

# 2011

## **BRIGHAM YOUNG UNIVERSITY – IDAHO TELECOMMUNICATIONS CABLING STANDARD**

Guidelines and best practices for those who have involvement in the cabling operations on the campus of BYU-Idaho.

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# Section 1: General Requirements for Doing Work on BYU-Idaho Cable Plant

## 1.1 Contractor Requirements

Cable contractors that do work on any aspect of the BYU-Idaho cable plant must meet the following requirements.

- Contractors doing work on campus must be certified members of Building Industry Consulting Services International (BICSI).
- Have a Registered Communications Distribution Designer (RCDD) as a member of the staff and team that actively participates in the work being done on campus.
- Contractors must be Certified SYSTIMAX Structure Cabling System installers of copper and fiber solutions and be a SYSTIMAX Certified VAR.
- Company must have at least 10 years of experience in the installation of copper and fiber solutions. This includes but is not limited to termination of fiber and copper ends and splicing of large count fiber and copper cables.
- Individual technicians must understand and be formally trained in the installation of copper and fiber cabling and have 5 years of experience in such work. This experience includes but is not limited to the status of SYSTIMAX Certified Installer.
- On jobs and projects awarded to a contractor a lead technician must be assigned. This lead technician shall not be replaced or removed from the project until its completion without coordination with BYU-Idaho IT Infrastructure personnel representing the project. BYU-Idaho also reserves the right to request a new lead technician for unacceptable work during the process of the project.
- Contractor is required to have a Labor and Performance Bond equal to value of the contract.
- Contractor is responsible for repair or replacement of items damaged by them in the work process. The repair or replacement must match, meet, or exceed the model, and or quality, and or value of the item damaged.
- All work performed shall be in accordance to all NEC, NFPA, NESC, ANSI/TIA/EIA Standards, local codes, this BYU-Idaho Cabling Standard, and all other applicable codes and standards.
- Contractors must provide at least 1 year of warranty on their installation. This warranty assures that all equipment, materials, and workmanship are in accordance with this document, contract bid specification documents, and previous and for-mentioned codes in this document.
- Contractor must be capable and authorized to provide manufacturer product warranty including but not limited to the SYSTIMAX 20 year materials and installation warranty.
- Bidders shall be selected from a list of pre-approved cabling contractors. This list is ever subject to change based on past performance of contractors and availability of contractors that do this type of work. The approved list is included in this document. (Refer to page 23 – Approved Contractors)

- Individuals doing work on the BYU-Idaho campus shall be respectful and considerate of students, faculty, and staff of this University. This includes using modesty in language and dress while working on campus.
- When doing work in and around buildings, it may be necessary to temporarily navigate vehicles on sidewalks for ease of loading and unloading. Effort shall be made to minimize this type of vehicle traffic. Also, special care will be taken to avoid damage to landscape. Damage to landscape will be the contractor's responsibility to repair.
- Bidders shall be required to read this document before submission of bid. Potential workers on the cable plant of BYU-Idaho signify that they understand this document by signature on the last page. These include outside contractors, student employees, and full time employees of BYU-Idaho.

## Section 2: BYU-Idaho Students Doing Work on the BYU-Idaho Cable Plant

### 2.1 Student Team Members

BYU-Idaho employs students as technicians doing work on the various cabling and network systems on campus. BYU-Idaho considers very valuable the contributions that students make. Students are trained in the methods and approaches that we use on campus. Students doing work on campus will read and understand this document before doing work. Work done in deviation from what is outlined in this document will be done again. Students shall approach their different tasks with consideration to safety. Student will use best safety practices when working on campus. This includes but is not limited to proper use of tools and ladders and the use of Personal Protective Equipment such as safety glasses and hardhats when necessary. There is a lead student who is a resource for questions from other student team members concerning what are best practices for work on the BYU-Idaho campus. In addition to the lead student, questions can be directed to members of the IT-Infrastructure team. Questions about how to best accomplish tasks are not only necessary, but encouraged. Students who are not able and or not willing to work in accordance to this standard and or not able to follow instruction from members of the IT Network Infrastructure team will be dismissed.

### 2.2 Student Tasks

- Demolition of cabling and other infrastructure that is no longer needed or used.
- Pulling of copper horizontal permanent link station cables.
- Termination and testing of copper horizontal permanent link station cables.
- Pulling of fiber cables.
- Termination and testing of fiber permanent link cables.
- Labeling of cables on TR end and station end.

- Installation of appropriate pathway components including J-hooks, cable tray, raceways, and conduits.
- Connection of patch cables to create links between equipment and users.
- Documentation of cables, connections, and infrastructure.

## Section 3: Telecommunication Rooms and Building Entrance Facilities

In this document, and in related discussions, BYU-Idaho uses the term Telecommunication Room or TR in accord with TIA/EIA and industry standard. We also use the term Entrance Facility to designate a TR that is allocated for the room where network cabling and other service enter the building from the outside. Entrance Facilities need to follow the same minimum guidelines as basic TR's with possible additional guidelines. Special considerations for Entrance Facilities will be outlined in more detail in Section 4 of this document. Other previously used terms for these types of rooms but not used on this campus include: BDF, IDF, and closet. Telecommunication Rooms are rooms that provide a secure location for network and telecommunication cabling and supporting network equipment. Telecommunication Rooms provide a distribution and connection point between backbone cabling and distribution cabling. Whenever possible at least 1 TR should be located on each building floor. In new constructions, careful consideration to network standards and network protocol limitations including cable length should be made in selection of a location for a TR.

### 3.1 Placement of TR's and Entrance Facilities

TR placement in new construction should be a decision that is made in close coordination with representatives from contracted engineers tasked with building design, members of IT Infrastructure, and members of the Physical Facilities design team. Any deviation from what is outlined in this document should be agreed upon by all parties involved.

Considerations for placement of Telecommunication Rooms:

- Size of allocated space that will be served by the TR.
- Centrality on floor that TR will be serving.
- Allowance for copper horizontal station cable permanent link runs to be less than 295 feet.
- Accessibility to receive pathway from other parts of building including cable trays and conduits.
- Ability to follow the TR stack approach when another floor serving TR is above or below.
- Accessibility to TR from a common space such as a hall way.

### 3.2 TR's and Entrance Facilities as Secure and Dedicated Rooms

The secure nature of a Telecommunication Room makes it necessary that it not be a shared space. Only authorized individuals doing specific tasks should be allowed into the rooms that are considered TR's. This approach makes it necessary that functionality of the room be limited to activities associated with

moves, adds, and changes to network infrastructure and be performed by personnel in the Network Infrastructure group. Entrance from other personnel and activities outside of this shall be prohibited. TR's must be secured with a campus 4165 key. This key should only be in possession of individuals that have regular need of entering TR's including Network Engineers in the Network Infrastructure group. Any deviation from this outline of appropriate use of TR spaces should be agreed upon by the members of the Network Infrastructure group.

TR's can contain but are not limited to containing the following:

- Patch cables
- Permanent link cables
- Cable management components
- Grounding equipment
- Hook-up wire for cross connection.
- Network switching gear
- Uninterruptable Power Supplies
- Copper Station Cables
- Single mode and multimode fiber cables
- Power Transfer switching gear
- Cabling and ground/lightning protection equipment for outside Emergency Phones

TR's shall not be used for:

- Storage for miscellaneous items from around the building
- Custodial rooms for storage of mops, cleaning supplies, etc.
- Office space
- Electrical / HVAC / Security Systems
- Tool and material storage
- Student study or quiet space at any time of day
- Space for miscellaneous IT equipment connectivity without coordination with IT Infrastructure
- A pass through point for wiring for other systems not related to network infrastructure
- An equipment location for systems not related to network infrastructure without coordination with IT Infrastructure

### 3.3 Equipment Consistency in TR's and Entrance Facilities

TR's on campus consist of a uniform combination of equipment, cable management, cable, connectors, and patch panels. This consistent approach allows us to keep a manageable stock of supplies for scaling our cable plant and network infrastructure. We have adopted specific manufacturers of parts and equipment that we accept as standard equipment in TR's on campus. Individuals in IT Infrastructure have received training in the installation and maintenance of many of these components. Support and

warranties are based on the professional installation of these specific components by BYU-Idaho personnel and approved outside contractors.

### 3.4 Chatsworth Products Inc. (CPI) TR Standard Equipment

Minimum Chatswork Products Inc. components of a Telecommunication Room:

- 3 ea. Chatsworth Products Inc. (CPI) 19" x 7' Equipment Rack black in color (See diagram on page 9)
- 4 ea. CPI 6" Dual-Sided Vertical Wire Manager Black to be installed on both sides of each 19" rack black in color (See diagram on page 9)
- 3 ea. CPI 19" Horizontal Wire Manager Black in color
- 1 ea. CPI Rack Installation Kit black in color (1 ea. per rack)
- CPI Rack Grounding Kit (1 ea. per rack)
- CPI 18" Cable Runway Ladder Rack w/ appropriate joining hardware. Ladder rack should span the entire top of the rack black in color
- CPI 18" Cable radius maintaining waterfall for all locations where cable drops off Ladder Rack
- CPI Ladder Rack stand-off kits for raising ladder rack above tops of 19" racks black in color
- CPI 18" Wall angle support kit for all locations where ladder rack runs to wall
- 8 ea. CPI 6" Cable Retaining Posts black in color
- CPI 18" Rack to Runway mounting plates as necessary to secure rack to stand off kits and runway black in color
- CPI Ladder Rack Rubber Bumpers to finish cut ends of Ladder Rack where necessary black in color
- Appropriate hardware to anchor racks to concrete floor and interconnect sections of Ladder Rack.

### 3.5 Minimum SYSTIMAX GigaSpeed Components of a TR or Entrance Facility:

- Systimax 2091 Category 6A rated cabling in new buildings or new TR's. In existing TR's where cable is being added to an existing cable plant and Category 6 is already installed, SYSTIMAX 2071 cable is adequate. Color of cable in new buildings should be white. Cable added to existing buildings should match the color of cable currently in TR. (White or green)
- SYSTIMAX GigaSpeed XL X10D 48 port patch panels with cable management rings shall be installed in new buildings. In existing TR's where cable is being added to an existing cable plant and Category 6 is already installed, SYSTIMAX XL 48 port patch panels with cable management rings are adequate.
- Cable retaining clips provided with each SYSTIMAX patch panel will be used on all patch panel terminations.
- SYSTIMAX plastic label holders will be installed above each bank of six patch panel ports.

- SYSTIMAX LIU get parts specific
- SYSTIMAX FIBER (OR CORNING)
- SYSTIMAX PATCH CABLES COPPER
- SYSTIMAX FIBER JUMPER CABLES YELLOW OR ORANGE

### 3.6 Size and Dimensions of TR's and Entrance Facilities

The size and dimensions of the TR and or Entrance Facility/TR are crucial to accommodating large pieces of networking gear and often large counts of building cable. Typically larger spaces are needed for additional Telecommunication Rooms that are also considered Building Entrance Facilities. Close coordination between contracted engineers, IT Infrastructure, and facilities should occur when planning a space for a TR or an Entrance Facility/TR.

General layout requirements for the Telecommunications Room include but are not limited to:

- Rooms considered TR's shall be at least 10' by at least 8'. This size requirement may need expanded based on the circumstantial demands on the room. These special circumstance demands could include size of floor space served, building occupant needs, future requirements of expansion and growth, and special network/telecom services used.
- Rooms that are considered Entrance Facilities in addition to Telecommunication Rooms shall have dimensions of at least 16' by at least 8' to accommodate the extra racks and gear associated. (Refer to 4.4 for more details on Entrance Facility size)
- The front most protruding portion of any equipment rack within the TR or Entrance Facility/TR shall not be closer than 4 feet from the front wall of the TR. (See Diagram on page 9)
- The back most protruding portion of any equipment rack within the TR or Entrance Facility/TR shall not be closer than 3 feet from the back wall of the TR. (See Diagram on page 9)
- It is preferred that no sprinkler heads be installed in TR's or Entrance Facility/TR's. In the event that code requires sprinkler head(s) a wire protective cage shall be installed to protect the head. Also, troughs shall be installed under water carrying pipes to prevent water damage to network equipment.

### 3.7 Guidelines for Cable Pathways Within, Entering, and Leaving TR's and Entrance Facilities

Conduits and trays are the preferred form of pathway bringing cables to and from a TR and Entrance Facility. Within the TR or Entrance Facility Black CPI 18" Ladder Tray is the preferred method for supporting cables. In special cases cables may be routed inside of the TR using D rings as support. These cases include the routing of cable for a wall mount TR phone, or the routing of grounding cable. The smallest D Ring that accomplishes a neat and finished end product shall be used.

Inside TR pathway requirements include but are not limited to:

- A minimum of 4 ea. 4" EMT conduits feeding a TR from the Building Entrance Facility.
- A minimum of 4 ea. 4" EMT conduits from the TR to each of the individual floors that it serves.
- Waterfall style cable management shall be installed to make the transition from the basket cable tray that enters the TR or Entrance Facility to the 18" Ladder Tray within 36" of the basket tray entering the TR or Entrance Facility.
- Feeding conduits or conduit sleeves shall enter a TR or Entrance Facility and protrude at least 3". This 3" protrusion shall be typical of conduits entering through a floor, wall, or ceiling.
- All conduits shall be reamed and have a plastic bushing installed.
- Conduits shall not be left open. All applicable codes shall be followed regarding the installation of appropriate fire stopping materials including but not limited to UL 1497, ASTM E814, and ASTM E119. Acceptable fire stopping materials include but are not limited to putty, caulks, and expanding pillows.

### 3.8 Environmental Requirements for TR's and Entrance Facilities

- TR's and Entrance Facilities shall be part of an HVAC system that is able to maintain an ambient temperature between 64 and 74 degrees Fahrenheit.
- Relative humidity in TR's shall be between 30% and 55% non-condensing.
- Positive pressure shall be maintained in TR's and Entrance Facilities with a minimum of one air change every hour.
- TR's and Entrance Facilities must be part of an HVAC system that can maintain the above mentioned temperatures and humidity range and air changes 24 hours each day and 365 days each year.
- Necessary maintenance to HVAC systems and replacement of filters shall be performed on a regular schedule.

### 3.9 Power Requirements Inside of TR's and Entrance Facilities

Power needs in the TR's and Entrance Facility change depending on how the space will be used and special requirements of the network gear that will be housed in the room. Close coordination shall be made to discuss the individual power needs of each new TR or Entrance Facility with contracted engineers, representatives from IT Infrastructure and Physical Facilities on new constructions. Below are minimum requirements for a basic TR without consideration to special needs.

- Each TR and Entrance Facility shall have a dedicated electrical panel that is servicing only of the TR or Entrance Facility that it is in. This panel shall have circuitry to a building UPS system or to E-power or to generator power that is considered E-power.
- There shall be a minimum of 4 dedicated 3 wire 120 V 30 A circuits using NEMA L 6-20R.
- There shall be a minimum of 2 ea. 120 V 20 A circuits on normal building power for use of power tools and testers within the TR.

### 3.10 TR and Entrance Facility Grounding and Bonding Requirements

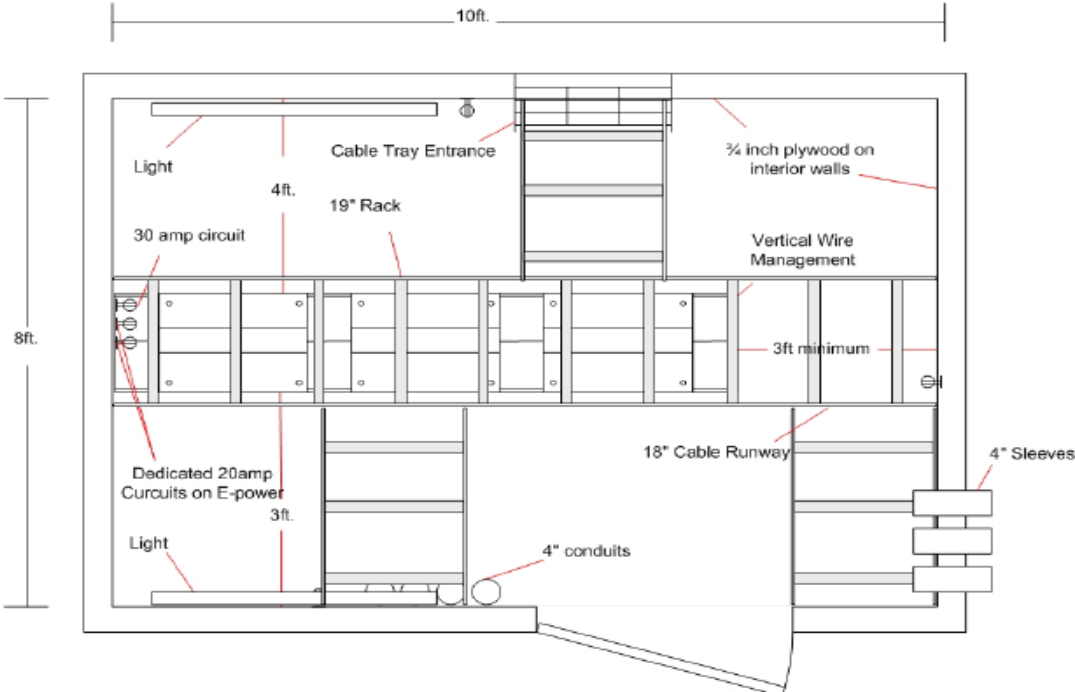
- Applicable codes and standards must be adhered to with regard to grounding and bonding including but not limited to NEC 250, ANSI/NFPA 780, and ANSI/EIA/TIA-607.
- All racks, equipment, and cable shields shall be properly grounded. All cable trays shall be bonded between sections and tied to ground.
- The minimum cable that shall be used for grounding or bonding shall be of 6 gauge stranded copper.
- Direct attachment shall be made to the closest grounding point that is considered building ground on the electrical grounding system of the building. This connection must provide the necessary proper grounding equalization.
- As mentioned in 3.3 of this document, the preferred manufacturer of parts for constructing a ground bus bar or ground window is Chatsworth Products Inc.

### 3.11 Work Accessibility in TR's and Entrance Facilities

Constant network moves adds and changes in a building mandate that TR's and Entrance Facilities be constructed in a fashion that facilitates adding station cables, demolishing station and riser cable, adding network electronic equipment, and changing or replacing equipment. Special considerations in the construction of the room should be made to facilitate this work. This includes but is not limited to:

- Any type of ceiling that hinders the addition of cables to TR or Entrance Facility pathways shall not be installed. When a ceiling is absolutely required by code the minimum floor to ceiling height shall be no less than 8' 6". False or drop in grid ceilings are also not preferred.
- TR's and Entrance Facilities shall have fully opening doors that swing outward. Door openings shall be without thresholds as they make difficult the maneuvering of heavy equipment. In dual door openings, center posts shall not be installed. Doors shall be a minimum of 36" wide. Door shall be secured with the 4165 campus key.
- Fluorescent lighting fixtures shall be placed with consideration to rack placement. Lights shall be mounted on walls at least on both sides of rack facing each other when possible. (See TR diagram) Motion detecting light switches shall be installed. A minimum of 12" of space should be between any portion of a light or lighting fixture and a cable tray or cable runway. Walls shall be white to enhance room lighting.
- 3/4" AC grade Fire-rated Plywood shall be mounted on walls where there is a need to mount multiple and various equipment items on walls. Flush hardware will be used for mounting this plywood to wall. Plywood shall be painted white to match the rest of the room.
- Floor shall have loading capacity of 100 pounds per square foot. Polished concrete or tile is preferred for the floor finish. Carpet in TR's or Entrance Facilities is not allowed.
- All TR's and Entrance Facilities shall be equipped with a broom, dust pan, and waste basket. These items are not to leave the TR or Entrance Facility.

### 3.12 Example TR Layout Diagrams with Minimum Requirements



## Section 4: Backbone Cabling

Backbone cables typically originate out of the Joseph F. Smith Building and extend through our system of utility vaults on campus. Entrance Facilities are the point at which these backbone services enter a building. These rooms typically must be larger than a regular TR space because of the higher number of racks, backbone cabling, and equipment that goes into these rooms. Building Entrance Facilities are the point where backbone cables entering the building are usually terminated.

### 4.1 Backbone Cable Count Requirements

- Each building on the BYU-Idaho campus shall receive at least 24 single mode fibers. This count requirement could be increased based on the services that are needed in the building. All fibers and fiber terminating components shall be of the SYSTIMAX product line.
- Each building on the BYU-Idaho campus shall receive at least 25 pairs of copper backbone cabling. Outside copper backbone cabling shall be 24 gauge.
- There are multiple large fiber and copper dark cable counts that are available in utility vaults for splicing and taking cable counts into new constructions. Close coordination with BYU-Idaho IT Infrastructure, Facilities personnel and contracted engineers and installers should occur when splicing into existing infrastructure in utility vaults.
- All backbone copper cable counts shall be protected with gas style cable protection fuses on both ends of the cable.
- All backbone copper cable counts shall be terminated on a 110 style panel in the Entrance Facility with a separate cable extending the connectivity to a SYSTIMAX patch panel ready for distribution to other TR's in the building via risers.
- All fiber backbone cable counts shall be terminated with LC style connectors that are loaded in bulkheads and mounted in SYSTIMAX LIU(s).
- Sharp kinks or bends will not be accepted on fiber or copper backbone cables.
- A service loop of at least 20' shall be installed on all backbone cables within the Entrance Facility and be neatly looped and secured with Velcro and supported on Ladder Racks or attached to a wall.

### 4.2 Backbone Cabling in Utility Vaults

- Utility Vaults shall be cabled in a neat and organized manner.
- Splice cases that are housed in utility vaults shall not be left on the ground, or hanging, or suspended from the cables that they are splicing.
- Splice cases shall be labeled according to the cables that they are splicing.
- Angle supports shall be installed with necessary trays and shelves to keep cable loops off the ground in a neat and organized manner.

- Utility vaults on campus are a shared resource with our high voltage plant. Communications cables shall not weave, cross, or mix in any way with the cables that are for high voltage. As much distance as possible should be maintained between the two cable types.
- Precautionary safety measures are the responsibility of the individual contractors that will be doing work in the vaults. Utility vaults are considered a confined space on the campus of BYU-Idaho. Safety measures should be taken by the contractor to assure a safe working environment. This includes but should not be limited to testing for adequate oxygen levels in vaults before entry.
- 20' of service loop shall be installed in a neat manner in each vault that a new cable install passes through.
- Vaults should be maintained free of water and mud.
- Vaults should be kept secure through the process of work that is happening in them and around them. Workers shall make certain that all vaults are locked and secure when they are not immediately attended to.

### 4.3 Backbone Containing Conduits in Entrance Facilities

- At least 4 ea. 4" conduits shall be installed for the telecommunication systems cables entering the building.
- Cables shall not be installed between the utility vault or manhole and the Entrance Facility without inner-duct. Cables pulled through 4" conduits without any type of inner-duct will not be accepted.
- At least one of the four conduits shall have 4 ea. 1" corrugated inner-duct installed. All conduits that are cable containing at the time of turnover to owner will be threaded with the maximum number of 1" inner-ducts to maximize the capacity of the 4" conduit.
- All inner-ducts, fabric or corrugated that do not have cables installed shall be threaded with pull lines.
- Fabric inner-duct is a viable replacement solution for corrugated inner-duct. If fabric duct is used, 3 ea. x 3 channel fabrics shall be installed using best practices to mitigate problems with twist and bind in the fabric. Max Cell is the fabric inner-duct of choice on campus.
- Conduits shall slope to the outside of the building as to not allow possible water drainage into the building.
- All best practices as defined by BICSI's TDMM, electrical codes, and standards will be used in the installation of underground conduits that feed Entrance Facilities. To be considered best practice on BYU-Idaho campus the following is applicable:
  - No conduit bends shall exceed 90 degrees.
  - The conduit run must extend all the way into the building. No direct buried cable will be accepted.
  - Max bend radius of a 4" conduit is 10 times the inside diameter of the conduit. The max bend radius of a 4" conduit is 40".

- Empty conduits that enter a building shall be plugged with an appropriate fitting that does not allow water or creatures to enter building.
- All conduit banks shall be encased in red concrete from the point where they leave the utility vault until they either reach the building or reach the next utility vault.
- Outdoor cables entering a building in a conduit must be terminated within 50' of exiting the conduit.

#### 4.4 Requirements for Entrance Facilities that Exceed those of TR's

- Entrance Facilities must be in a location that is in proximity to the utility vault that will be feeding the building.
- The minimum size of an Entrance Facility shall be 8' x 16'. This dimension is a minimum size. The equipment and demands of the room could necessitate that the room be larger.
- 5 CPI equipment racks and corresponding CPI cable managers, CPI Ladder Racks, etc. shall be typical of each building's Entrance Facility. Refer to 3.4 for list of accepted CPI parts.

## Section 5: Riser Cabling

Riser cabling is fiber or copper cabling that is used to extend services and connectivity from the Entrance Facility to other TR's within the same building.

### 5.1 Fiber Riser Cable Count Requirements

- In most cases single mode fiber riser cable counts shall match the backbone cable counts to each of the TR's from the Entrance facility. This means that at least 24 strands of SYSTIMAX single mode fiber shall be installed from the Entrance facility to each of the other TR's in the building.
- At least 24 strands of SYSTIMAX 62.5 micron multimode fiber shall also be installed between the Entrance Facility and each TR of the building.
- All multimode and single mode fiber shall be terminated with SYSTIMAX LC style connectors on both the Entrance Facility end and the TR end. These terminations shall be loaded in bulk heads and mounted in the SYSTIMAX rack mounted LIU.
- Fiber risers shall be installed free of sharp kinks or bends
- Fiber risers shall be installed in 1" plenum rated corrugated inner-duct. An alternate method may be the use of armored cable for the riser.
- In all cases, fiber cables installed between the Entrance Facility and the TR must be appropriately rated for plenum spaces.
- Refer to 8.3 and 8.4 for information on labeling fiber optic cables.

## 5.2 Copper Riser Cable Count Requirements

- In most cases copper riser cable counts shall match the backbone cable counts to each of the TR's from the Entrance facility. This means that at least 25 copper pairs of 24 gauge shall be installed from the Entrance facility to each of the other TR's in the building. This cable shall be of the SYSTIMAX product line.
- All copper riser cable counts shall be terminated on a 24 port SYSTIMAX XL patch panel mounted in the CPI 19" rack with one pair terminated per patch panel port. This patch panel supports termination positions for 24 pairs. The 25<sup>th</sup> pair shall be left coiled and un-terminated on both ends.
- In all cases, copper cables installed between the Entrance Facility and the TR must be appropriately rated for plenum spaces.

## Section 6: Horizontal Station Cabling

Horizontal cable is the connecting cable that typically extends from the TR to the user or station that it is providing network connectivity for. Typically this cable is terminated on a patch panel on the TR end and a jack or information outlet on the user end. Horizontal cabling on the BYU-Idaho campus is part of a SCS or Structure Cabling System. The manufacturer of choice for our SCS is SYSTIMAX. Lack of cable connectivity or network jacks in a particular location is solved by installing additional cables to meet the specific user need. Solutions for lack of connectable ports do not include altering existing terminated cable, connecting hubs, switches, or wireless devices.

### 6.1 Requirements for Uniform Horizontal Station Cabling

- Only one Structure Cabling Solution shall be allowed to be installed on campus. The solution shall be SYSTIMAX SCS.
- Category 6 cabling is the standard for our campus. Category 3, 5, and 5e are not acceptable grades of cable. They will not be allowed. The BYU-Idaho Center and the Hyrum Manwaring Building are cabled with Category 6A white cabling. When additional cables are added to these buildings they shall match in color and grade.
- There are two colors of cables that shall be installed on campus. These colors are white and green. Cable installed after the initial wiring of the building shall match the color of the rest of the cable installed; either white or green.
- We use the colors electric ivory and grey for our faceplates, information outlets or jacks. The color of the jacks shall match the color of the rest of the jacks in the building. In new constructions the color of the faceplates and jacks shall be coordinated with representatives of IT Infrastructure, Facilities Management, and the contracted engineer.

- The patch panel, cable and jack shall match in grade in all cases. This means that CAT 6 cable shall be terminated on CAT 6 patch panels and CAT 6 Jacks. Mismatches in grade or manufacturer of components will not be accepted.
- Styles of faceplates shall be uniform throughout an entire building.
- All cabling shall meet requirements of the space that it is installed in. Spaces that are considered plenums shall be cabled with plenum rated cables.
- Station cabling shall have at least a 10' service loop inside the TR. The service loop shall be neatly dressed and managed on the Ladder tray. Loops shall be managed and maintained in the TR using Velcro. Plastic wire ties will not be accepted.
- Horizontal or vertical orientation of faceplates shall match orientation of existing faceplates or electrical outlets in the room.

## 6.2 Horizontal Station Cabling Count Requirements

- Each space that is considered an office at the time of construction shall have at least 2 separate locations of 3 station cables installed. These locations shall fit with the design of the furniture that will be installed.
- Each space that is considered for a location for vending machines shall have at least 1 location of 6 station cables installed
- Each space that is considered a location for a wireless access point shall have at least 1 location of 3 cables installed.
- Each space that is considered for locating mechanical controls or networkable HVAC equipment shall have at least 1 location of 3 cables installed.
- Each space that is considered for locating electrical controls or networkable electrical equipment shall have at least 1 location of 3 cables installed.
- Classroom teaching stations or podiums shall have at least 1 location of 6 station cables installed inside the podium to the standard and specification of our current campus podium design.
- Each location where a TV or monitor would be mounted shall have at least 1 location of 3 station cables installed.
- Each location where a multi-use printer/fax/copier machine will be shall have at least 1 location of 6 station cables installed.
- Each outdoor location of an Emergency Phone shall have 2 cables pulled in a conduit from the phone pedestal outside to the nearest TR inside the nearest building to the phone. These cables shall be of grade suitable for outside exposure, and be protected and grounded.
- Courtesy phone locations shall have a single location of 1 cable installed. The jack shall be installed in a SYSTIMAX stainless steel faceplate for durability.
- Cabling counts for computer labs and other special needs areas will be addressed on an individual lab basis. Sensible cabling counts will be installed to accommodate the needs of the lab.

## 6.3 Guidelines for Horizontal Cable Dressing in the TR or Entrance Facility

- Cables shall be neatly pencil dressed upon entering the TR or Entrance Facility. This pencil style dressing shall be maintained until termination at the patch panel.
- Tangled or taught cables within the TR will not be accepted.
- Cables shall be bundled in groups of 48 and Velcro wrapped every 2'. Cables adds shall build off of partially formed bundles until the bundle reaches the count of 48 cables at which point a new bundle shall be formed.
- These bundles shall consist of a service loop of at least 10' of horizontal cable.

## 6.4 Example of Well Pencil Dressed Horizontal Cable



## Section 7: Horizontal Pathways

Horizontal pathways dictates how and where cables are routed. This includes the equipment that is put in place in ceilings and on walls to keep cables managed and contained. Horizontal pathways should also be engineered to protect cables from damage caused by work done in ceilings by other trades and harmful effects of EMI on data signals on a copper cable.

## 7.1 Guidelines for Surface Raceways and In-Wall Installations

- In new constructions conduits shall be extended from the jack location through walls to ceiling spaces and continue to the main cable pathway for the building; usually a cable basket tray.
- Surface raceways should never be the first choice of pathway for extending cable down a wall. In adding cable to a finished building when possible wall cavities shall be fished to extend cable to a location. A cut in box or old house box shall be used to attach a faceplate to a dry wall where cable has been fished through the wall.
- When the wall is unable to be fished the accepted pathway product to use is Wiremold brand 2300 series non-metallic raceway. This raceway shall be electric ivory in color. Components of this raceway system that must be used include but are not limited to the following:
  - Wiremold 2300 Series 5' length pieces
  - 2300 Series Entrance End Fitting for butting raceways up to ceiling
  - 2300 Series Join Covers to cover all seams in raceway installations
  - 2300 Series Deep Device Box for surface mount box installations
  - 2300 Series Flat Elbow
  - 2300 Series Inside Elbow
  - 2300 Series Outside Elbow
- Wiremold 2300 Series raceway shall be installed using wall anchors and not the sticky adhesive backing.
- The maximum number of cables to be fit in Wiremold 2300 Series raceway is 8.
- All locations in raceway or not in raceway shall extend to the same off the floor distance as the rest of the power outlets and data outlets in the room unless otherwise specified.
- All raceway installations shall be straight and neat with no exposed cable to be seen.

## 7.2 Guidelines for Using Basket Style Cable Trays

- Basket Trays are the preferred method of pathway for extending large amounts of cable for long distances. The preferred model of tray in new constructions shall be CPI FastTrak with all of its interconnecting components.
- In new constructions basket trays should follow main hallways or corridors that are routes for large amounts of cable.
- Basket trays shall be installed with a minimum of 12" of clearance of lighting fixtures in ceilings.
- Basket trays and all cable supports shall never make contact with the ceiling grid or use the ceiling grid support wires for extra support.
- In new construction conduits shall be extended from the location on the wall to a basket tray to carry the cable the rest of the distance back to the TR.
- Wire ties shall not be used to fasten cables to basket trays.
- Cables shall not route tightly around basket tray intersections and corners, but rather loop gradually with slack around the corners.

- Trays in the ceiling shall be securely fastened to structurally sound members in the ceiling to avoid sagging and swaying of tray.
- Rough cut and Sharp edges on basket tray shall be filed off to avoid future injury to workers installing cables.
- Basket trays shall be sized appropriately for the amount of cable they will be supporting. Over or undersized basket trays will not be acceptable.
- Basket trays installed for support of network cables shall only be used for that purpose. Basket trays shall not be used as support for other types of ceiling infrastructure.

### 7.3 Guidelines for Horizontal Cable Runs in Conduits

- In new construction conduits shall be used to extend cable runs from their location on the wall to a cable tray or to the TR.
- Conduits feeding cable from cable tray shall extend 2” to 3” inches into the tray.
- All conduits installed for the purpose of providing pathway for horizontal cable shall be at least 1” inside diameter regardless of the number of cables called for at the immediate install. Larger than 1” trade size conduit shall be installed based on cable counts in reference to the table below.

Inside Diameter mm	Trade Size	Cable Outside Diameter mm (in)									
		3.3 (0.13)	4.6 (0.18)	5.6 (0.22)	6.1 (0.24)	7.4 (0.29)	7.9 (0.31)	9.4 (0.37)	13.5 (0.53)	15.8 (0.62)	17.8 (0.70)
16	1/2	1	1	0	0	0	0	0	0	0	0
21	3/4	6	5	4	3	2	2	1	0	0	0
27	1	8	8	7	6	3	3	2	1	0	0
35	1-1/4	16	14	12	10	6	4	3	1	1	1
41	1-1/2	20	18	16	15	7	6	4	2	1	1
53	2	30	26	22	20	14	12	7	4	3	2
63	2-1/2	45	40	36	30	17	14	12	6	3	3
78	3	70	60	50	40	20	20	17	7	6	6
91	3-1/2							22	12	7	6
103	4							30	14	12	7

- No more than 6 cables shall be installed in a 1” inside diameter conduit.
- All conduit ends shall be fitted with a plastic bushing.
- Conduit runs shall be installed with appropriate pull boxes and bends that do not exceed 90 degrees for ease and ability of pulling cable.
- Conduits that do not have cable immediately installed shall be equipped with a pull line for future cable installation.
- Open conduits shall be stopped with fire-stopping putty or caulk in accordance to UL 1479 and ASTM E814.

### 7.4 Guidelines for J-Hooks and Cable Saddles as Cable Support

- J-Hooks are an acceptable pathway for cable only when a basket tray is not able to be installed, or doesn’t make sense to install because of space and or accessibility limitations.

- Erico Caddy CAT32 and CAT425 are the preferred model of cable support to be used on the BYU-Idaho campus.
- Minimum J-Hook size shall be 2 inches.
- Cable retaining clips shall be installed with all J-Hooks to prevent cables from falling out of the hooks
- Hooks and cable saddles shall be properly and securely fastened using angle hanging brackets and or beam clamps.
- J-Hooks and or saddles shall be installed every 4' to 5'. With a staggered distance between 4' and 5' to avoid a harmonic anomaly in the data signal.
- 3 Velcro tie wraps shall be installed between each J-Hook or saddle maintaining a neat and contained bundle of cable.
- Grid wire, sprinkler pipe, electrical conduit, HVAC duct work, ceiling grid, and ceiling tile are never acceptable fasteners or supports for cabling.

## Section 8: Testing and Test Reports

### 8.1 Guidelines for Testing

- All Category 6 and 6A horizontal station cables and singlemode and multimode fiber optic cables shall be tested using Fluke DTX 1800 Cable Analyzer. Contractors who wish to use other test equipment may do so only with the approval of representatives of IT Infrastructure.
- The Fluke DTX 1800 used for testing shall be within 1 year of its most recent calibration to be used for certifying cable on campus.
- The Fluke DTX 1800 shall be updated with the latest firmware when testing on our campus.
- The Fluke DTX 1800 shall be set to the SYSTIMAX GigaSpeed cable Auto testing mode.
- Horizontal copper cabling shall be tested only after the finishing faceplate has been put in place. If for any reason the faceplate is removed and replaced, all horizontal cables at the location shall be tested and certified again.
- No cable installation is considered finished until a passing test result is achieved.
- Copper riser and backbone pairs shall be tested using a DC continuity test.
- Fiber optic cabling shall be tested in both directions using the correctly referenced and calibrated Fluke DTX 1800 with fiber modules corresponding to the mode of fiber under test.
- Multimode fiber shall be tested at both 850 nm and 1300 nm wavelengths.
- Singlemode fiber shall be tested at both 1310 nm and 1550 nm wavelengths.
- Each strand's splice loss shall be no greater than 0.2 db. This shall not be an average measure of all strands tested, but an individual strand requirement.
- Loss per mated connector shall be 0.6 db or less for acceptance. This shall not be an average measure of all strands tested, but an individual strand requirement.
- No sampling testing will be allowed. All cables installed shall be tested and submitted.

## 8.2 Guidelines for Submission of Test Reports

- The individual PASS test files shall be saved as the label of the cable that was tested.
- An electronic copy of the test results shall be submitted to a representative of IT Infrastructure before the install shall be considered complete.
- Test results shall be submitted as .FLW file format for viewing with use of the Fluke Linkware software.
- On new constructions, as part of the test result submission a certificate noting a Certified SYSTIMAX install has been performed shall also be submitted by the contractor who did the installation.

## Section 9: Labeling of Copper and Fiber Optic Cabling

Labeling is a crucial component of a finish cable install. Labeling shall be consistent in all building across campus. An install will not be accepted until cables are properly labeled.

### 9.1 Labeling Copper Horizontal Station Cables, Backbone Cables, and Riser Cables

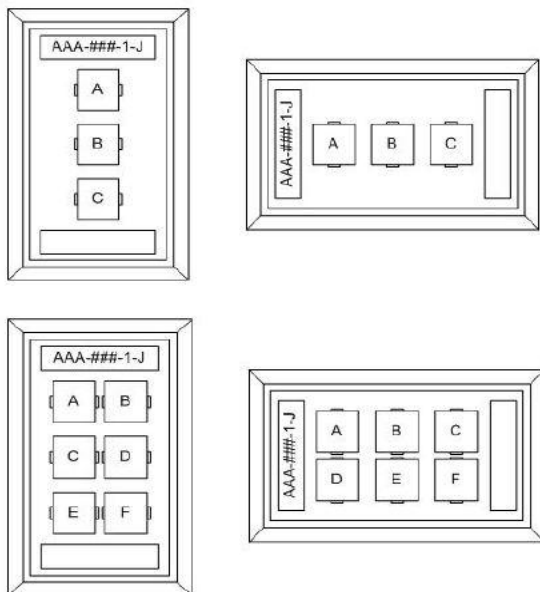
- All labels shall be printed. No hand written labels will be accepted.
- Station cables shall have a wrap style label on the cable jacket behind the faceplate within 1" of the termination to the jack, and another identical label that is on the jacket 1" from the termination on the patch panel. This label shall be printed off from a professional model labeler such as P-Touch, Brady, or Dyno Labeler.
- Installers shall consistently follow the BYU-Idaho cable labeling schemes for copper cables. New methods and or schemes of cable labeling will not be allowed.
- Labels on SYSTIMAX patch panels shall be inserted into the plastic label holder accessory available through SYSTIMAX. Gluing, taping, or hanging labels on patch panels will not be accepted.
- Labels on SYSTIMAX faceplates shall be printed. They shall also neatly and squarely be installed behind the clear plastic window on the top or far left of the faceplate. The second clear plastic window shall be inserted in the bottom or right side position available. This label shall have the TR room number that the cable terminates in. The opaque window strip provided in the SYSTIMAX faceplate kit shall not be used.
- Backbone cable pairs shall be labeled at the patch panel where they terminate. They shall be labeled with the four digit call out number that corresponds with its identifying label on the Smith Building end of the cable. Coordination with BYU-Idaho IT Infrastructure personnel shall be made to determine the sequence of numbers to use.

- Backbone cable jackets shall be labeled with their pair sequences as the leave splice cases in utility vaults.

## 9.2 Example of Labeling Horizontal Station Cable Faceplates

In reference to faceplate diagram below

- AAA = 3 letter building designation. Each building has a 2 or 3 letter designator. Consult with a representative of BYU-Idaho IT Infrastructure to know the correct building designator.
- ### = Room number that cable location is in. Sometimes a room has a letter designator to go along with the room number. This letter designator shall be part of the faceplate label.
- 1 = Position of faceplate in the room. Rooms with multiple faceplates shall be labeled starting with the location to the left of the main entrance of the room and rotate around the room clockwise. A room with three separate face plates would be labeled 1 through 3 clockwise going around the room.
- ABC = Letter designator for position of individual cable in faceplate.
- An example of a real face plate label could be: TAY-224-1 (this is only an example and shall not be used verbatim on future installations)



## 9.3 Guidelines for Labeling of Fiber Optic Cables

- A label shall be applied that calls out each strand in a fiber optic cable.
- Labels shall be left hanging in the front of the LIU on both ends of the fiber cable.
- Fiber labels shall match on both ends of the fiber.

- Jackets of fiber optic cables shall be wrap labeled with their sequence and range where they leave a splice case in the utility vault.

## 9.4 Example of Labeling Fiber Optic Cabling

# AAA-###-BSM-123

- AAA = 3 letter building designation. Each building has a 2 or 3 letter designator. Consult with a representative of BYU-Idaho IT Infrastructure to know the correct building designator.
- ### = Designates the TR room or the Entrance Facility where the far end of the fiber is terminated.
- BSM = Backbone Single Mode. This calls out the mode of the fiber and distinguishes the cable as either backbone or riser fiber. A fiber designated for Multi Mode Riser use would be RMM for Riser Multi Mode.
- 123 = Designates the strand count. This would be 123<sup>rd</sup> strand in that sequence.
- An example of a real single mode backbone fiber 8th strand label in the Taylor building TR might be: TAY-107-BSM-008. (this is only an example and shall not be used verbatim on future installations)

## Section 10: Demolition of Cabling and Infrastructure

Cables are typically considered a valuable resource even when they are not connecting a current network device. Cables that are not connecting devices usually shall be left terminated in place for possible future use. Arbitrary demolition of cable simply because they are not currently being used shall not occur. In the event of a remodel or reworking of a space it often becomes necessary to remove old cabling or unused cabling from a building. When a cabling system becomes outdated and due for upgrade, the old cabling system must be completely demolished and removed.

### 10.1 Guidelines for Cable Demolition

- Cable that is to be demolished shall be completely removed end to end. No remnants of the cable shall be left in the ceilings, walls, pull boxes, or device boxes.
- When a cable system is upgraded no left over components of the old system shall be salvaged and used in the new system. This includes jacks, patch panels, and cable lengths.
- When a contractor is commissioned to do demolition work that contractor shall be responsible for the complete demo and discard of all aspects of the infrastructure to be demolished.
- Any damage by a contractor to infrastructure during the demolition process shall be the responsibility of that contractor.

- In the event of a building re-cable the cable demo and new cable installation shall be closely coordinated with representatives of IT Infrastructure to minimize and or mitigate down time to connected users of the cables in question.

## Section 11: Miscellaneous

- BYU-Idaho adheres to any new standards and codes that may be applicable that are not a current part of this document. Anyone doing work on the BYU-Idaho cable plant is expected to follow above mentioned new codes and standards.
- BYU-Idaho considers all standards, codes, and best practices applicable that are outlined in the BICSI Publication TDMM 12. (Telecommunications Distribution Methods Manual 12<sup>th</sup> Release)
- Any exceptions or suggestions that deviate from this standard must be discussed with and approved by members of the BYU-Idaho IT Infrastructure team.
- The BYU-Idaho IT Infrastructure team desires to take a roll in the overall design of cabling solutions and network systems of new constructions in conjunction with contracted engineers. The IT Infrastructure team shall design TR layout, information outlet locations, and network equipment placement strategies.
- Those who shall understand and adhere to this document include:
  - All employees of a cabling contractor doing work on the campus of BYU-Idaho.
  - All technical staff of BYU-Idaho that may have dealings in the cable plant.
  - All involved with the design, consulting, and implementation of new construction.

## Approved Contractors

Cache Valley Electric  
2345 South John Henry Drive  
Salt Lake City, UT 84119  
Contact: Brad Christensen  
Phone: 801-908-4179  
Mobile: 801-870-7198

System Tech Inc.  
2854 Featherly Way  
Boise, ID 83709  
Contact: Jaren Layton  
Phone 208-709-7521

# Verification Sheet

I \_\_\_\_\_, have read and understand the BYU-Idaho Cabling Standard. I agree to use this standard along with all applicable local codes and standards in designing, installing and maintaining the cabling infrastructure of BYU-Idaho. I understand that any questions regarding this code should be directed to members of the BYU-Idaho IT Infrastructure team. I also understand that suggestions of changes or new ideas must be reviewed and accepted by members of the BYU-Idaho IT Infrastructure team.

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Signature

Verification can be sent to:

Travis Williams  
525 S. Center Street  
Rexburg, ID 83460  
Phone: 208-496-7097  
Mobile: 208-709-2192  
williamstr@byui.edu