27 00 00 Telecommunications
Cabling System Technical Specification

1.0 INTRODUCTION

1.1 PURPOSE

The intent of this document is to provide a standard specification that will be used for all University of Northern Colorado facilities requiring copper and fiber optic cabling installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete cabling system that shall accommodate the Owner'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 University of Northern Colorado facility will be provided as an attachment to this document. If the bid documents are in conflict, the written specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cabling system described in this document.

The University of Northern Colorado's infrastructure requires an Commscope Netconnect structured cabling system or a UNC Information Management & Technology (UNC IM&T) **approved** equivalent end-to- end single vendor solution installed by a contractor capable of providing a warranty for Commscope Netconnect, local to the State of Colorado. Contractor must be within a two-hour travel distance from the University of Northern Colorado. The Category 6 portion of the cabling system shall comply with the proposed link and channel performance requirements of the latest revision of ANSI/TIA/EIA 568-B.2-1 "Performance Specifications for 4-pair 100 Ohm Category 6 Cabling". A copper cabling system shall be backed by a Tyco Electronics, 25-Year System Warranty. A fiber optic cabling system shall be backed by a Tyco Electronics, 25-Year System Warranty or Corning, 25-Year System Warranty. The system warranty shall be facilitated by the Contractor and be established between the University of Northern Colorado and thecabling system manufacturer.

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 Cable Infrastructure Project. The Contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the 25-Year System Warranty requirements. After installation, the Contractor shall submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, and to apply for said warranty on behalf of the University of Northern Colorado. The warranty will cover the components and labor associated with the repair/replacement of any failed link, within the warranty period, that is a valid warranty claim.

1.2 SCOPE

This document defines the cabling system and subsystem components specific to cable, termination hardware, supporting hardware, and miscellany that are necessary for a complete telecommunications system supporting voice and data. The intent of this document is to provide all pertinent information to allow the vendor to bid the labor, supervision, tooling, and miscellaneous mounting hardware and consumables to install a complete system. However, it is the responsibility of the vendor to propose any and all items required for a complete system installation if not specifically identified within the scope of the project.

1.3 APPLICABLE DOCUMENTS:

The cabling system described in this specification is derived in part from the recommendations made in industry standard documents. The lists of documents below are incorporated by reference:

1) This Technical Specification and Associated Drawings
2) ANSI/TIA/EIA 568-B.2-1 Performance Specification for 4-Pair 100 Ohm Category 6 Cabling (latest revision)
3) ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard – April, 2001
4) ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces - February, 1998
5) ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - February, 1993
6) TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications - August, 1994
7) Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – 11th edition
8) National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) - 2011

If a conflict exists between applicable documents, then the order in the list above 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.

If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the vendor is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.4 SUBMITTALS

- Submittals shall include product data literature. Submittals shall include adequate descriptive literature, catalog cut sheets, and other data necessary for UNC IM&T to ascertain that the proposed equipment and materials comply with specification requirements.
- Product data submittals shall consist of technical data sheets, manufacturer specifications, illustrations, standard schedules, performance charts, instructions, brochures, diagrams and test data furnished to illustrate a product, material or system for some portion of the work. Product data literature is required on all items of material and equipment and should be clearly marked, identifying specific items proposed.
- Prior to assembling or installing the work, prepare and submit shop drawings for review and approval.
- The contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed submittals from UNC IM&T.
- Review of product data shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attention to such deviations at the time of submission and secured written approval.
- Samples may be requested; which shall be physical examples, which represent materials, equipment, or workmanship and establish standards by which the work will be judged.

1.5 CONTRACTOR QUALIFICATIONS

Contractors bidding on this project must meet the following minimum requirements:

- Bidding contractors shall be companies specializing in the installation, fabrications, and design of telecommunications systems.
- The Contractor shall have a minimum of five (5) years of experience in this specialized field and shall

have completed a minimum of three projects similar in the scope to this project.

- The telecommunications Contractor must be certified for installing the proposed manufactures solution throughout the entire completion of project.
- Contractors must submit proof of above stated required qualifications.

2.0 TELECOMMUNICATIONS SYSTEM REQUIREMENTS

2.1 FACILITIES DESCRIPTION

The University of Northern Colorado's facilities vary in function and size. The majority of personnel are situated in modular office furniture, with some hard wall offices typically around the exterior of the floor.

2.2 TELECOMMUNICATIONS SYSTEM DESCRIPTION

Unless otherwise specified by the scope of the project, the University of Northern Colorado deploys at least one data connection to each user outlet as a standard configuration. The two data circuit is provided via a dedicated Category 6 cable using SL series jacks. Horizontal data cables are terminated on rack- mounted Category 6 patch panels. Horizontal data circuits are connected to LAN electronics within each Intermediate Distribution Frame (IDF). Horizontal voice circuits are cross-connected to backbone riser frames within each Intermediate Distribution Frame (IDF).

Where applicable a 6 strand Single Mode fiber optic backbone is employed between the Main Distribution Frame (MDF) and each Intermediate Distribution Frame (IDF) for data connectivity, and high pair count Category 3 CMR riser cables are employed between the MDF and each IDF for voice connectivity. Within the data MDF and the IDF's, single-mode backbone fiber strands are terminated and housed in rack-mount fiber optic enclosures. Within the voice MDF and the IDF's, backbone copper pairs are terminated on rack-mount 6-110Connect XC termination frames.

Please note, UNC uses category 6 SL series for all modular jacks, and faceplates. Please make sure that all parts and equipment fit the scheme of the SL series.

2.3 UNC IMT NETWORK HARDWARE INSTALLATION

UNC Installs its own Network Switches, Cameras, UPSs, and Wireless Access Points. Please work with the Information Management and Technology teams to verify details of this equipment.

3.0 HORIZONTAL DISTRIBUTION SUBSYSTEM

3.1 TELECOMMUNICATIONS OUTLETS

Each outlet location, unless otherwise noted in the scope of the project shall be terminated on an 8-position, 8-conductor Category 6 SL series jack to the T568B color code. The outlet plates, unless otherwise noted in the scope of the project, shall be mounted to single gang boxes, box eliminators, surface mount boxes and/or floor monuments (3rd party) as required. Due to the fact that voice communications on campus are strictly VoIP, standard desk set phones are serviced with data connections. Throughout this document, the term "voice" shall reference traditional ***analog*** voice services only. "Voice cable" will be utilized by faxes, modems, and traditional credit card readers as well as anything else that requires traditional ***analog*** voice communication. In addition to "data" and "voice" services, UNC willreference "life safety" services as a third classification for cabling. Life safety cable will be utilized by fire alarm panels.

3.1.1 PRODUCT SPECIFICATIONS

Category 6 Cabling – Non-plenum
Horizontal cabling shall be 23 AWG, 4-pair UTP, UL/NEC/NFPA CMR rated, with a PVC jacket. Cable jacketing shall be lead-free. Cable shall be 3rd party verified to ANSI/TIA/EIA-568-B.2.1 and meet the performance requirements listed in the table below in addition to all other standard Category 6 performance requirements. Cable shall be supplied on wooden reels or in reel-in-box. Cable shall be safety listed to ANSI/UL 1666. Horizontal cable shall be:

- Commscope part number CS37R BLU (Blue) for designated data.
- Commscope part number CS37R YEL (Yellow) for designated analog voice.
- Commscope part number CS37R RED (Red) for life safety (e.g. fire alarm panels).
- Commscope part number CS37R GRN (Green) for designated Audio Video or Digital Media.

Category 6 Cabling – Plenum
Horizontal cabling shall be 23 AWG, 4-pair UTP, UL/NEC/NFPA CMR rated, with a PVC jacket. Cable jacketing shall be lead-free. Cable shall be 3rd party verified to ANSI/TIA/EIA-568-B.2.1 and meet the performance requirements listed in the table below in addition to all other standard Category 6 performance requirements. Cable shall be supplied on wooden reels or in reel-in-box. Cable shall be safety listed to ANSI/UL 1666. Horizontal cable for data shall be:

- Commscope part number CS37P BLU (Blue) for designated data.
- Commscope part number CS37P YEL (Yellow) for designated analog voice.
- Commscope part number CS37P RED (Red) for life safety (e.g. fire alarm panels).
- Commscope part number CS37P GRN (Green) for designated Audio Video or Digital Media.

Modular Jacks
UNC uses category 6 SL series. All modular jacks shall be wired to the T568B wiring pattern. Modular jacks shall be constructed with a housing of polyphenylene oxide, 94V-0 rated. Modular jacks shall be terminated using a 110-style pc board connector (made of 94V-0 rated polycarbonate), color-coded for both T568A and T568B wiring. The 110 connector shall terminate 22-24 AWG solid conductors with a maximum insulation diameter of .050 inches. The modular jack contacts shall be plated with a minimum of 50 microinches of gold in the contact area overa 50 microinch minimum nickel underplate. Modular jacks shall be compatible with panel thicknesses of
.058” - .063”. Modular jacks shall snap into a .790" X .582" opening. Modular jacks shall be UL Listed under file number E81956. Modular jacks shall match the appropriate color for designation of data, voice, or life safety at the office/work area.
Category 6 modular jacks shall be unkeyed 4-pair and shall meet the performance requirements listed in the table below. Modular jacks shall fit in a .790" X .582" opening. Modular jacks shall be terminated using a 110-style pc board connector, color-coded for both T568A and T568B wiring. Each jack shall be wired to **T568B**. Modular jacks shall be UL Listed under file number E81956. Modular jacks shall be:

- Commscope part number 1375055-6 (Blue) for designated data.
- Commscope part number 1375055-8 (Yellow) for designated analog voice.
- Commscope part number 1375055-7 (Red) for life safety (e.g. fire alarm panels).
- Commscope part number 1375055-9 (Green) for designated Audio Video or Digital Media.

Modular Furniture Outlets
Use appropriate FLEX-MODE faceplate determined by modular furniture brand. FLEX-MODE faceplates shall be made of polycarbonate molding compound. If possible, faceplate shall contain at least one Category 6 jack.If required, two faceplates may be installed in each work area. There shall be at least one Category 6 cables terminated as noted in 3.1 above. The faceplate(s) shall be mounted in the appropriate knockout(s) in the furniture channel.

Office Outlets

UNC uses SL series faceplates 211100X-Y (where X can be altered for port number, and Y color). Faceplates shall be constructed of ABS molding compound and be4.53" X 2.77" X .60" in size. Each faceplate shall contain the proper number of ports to accommodate the amount of network drops. Any remaining ports shall be filled with blank inserts.

Building Entrance Phone

Use GAI-Tronics Model #298-702 where designated for building entrance phone use. Each entrance phone must be serviced by one Category 6 cable. Cable must be jacked using the approved methods outline in Products Specifications or otherwise approved by UNC IT. Entrance phone is SIP capable and should be serviced by a data connection. Alternates must be approved by UNC Information Technology.

3.1.2 TELECOMMUNICATIONS OUTLET INSTALLATION

All outlets shall be installed in the following manner:

- Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire will be stored in the wall with a minimum of 12" of slack. No more than 12" of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable or the wall.

In addition, each cable type shall be terminated as indicated below:

- Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
- Pair untwist at the termination shall not exceed .24 inch for Category 6 connecting hardware.
- Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
- The cable jacket shall be maintained as close as possible to the termination point.
- Voice jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Voice jacks in horizontally oriented faceplates shall occupy the right-most position(s). Modem jacks shall be considered the last voice jack in the sequence.
- Data jacks shall occupy the top position(s) on the faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).
- Life safety jacks should be terminated similar to data or voice wherever possible. Where lack of space may dictate, modular jack boxes may be utilized.

3.2 HORIZONTAL DISTRIBUTION CABLE

Horizontal distribution cable for data circuits shall be Category 6, 4-pair unshielded twisted pair, CMP or CMR rated cable as required. Quantities of cables to each outlet type shall be in accordance with the definitions provided in Section 3.1.1 above.

3.2.1 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.Cables shall be installed in continuous lengths from origin to destination (no splices).
- The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be

supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceilinggrids or panels.

- Horizontal distribution cables shall be bundled in groups of not greater than 48 cables. Cable bundle quantities in excess of 48 cables may cause deformation of the bottom cables within the bundle.
- Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware. The cabling system and support hardware shall be installed sothat it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs are required, the contractor shall install clips to support the cabling.
- Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the owner.
- Spliced cables on new installations are not acceptable.
- Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
- Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
- Cables shall be grouped by color for the duration of the run.

3.3 Horizontal Cross-Connect Termination Hardware

3.3.1 HORIZONTAL DATA CROSS-CONNECT

The horizontal cross-connect for data circuits shall consist of patch cords from the horizontal Category 6 termination panels to the network equipment within the same or adjacent racks. The horizontal data cross-connect shall be contained in Black 19” x 7’ Rack(s). All equipment racks shall be augmented with Black horizontal and vertical management hardware, both front and rear, to properly dress horizontal cables and patch cords. Patch panels shall be 3.5 inches high and provide 48 SL modular jack ports, wired to T568B. The front of each patch panel module shall be capable of accepting 9mm to 12mm labels. Patch panels must be UL Listed under file number E81956. Patch panels shall be Commscope part number CPP-UDDM-SL-2U-48 (48-Port) by default,CPP-UDDM-2I-1U-24 (24-Port).

Connections installed for life safety devices requiring the designation of red cable shall be terminated at a separate 24-port patch panel within the IDF or MDF designated for UL Listed electronics unless otherwise identified by UNC IT.

Below are 2 options for racks that UNC uses. If another rack is needed, the contractor must discuss and have that rack approved by UNC IMT.

Commscope
Floor Mount Rack Part No. RK3-45A (19”W X 7’H)

Middle Atlantic
Wall Mount Rack Part No. CWR-18-22PD

3.3.2 VOICE CROSS-CONNECT

If needed, the cross-connect for analog voice connectivity shall be a discussed item with UNC Information Management and Technology if needed.

3.3.3 HORIZONTAL CROSS-CONNECT INSTALLATION

Copper termination and management hardware shall be installed in the following manner:

- Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
- Pair untwist at the termination shall not exceed .24 inch for Category 6 connecting hardware.
- Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- The cable jacket shall be maintained as close as possible to the termination point.
- Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

Fiber optic termination hardware shall be installed in the following manner:

- Fiber slack shall be neatly coiled within the fiber termination panel. A 15' fiber coil shall be looped above the fiber rack within the cable tray or ladder rack.
- Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel.
- Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel.
- Each cable shall be clearly labeled at the entrance to the termination panel. Cables labeled within the bundle shall not be acceptable.
- Fiber optic connectors shall be installed on both ends of all fiber optic backbone cable strands, providing the connecting hardware for terminating backbone cables into fiber optic patch panels.
- Fiber optic connectors should be multimode/single mode ST type connectors and shall meet all ANSI/TIA/EIA568A specifications.
- Dust caps shall be installed on the connectors and couplings at all times unless physically connected.
- Optical fiber patch panels shall be rack mountable in a 19" equipment rack at the top and/or next available (u).
- If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- Fiber Optic Splice case shall be Corning Manufactured unless otherwise approved by IMT.
- Fiber Optic cables shall be terminated into Commscope fiber patch enclosures (see below).

Acceptable Hardware -		
LC-Style 6-Fiber Single mode Plate (SM)		
Blank Plate	Commscope	760147736
1U Rack Mount Patch Enclosure, Black	Commscope	760231449
2U Rack Mount Patch Enclosure, Black	Commscope	760231456
4U Rack Mount Patch Enclosure, Black	Commscope	760231464

4.0 BACKBONE CABLE

A minimum of two six strand single mode fiber optic cables shall be utilized to connect buildings Main Distribution Frame (MDF) to the Core Data Center in a dual home fashion. The Core Data Center (CDC) for Central Campus is located in Carter Hall and Gray Hall. The Core Data Center (CDC) for West Campus is located in McKee Hall and Ross Hall. A minimum of six strand fiber optic cable shall be utilized to provide backbone connectivity between the MDF and each Intermediate Distribution Frame (IDF). Inter-building fiber optic cabling shall be single mode Indoor/Outdoor Loose Tube. Intra-building fiber optic cabling shall be single mode Indoor/Outdoor Interlocking Armored Plenum. The cable shall provide a maximum attenuation of 3.5 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm. The bandwidth of the cable shall be 500 MHz/km @ 850 nm and 500 MHz/km @ 1300 nm. The optical fiber cable shall be Commscope or Corning.

4.1 BACKBONE CABLE INSTALLATION

All backbone cables shall be installed in the following manner:

- Fiber Optic cables installed within UNC tunnel system, shall be separated by a minimum of three feet when applicable.
- All Fiber Optic cables installed outside the UNC tunnel system shall be installed in separate conduit, separate innerduct or as indicated on prints/drawings.
- Backbone cables shall be installed separately from horizontal distribution cables.
- Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate innerducts within conduits.
- Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum innerduct to provide protection to the cable
- Where horizontal backbone cables and distribution cables [NRR1]are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- Support brackets with cable tie slots for fastening cable ties to brackets.
- Lacing bars, spools, J-hooks and D-rings are acceptable.
- If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- Fiber Optic Splice case shall be Corning Manufactured unless otherwise approved by IMT.
- Fiber Optic cables shall be terminated into Commscope fiber patch enclosures.

4.2 BACKBONE TERMINATION HARDWARE.

Each fiber optic cable shall be terminated in the MDF and IDF in a UNC specified rack mount enclosures providing protection to the terminated fibers. The optical fiber patch panel(s) shall each be capable of containing LC connectors in an enclosure. The LC jacks shall be single mode. The connectors shall be field-installable, requiring no epoxy, or polishing. The connectors shall meet the intermate ability requirements of TIA/EIA-604-12. Connector performance requirements are listed in the following table:

Typical Performance Characteristics

Test Description	FOTP	Requirement (dB)
Visual and Mechanical Inspection	13	TIA/EIA-604-2 or -3 Intermateability
Attenuation	34	□0.75
Return Loss	107	□-20
Low Temperature (0^0C for 4 days)	188	□0.3 change
Temperature Life (55^0C for 14 days)	7	□0.3 change
Humidity (90 to 95% @ 40^0C for 4 days)	5	□0.3 change
Impact (8 drops from 1.8 meters)	2	□0.75 IL, □-20 RL
Durability (500 cycles)	21	□0.75 IL, □-20 RL
Cable Retention ($0^0$and 90^0)	6	□0.75 IL, □-20 RL
Flex (100 cycles)	1	□0.75 IL, □-20 RL
Twist (10 cycles)	36	□0.75 IL, □-20 RL

Voice backbone cables shall be terminated in **wall** mount Porta Systems building entrance terminal series 24 BET with model 45BCN-protector module on ¾ "virgin fire retardant plywood. 100 pair frames shall be used as required by the backbone pair counts to be terminated in the voice MC. High pair count Category 3 CMR riser cables are employed between the BET and the rack mount field-terminated 6-110Connect XC kit frames.

4.2.1 TERMINATION HARDWARE INSTALLATION

Copper termination and management hardware shall be installed in the following manner:

- Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
- Pair untwist at the termination shall not exceed one-half an inch for Category 6 connecting hardware.
- Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- The cable jacket shall be maintained as close as possible to the termination point.
- Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

Fiber optic termination hardware shall be installed in the following manner:

- Fiber slack shall be neatly coiled within the fiber termination panel. A 15' fiber coil shall be looped above the fiber rack within the cable tray or ladder rack.
- Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel.
- Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel.
- Each cable shall be clearly labeled at the entrance to the termination panel. Cables labeled within the bundle shall not be acceptable.
- Fiber optic connectors shall be installed on both ends of all fiber optic backbone cable strands, providing the connecting hardware for terminating backbone cables into fiber optic patch panels.
- Fiber optic connectors should be multimode/single mode LC type connectors and shall meet all ANSI/TIA/EIA568A specifications.
- Dust caps shall be installed on the connectors and couplings at all times unless physically connected.
- Optical fiber patch panels shall be rack mountable in a 19" equipment rack
- Fiber Optic Splice case shall be Corning Manufactured
- Fiber Optic cables shall be terminated into Commscope patch panels.

5.0 TELECOMMUNICATIONS SPACES

The telecommunication space provided at all MDF's and IDF's must be at least if not greater than 10' x 10'. The telecommunications closets shall house racks, voice termination fields and required cable routing hardware. Racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 10" to the wall to allow room for vertical management. Where there is more than one rack, the racks shall be ganged with vertical management hardware to provide interbay management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side of the ganged assembly.

Conduits a minimum of 4" in diameter shall be used in all closets. Conduits for data backbone shall be located adjacent to the racks and conduits for voice backbone shall be located adjacent to the voice termination fields. The contractor shall provide Innerduct for all backbone fiber runs. Contractor shall provide required ladder and wall mount management rings to properly support and dress cables from conduits to

racks and frames. Contractors shall use existing conduits, innerducts, ladder and wall mount management when available unless new is specified within prints/drawings.

5.1 INSTALLATION SPECIFICATIONS

Racks shall be installed in the following manner:

- Racks shall be securely attached to the concrete floor using 3/8" hardware
- All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 9.0 of this document.
- Rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- Racks equipment must be Commscope, Middle Atlantic, or approved by UNC IMT prior to install.
- Vertical cable management width should be 10" for the volume of connections in the rack not to exceed 40% capacity with covers on both the front and rear.

6.0 WORK AREA AND PATCH CORD CABLE ASSEMBLIES

Patch cords used at the telecommunication rack and at the workstation shall be Category 6, 4-pair assemblies. Patch cords shall be factory-assembled by a Commscope manufacturer. Contractors will be requiredto provide a patch cord per user outlet in the following manner (50% should be 15', 25% should be 10', 25%should be 25') Category 6 patch cords. The phone cords shall be provided by the owner.

In the MDF's and IDF's, 12" patch cords shall be provided by the contractor to cross-connect between the datapatch panels and network equipment per user outlet. Fiber type appropriate optical zip cords shall be provided by the contractor per strand count to patch the network equipment to the enclosures and shall be 1 meter in length within the Intermediate Distribution Frames. Fiber Optic Zip cords will be contractor furnished and owner installed (see appendix IV). Fiber Optic zip cords must be ST to LC unless otherwise specified within the print/drawings. [NRR2]

Copper Patch Cords		
Cat 6 Patch Cable, 12 in, Blue	Commscope	UNC6-BL-1FT
Cat 6 Patch Cable, 10 ft, Blue	Commscope	UNC6-BL-10FT
Cat 6 Patch Cable, 15 ft, Blue	Commscope	UNC6-BL-15FT
Cat 6 Patch Cable, 25 ft, Blue	Commscope	UNC6-BL-25FT

Fiber Patch Cords LC-LC		
SM Fiber Yellow (size may vary)	Commscope	FEWLCLC42-JXM
MM Fiber Aqua (size may vary)	Commscope	FEWLCLC42-MXM

7.0 CABLING SYSTEM TESTING

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

All cables shall be tested in accordance with this document, the ND&I Contract agreement, and best industry practices. If any of these are in conflict, the Contractor shall be responsible to bring any discrepancies to the attention of the project team for clarification and/or resolution.

7.1 COPPER

Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a “green light” type test set. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. These data cables shall be tested using a Level III cable scanner.

7.1.1 CONTINUITY

Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. 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.

7.1.2 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 ANSI/TIA/EIA-568-A 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.

7.1.3 PERFORMANCE VERIFICATION

Category 6 data cabling systems 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:

Pair-to-Pair Near End Crosstalk (NEXT)
Power Sum Near End Crosstalk (PSNEXT
Insertion Loss
Return Loss
Equal Level Far End Crosstalk (ELFEXT)
Power Sum Equal Level Far End Crosstalk (Power Sum ELFEXT)
Attenuation to Crosstalk Ratio (ACR)

Category 6 data cable shall be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA –568-B.2.1 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.

7.2 FIBER OPTIC TESTING

In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source. Cable length and splice attenuation shall be verified using an OTDR.

7.2.1 ATTENUATION

Horizontal distribution multimode optical fiber attenuation shall be measured in one direction at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14 Standard, Method B. The MT-RJ system shall be tested in accordance with the industry testing procedures established in “MT-RJ Optical Fiber Systems Testing” literature# 1307540. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall bebased on the values set forth in ANSI/TIA/EIA-568-B.1.

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 the Owner and the Contractor prior to the start of the test.

Single-mode optical fiber attenuation shall be measured at 1310 nm and 1500 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 set-up and test shall be performed in accordance with ANSI/TIA/EIA-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. The MT-RJ system shall be tested in accordance with the industry testing procedures established in “MT-RJ Optical Fiber Systems Testing” literature # 1307540. This measurement is consistent with the loss which network equipment will see under normal installation and use.

Test evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA/EIA-568-B.1. 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. Maximum attenuation for installed cables shall be evaluated based on the following formula: manufacturer’s maximum attenuation per kilometer, divided by 1000 and then multiplied by the installed cable length in meters*. The adjusted cable attenuation value shall be added to the manufacturers mean loss per mated pair of connectors multiplied by the number of mated pairs under test**.

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 value by more than (?dB) shall be repaired or replaced at no cost to the Owner.

> *For this application, the length based on cable length measurements marked on the jacket, will be suitable. If OTDR testing is performed in accordance with 8.2.2, then the actual measured length shall be used. Conversion from metric to US Standard measurement shall use 3.2808 as a constant with the result rounded to the next highest whole number.
>
> **The testing for this project is measuring the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors. Subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test.

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 the Owner and the Contractor prior to the start of the test.

7.2.2 LENGTH AND SPLICE LOSS

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 ANSI/TIA/EIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturer's recommendations and best industry practices. These tests shall be employed where one or more of the following conditions exist.

- Where OTDR testing is specifically requested by the Owner
- Each strand shall be tested on all outside plant cables and/or where splices exist.
- A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, in respect to cable function, in the TIA/EIA-568-B Standard.
- Where abnormal or unexpected results are obtained during attenuation testing
- Where the cable has been subjected to extreme conditions or stresses during installation.

8.0 FIRESTOP SYSTEMS

A firestop system is comprised of: the item or items penetrating the fire rated structure; the opening in the structure and the 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 firestopped.

8.1 PRODUCT SPECIFICATIONS

Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

8.2 FIRESTOP SYSTEM INSTALLATION

All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cabling system acceptance.

9.0 GROUNDING AND BONDING

The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current carrying conductor. The TBB shall be installed independent of the buildings electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607-A Telecommunications Bonding and Grounding Standard.

The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications closet shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

9.1 PRODUCT SPECIFICATIONS

All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the CDC, MDF or IDF shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack to not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack mount equipment. The conductor shall be continuous, attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector.

All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables, and busbars shall be identified and labeled in accordance with the System Documentation Section of this specification.

9.2 GROUND SYSTEM INSTALLATION

The TBB shall be designed and/or approved by a qualified PE, licensed (actual or reciprocal) in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607-A standard, and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, shall be performed by a licensed electrical contractor.

10.0 SYSTEM DOCUMENTATION

The following section describes the installation, administration, testing, and as-built documentation required to be produced and/or maintained by the contractor during the course of the installation.

10.1 CABLING SYSTEM LABELING

The contractor shall develop and submit for approval a labeling system for the cable installation. University of Northern Colorado will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cabling system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

Contractors must also supply an electronic copy of every data and phone jacks location in the building (jack # /room #, Floor, Wall (N,S,E,W)).

EXAMPLE: (closet, patch panel number, cable type) J216-22D (for 22nd data port in J216 closet)
EXAMPLE: (closet, patch panel number, cable type) 3005-5AV (for 5th AV port in 3005 closet)

All label printing will be machine generated using indelible ink ribbons or cartridges. 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. Outlet labels will be the manufacturer's labels provided with the outlet assembly.

10.3 AS-BUILT DRAWINGS

The installation contractor will be provided with 2 sets of letter size drawings at the start of the project. One

set will be designated for as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the Owner.

The Contractor shall provide an updated electronic copy of the central drawings to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cabling system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

Contractors must also supply an electronic copy of every data and phone jacks location in the building (jack# /room #, Floor, Wall (N,S,E,W)).

10.4 TEST DOCUMENTATION

Test documentation shall be provided in PDF form within three weeks after the completion of the project. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3 or 6), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name,manufacturer, model number and last calibration date will also be provided at the end of the document.
Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

Test documentation can also be provided electronically.

Scanner tests shall be printed on 8-1/2" x 11" paper. Hand written test results (attenuation results and green light results) shall be documented on the attached test form (Appendix C). OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder.

When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

11.0 CONDUITS, TRENCHING AND DIRECTIONAL BORING

- Contractor option – Directional Bore or Trench to install conduit between locations identified on prints. Trenching may not be used through asphalt / concrete locations unless indicated on prints.
- Minimum of 24" cover required along length of directional bore / trenching
- Place 3" HDPE Communication Duct in trench / bore hole
    - JM Eagle Schedule 80 or UNC IM&T approved equal
- Provide Tracer Wire full length of directional bore. Terminate in each handhole using triple nut anchorage.
    - 12 gauge solid copper with thermoplastic insulation
- Provide Handhole (24"x36" minimum) at each end of bore within 5' of building foundation
    - Hubbell Power Systems PG2436BA24 – LABLE = "COMMUNICATION" or approved equal
- Coordinate location for building entry with UNC IM&T
    - If entry is below grade, use watertight seal
        - Link Seal Modular Seal or UNC IM&T approved equal

- If entry is above grade, transition to 3" Rigid Metal Conduit with long-sweep elbows. Provide weathertight seal at entry to building using all weather polyurethane sealant, color to match surrounding finishes.
- If entry is through slab on grade, handhole may be eliminated, and HDPE Communication Duct may be swept up to grade (near vertical) and cut off approximately 2" above slab.

- Contractor is responsible for calling for all utility locates and shall pothole all critical crossings prior to boring.
- Contractor shall protect all open trenches.
- Site Restoration
  - Repair all damage to existing systems prior to closing trench.
  - Backfill all trenches and borehole openings using "jumping jack" / Plate Compactor type compaction equipment. Add water to achieve adequate compaction to prevent future settling.
  - SOD AREAS
    - Scrape / Retain topsoil (+/- 6" deep) separate from trench spoils. Replace topsoil over well compacted soil. Grade to match existing.
    - Place new sod (New sod shall be equivalent of a ninety-nine percent improved variety blue grass sod).
    - Coordinate sod placement / maintenance with UNC Facilities.
  - PAVED AREAS
    - Replace pavement (concrete / asphalt) to match existing thickness
      - Minimum of 4" thick
    - Protect new pavement from damage until cured

12.0 WARRANTY AND SERVICES

The contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion. Contract warranty must be a minimum of five years including materials and labor.

12.1 INSTALLATION WARRANTY

The contractor shall warrant the cabling system against defects in workmanship for a period of five years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

12.2 CABLING SYSTEM WARRANTY

The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed 250 MHz horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in ANSI/TIA/EIA-568-B.2-1 (latest draft). Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-B.1.

12.3 POST INSTALLATION MAINTENANCE

The contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall not void the Contractor's nor manufacturer's warranty.

12.4 PROJECT MANAGEMENT / GENERAL

The contractor shall establish a single point of contact with the University of Northern Colorado who will be responsible for reporting progress and updating the University of Northern Colorado's Technical Representative with issues that the Owner must address to facilitate the cabling system installation. The contractor's POC shall provide *weekly written* reports to the University of Northern Colorado's Technical Representative detailing progress. Requests for access to limited access or restricted areas shall be made (*the day prior to the required access*). Information critical to the completion of the task or project shall be communicated to the Technical Representative as the requirement becomes known. Casual information shall be passed during the scheduled progress report.

The contractor shall maintain the University of Northern Colorado's facility in a neat and orderly manner during the installation of the communications cabling system. The University of Northern Colorado's facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

13.0 CABLING SYSTEM ACCEPTANCE

The University of Northern Colorado's Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the firestopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

13.1 FINAL INSPECTION

Upon completion of the project, The University of Northern Colorado's Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the University of Northern Colorado.

13.2 TEST VERIFICATION

Upon receipt of the test documentation, The University of Northern Colorado reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. University of Northern Colorado testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found the Contractor will be notified for resolution.

13.2 SYSTEM PERFORMANCE

During the three-week period between final inspection and delivery of the test and as-built documentation, The University of Northern Colorado will activate the cabling system. The University of Northern Colorado will validate operation of the cabling system during this period.

13.4 FINAL ACCEPTANCE

Completion of the installation; in-progress and final inspections; receipt of the test and as-built electronic documentation; and successful performance of the system for a two week period will constitute acceptance of the system.

General Notes:

- All demolition debris shall be removed from the site and swept clean on a daily basis. At no time shall the work block emergency egress from the exit corridors, building exits or site.

- Cut and patch with care to avoid damage to adjacent construction.

- When penetrating a rated wall assembly, it is important to maintain the fire rating of the assembly. Use only materials rated for the installation.

- At completion of the work, remove from the job site all tools and equipment, surplus materials, equipment, scrap and debris,

- All Wiremold will be field routed and approved by Principal Represntative at time of construction

- The following are dimensions of recommended Wiremold

700 Wiremold - 0.65" x 0.75"
4000 Wiremold - 1.75" x 4.75"

Drawing List

Wiremold Raceway Routing

route 700 on wall

1-1/2" EMT

IDF for SOUTH SIDE of building

Intercept existing wiremold on wall below ceiling elevation change

Route along wall under chase

1-1/2" EMT

IDF for NORTH SIDE of building

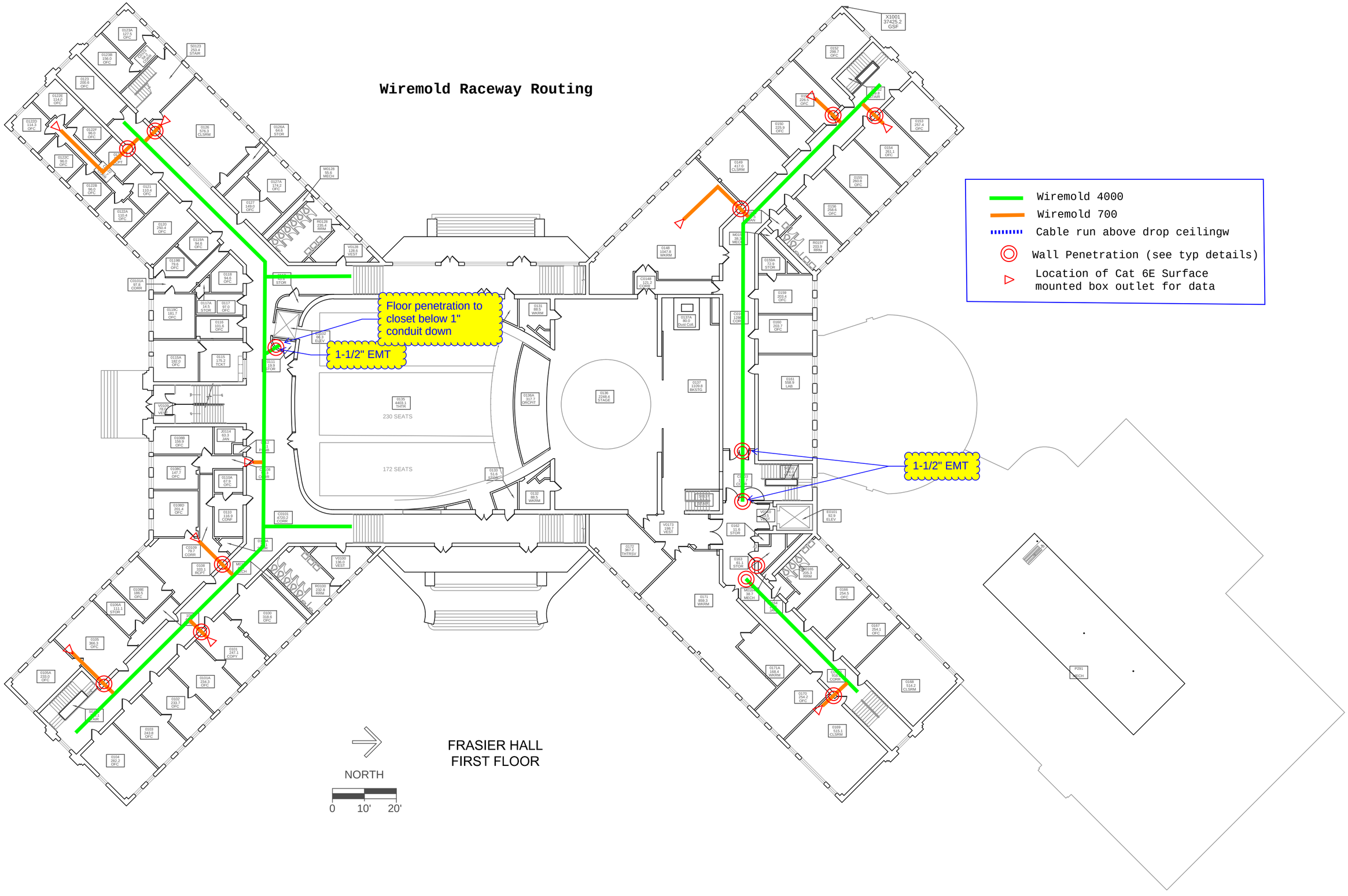
- Wiremold 4000
- Wiremold 700
- Cable run above drop ceiling
- Wall Penetration (see typ details)
- Location of Cat 6E Surface mounted box outlet for data

NORTH

0 10' 20'

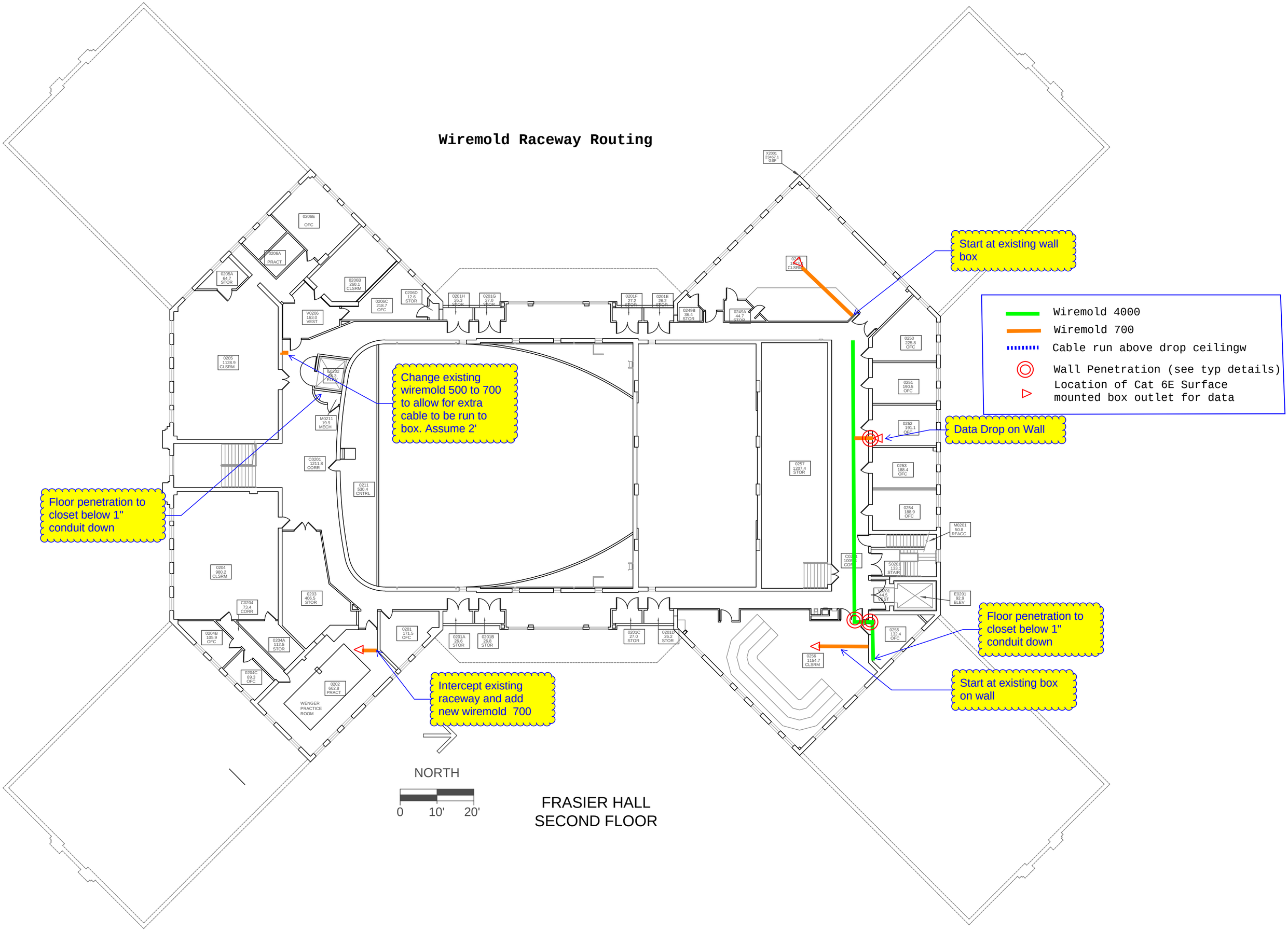
FRASIER HALL
GROUND FLOOR

Wiremold Raceway Routing



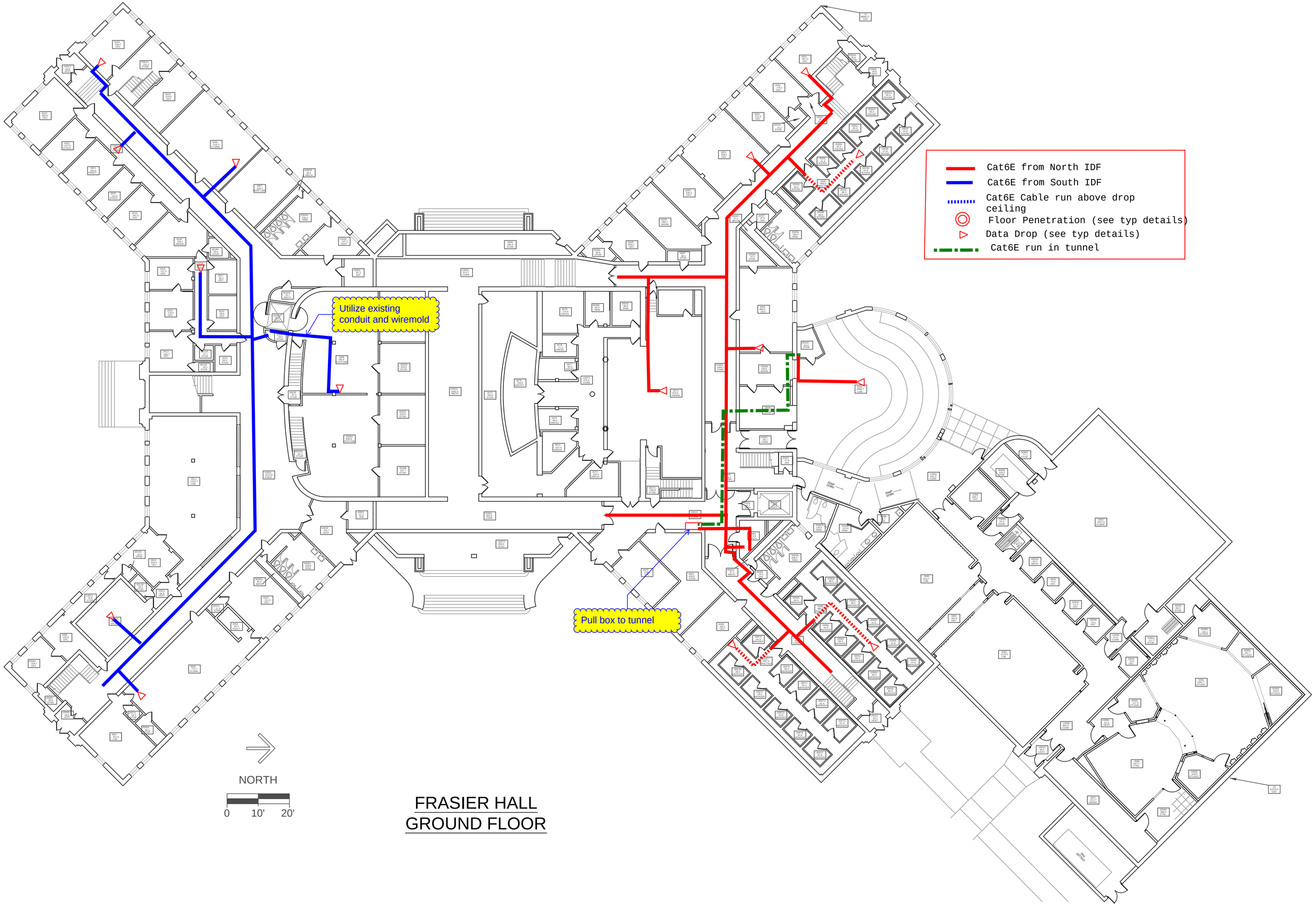
February 16, 2006 1:40 p.m.
Drawing: FRASIER HALL ALL FLOORS.DWG

Wiremold Raceway Routing



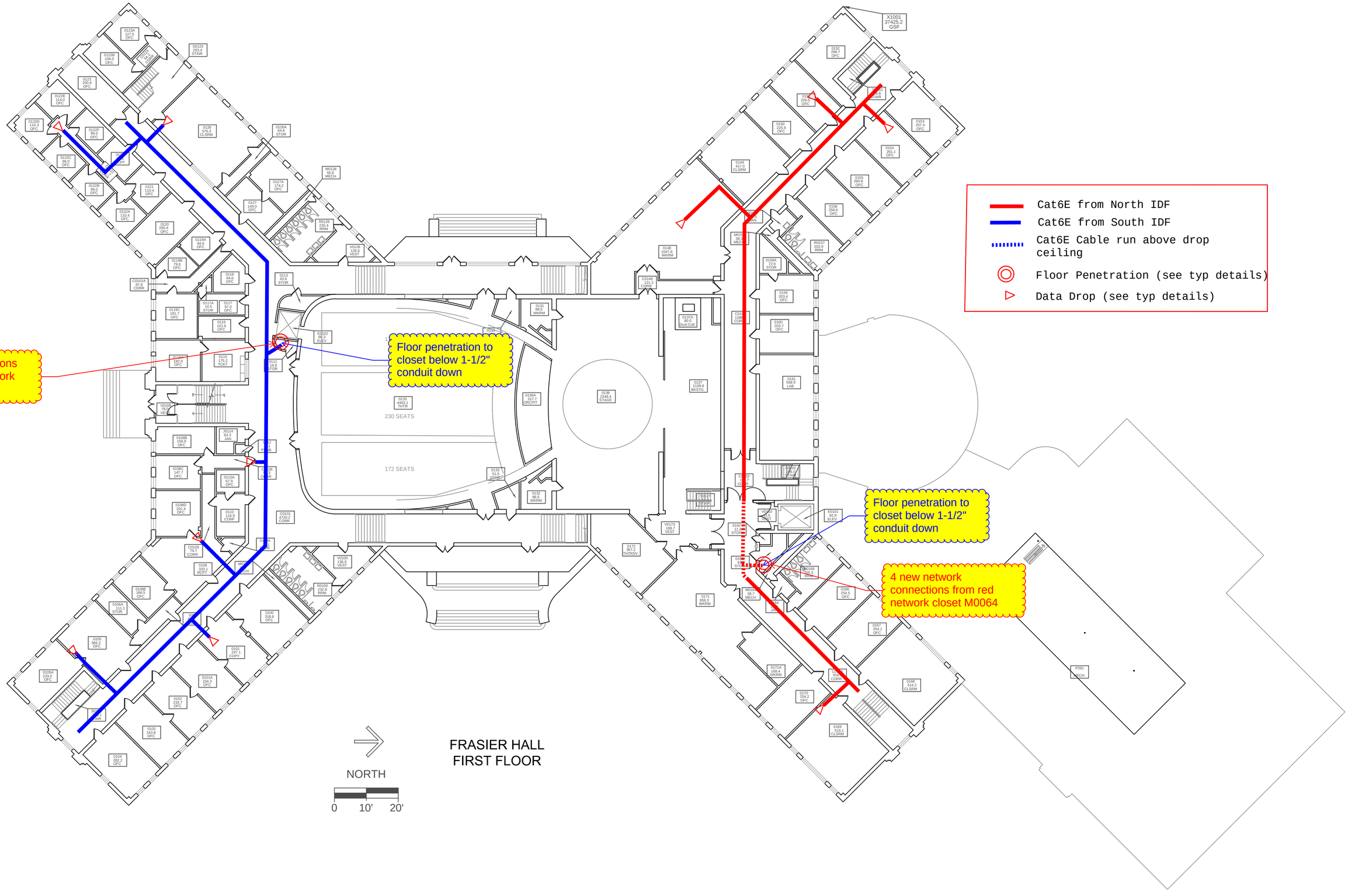
FRASIER HALL
SECOND FLOOR

CAT6E Cable Routing



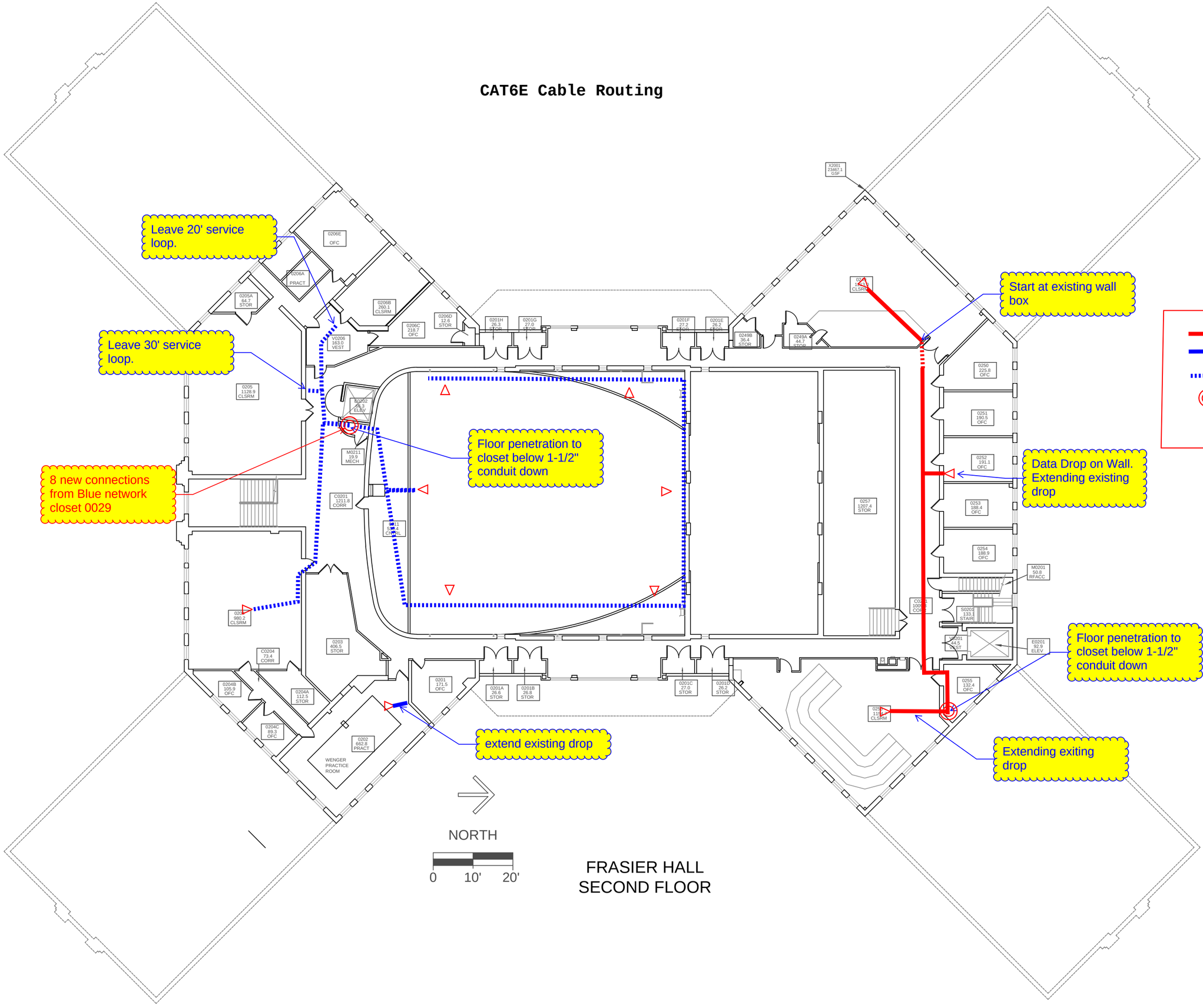
FRASIER HALL
GROUND FLOOR

CAT6E Cable Routing

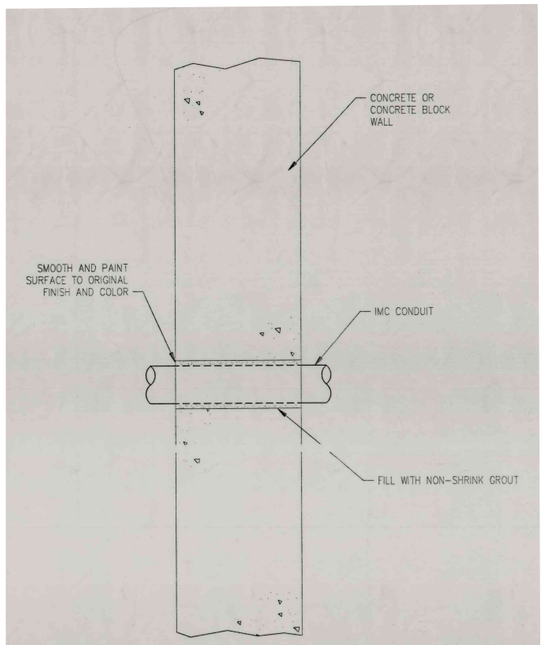


February 16, 2006 1:40 p.m.
Drawing: FRASIER HALL ALL FLOORS.DWG

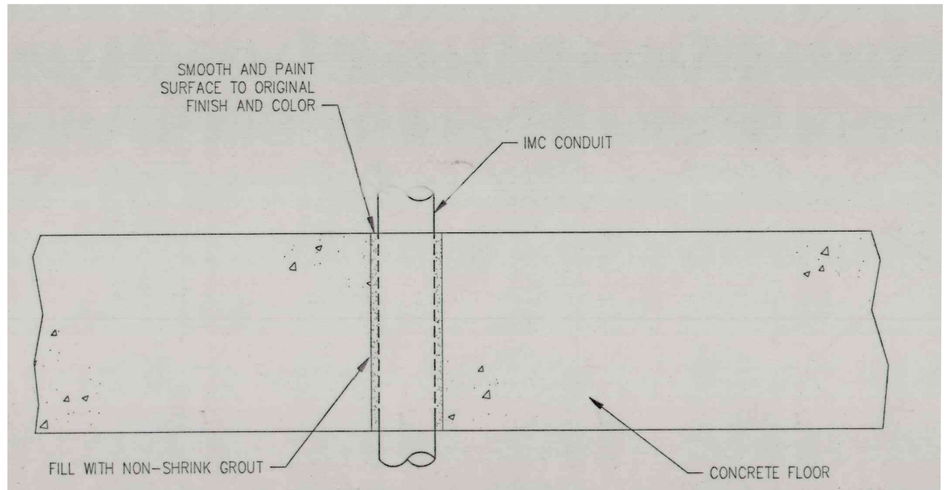
CAT6E Cable Routing



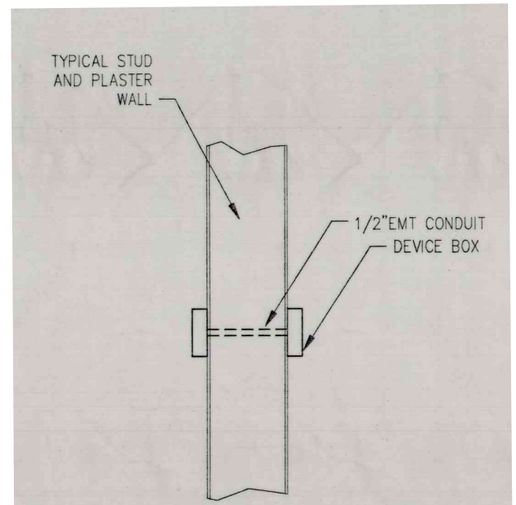
WALL AND FLOOR PENETRATION DETAILS



TYPICAL WALL PENETRATION
SCALE: N.T.S.



TYPICAL FLOOR PENETRATION
SCALE: N.T.S.



TYPICAL PLASTER WALL PENETRATION
SCALE: N.T.S.