1. Part I - General

1.0. Purpose

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A. Building Service
1. Service – Data
2. Service – Voice
B. Service Entries
C. Manholes
D. Cable Splicing

1. Preparation for Splices
2. Splicing requirements
   a. No splice cases will be permitted in cable trays.
   b. All splice closures for use on underground non-pressurized systems shall be manufactured of clear, self-extinguishing, tongue and groove fitting PVC.
   c. End caps must be tapered and flexible and be capable of separate cable entries.
   d. Rigid bonding and strain relief bars must be an integral part of the finished closure.
   e. Re-enterable, polyurethane compound shall be used.
   f. All cable splices must be tagged or marked showing the cable number and pair count spliced. Markings may be placed on the splice closure or on both the in and out cables.
   g. Supports: All cable splices shall be supported by a minimum of two cable hooks. Horizontal racking for support may utilize 3M Brand RC-100 rack adapters, manhole racks, or University approved equivalent.
   h. Closures: 3M splice closures or University approved closures will be used for splicing throughout the system.
   i. Protection: All cable splices must be protected from damage at sheath openings by mechanically protecting all conductors utilizing 3M Scotchcase Pair Saver 4458 or approved equivalent.

E. Building Voice and Data Terminal Rooms

1. Main Distribution Facility (MDF) Specifications
   a. The MDFs shall not contain any equipment not specified by UNLV Network Development and Engineering. This includes, but is not limited to, Marlok equipment, transformers, sinks, fire or building alarm equipment. They shall be kept as clear of all other equipment.
   b. Each MDF will be provided with isolated grounds, including a 6’ vertical earth ground, and an isolated electrical panel with 200-amp service.
   c. Each MDF will have four 20 amp, 110 V.A.C. outlets, terminated with NEMA 5-20Rs and four 30 amp 208 V.A.C. outlets, terminated with NEMA L6-30Rs. All outlets will be serviced by the emergency power system and colored orange or otherwise marked as such. All outlets will be positioned within 4 feet of the rear of the provided racks, near floor level.
   d. All MDFs shall be accessible only from inside the building. No outside entrances are permitted. All doors between the outside and the MDF must be at least 36” wide and 80” high.
   e. Rooms will be rectangular or square, have a minimum clearance height of eight feet without obstructions (sprinklers, etc.), be at least 14’ x 10’, and not have false floors or ceilings.
2. Intermediate Distribution Facilities (IDFs)..........................................................11
   a. The IDFs shall not contain any equipment not specified by UNLV Network Development
      and Engineering. This includes, but is not limited to, Marlok equipment, transformers,
      sinks, fire or building alarm equipment. They shall be kept as clear of all other equipment. 11
   b. Each IDF will be provided with isolated grounds, including a 6’ vertical earth ground. 12
   c. Each IDF will have four 20 amp, 110 V.A.C. outlets, terminated with NEMA 5-20Rs and
      two 30 amp 208 V.A.C. outlets, terminated with NEMA L6-30Rs. All outlets will be serviced
      by the emergency power system and colored orange or otherwise marked as such. All outlets
      will be positioned within 4 feet of the rear of the provided racks, near floor level. 12
   d. All IDFs shall be accessible only from inside the building. No outside entrances are
      permitted. All doors between the outside and the IDF must be at least 36” wide and 80” high. 12
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   e. Rooms will be rectangular or square, have a minimum clearance height of eight feet without
      obstructions (sprinklers, etc.), be at least 8’ x 10’, and not have false floors or ceilings. 12
   f. No exposed water or gas pipes shall enter in or run through the main terminal room or data
      room. No drains, ducts or clean-out will be permitted. 12
   g. A separate HVAC thermostat control will be installed for all IDF rooms, and shall be air
      conditioned with separate zone or air conditioning unit 24 hours a day, seven days a week. A
      positive pressure shall be maintained with a minimum of one air change per hour. 12
   h. All IDFs shall be secured using a Marlok card swipe reader and striker, the access of which
      is to be managed by the Network Operations Center. 12
   i. All IDFs shall be provisioned with at least one standard data rack, Panduit CMR4P84CN,
      bolted to the floor. These rack(s) shall be placed side-by-side, with vertical cable management,
      Panduit part# WMPVHC45E in between and on both sides. The racks must have a minimum
      of 36” of clearance front and back and at least 18” on both sides. OIT provided room drawings
      must be followed. 12
   j. Enough rack space must be provided to terminate all fiber and copper, with associated cable
      management, plus 200%. 12
   k. Ladder rack shall be provided and installed sufficient to secure the equipment rack to the
      adjacent wall(s) as determined at installation and to provide support for incoming cables. 12
   l. A minimum of four walls must be covered by backboards as defined in Part II. 12

2. Intermediate Distribution Facilities (IDFs)..........................................................11

   a. The IDFs shall not contain any equipment not specified by UNLV Network Development
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      room. No drains, ducts or clean-outs will be permitted. 12
   g. A separate HVAC thermostat control will be installed for all IDF rooms, and shall be air
      conditioned with separate zone or air conditioning unit 24 hours a day, seven days a week. A
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m. Floor loading shall be designed to support a minimum of 1000 pounds of equipment per data rack provided
n. All other elements of room to be designed and provisioned per ANSI/EIA/TIA 569 or better

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2. Data Rooms
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   b. Cabling
   c. Habitable Space Provisioning
   d. Non-habitable Space Provisioning
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1. PART I - GENERAL

1.0. PURPOSE

The intent of this document is to provide a standard specification that will be used for all UNLV facilities requiring cable installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete cabling system that shall accommodate UNLV’s requirements in excess of ten years.

Product specifications, general design considerations, and installation guidelines are provided in this written document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types for a specific UNLV facility will be provided as an attachment to a Request for Proposal. If the bid documents are in conflict, the Request for Proposal specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cabling system described in this document.

This specification is intended to provide general design guidelines for new construction, and performance criteria for additions/renovations to existing facilities. Since all new construction will have telephone/data communication service raceways provided by an electrical subcontractor under the general contract, the specifications included in this document are intended as supplemental information to insure an acceptable, effective installation.

The successful contractor is required to furnish all labor, supervision, tooling, miscellaneous mounting hardware and consumables for each cabling system installed. The contractor shall maintain current status with the warranting manufacturer, including all training requirements, for the duration of the contract. The Contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their warranty. After installation, the Contractor shall submit documentation to support a contractor installation 10-year warranty. The 10-year warranty will cover the components and labor associated with the repair/replacement of any failed link, which is a valid warranty claim, within the warranty period.

1.1. APPLICABLE REGULATIONS

A. RELATED DOCUMENTS

Equipment and material shall be Underwriter’s Laboratories listed and labeled. The latest editions of the following standards are minimum requirements. If a conflict exists between applicable documents, then the order in the list below shall dictate the order of precedence in resolving conflicts. This order of
precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by a local, state, or federal inspection agency.

1. ANSI/TIA/EIA- Transmission Performance Specifications for 4-Pair Category 6 Cabling
2. ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard
3. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces
4. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Building
5. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
6. National Electrical Manufacturers Association (NEMA)
7. National Electrical Code, latest revision (NEC)
8. National Fire Protection Agency (NFPA) – 70
9. Local, State and Federal Codes including Nevada Revised Statute (NRS) 278.583
10. Nevada State Public Works Board Adopted Standards
11. UL 497 Protectors
12. UL 1459 Standard for Safety for Telephone Equipment
13. UL 1863 Standard for Safety for Communications Circuit Accessories
14. UL 2024 Standard for Safety for Optical Fiber Cable Raceway
15. UL 723 Standard for Safety for Surface Burning Characteristics of Building Materials
17. TIA SP-4195
19. ANSI/EIA 310D

1.2. DESIGN REQUIREMENTS

Work must conform to the design requirement for each identified element.

A. BUILDING SERVICE

Plans for all new buildings shall include a design for extending the campus voice, data and video networks to the building. Consistent with this design, network trunks shall be extended as a part of the initial construction and equipment shall be installed to provide connection to the building. Every building, regardless of size, shall be constructed to allow for a 19-tube cable (Sumitomo part number TC19TLW or similar) to enter through individual 4” conduits from the campus underground plant from two diverse locations. Voice cables (minimum 50 pair) to enter from the campus underground plant
from one location. In addition, every building shall be equipped with at least two empty 4" conduits to the campus underground plant for later use by UNLV after installation of all voice and data cables. All raceways to have 880 lb. nylon pull strings installed. All new service entrance conduits shall be a minimum 4" trade size and of sufficient number to provide 50% growth capacity, and will terminate 4” above finished floor in the MDF (main distribution frame) room inside the building.

1. Service – Data

Data communication service to each building shall consist of a minimum of 24 strands of 50/125-micron multi-mode fiber and 72 strands of 9.0/125-micron single-mode fiber and terminated at two separate major distribution locations on campus as determined by UNLV Network Development and Engineering. Fiber optic cable is to be contained in its own 19-tube air-blown cable, Sumitomo part number TC19TLA or similar. If different part number is to be used, approval must be granted by UNLV Network Development and Engineering. Multi-mode fiber is to be terminated with LC style connectors, UPC Polish and single-mode fiber is to be terminated with SC style connectors, UPC Polish. Multimode and Singlemode terminated in separate rack mounted light guides. MDF to include a Tube Distribution Unit (Sumitomo part number DE12IDU or similar). If different part number is to be used, approval must be granted by UNLV Network Development and Engineering. Each light guide must be labeled with building, and IDF room number of opposing end. Patch panels to be mounted in such a manner as to allow the maximum usage of each rack. Appropriate wire management, determined by consultation with Network Development and Engineering and with regards to building design, shall be installed. A minimum of 10 ft. of fiber-optic cable will be coiled, to meet manufacturer specifications, at both termination points. Complete IDF room design, including rack layout, power requirements, cable management will be provided by UNLV Network Development and Engineering.

2. Service – Voice

Voice communication service to each building shall consist of a minimum of one 24 AWG, solid annealed copper, 50 pair twisted cable. Cable to enter building through a separate, dedicated conduit. Cable to be terminated patch panel(s) in data rack(s). One pair per RJ-45 block, terminated on blue/white-blue. Lightning protection to be provided as required per design specifications and/or applicable codes and regulations.

B. SERVICE ENTRIES

Elements of the service entry facilities design are to include type, size, gauge, and insulation of distribution cables. Every copper cable shall be bonded and
grounded for lightning protection per NEC 800-30A at both terminations using solid-state 5-pin protectors, 50 to 100 volt range.

Building entry conduit shall allow for 50% growth and have a minimum of four 4” conduits from manhole to MDF room.

C. MANHOLES
All manholes shall be at minimum 4’ by 4’ by 4’ and encased in concrete. All cable is to have service loops and be racked and mounted. Each manhole will have drainage holes and be engineered so water will not accumulate. Top of manholes are to be flush with paved areas, 6” above finished grade in landscaped areas.

D. CABLE SPLICING
Copper cable splicing is only allowed where previously approved by UNLV Network Development and Engineering. Fiber-optic cable will only be spliced at the termination point. Fiber-optic splicing must be fusion based with two fibers optic strands of the exact make and model on each end using factory terminated connectors on pigtails. Splicing is not acceptable outside of Tele/Data rooms. Epoxy based splices shall not be acceptable.
The following cable splicing techniques and materials for copper cable shall be utilized:

1. Preparation for Splices
   All copper cables shall be thoroughly cleaned and scuffed in a manner to insure a good mechanical bond when splicing. 3M Scotchcase 4435 non-conductive aluminum oxide abrasive strip, or UNLV approved equal shall be used. All cable shall be thoroughly cleaned with a non-toxic solvent, 3M Scotchcase 4414 or 4415 or UNLV approved equal.

2. Splicing requirements
   a. No splice cases will be permitted in cable trays.
   b. All splice closures for use on underground non-pressurized systems shall be manufactured of clear, self-extinguishing, tongue and groove fitting PVC.
   c. End caps must be tapered and flexible and be capable of separate cable entries.
   d. Rigid bonding and strain relief bars must be an integral part of the finished closure.
   e. Re-enterable, polyurethane compound shall be used.
f. All cable splices must be tagged or marked showing the cable number and pair count spliced. Markings may be placed on the splice closure or on both the in and out cables.

g. Supports: All cable splices shall be supported by a minimum of two cable hooks. Horizontal racking for support may utilize 3M Brand RC-100 rack adapters, manhole racks, or University approved equivalent.

h. Closures: 3M splice closures or University approved closures will be used for splicing throughout the system.

i. Protection: All cable splices must be protected from damage at sheath openings by mechanically protecting all conductors utilizing 3M Scotchcase Pair Saver 4458 or approved equivalent.

E. BUILDING VOICE AND DATA TERMINAL ROOMS

All new building structures shall have minimum one primary Data communication room in which the outside cable terminates, henceforth referred to as the Main Distribution Facility (MDF). Each building may have additional data rooms for end wiring, henceforth referred to as Intermediate Distribution Facilities (IDFs).

1. Main Distribution Facility (MDF) Specifications

   a. The MDFs shall not contain any equipment not specified by UNLV Network Development and Engineering. This includes, but is not limited to, Marlok equipment, transformers, sinks, fire or building alarm equipment. They shall be kept as clear of all other equipment.

   b. Each MDF will be provided with isolated grounds, including a 6’ vertical earth ground, and an isolated electrical panel with 200-amp service.

   c. Each MDF will have four 20 amp, 110 V.A.C. outlets, terminated with NEMA 5-20Rs and four 30 amp 208 V.A.C. outlets, terminated with NEMA L6-30Rs. All outlets will be serviced by the emergency power system and colored orange or otherwise marked as such. All outlets will be positioned within 4 feet of the rear of the provided racks, near floor level.

   d. All MDFs shall be accessible only from inside the building. No outside entrances are permitted. All doors between the outside and the MDF must be at least 36” wide and 80” high.
e. Rooms will be rectangular or square, have a minimum clearance height of eight feet without obstructions (sprinklers, etc.), be at least 14’ x 10’, and not have false floors or ceilings.

f. No exposed water or gas pipes shall enter in or run through the main terminal room or data room. No drains, ducts or clean-outs will be permitted.

g. A separate HVAC thermostat control will be installed for all MDF rooms, and shall be air conditioned with separate zone or air conditioning unit 24 hours a day, seven days a week. A positive pressure shall be maintained with a minimum of one air change per hour.

h. All MDFs shall be secured using a Marlock card swipe reader and striker, the access of which is to be managed by the Network Operations Center.

i. All MDFs shall be provisioned with at least one standard data rack, Panduit CMR4P84CN, bolted to the floor. These rack(s) shall be placed side-by-side, with vertical cable management, Panduit part# WMPVHC45E in between and on both sides. The racks must have a minimum of 36” of clearance front and back and at least 18” on both sides. OIT provided room drawings must be followed.

j. Ladder rack shall be provided and installed sufficient to secure the equipment rack to the adjacent wall(s) as determined at installation and to provide support for incoming cables.

k. A minimum of two walls must be covered by backboards as defined in Part II.

l. Floor loading shall be designed to support a minimum of 1000 pounds of equipment per data rack provided.

m. All other elements of room to be designed and provisioned per ANSI/EIA/TIA 569 or better.

2. Intermediate Distribution Facilities (IDFs)

a. The IDF shall not contain any equipment not specified by UNLV Network Development and Engineering. This includes, but is not limited to, Marlok equipment, transformers, sinks, fire or building alarm equipment. They shall be kept as clear of all other equipment.
b. Each IDF will be provided with isolated grounds, including a 6’ vertical earth ground.

c. Each IDF will have four 20 amp, 110 V.A.C. outlets, terminated with NEMA 5-20Rs and two 30 amp 208 V.A.C. outlets, terminated with NEMA L6-30Rs. All outlets will be serviced by the emergency power system and colored orange or otherwise marked as such. All outlets will be positioned within 4 feet of the rear of the provided racks, near floor level.

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f. No exposed water or gas pipes shall enter in or run through the main terminal room or data room. No drains, ducts or clean-outs will be permitted.

g. A separate HVAC thermostat control will be installed for all IDF rooms, and shall be air conditioned with separate own zone or air conditioning unit 24 hours a day, seven days a week. A positive pressure shall be maintained with a minimum of one air change per hour.

h. All IDFs shall be secured using a Marlock card swipe reader and striker, the access of which is to be managed by the Network Operations Center.

i. All IDFs shall be provisioned with at least one standard data rack, Panduit CMR4P84CN, bolted to the floor. These rack(s) shall be placed side-by-side, with vertical cable management, Panduit part# WMPVHC45E in between and on both sides. The racks must have a minimum of 36” of clearance front and back and at least 18” on both sides. OIT provided room drawings must be followed.

j. Enough rack space must be provided to terminate all fiber and copper, with associated cable management, plus 200%.

k. Ladder rack shall be provided and installed sufficient to secure the equipment rack to the adjacent wall(s) as determined at installation and to provide support for incoming cables.
1. A minimum of four walls must be covered by backboards as defined in Part II.

m. Floor loading shall be designed to support a minimum of 1000 pounds of equipment per data rack provided.

n. All other elements of room to be designed and provisioned per ANSI/EIA/TIA 569 or better.

F. BUILDING INTERIORS

1. Underground Plant
   The cables from the underground plant shall enter the building in a MDF room. Appropriate wire management shall be installed such as ladder racks, D-rings, and tie wraps so as not to exceed the acceptable cable bend radius.

2. Data Rooms
   Additional IDF(s) shall be provided if necessary to prevent total length of data cable runs from exceeding 300 feet. Additional IDF rooms in multistory buildings shall be aligned vertically with the MDF room if possible.

3. Internal Backbones (Risers)
   A minimum of two 4" conduits shall run between every IDF and the MDF within buildings. Pull strings shall be provided in every conduit. Data interconnections between each IDF and the MDF shall be via fiber optic cable containing a minimum of 24 strands of multi-mode and 24 strands of single-mode fiber, as defined in Part II. Fiber optic cable is to be contained inside 7-tube air-blown conduit, Sumitomo part TC07TRX. 12 Cat6 provided between every IDF and the MDF. Patch panels are to be mounted in such a manner as to allow the maximum usage of each rack.

4. Station Wiring
   a. Outlets
      All outlets shall be constructed using single gang, 4-port faceplates, colored almond, AMP part number 558088-1 or similar. All outlets shall have at least two network drops each.

   b. Cabling
      All drops shall be connected with blue network cabling from patch panels to each drop location and terminated on black data jack. Every cable shall be continuous and unspliced, with data cables attached to a
single port in the patch panel at one end and to a single jack at the station end. All connections are to be done using the T568B wiring scheme. No cable run from patch panel to connection point may exceed 300 feet. All cabling must terminate in an IDF or MDF room on the same floor as the outlet unless building plans, certified by Network Development and Engineering, specify otherwise. Additional specifications for cabling, patch panels and data jacks as per specifications in Part II.

c. Habitable Space Provisioning
Every habitable space shall be provisioned a minimum of one outlet per person planned for the space or one outlet per 60 ft², whichever is greater. If the number of people planned for a space is not known, the 60 ft² guideline must be used.

d. Non-habitable Space Provisioning
Every non-habitable space shall be provisioned with one outlet every 500 ft², minimum of 1 per enclosed space. Exceptions may be granted for unusual circumstances by Network Development and Engineering, in writing.

e. Labeling
The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cable's origin and destination. Station identifiers shall increment starting from the jack at the right when facing into the room at the main entrance and incrementing counterclockwise; and shall increment from left to right then top to bottom on each individual faceplate. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. All label printing will be machine generated using indelible ink. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Faceplate labels will be the manufacturer’s labels provided with the outlet assembly unless otherwise specified. As-buils & test results to be provided in .PDF and CAD format. The labeling schema shall be as follows:

1. Data Room Patch Panel
All patch panels shall be labeled in the format “### - X”, where ### is the station room number, and X is the station identifier discussed above. All wireless drops must be labeled in the format “W###-X”.
2. **Station Jack**

All station jacks shall have the data drops on the patch panel and the station numbers labeled on the faceplate. The top label of the jack must be in the format of “### X-Y”, ### being the station room number. “X” being the first data drop present at that faceplate location, and “Y” being the last data drop present at that faceplate location. In addition, each jack shall have an individual label placed adjacent to the jack on the perimeter of the faceplate. This label will be a single number from the X-Y range and shall be ordered from left to right and top to bottom. This number range shall start at one and increment up to the last jack in the room. The first increment for each room is one. The bottom label must also include the room number of the IDF that jack pulls to.

See “Standard Outlet Configuration” in section 4.

5. **Wireless – 802.11**

All wireless locations shall be mounted parallel to the ceiling, above the drop-ceiling grid panels. Two blue data cables shall run from a patch panel to data jacks in the box. These locations shall have a minimum clearance of 14” x 14” x 8”. No cable run from patch panel to connection point may exceed 300 feet.

6. **Wireless Access Point Placement and Wireless Overlay for 802.11**

Locations will be specified by consultation with UNLV Network Development and Engineering. The use of 3rd party professional RF Engineering design may be required under the special conditions. These conditions include but are not limited to the following:

a. Any wireless bridge installation which requires rooftop cabling and mounting of wireless bridging hardware, antennae and masts.
b. Installations which require access points to use antennae other than the standard dipole antennae
c. The finished ceiling plan is exposed and the customer has specified that wireless hardware and antennae placement must be as limited as possible in order to meet aesthetic requirements of the building Consultation with UNLV Network Development and Engineering is required for all 802.11 Wireless infrastructure design.

7. **Cable Trays**

All cable trays must be UL rated and approved by UNLV Network Development and Engineering prior to their inclusion in specifications.

a. Supports
Cable trays for horizontal distribution cables, utilizing a center support hanger method to support the cable trays, will utilize threaded rods of not less than 1/2” in diameter.

b. Capacity
   Cable trays shall be sized for a minimum growth of 50%.

8. Installation
   Installation is to meet or exceed ANSI/EIA/TIA 568-B and ANSI/EIA/TIA 569. Completed installation is to be Certified Category 6 using the TIA TSB-95 testing standard or better. Test documents/results to be supplied to UNLV in .PDF and Linkware format. Completed installation is to be approved by UNLV Network Development and Engineering.

9. Pull and Splice Boxes
   c. Location
      Pull boxes must be installed in easily accessible locations. It is not permissible to locate a pull box in the ceiling for conduits larger than 2” in diameter. Conduits larger than 2” diameter, entering a box shall be routed down a wall or column and the box shall be installed accordingly.

      All pull boxes shall be placed in a straight section of conduit. Align the corresponding conduits at each end. All boxes shall be properly and adequately secured. They are not to be supported by the conduits entering the box. Install boxes for station cabling immediately above the suspended ceiling.

d. Access
   Provide boxes with a suitable cover.

G. GROUNDING

1. Regulations
   All conduit and cable tray systems, supports, cabinets, equipment, etc., shall be properly grounded in accordance with the latest edition of the National Electrical Code (NEC) and all other applicable codes and regulations.
2. **Installation Requirements**
   Provide all bonding wire and jumpers, grounding bushings, clamps, etc., required for complete grounding. Route ground conductors to provide the shortest, most direct path to the ground electrode system.

3. **Grounded Connectors**
   Provide a separate grounding conductor, securely grounded on each side of all conduit and cable trays that do not provide a continuous, metallic path. Size shall be in accordance with the National Electrical Code (NEC). All ground connections will have clean contact surfaces, tinned and sweated while bolting. Avoid splices in bonding or grounding conductors. If splices are required they must be cad welded. Any grounding or bonding conductor that is run through a metallic conduit should be bonded to the conduit on both ends. Do not use a gas pipe as the grounding electrode.

4. **IDF/MDF Room Grounding**
   All IDF and MDF rooms require an earth ground. Additionally, if the IDF/MDF room houses telecommunications switching or fiber remote equipment, single point of ground technology is required. This requires a separate ground bus in the service panel to the building transformer; otherwise power receptacles in the room must be isolated and grounded together with a number 6 AWG or larger copper wire.

2. **PART II – PRODUCTS AND ACCEPTED MATERIALS**

2.0. **BACKBOARDS**
   All backboards required in the IDF/MDF rooms shall be plywood, ¾”, 4’ by 8’ sheets, grade A, treated on one side with fire resistant paint or material, installed with finished side exposed.

2.1. **CABLE SPECIFICATIONS**

A. **DATA COPPER**
   All copper data cable must be Category 6, 4 pair, UTP (Unshielded Twisted Pair). Accepted materials are Belden 2412 for non-plenum spaces, and Belden 2413 for plenum spaces. Equivalent cable must be verified by UNLV Network Development and Engineering. All terminations are to follow ANSI/EIA/TIA 568-B.
B. EXTERIOR CABLE
All telephone cable that supports devices external of a building such as emergency phones use Superior Essex cable part number 09-092-02,6 pair buried drop.

C. MULTIMODE FIBER OPTIC
All multimode fiber optic cable must 50.0/125 micron inside 19-tube air-blown conduit, Sumitomo part number FB24M5 (24 Strand). All multimode terminations are to be LC, UPC finish.

D. SINGLEMODE FIBER OPTIC
All singlemode fiber optic cable must be 9.0/125 micron inside 19-tube air-blown conduit, Sumitomo part number FB24SX (24 strand). All singlemode terminations are to be SC, UPC finish.

2.2. DATA TERMINATIONS

A. DATA COPPER PATCH PANELS
All data patch panels are to be 110 block, Category 6, in either 1U, 24 port or 2U, 48 port configuration, and must meet or exceed EIA/TIA and ISO/IEC Category 6/Class E requirements. AMP parts 1375014-1 (24 count) or 1375015-1 (48 count) or equivalent. Every group of 48 must be separated by 1U of horizontal cable management, Panduit part# NCMHF1. All terminations are to follow ANSI/EIA/TIA 568-B.

B. VOICE COPPER TERMINATION BLOCKS
All voice wire terminations are to be terminated on patch panel(s) in data rack(s). One pair per RJ-45 block, terminated on blue/white-blue.

C. COPPER DATA JACKS
All modular data jacks shall be unshielded, 4-pair, 8P8C, 110 block, Category 6, black, unless otherwise specified, and must meet or exceed EIA/TIA and ISO/IEC Category 6/Class E requirements. AMP parts 1375055-2 or equivalent. All terminations are to follow ANSI/EIA/TIA 568-B.

All faceplates shall be 4 port, light almond, single gang, low profile, AMP part 558088-1 or equivalent.

D. FIBER OPTIC
Multi-mode fiber is to be terminated with LC style connectors, UPC Polish and single-mode fiber is to be terminated with SC style connectors, UPC Polish. Multimode and Singlemode terminated in separate rack mounted light guides.
2.3. DATA EQUIPMENT RACKS

All racks are to be four post, open frame, square hole, black, Panduit part number CMR4P84CN. Substitutions must be authorized in writing by UNLV Network Development and Engineering.

2.4. CABLE TRAYS

All cable trays are to be a minimum of 18” wide by 4” deep, solid trough or ladder. Thomas & Betts #(HG(PG for pre-galvanized)1-4)-18-S(L09 for ladder with 9” rung spacing)-144 or equivalent, with associated fittings, hardware, and supports.

2.5. EXCEPTIONS

Exceptions may be authorized for existing buildings only with approval of UNLV Network Development and Engineering and shall be granted in writing.

PART 3 - EXECUTION

A. EXAMINATION

1. The minimum concrete pour depth shall 3-1/2 inches (89mm).

2. With Installer present, verify that manufacturer's requirements for floor opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.
B. PREPARATION

1. Arrange for jobsite approval of the equipment prior to commencing installation.

2. Verify exact locations of floorbox installation.

C. INSTALLATION

1. Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.

2. Install in position and relationship to adjoining work indicated, securely anchored to supporting structure, sealed and finished, and in a manner, which produces a level box with square, plumb, and straight edges.

3. Telecommunications Cabling Floor box shall have a total of three separate EC with pull string at each box as follows:
   a. One 3/4-inch EC from box to circuit panel. (Duplex AC Power)
   b. Two 1-1/4 inch EC from box to telecomm cable tray A.F.C (CAT. 6 data cables)

4. Coordinate installation with floor covering to finish each floor box. Install floor covering with oversized cable management pop-up pass-thru in top, matching surrounding floor covering in cover insert.

D. ADJUSTING

1. Adjust door and cover for proper operation.

E. PROTECTION

1. Protect installed equipment in original undamaged condition until Substantial Completion. Remove and provide new components or units that cannot be repaired to the satisfaction of the Architect.

3. PART III – EXECUTION

The University has drawings detailing existing cable runs, terminal cabinets/closets, risers, etc. Copies may be obtained from UNLV Network Development and Engineering to facilitate the requirements of Part III - Execution.
Unless otherwise expressly provided in the Contract, any provisions of the standard specifications, which require the University to inspect certain material or work, shall mean that the University has the option, rather than the obligation, to do so. Any warranty or guarantee provisions contained in the Contractors'/Vendors' standard specifications shall be of no effect and the warranty and guarantee provisions, if any, of the Contract shall apply.

3.0. DEMOLITION

A. COORDINATION WITH UNIVERSITY OPERATIONS
   No telecommunication or data jacks, cabling terminals, or other hardware will be moved, disconnected, or removed without prior approval of UNLV Network Development and Engineering. Coordination of demolition activities with the departments will be strictly enforced to minimize service disruptions.

B. WORK TO BE PERFORMED BY OWNER
   Upon notification by contractor, UNLV Network Development and Engineering will dispatch a technician to the requested work location. The technician will determine if the facilities to be moved or removed are in service (hot) or out of service (dead). If station cabling is dead the technician will insure that all cross-connects have been removed. If the facilities to be moved or removed are determined to be in service, the technician will take the necessary actions to render the facilities dead. Under NO circumstances will removal of telecommunications or data facilities begin until UNLV Network Development and Engineering has ensured that services are dead.

C. DISPOSAL OF SURFACE-MOUNT RACEWAY
   Surface mount raceway that has been vacated, or otherwise determined not required, will be removed after all cabling has been properly removed.

3.1. EXCAVATION
   The Contractor shall be required to excavate for underground mechanical piping, and shall perform all auxiliary work that may be required to do so.

   No trenching will commence until UNLV Planning and Construction and UNLV Network Development and Engineering grants approval. The University has drawings of existing underground utilities to assist the Contractor to locate all underground utilities. All Contractors are to Call Before U Dig. All lines damaged by Contractor will be repaired at Contractor’s expense.
Asphalt and concrete pavement shall be sawed or cut to a depth necessary to bring about a straight-line break parallel to the sides of the trench, so as not to disturb the adjoining pavement.

All underground construction work, during progress and after completion, shall conform truly to lines and grades.

If the trench is excavated to a greater depth than that given, the Contractor shall, at his own expense, bring such excavation to required grade with such material as directed, notwithstanding that it may be necessary to bring such material from other localities or to purchase suitable materials.

The material excavated shall be deposited along the side of the trench in such a manner as to create the least inconvenience possible.

Contractor shall not obstruct the gutter of any street or driveways, but shall use all proper means to provide the free passage of surface water along the gutters into storm water inlets. Contractor shall provide channels where required.

Special care shall be taken to keep all fire hydrants and gate valves on water mains accessible at all times. Fire lanes are to be kept open.

Wherever required, sides of the trench shall be sheeted and braced in strict accordance to the rules, orders and regulations of the State, County, and the City. Trenches shall be barricaded.

Grass will be replaced by a method approved by the University.

Bricks, blocks and other debris removed from trenches will not be used as fill for trenches.

3.2. INSTALLATION

A. REGULATIONS

All work and materials will comply with all federal and State laws, municipal ordinances, codes, regulations and direction of inspectors appointed by proper authorities having jurisdiction.

If there are violations of codes, the vendor will correct the deficiency at no cost to the University.

Working conditions must meet the industry standards for safety and work procedures, and protection of property established by prevailing rules, regulations, codes, and ordinances.
B. QUALITY ASSURANCE

Workmanship and neat appearance shall be as important as the mechanical and electrical efficiency of the system. All testing and clean-up shall be completed to the satisfaction of UNLV Network Development and Engineering before sign-off. This includes, but is not limited to, cable testing, proper labeling, debris removal, and proper cable bundling and routing.

C. DAMAGE OF EXISTING FACILITIES

The Contractors shall be responsible for replacing, restoring, or bringing to at least original condition any damage to floors, ceilings, walls, furniture, grounds, pavement, etc., caused by its personnel and operations. Any damage or disfiguration will be restored at the Contractor's expense.

D. COORDINATION

Contractor is responsible for insuring minimal disruption of existing television, telemetry, telephone and data communications facilities and networks.

Outages shall be scheduled only with permission from UNLV Network Development and Engineering at its convenience.

All work areas shall be cleared of all litter, and properly disposed of by Contractor on a daily basis.

At its own expense, Contractor shall erect temporary fencing where required or deemed necessary by University personnel, or where deemed necessary by the Contractor for securing materials.

Contractors shall provide all necessary temporary equipment and material, shall maintain them in a safe and adequate manner, and shall remove them immediately upon completion of work requiring their presence.

E. CABLE SUPPORT AND ANCHORS

All cables, wires and equipment will be firmly anchored. Fasteners and supports shall be adequate to support loads with ample safety factors.

F. FIRESTOP SYSTEMS

A firestop system is comprised of an item or items penetrating a fire rated structure, the opening in the structure, the sealing materials, and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to
through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped using state approved fire resistant materials installed in accordance with the manufacturer’s tested methods. All penetrations through fire rated surfaces shall comply with the following:

2. ASTM E 119: Methods of Fire Tests of Building Construction Materials
3. ASTM E 814: Standard Method of Fire Tests of Through-Penetration Firestops
4. ASTM C 719: Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement
6. UL 263: Fire Tests of Building Construction Materials
7. UL 723: Surface Burning Characteristics of Building Materials
8. UL 1479: Fire Tests of Through Penetration Firestops

G. CONDUIT

Conduit shall be Electrical Metallic Tubing produced in accordance with ANSI C80.3 standard and run in the most direct route practical.

Conduit runs containing more than two 90-degree bends, or a reverse (180 degree) bend require a pull box.

All offsets shall be considered equivalent to a 90-degree bend.

Conduit bend radii will be a standard ten times the outside diameter of conduit unless otherwise approved by UNLV Network Development and Engineering.

Conduits entering the IDF through the wall shall be reamed or bushed, and terminated not more than 4 inches from the wall surface.

Conduits entering the IDF from below shall be terminated 4 inches above finished floor.

Conduit runs for distribution cables (both horizontal and vertical), except station outlets, shall be not less than 4” in diameter. They will be equipped with a plastic or nylon number 12 or larger pull line that is rated at 800-lb. test minimum.
Conduit installed for data and/or voice cabling may not be shared with any other cable.

All conduit runs for station outlets shall be not less than 3/4” in diameter. All conduit runs for station outlets with more than 3 cables shall be not less than 1” in diameter. They will be equipped with a plastic or nylon number 12 or larger pull line that is rated at 800-lb. test minimum.

After installation, all conduits shall be clean, dry, unobstructed, capped for protection and labeled with their destination (by room number) for identification.

Allowable fill capacity is 40% or as defined by the National Electric Code, whichever is lower.

Conduit runs for horizontal distribution cables, utilizing the trapeze hanger method to support the conduits, shall utilize threaded rods of not less than 3/8” in diameter.

Conduit shall not block access to existing services.

**H. CABLE INSTALLATION**

All cable shall be installed free of kinks. A kink is defined as a violation of the manufacturer's specified Minimum Bend Radius for each type of cable. Cable shall not be formed into a condition that causes the outside sheath to wrinkle.

Any cable to be placed through an electrical room or any other potentially hazardous conditional shall be placed in conduit.

All cable will be secured to the backboard in such a manner as to allow cross connections to be made without crossing over any cables.

All outlets will have a minimum of eight (8) inches of cable stored at each drop after the cable has been terminated.

Where considerations of practicality eliminate the installation of conduit, plenum cable will be used. Cables are not permitted to lie atop a lay-in ceiling or simply drape over pipe and ductwork; appropriate wire hangers/supports or dressing will be used.

Cables are to be anchored to the wall extensions, existing conduits, pipe, or duct work in a neat manner.
Cable pulled in a cable tray with existing cable should not be pulled where stress would be applied to the existing cable.

All cable is to be terminated at both ends, tested, labeled and ready to provide service to and within the building.

Installation to meet or exceed ANSI/EIA/TIA 568B and ANSI/EIA/TIA 569. UNLV Network Development and Engineering must approve completed installation.

I. CABLE TESTING

All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. The contractor, prior to system acceptance, shall verify all conductors of each installed cable. Any defect in the cabling system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% usable conductors in all cables installed.

1. Data Copper

All Data cables shall be tested in accordance with ANSI/TIA/EIA Category 6 Standard Performance Specifications for 4-Pair 250 Ohm Category 6 Cabling using TIA TSB-95 or better, and best industry practices. If any of these are in conflict, the Contractor shall be responsible to bring any discrepancies to the attention of UNLV Network Development and Engineering.

   a. Testing

      Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for continuity, pair reversals, and shorts. Twisted-pair data cables shall be tested for all of the above requirements, plus tests that indicate installed cable performance. The data cables shall be bi-directional tested using a Class II-E or better cable analyzer.

   1. Continuity

      Each pair of each installed cable shall be tested for opens, shorts, polarity and pair-reversals. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
2. **Length**

Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multipair cables, the longest pair length shall be recorded as the length for the cable.

3. **Performance Verification**

Enhanced Category 6 data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests: near end crosstalk (NEXT), attenuation, ambient noise, and attenuation to crosstalk ratio (ACR).

4. **Equipment**

Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved. All test results to be provided to UNLV Network Development and Engineering in .PDF and Linkware format prior to acceptance of completed project. All test results must be labeled with the specific data cable that was tested by its identifier on the patch panel.

2. **Fiber Optic**

Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The test results shall include all tests performed, the expected test result and the actual test result achieved. All test results to be provided to the UNLV Network Development and Engineering in .PDF format prior to acceptance of completed project. All test results must be labeled with the specific data cable that was tested by its identifier on the patch panel.

Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the EIA/TIA-568-B Annex H, Optical Fiber Link Performance Testing.
Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

The expected results for each cable (or group of cables of the same nominal length) shall be calculated before the start of testing and recorded in a space provided on the Contractor’s test matrix. Each strand of fiber in the respective cable shall be evaluated against this target number. Any fibers that exceed this number by more than -0.5dB shall be repaired or replaced at the installers’ cost.

Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between UNLV Network Development and Engineering and the Contractor prior to the start of the test.

a. Multimode

All multimode optical fiber attenuation shall be measured at 850 nanometers (nm) and 1300 nm using an LED light source and power meter. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one-jumper reference, two-jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss that network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link. Multimode fiber optic cable must meet or exceed the following limits:

1. Attenuation
   3.5dB/km at 850nm, 1.5dB/km at 1300nm.

2. Bandwidth
   1500MHz*km at 850nm, 500MHz*km at 1300nm.

3. Connectors
Max loss for a mated pair of connectors shall be less than 0.5dB

b. Singlemode

Single mode optical fiber attenuation shall be measured at 1310 nm and 1550 nm using a laser light source and power meter. Tests shall be performed at both wavelengths in one direction on each strand of fiber. The setup and test shall be performed in accordance with EIA/TIA-526-7 Standard, Method 1A. Two-meter patch cords shall be used as test references and for the actual test. This test method utilizes a one-jumper reference, two-jumper test to estimate the actual link loss of the install cable plus two patch cords. Singlemode fiber optic cable must meet or exceed the following limits:

1. Attenuation
   0.4dB/km at 1310nm, 0.3dB/km at 1550nm.

2. Connectors
   Max loss for a mated pair of connectors shall be less than 0.5dB

3. OTDR

   Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturer’s recommendations and best industry practices.

4. As-Builts

   All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. The As-built drawings shall clearly identify the patch panel label and it's corresponding station side location. As-builts will be created from latest digital architectural drawings, to most closely resemble exact building conditions, as possible. Hand drawings are not acceptable. As-builts & test results must be provided in both .PDF and CAD format. Upon acceptance of contract, vendor will be required to provide an acceptable time-line for provision of As-Built drawings. Acceptable time-line shall be verified by UNLV Network Development and Engineering. Ample time must be allocated for verification of As-builts & test results and subsequent corrected versions of those documents. Network equipment (Including Voice, Data and A/V services) will not be provisioned until this documentation is provided.
4. **APPENDIX A – EXHIBITS**

4.0. **STANDARD OUTLET CONFIGURATION**

- **Faceplate**: Ivory, 4 port AMP #558088-1
- **Data Jacks**: Black 8P8C, AMP #1375055-2
- **Blank Inserts**: Ivory, AMP #1116412-1
- **Conduit**: 1" diameter

**Faceplate Label**
- Station room number: 305 1-2

**Jack Label**
- Station numbers: 1, 2

**Faceplate Label:**
- IDF Room#: IDF 134
4.1. STANDARD CONDUIT ROUTING

**PLAN VIEW**

- Single Gang Box
- 1” conduit to cable tray

**ELEVATION VIEW**

- 90 degree bend
- 1 Inch Conduit

**STATION BOXES**

- CABLE TRAY

**FASTENED TO CABLE TRAY WITH BUSHING**