point in the telecommunications closet. When complete, each telecommunications port location will have a minimum of two Category 6 plenum rated lines, unless specified otherwise. Each line will consist only of a continuous home run back to the telecommunications closet and will be terminated in a patch panel.
- C. Upon completion of the work and before final payment, the Contractor shall provide the following "as-built" in both electronic format and hard copy:
 - Wire/cable routing diagram showing locations of any new or pertinent man holes, conduits, pull boxes, chases, and the cable pathways between them;
 - Complete floor plan diagrams depicting telecommunications closet and port locations listed by label identification; and
 - Test results demonstrating full compliance with Category 6 wiring standards for each cable system.
 - Each Category 6 cable shall be tested for compliance using a Fluke DSP-4 or more current model, with Category 6 rated modules for test conditions, and the ability to fully test compliance with Category 6 standards and comply with federal standards. Test sets should have a current NIST traceable calibration sticker on it. The Contractor shall provide to IT@Sam Networking a statement of the type of equipment to be used for testing of both Category 6 cabling and fiber prior to the beginning of testing. The test results shall be provided in paper and electronic format, verifying the compliance of every cable system.
 - End-to-end bidirectional loss analysis shall be provided for each fiber strand using Optical Loss Test Set (OLTS) and Optical Time Domain Reflectometer (OTDR) test sets. The test

results shall be provided in paper and electronic format, verifying the compliance of every cable system.

1.9 Grounding and Bonding

- A. All telecommunications facilities shall be grounded per BICSI specification for large telecommunication systems.

1.10 Administration (Labeling)

- A. The Contractor shall place identical labels at the telecommunications faceplate and the patch panel in NUMERICAL ORDER, as well as on each end of every cable for each Category 6 cable system. The labeling scheme shall be consistent with: the room number where it originates, a period, a letter indicating which faceplate within the room, and a number indicating the port within that faceplate, i.e., “203.a2”, or “110.b1”. If there are multiple faceplates within the room, the alphabetical sequence shall begin at the door and will increment sequentially in a clockwise direction around the room.
 - Special circumstance connections, such as for wireless, camera, courtesy phone, or door access connections, should be placed together in a common area on the patch panel. These should be labeled with WAP-closet-room, or CAM-closet-room.1 (if multi in same room, .1 to left of door then clockwise), CPH-closet-room and DOOR-closet-room, on both ends, as CPH-A-215, WAP- C-400.1.
 - Cable TV wiring will also be labeled identically on each end with cable-wrap labels.
- B. Refer to typical drawings in section 10 for examples.

Part 2 – Telecommunications and Equipment Room Guidelines

2.1 Definitions

- A. **Main Distribution Facility (MDF), or Equipment Room (ER):** Any space where telecommunications equipment common to the occupants of a building resides.
- B. **Intermediate Distribution Facility (IDF), or Telecommunications Room (TR):** The space that acts as the common access point between backbone and horizontal distribution pathways. TR’s contain telecommunications equipment, control equipment, cable terminations and cross-connect wiring.
- C. **Optical Loss Test Set (OLTS):** Used to measure optical power and power loss, and reflectance and reflected power loss on fiber medium.
- D. **Optical Time Domain Reflectometer (OTDR):** Used to measure optical link loss if its markers are set at the terminus points for which the fiber loss is desired.

2.2 Room Planning and Spacing

Serving Area (Sq. Ft.)	Room Size
40,000	12’ X 14’ min.
19,000	9’ X 7’ min.
8,000	6’ X 7’ min.

*NOTE: SPECIAL PURPOSE ROOMS, SUCH AS LABORATORIES, COMPUTER ROOMS AND CERTAIN INSTRUCTIONAL SPACES, MAY HAVE A HIGHER THAN AVERAGE DENSITY OF COMMUNICATIONS OUTLETS. THE SIZE OF THE MDF/IDF SERVING THESE ROOMS SHALL BE INCREASED/DECREASED ACCORDINGLY, AS DETERMINED BY IT@SAM NETWORKING DIRECTOR.

**REFER TO TYPICAL DRAWINGS IN SEC 10 FOR EXAMPLE

- A. The MDF and IDF shall be dedicated to the telecommunications function and related support facilities. For security purposes, non-IT@Sam systems shall not be co-located in the MDFs and IDFs. The MDF and IDF shall not be shared with electrical installations other than those supporting telecommunications. Equipment not related to support of the MDF or IDF (e.g., piping, HVAC systems, pneumatic tubing) shall not be installed in, pass through, enter, nor be stored in the MDF or IDF.
- B. If there are fewer than 48 telecommunications ports to be terminated in a closet, a wall-mounted rack or cabinet may be acceptable with prior agreement by IT@Sam Networking Director.
- C. Telephone cable entering the building shall be terminated on entrance terminals and grounded in accordance with NEC and BICSI standards. Cross-connect panels and telephone tie cables shall be installed where necessary within and between distribution facilities, and shall be terminated into patch panels in the equipment racks. These panels shall be placed in a group separated from the Category 6 patch panels distributing horizontal cable. Final placement of panels in equipment racks shall be pre-approved by IT@Sam Networking Director.
- D. Telephone tie cable run between distribution facilities within the building shall be Superior Essex Plenum rated cable of a size determined by IT@Sam Networking commensurate with the size of the cable providing service to the building.
- E. Telco-style ladders shall be bolted together for stabilization and used to run cable horizontally and vertically in the distribution facilities.
- F. The patch panels shall be mounted in an open rack meeting this guideline's specifications, secured both to the wall by ladder rack, and to the floor by bolts. The patch panel shall be sized to provide not less than 20% spare terminal ports available to accommodate future expansion of the system.
- G. Rack size shall be determined in a way so as to provide not less than 40% free space.
- H. MDF and IDF design, including location, should be developed in accordance with security and disaster avoidance plans of the building. The IDFs shall be located directly above the MDF closet, where applicable.
- I. The Contractor shall assure the space allocated for the distribution facilities or other designated spaces are appropriate to comply with BICSI standards, and are in agreement with specifications provided in this document. Any concerns should be discussed with the IT@Sam Networking prior to installation.
- J. The MDF/IDF HVAC system(s) shall be able to operate on a 24-hour basis independent of building HVAC scheduling or temperature settings, to include independent thermostats in each MDF/IDF. If emergency power is available, the HVAC system should remain operational.
- K. Receptacles shall be two L6-30 twist lock female outlets. Location should be close to the UPS, Networking will determine exact location.

- L. Free-standing racks shall be provided according to space requirements. Vertical cable management shall be provided in minimum quantity of at least one with each separately placed rack, otherwise one between each rack when placed in a single row.
- M. A 1U Blanking panel(Monoprice product #7261) will be installed between each patch panel.
- N. Where equipment fields are required on wall(s) there shall be a minimum of 36 inches dedicated clearance.

2.3 Construction

- A. False ceiling shall not be provided.
- B. For MDF or IDFs, the minimum clear height in the room shall be 8 ft. without obstructions.
- C. Walls shall be layered with 3/4" plywood and finished to BICSI specifications.
- D. Floors shall be sealed to minimize dust and static; finishes shall be light in color to enhance room lighting.
- E. Lighting shall be a minimum of 400 lux. IT@Sam requires that at least two lighting fixtures be installed per MDF/IDF. These lights shall be installed in front and behind the telecommunication equipment rack(s). The location of the lighting fixtures is to be coordinated with IT@Sam Networking. Lighting shall be controlled by one or more switches located near the entrance door(s) to the room. Dimmer switches shall not be used. All lights will be covered by wire cages. If energy efficient timed lighting is utilized they must have a manual over ride to bypass the timer.
- F. Floor loading capacity of MDF/IDFs shall be at least 500 lb/sf or located on a load bearing wall. The architect/engineer shall verify that concentrations of proposed equipment do not exceed the floor loading limit, which may require increasing the floor loading capacity in some cases.
- G. The door shall be a minimum of 36" wide and 80" high, without door sill, hinged to open outward (codes permitting) and fitted with a lock.
- H. The door shall have a lever handle, pick guard.
- I. The locks for the MDF and IDFs shall be the IT Key. These locks shall be incapable of remaining in an unlocked state when the key is removed.
- J. The door shall be equipped with an electronic lock integrated with the building access control system.
- K. The door shall be equipped with an auto closing device.
- L. The fire rating of the door shall be consistent with the fire rating of the walls of the room.
- M. On outward opening doors, the hinges shall be of the anti-tampering type. These hinges shall be consistent with and match similar mechanisms throughout the building.

2.4 Fire Protection

- A. The Contractor shall provide fire protection for the room as required by code.
- B. Sprinkler heads if required shall be provided with wire cages to prevent accidental operation.
- C. Penetrations through or into firewalls or floors shall use an appropriate EZ Path product per the referenced codes and standards.

Part 3 – Inside Plant Guidelines

3.1 Pathways and Room Penetrations

- A. References to specific equipment in this area can be found in Section 1.5.
- B. The Contractor shall be responsible for construction of the cable pathways and to overcome obstacles, install conduit as specified and as further need is determined by the RCDD, and to correct any building alterations made necessary by their installations. Pathways shall follow along hallways and vertical chases designated for telecommunications. The pathway location of all cable runs shall be from the telecommunications port to the hallway, along adjoining hallways to the telecommunications closet or location designated. Cable shall not be run over groups of offices or work areas when a pathway recommended herein is available.
- C. When crossing through a mechanical room or other areas requiring additional protection, rigid metal conduit, EMT (with nylon bushings) or metal cable tray shall be supplied to protect telecommunications cables and reduce the potential of EMI/RFI interference. Cable separation shall be maintained from possible sources of EMI/RFI. All EMT conduit, metal cable trays, equipment racks or cabinets shall be grounded per BICSI standards.
- D. Telecommunications cable concealed within a wall shall be run from the outlet box within a minimum of ¾" metal conduit with nylon bushings and stubbed out into the ceiling space a minimum of 2" above drop ceilings. If the finished ceiling will not provide ready access, metal conduit must provide a continuous pathway to the accessible cable path allowing no more than two 90-degree sweeping turns.
- E. Outside of main cable corridors, all cable pathways shall be supported per BICSI standards by loop cable hangers. The support distance shall not exceed 5'. Each hanger shall be suspended from systems provided by the Contractor and not from any other structures which are not intended to support cabling.
- F. There shall be no splice other than within the termination trays for the fiber install. All runs shall be home runs and complete from end to end. If OSP cable is used, it should be brought into the MDF in a plenum rated conduit per BICSI standard. IT@Sam Networking will have to be notified and approve any special cases that require a splice. If a splice is required, the splice must be a fusion splice and maintain no more than a 0.2 dB of loss.
- G. All cable shall be run with basket trays in main corridors within ceilings and maintain a 6" clearance on the top of the tray. Trays shall be sized appropriately for the amount of cables to be contained(ie. 24" cable trays are not appropriate for 60 cat6 cables).
- H. Telephone entrance terminals shall be filled with protectors.
- I. There shall be a service loop of 50' routed appropriately in the telecommunications closets at each end of a fiber run.
- J. Provide a Mule tape spare pull cord in all voice/data service entrance and tie conduits. Provide pull cords in all interior cable trays.
- K. All conduits shall have a nylon bushing installed on exposed ends.
- L. All firewall penetrations shall use the appropriate sized EZ-Path product.
- M. All data lines terminating in the MDF or an IDF shall be teal Category 6.
- N. All data lines that are point-to-point, or terminate in an auxiliary support room (ie. video control) shall be yellow Category 6.
- O. Expanding foam shall not be used in any pathways.

*NOTE ON MISUSE: DO NOT USE VOICE/DATA SLEEVES FOR TEMPORARY CONSTRUCTION POWER WIRING.

3.2 Station Wiring and Jacks

- A. Unused spaces in a face plate shall have a blank filler module.
- B. In areas designed for vending or laundry service machines, there shall be one Category 6 data line per machine.
- C. Fire alarm panels shall have two Category 6 data cables installed to the nearest data closet.
- D. Elevators shall have three Category 6 data cables installed to the cab, and two Category 6 data cables installed to the control panel.
- E. Station Wiring Minimum
 - All rooms at minimum shall have one faceplate consisting of two lines per every 25 linear feet of wall.
 - All rooms designated as offices shall at minimum have two faceplates consisting of lines each, placed on opposing walls
 - Four data ports shall be installed in any floor boxes that are required, and dust covers shall be used on modules.
- F. Where telecommunications cables cannot be concealed within the walls at a telecommunications port location, surface mounted wire mold shall be installed. The wire mold shall extend into and above the ceiling a minimum of 2", and continue down to a surface mounted box. The surface mounted full-sized, single gang box will house the faceplate and modular jacks as well as provide mechanical protection for the terminals. The wire mold and surface mounted box colors shall match, and shall complement the existing wall color. Wire mold may be of either metal or plastic which shall be mechanically affixed to the surface. Mounting brackets will be concealed or pre-approved by IT@Sam Networking.

3.3 Inside Plant Wireless

- A. Wireless access point locations shall be located above ceiling when practical and shall consist of 2 (Two) data lines terminated into a small surface mount box at the end of a 15' service loop. The loop shall be suspended above the ceiling and labeled for easy identification as well as being labeled on face plate and cable..
- B. A building shall have at least 2 wireless access point lines for every 1800 sf of floor space with staggered locations so that they don't overlap on the adjacent floor.
- C. Wireless access point line locations above the ceiling shall be marked with a removable sticker that is visible from the floor.

3.4 Inside Plant Telephone

- A. All telephone station lines shall be data station lines and shall follow the appropriate standards.
- B. There shall be at least one courtesy phone location per floor in a structure.
- C. The location shall be 40" AFF and be terminated with a wall phone keystone jack to a single gang telephone face plate, as specified.
- D. The location should be generally in the area of the elevator but final placement shall be decided after consulting with SHSU.

3.5 Inside Plant Public Safety and Cellular Communications

3.5.1 Bidirectional Amplification for Public Safety Two-Way Radio and Cellular/Smart Phone

- A. Provide RF amplified communications within the public areas including stairwells and mechanical areas of a building to ensure that public safety two-way radios and cellular telephones/3G/4G services do not encounter dead spots or zones.
- B. System should be made up of a distributed antenna system for the interior of the building.
- C. An external Roof Donor Antenna(s) will be mounted to provide communications to local RF access points for the service being amplified.
- D. A radio mounting point on the roof shall be provided for the mounting of up to three antennas with appropriate grounding to building. A roof penetration shall be provided for multiple antenna feed line down to a radio mounting room. Power to support the radio mounting point shall be located in close proximity.
- E. Two-way Radio coverage will be in the 700 and 800 MHz range to serve public safety radios. The system shall be designed and programmed to enhance specified/channelized locally-used public safety channels including interoperability channels and will require input and signoff from SHSU University Police Department.
- F. Cellular communications that are amplified shall be coordinated with the carriers so that the system meets their requirements for acceptable operations. The Contractor shall be liable and responsible for correction of any omissions or system operation due to design and construction that does not meet carrier requirements and/or FCC Regulations.
- G. The Contractor shall submit plan to IT@Sam for the bidirectional systems that includes a description of operation, coverage plots and evidence of collaboration with cellular companies and public safety agencies. Upon commissioning and signoff by the customer, as built drawings, cut sheets, equipment manuals and documentation shall be provided in hard copy and digital form. The contractor shall provide training to IT@Sam on system operation and configuration. Drawings shall be in DWG or DXF file type as well as PDF. If the units are programmable, IT@Sam shall be provided all un-complied code, programming software and any required passwords.
- H. Unit(s) shall be warrantied for a period of three years for on-site parts and labor. Warranty shall begin upon customer acceptance of installation of the unit.

3.5.2 Roof Top Antenna Mounting Hard Points

- A. An antenna mounting point on the roof shall be provided for the mounting of multiple antennas with appropriate grounding to building lightning protection system.
- B. Mounting points shall be made up of 3" galvanized pipe extending 8' above the roof surface on four points 10' by 10' square with a 3" pipe connecting the four pipes horizontally 4' above the roof surface. The top of the vertical pipes shall be sealed.
- C. A walk door or roof hatch shall provide access to the antenna mounting point.
- D. A roof penetration and access path shall be provided for antenna feed line down to a radio mounting room.
- E. Power to support the radio mounting point shall be located in close proximity. Two 120-volt 20-amp circuits shall be provided.
- F. Distance between roof penetration and radio room must be minimized.

- G. The roof penetration shall be comprised of two 3” conduits into an individual weather proof box for each located on the roof top within the antenna mounting.
- H. A 120-volt 20-amp outlet shall be provided in a weatherproof enclosure and shall be located next to the antenna feed line enclosure.
- I. Conduits are preferred to have 1’ physical separation to avoid possible interference.

Part 4 – Outside Plant Guidelines

4.1 Pathways

- A. All duct banks shall be constructed of non-metallic schedule 80 conduit. All bends shall have a minimum radius of 36”. Manufactured bends shall be utilized.
- B. All ducts shall be a minimum of 36” below grade.
- C. All ducts in pertinent maintenance holes or those connecting to exterior locations, whether in use or empty, shall be sealed with duct plugs at each end.
- D. All ducts shall be able to hold 100 psi for 45 minutes.
- E. All ducts shall have locatable tracer-tape installed and properly secured in them.
- F. All buildings shall have divergent pathways enter the building from separate maintenance holes.
- G. All ducts shall be inspected by IT@Sam Networking prior to being back filled.
- H. Provide galvanized rigid metal conduit at the entrance to each building starting at 6’ minimum outside the foundation wall to termination in the Equipment Room. Bond the conduits to the TMGB with a #6 AWG copper ground wire and bonding bushings.
- I. All existing communications ducts that are within a construction site must be proofed using a rod prior to substantial completion.
- J. Expanding foam shall not be used in any pathway

4.2 Maintenance Holes

- A. Feeder ducts shall enter on the narrow walls of the maintenance holes. Ducts providing service laterals to buildings may enter on the long walls.
- B. Ducts shall not enter the maintenance hole in the cover chimney.
- C. Ducts shall enter maintenance holes perpendicular to the wall.
- D. Utilize installed TERMADUCTS for all conduits entering the maintenance hole wherever possible. Populate the lowest knock-outs available to allow for future expansion. Ducts shall be installed flush with the interior wall of the maintenance hole and shall not protrude into the interior space.
- E. Splay all ducts entering the narrow wall of telecommunication maintenance holes. Equally separate duct banks so that half the ducts will enter near the left corner of the narrow wall and the other half will enter near the right corner of the same narrow wall. The splaying of the ducts should start at least 20’ from the maintenance hole. Service lateral ducts are not required to be splayed.
- F. Where possible, organize ducts in such a manner as to provide "in-line" or "pull-through" cable installations.

- G. At all road and driveway crossings the duct bank shall be reinforced with engineer designed reinforcement.
- H. Maintenance holes that are positioned in roadways shall have at minimum a 1ft wide 6 inch deep concrete lip surrounding the lid.
- I. Each maintenance hole lid shall be permanently marked with "SH Communications", CH Number, and "936-496-1950". *see example in typical drawings section

4.2a Hand Holes

- A. Hand holes shall have minimum dimensions of 30"x48"x36".
- B. Feeder ducts shall enter on the narrow walls of the hand hole. Ducts providing service laterals to buildings shall enter on the long side of the walls.
- C. Hand holes shall have 4" of large gravel or river rock covering the bottom.
- D. All hand holes shall have two bags of rainbow 4480 granular fire ant killer placed in hand hole.
- E. All ducts entering hand hole shall extend 6" into the hand hole and be plugged with an expanding duct plug.
- F. Any penetrations made to hand hole shall be sealed appropriately.
- G. All hand holes shall have a two piece lid.

4.3 Splicing

- A. All splices of copper cable up to 300 pair shall be set up as a butt splice and housed in an appropriately-sized stainless case. All stainless cases shall be pressure encapsulated. The splice itself shall be made utilizing a fold back technique. Splices up to 300 pair shall be made using 3m UY-2 filled connectors.
- B. All splices of copper cable over 300 pair shall be made using 710-sc1 connectors.
- C. There shall be no three-way splicing, half-tapping, back tapping, or bridging of any type.
- D. The field side of any un-spliced copper cable shall be cleared using 3m UCC clearing caps.
- E. For all splices there shall be a minimum of 15' of slack left in the maintenance hole. All slack shall be neatly coiled and affixed to the side of the hand hole in a manner which places the splice at the top of the maintenance hole.
- F. All splices shall have sufficient clearance between splice and maintenance hole lid.
- G. All splices shall have a metallic tag indicating cable count permanently attached to the cable near the splice case.
- H. Splice procedure and setup for copper cables larger than 300 pair shall be on a per project basis and will be determined by IT@Sam Networking.
- I. All fiber splices will be set up as a butt splice and housed in an appropriate coyote splice enclosure.
- J. All fiber splices shall be fusion splices, and shall have a loss of less than .2 db. L. There shall be no mechanical connections of any kind in a fiber splice.
- K. Fiber splices shall be set up in such a way that there is 50ft of slack stored appropriately in case to facilitate any future repairs or cable throws with minimal interruption of service.
- L. All splice cases shall be pressure tested to the manufacturer's specifications.
- M. All splices (copper and fiber) must be approved and inspected by IT@Sam Networking prior to sealing.

4.4 KatSafe Emergency Telephones & Towers

- A. When required as part of the project, entrance phones must be approved by SHSU Networking. A list of acceptable Talk-A-Phone models and housings depending on the installation are listed in the Specific Equipment area of this document, Section 1.5. All emergency tower MUST include the WEBS(wide area emergency broadcast system) option.
- B. When required as part of the project, emergency telephones shall be pedestal-mounted (Talk-A-Phone Tower, single emergency phone or equivalent approved by IT@Sam Networking).
- C. When required as part of the project, emergency pedestal-mounted telephones shall have a quad GFCI outlet installed in their base.
- D. When required as part of the project, emergency pedestal-mounted telephones shall have at minimum a 3ft x 3ft x 3ft concrete footing to stabilize the base.

4.5 Light Pole Camera Fixtures

- A. Poles must be designed to meet NEC wiring standards by either separating communications cable and power cables or by using the appropriate UL listed communications cable. Separation can be achieved by using an internal separator or other barrier inside the pole.
- B. Communications cable shall have a weatherproof disconnect installed at the base of the pole.
- C. Communications cable shall penetrate the pole approx. 10ft above ground on the side identified as the camera location.
- D. Each location shall have one ¾” conduit penetrating from the base of the pole to the nearest communications pathway junction. If the nearest pathway junction is not within 290’ of the pole a 4x3 communications vault or a 10” pedestal must be installed and connected to the general communications pathway.
- E. Locations greater than 290’ away from an SHSU data facility shall utilize Commscope 12Vdc Power Extenders located in the closest communications vault or dedicated pedestal. Commscope 12ga hybrid fiber PFC-S04O12F shall be run from the extender to an IT@Sam designated closet, and if applicable an appropriate rack mount power supply provided.
- F. SHSU IT@Sam Networking shall be consulted on appropriate communications pathway.

Part 5 – Software, Licenses and Connectivity

- A. All software or systems must provide a minimum of LDAP authentication. Preferred authentication mechanisms include RADIUS and CAS.
- B. All technologies should support high availability and online backups. Virtualization is preferred.
- C. Software should not require operating system-level administrative privileges to operate. D. Where applicable, software should have the capability to integrate with the central campus SIS/ERP to synchronize data in real-time. Additionally, IT@Sam should have the ability to extract data housed in the software to load into the campus data warehouse.
- D. All software licenses should include licenses for a minimum of a production and a development system.
- E. Software should support a mainstream, current database such as Oracle or Microsoft SQL Server. Software should provide high-availability using active-active technologies for failover and redundancy as well as supporting load balancing.
- F. Hosted Mass-email service:

- SMTP service to be RFC5321 compliant.
 - Must support multiple recipients (SHSU defined value) per single message as blind carbon copies.
- G. Hosted Web Services:
- Authentication and session (example = cookies) information must be encrypted.

Part 6 – Minimum Technology Enhanced Classroom Design Standards

- A. This classroom standard is for use in the design of facilities for Sam Houston State University. Consultants shall ensure compliance with all applicable regulating codes. Any deviations from these guidelines require Academic and Research Technologies Audio/Visual staff approval.
- B. These installations and purchases do not preclude, but compliment, existing construction standards. None of these installations will take the place of standard requirements and locations. For example, if standard wiring practices require three power outlets in a wall, and this document requires one outlet, then there will be four outlets in that wall. The end user may have additional requirements that must be coordinated with Academic and Research Technologies Audio/Visual staff.

6.1 Classroom Design Standards, Basic Technology Enhanced Classroom

- A. All classrooms will be designed and engineered from the client's and classroom needs standpoint, not by forcing any classroom into a specific shape formed by the building. Precedence is given to enhance human interaction in the audio and visual aspects of the learning environments.
- B. All students and audience members shall be able to easily see and hear all presenters and program materials, and All Faculty and presenters shall be able to easily see and hear all students and audience members.
- C. All student seats to be within 60-degree horizontal angle to farthest edge of screen, and no greater than a 30 degree vertical angle defined from the eyes of the closest student viewer to the top of any screen; horizontal line parallel to the floor that extends through the eyes.
- D. Closest seats to projected image are 1.5x the width of projection screen.
- E. Farthest seats to projected image are 5x the height of projection screen.
- F. Room layout should be relatively rectangular, ratio not exceeding 1.6 to 1. Staging shall be on the narrow wall. When staging is on the long wall, two or more screens may be appropriate.

6.2 Certification Requirements and Documentation

- A. The lead AV designer shall be a full time staff member employed with the contracting vendor and shall hold an AVIXA CTS-D Certification as well as a Crestron DMC E-4K Certification or other industry standard certification deemed acceptable by Academic and Research Technologies.
- B. The lead installer shall hold an AVIXA CTS-I Certification or other industry

standard certification deemed acceptable by Academic and Research Technologies and must be onsite during all stages of the installation.

- C. Submittals shall be provided with cut sheets and design drawings during the design phase and approved by Academic and Research Technologies.
- D. Progress reports shall be provided to Academic and Research Technologies at least once per month and once per week once installation of AV equipment has begun. Official correspondence must be emailed to avteam@shsu.edu with appropriate updates.
- E. As built drawings shall be provided in PDF digital format upon completion of the project. Digital copies of all manuals shall be part of the final submissions.
- F. All AV Cable Testing documentation shall be provided to Academic and Research Technologies for review before the final inspection of the system.
- G. All AV equipment and cables shall be labeled on both ends according to industry standard labeling conventions including cabling inside the lectern.
- H. Contractor shall deliver all un-compiled code for all systems configured as part of the AV design after final testing has been completed.
- I. ALL equipment capable of having a password set must remain on the manufacturers default username and password unless authorized in writing by an Academic and Research Technologies representative. Only Academic and Research Technologies personnel are allowed to authorize contractor to make changes.
- J. Contractor shall schedule at least one training session with the owner for each system type installed in the building. More sessions may be required depending on number of end-users requiring training.
- K. Upon completion of project, AV contractor shall provide to Academic and Research Technologies a commissioning plan for approval. The AVIXA "Audiovisual Systems Performance Verification Checklist" shall serve as a format and content guide for this list. Upon approval contractor will schedule the commissioning with Academic and Research Technologies personnel and end-users who will participate in the process.

6.3 Warranty and Maintenance

- A. All AV systems shall be covered by a next business day on-site parts and labor warranty against defects in parts, workmanship, equipment failure and cabling infrastructure. This warranty shall be for a term of one year. An optional three year warranty may be purchased at time of completion of work and should be offered by contractor.
- B. Maintenance on the AV System should be covered by the contractor at no additional charge to Sam Houston State University for a term of one year beginning on the date of sign off.

- C. Contractor shall provide information regarding any annual maintenance costs associated with the products designed to create the AV system.

6.4 Projection Screens, Basic Technology Enhanced Classroom

- A. AV Designer will specify screen size and contractor will install specified screens.
- B. All electric screens shall have a single, dedicated, electric circuit.
- C. Optimal distance between the first row of seating and the projector screen is 1.5x the width of the specified screen. Optimal distance to farthest is 5x screen height.
- D. Provide space for whiteboard on side(s) of screen.
- E. The bottom of the screen should be a minimum of 4' above the audience floor, allowing those seated toward the rear of the audience an unobstructed view of the screen.
- F. Projection screens shall be a DaLite model manual or electric screen. The screen shall have a 16:9 aspect ratio. All screens should have a high contrast matte white surface for front projection unless approved by Academic and Research Technologies.
- G. Projection screens for ceilings higher than 9' shall be a Da-Lite model ceiling recessed or wall mounted electric screen(s). All screens shall be installed according to the manufacturer's published guidelines. Wall mounted screens shall have a wood backing that extends 2" beyond the screen housing on all sides.
- H. Plenum ceiling spaces above recessed electric screens shall remain unobstructed to deck above for a distance of 36" from projection wall.
- I. Wall-mounted raise/lower switches will be required adjacent to the lighting controls for electric screens, centralized at a location near the instructor's station. These switches will be clearly marked with text "Screen Control", "Raise", and "Lower". The cable used to connect the low voltage controller to the low voltage switch shall conform to manufacturer's published guidelines. Coordinate with MEP and Academic and Research Technologies early in the project to avoid possible problems with teaching position placement.

6.5 Ceiling Mounted Data Projector Mounting, Basic Technology Enhanced Classroom

- A. Distance from screen to front of projector lens varies with size of screen, which is determined by height of ceiling and depth of room, and projector model/type and lens throw ratios. Academic and Research Technologies and throw distance calculators should be consulted to determine the correct projector make and model and throw distance.
- B. Projector shall be mounted so that the projector lens is perpendicular to the center of the projection screen and level with the top edge of the screen reflective surface.
- C. The projector mounting kit is aligned to be centered on the projector screen.

Center row of ceiling grid, for single projector rooms, should be clear between 0' – 20' (from projection screen) of all A/C vents, smoke detectors, lighting, etc. to allow for future repositioning of projector infrastructure. Multi-projector/screen rooms should follow the same guideline with the row in the ceiling grid that is centered on the projection screens.

- D. Mounting hardware for non-suspended ceiling mount projector locations shall be recommended by AV consultant and approved by contractor. Academic and Research Technologies and throw-distance calculators should be consulted to determine the correct projector make and model and mounting location.
- E. Wall mounted ultra short-throw projectors are discouraged and require approval from Academic and Research Technologies. Only in very rare circumstances will ultra short-throw projectors be allowed.
- F. Projector power shall have a quadraplex 120VAC 20A dedicated power outlet and two data outlets with a 15' flex service loop to allow for repositioning of projector if needed. The projector should be mounted to a plenum enclosure or be flush mounted in the tile with the projector's support column. See specific equipment for ceiling Projection Mounting Systems required by Academic and Research Technologies.
- G. HVAC intake/exhaust ducts should not be located any closer than 6' to the projector location; this will eliminate circulation competition with the projector's fan and cooling unit.

6.6 Audio, Basic Technology Enhanced Classroom

- A. Sound system in the classroom shall be a 70-volt distributed system with speaker placement determined based on an analysis of the height of the ceiling, the dispersion of the speakers crossing at 48" above the floor, and a constant sound pressure footprint over the seating area of the room. Normal listening levels should be attained at 50% system gain. Speaker count and placement should be approved by Academic and Research Technologies AV Team.
- B. Amplifiers shall be sized so that load does not exceed 80% of the amplifiers rated power output.
- C. Amplifiers shall be sized for the number of channels of sound reinforcement required for the application or if sound zoning is required.
- D. A Digital Sound Processor (DSP) shall be used to properly tune audio system and microphones to a room. Audio ducking should be used to lower media audio when Instructor microphone is active.
- A. Separate classrooms should not share the same plenum area, as sound will carry over into adjacent rooms. Walls or sound attenuation barriers must be used to ensure each classroom's audio environment is isolated from adjacent rooms and corridors.

6.7 Multimedia and Video, Basic Technology Enhanced Classroom

- A. The teaching position is defined by the positioning of the floor box and lectern, the screen(s) and the projector(s). Coordination with MEP and others will be necessary to ensure that the teaching lectern can be placed over the floor box without creating obstructions to the projected image. When floor boxes are not available, all cabling shall be placed in an ADA compliant raceway between lectern and wall where cables are run to.
- B. Projectors used in SHSU classrooms shall have at least 2 HDMI inputs and will have a laser light source.
- C. Projectors used in SHSU classrooms shall be capable of fitting the Chief RPMAU mount listed under specific equipment in section 6.12. Exceptions for projectors that exceed the weight limit of the RPMAU mount will need to be approved by Academic and Research Technologies.
- D. All projector locations shall have two data lines located above ceiling near the projector, when practical, and shall consist of a data line terminated into a small surface mount box at the end of a 15' service loop. The loop shall be suspended above the ceiling and labeled for easy identification as well as being labeled on face plate and cable.
- E. Classroom lecterns will be designed by Academic and Research Technologies along with the contractor and purchased under the construction budget with furniture and fixtures. Lecterns shall be ADA compliant.
- F. Cable management must be performed in such a way as to separate power and signal distribution cables. Hook and loop tape must be used to manage Category cables. All signal cables for network and AV must have a 3' service loop within the lectern, neatly managed.
- G. All cables exiting a lectern or rack should terminate to a floor box, poke-through or AV wall plate. All connections must be labeled according to standards established within this document.
- H. All network cables connecting lectern devices to floor box or other network entry point shall be labeled by the AV Installer on the cable at the entry point stating the equipment that it connects and on the device end, the cable shall be labeled with the port label information.
- I. Classroom lecterns must be plugged directly into a floor box underneath the teaching location. No extension cords may be used.
- J. Lectern shall be supplied with rack mounted Power Distribution Units (PDU) located inside the lectern and shall have twenty percent expansion capacity after all equipment, including owners supplied equipment, is planned for. PDU's must not be daisy-chained within the lectern.
- K. Lectern Logo: the owner may want a logo on the front of the lectern. Consult with SHSU Integrated Marketing and Communications department for approved

branding and logos.

- L. Classroom lecterns or media racks typically contain the following items:
- A desktop computer (provided by Owner) with an output of Display port plus or HDMI. Computer shall be located on a 3RU shelf.
 - A gooseneck microphone for sound reinforcement.
 - A Digital Sound Processor (DSP) to properly tune room audio and provide a USB Bridge to bring camera and microphone signals to the local computer for Video Conferencing.
 - A cable cubby with 120-volt AC power to support the laptop cables.
 - HDMI cable for use with a laptop to support a laptop computer. There shall be one cable for HDMI and a custom BYOD adapter ring specified by Academic and Research Technologies. Laptop cable shall be capable of extending at least 36" outside the cable cubby.
 - Crestron AirMedia.
 - A touch panel controlled video and audio routing system that supports digital video sources interfaced into the SHSU local area network.
 - If design requires, an external amplifier for 70-volt distributed sound with power output providing 20% headroom when used within normal operating parameters.
 - Optional Blu-ray player and document camera when required to support teaching needs.
 - A standalone Network Switch to transmit Audio/Video over IP to display devices such as projectors and flat panel displays, maintaining HDCP compliance.
 - Video Conferencing equipment shall consist of ceiling array microphones and a PTZ camera.

6.8 AV Control System, Networking, Basic Technology Enhanced Classroom

- A. Audio Visual control systems of choice shall be manufactured by Crestron or QSC. All control systems subject to Academic and Research Technologies approval prior to installation.
- B. Wired Touch Panel shall be used in all classrooms and conference rooms. Size will be dependent on complexity of the GUI.
- C. All teaching positions will have a minimum of 5 data ports supplied to network the AV control system components and classroom computer.
- D. Network connections of control systems and other devices shall use the private network feature of the line of equipment. When designing and interfacing AV equipment for/to the SHSU network, only one MAC address is allowed on a single network port. Contractor will need to supply model number, serial number and MAC address of all networked devices to clear the port for communication. MAC

addresses should be supplied at least 2 weeks prior to deployment of equipment. Consult Academic and Research Technologies for devices that report more than one MAC address.

- E. Contractor shall provide a list of all Network ports that need to be active for the networked AV equipment.
- F. Standalone Network Switches for AVoIP and AES67/Dante products are allowed. Any standalone switch must be fully isolated from the SHSU LAN. Typical installation would use the Crestron CP4N controller using the LAN port for control and the control subnet port for the standalone switch. Contractor shall provide their own IP addresses for standalone devices and will supply that information to the Academic and Research Technologies AV Team.
- G. Contractor shall be responsible for obtaining IP address information from Academic and Research Technologies two weeks prior to the installation and networking of all projector and control system devices in consultation with SHSU to integrate all networked devices into the SHSU local area network. All programming shall have Crestron Fusion RoomView hooks and XPanel functionality of control systems. Contractor shall provide demonstration of all functionalities and provide training on all aspects of the system.
- H. All Crestron Control System interconnect cabling shall comply with the Crestron specifications for cabling and fiber infrastructure.
- I. All point-to-point Category wiring within classrooms, that is not going to a SHSU IDF or MDF, shall have a yellow jacket and be rated to standards of the manufacturer whose equipment is being interconnected.

6.9 Floor Boxes, Conduit and Networking, Basic Technology Enhanced Classroom

- A. An SHSU Networking specified floor box shall be used in all classroom, the position of the box shall be coordinated so that when the teaching lectern is placed over the box, it does not obstruct the function of the projection screen(s), is not an obstruction to the projected image from the projector(s) and does not allow for any cables to become a tripping hazard.
- B. The floor box shall have two (2) 120VAC 20A duplex outlets, on a single circuit, mounted in the box.
- C. A floor box should have as a minimum two (2) 1-1/4" conduits for AV that terminate at the pull box for the classroom with one conduit going to the hallway cable tray, one conduit going to the projector position. Dust plugs will be utilized in vacant ports in floor box.
- D. Conduits shall be free from burrs and have bushings on open ends.
- E. Depending on AV design, a minimum of five data outlets shall be installed into the floor box directly underneath the lectern.
- F. All cabling pulled in floors at grade level will be rated for direct burial due to

likelihood of condensation in conduits.

6.10 Lighting, Basic Technology Enhanced Classroom

- A. No ceiling light fixtures may be placed within 7' of any projection screens unless reflectors restrict lights directly downward to not spill or reflect onto screens. The front panel of lights reflecting onto the screen will be independently controlled.
- B. Plan for the instructor to adjust all the lighting levels for their needs from near the teaching position. All lights will be controlled from a minimum of two points; near the entry/exit to room, and near the location of the instructor/media cabinet. Besides being able to completely shut off the front panel of lights near the projection screen, the other lights in the room should be able to be dimmed.
- C. AV consultant and MEP shall coordinate to ensure that the location of pendant lighting shall not obstruct the light path of the projected image.

6.11 AV IDF, Conduit and Networking, Basic Technology Enhanced Classroom

- A. Provide at least one lockable AV closet per building, minimum 64 sf (8' W x 8' D x 10' H). AV closets will be accessible from hallways and will NOT be inside the classrooms, shall have a 36" wide entrance with swipe card access, electrical power, climate control and lighting.
- B. When an AV IDF is specified for a project, the IDF shall have two 4" EMT conduits running between the AV IDF and a telecommunications closet. In addition, one 4" EMT conduit shall provide a pathway between the AV IDF and the hallway cable tray. The IDF shall have at least one free standing rack. The IDF shall have data, electrical power, HVAC, and lighting installed. Consult owner for final design details.

6.12 Specific AV Equipment

- Control System
 - Crestron or QSC – current Series controller.
 - Crestron or QSC Touch Screen Control System appropriately sized dependent on GUI requirements.
- Standalone Network AV Switch
 - HP Aruba.
 - Netgear.
- Video Distribution
 - Crestron or QSC AV over IP signal distribution.
 - CAT cables for standalone network will have yellow jacket to designate it does not go to a Network IDF.
- Document Camera
 - Specified per install depending on client needs.
 - ELMO PX-10E

- ELMO PX-30E
- Laptop Connections
 - Crestron Air Media
 - Extron HDMI Ultra Series cable (12') with LWC DL-AR2804 adapter ring.
- Projection Mounting System
 - Chief CMS492C Plenum Box for drop tile ceilings.
 - Fixed Chief Extension Column as required per design.
 - Chief RPMAU Locking Mount.
 - Middle Atlantic PDX series Power Filter.
- Projector
 - Panasonic laser projector specified based on design with approval from Academic and Research Technologies.
- Projection Screen
 - DaLite High Contrast Matte White or approved material, 16:9 aspect ratio HD screen.
 - Size to be determined by AVIXA Design Standards for displays.
- Flat Panel Display
 - FPD to include RS232, RJ45, 3-year manufacturer warranty.
 - Some installations may require the use of a TV with Tuner. Exceptions must be approved by the Academic and Research Technologies team.
 - SHSU preferred manufacturers are Panasonic and Samsung.
 - Size to be determined by AVIXA Design Standards for displays.
 - FPD's over 60" will require a back board mounted to the wall and should have a Chief PAC526FWPx series back box to house equipment.
 - Any FPD that is mounted to an articulating arm will require a back board mounted to the wall regardless of the size of the display.
- Lecture Capture Rooms
 - PTZ camera. QSC is our preferred manufacturer
 - Ceiling array microphones for audience. Shure is our preferred manufacturer
 - Wireless lavalier microphone for presenter voice lift and recording. Shure SLX-D is our preferred wireless microphone.
 - A USB bridge will deliver microphone audio and camera video to the classroom computer.
- Digital Sound Processor – QSC is our approved manufacturer.
 - CORE 8 Flex or CORE 110f v2 are recommended
 - Academic and Research Technologies team should be consulted for approval of other models.
- Lectern
 - Middle Atlantic, Marshall and Spectrum are preferred manufacturers.
 - Lectern must be ADA compliant.
 - Cable Cubby with 120VAC power and HDMI laptop connection.

- A Liberty Wire and Cable, IT@Sam specified, laptop adapter ring for BYOD.
- Crestron or QSC Touch Screen interface for control.
- Academic and Research Technologies specified Local Monitor mounted on a monitor arm.
- Confidence Monitor
 - Optional Instructor’s Confidence Monitor shall be mounted to the back wall or ceiling hung. Display shall be sized based on the viewing distance from the lectern. Academic and Research Technologies shall approve final selection and location of display.
- Video Conferencing Equipment
 - SHSU employs TEAMS and ZOOM for conferencing.
 - Ceiling mounted array microphones to capture audience. Wireless lapel microphone to capture Presenter audio.
 - Approved PTZ camera, Field-of-View dependent on room size/layout.
- Audio
 - 70V distributed audio in most areas unless otherwise specified.
 - Ceiling recessed speakers in drop tile ceilings.
 - Pendant speakers when ceiling is open concept.
 - Digital Sound Processor to support audio design.
 - Listening Assisted System shall be provided for ADA compliance in accordance with DOJ guidelines. Number of receivers and headsets to be determined by seating capacity and ADA guidelines.

Part 7 – Minimum Technology Conference Room Design Standards

7.1 Integrated Audio-Video Systems and Equipment for Conference Rooms

- A. Conference rooms shall be equipped with a Flat Panel Display (FPD) that will allow for the appropriate viewing size for the room and the type of content being viewed. FPD’s over 60” will require a back board mounted to the wall and should have a Chief PAC526FWPx series back box to house equipment.
- B. The display chosen shall conform to Section 6.12 Specific AV Equipment guidelines.
- C. The display wall mount shall be from Chief Manufacturing and have tilt capability. Chief MTM1U, LTM1U and XTM1U are our preferred mounts.
- D. Any FPD that is mounted to an articulating arm will require a back board mounted to the wall regardless of the size of the display
- E. Control systems shall conform to the standards laid out within this document pertaining to classrooms. Crestron and QSC are the SHSU standard manufacturers
- F. Ceiling array microphones or table mounted boundary microphones should be provided for audio conferencing.

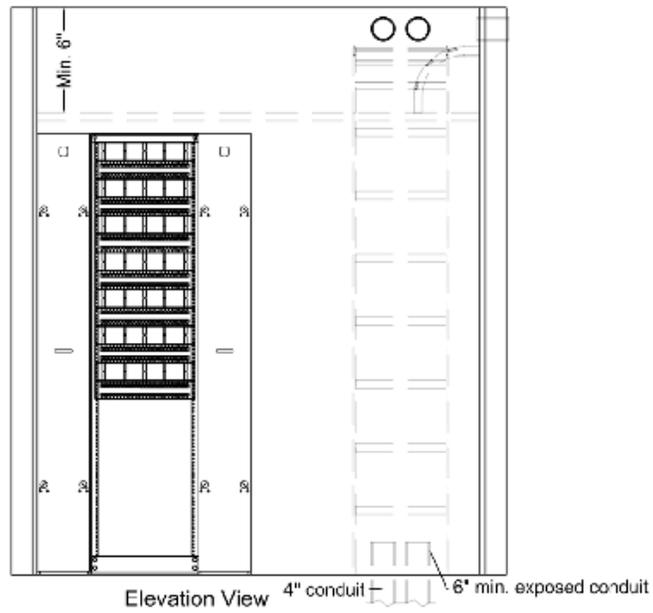
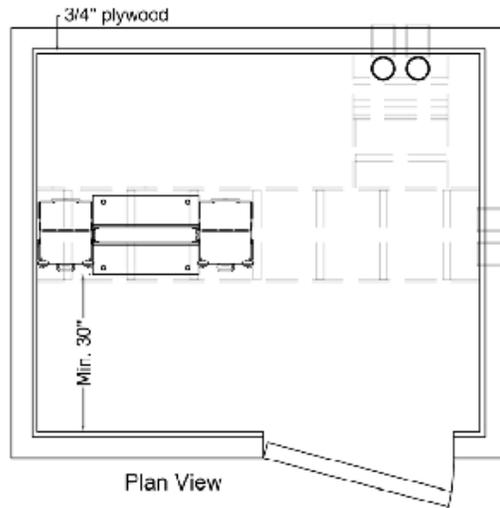
- G. Digital Sound Processor should be used to balance room audio and provide echo cancellation.
- H. Conference Room sound may be provided by external sound bar or distributed audio dependent upon room size and needs.
- I. PTZ camera to be provided for video conferencing. FOV to be dependent on room size and layout.
- J. Small conference rooms may utilize the Crestron UC-SB1-CAM sound bar with Academic and Research Technologies approval.
- K. Power and AV cabling should be installed in a floor box or ADA compliant floor track and brought to the conference table. Coordination with purchasing needs to be done to ensure the table has the correct power and AV components when ordered.
 - Owner, along with Academic and Research Technologies, will determine if an AV faceplate can be used instead of bringing power and AV components to the conference table.
- L. An Academic and Research Technologies specified HDMI cable and adapter ring should be installed for BYOD support. Noted in 6.12 Specific AV Equipment.
- M. Crestron AirMedia device may be specified instead of or supplemental to other HDMI connections.

Part 8 – Typical Drawings

8.1 Typical Drawings

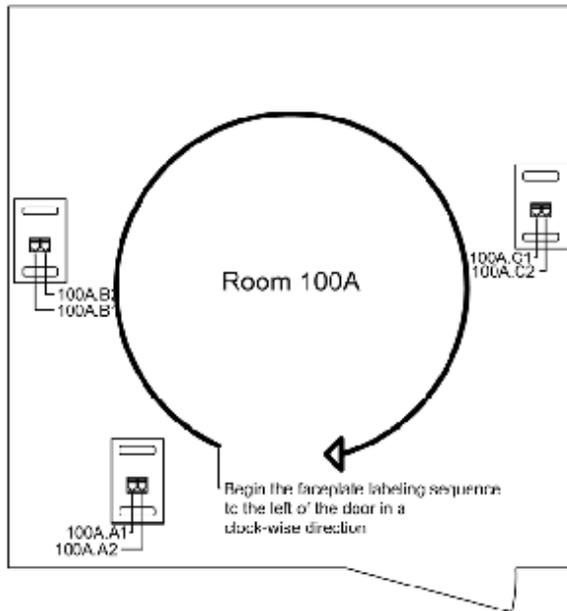
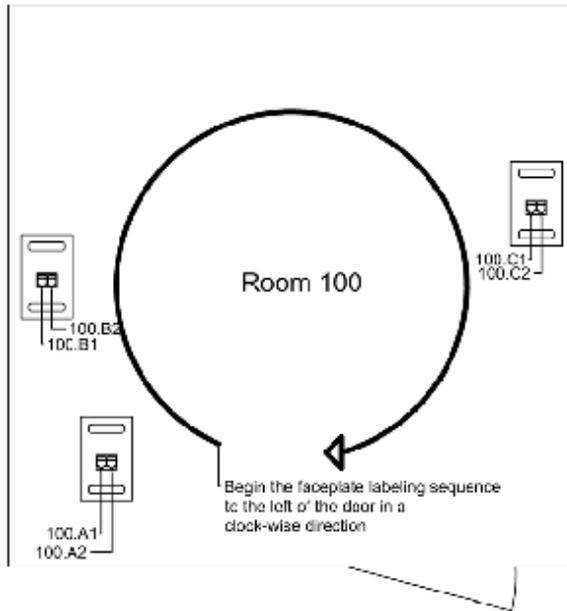
- Typical small distribution facility

Typical Distribution Facility

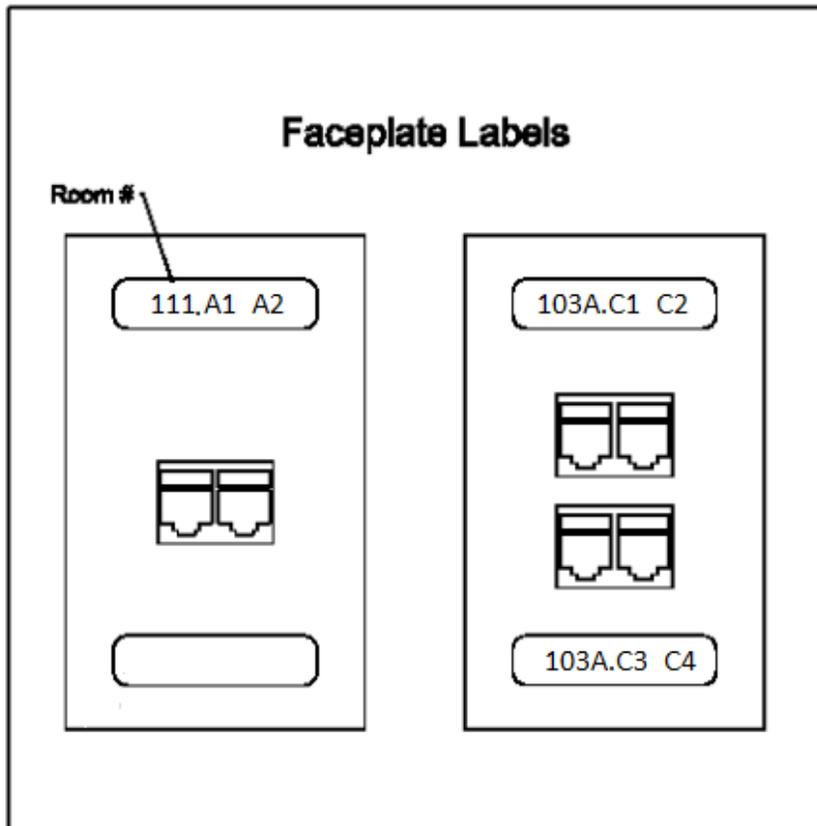


- Typical Labeling

Labeling Example



Labeling Example





Manhole ID Plate Example

