SECTION 27 13 00 – COMMUNICATIONS INFRASTRUCTURE

PART 1 - GENERAL

1.1 SCOPE

A. Provide a complete voice, data, and multimedia communications infrastructure system as specified herein and as shown on the Contract Drawings. This raceway system shall support cable plant for voice, data, and multimedia networks.

1.2 WORK INCLUDED

A. The Contractor shall provide all necessary labor, materials, equipment, services, and other items required to furnish a complete and functional raceway system. Among the items required are

1. Interconnecting raceway between campus network, Router Room, and Riser Rooms (RR, MDF and IDF)
2. Vertical riser sleeves and conduit
3. Grounding system
4. Horizontal distribution tray and conduit
5. Station drop conduits
6. Communications outlet boxes
7. Surface mounted raceway (SMR)
8. Router Room, MDF Room, and IDF Room provisioning

1.3 QUALITY ASSURANCE

A. Contractor Qualifications

B. The Contractor shall have installed raceway systems similar in size and scope to this Project.

C. Warranty

1. Refer to Division 01.

D. Regulatory Requirements

1. All work shall be subject to the strictest applicable governing codes and standards, including:

Uniform Building Code	International Conference of Building Officials (ICBO) 12505 Bel-Red Road, Bellevue, WA 98005
Seattle Building Code and Seattle Electrical Code (SEC)	City of Seattle Department of Construction and Land Use 400 Seattle Municipal Building, Seattle, WA 98104-1884 (Seattle Building and Electrical Codes are based on the Uniform Building Code)
NEC	National Electrical Code
FCC Part 76.611	CFR Title 47, Radiation leakage standards for CATV
FCC Part 15	

E. Other References

1. All work shall be performed in accordance with the latest revisions of all ANSI/TIA/EIA, BICSI, and Computing & Communications. Whichever is strictest shall take precedence.

1.4 SUBMITTALS

A. Refer to Section 16A10 and 01300 Submittals.

B. In addition to the requirements stated in Section 01300, provide complete manufacturer's product literature (not generic distributor's catalog sheets) for all cable tray, conduit, outlet boxes, and other products to be used, referenced to the applicable section in the project manual.

1.5 PRODUCT SUBSTITUTIONS

A. Refer to Section 01600; Materials, Equipment and Product Substitution

1.6 CONSTRUCTION SCHEDULE

A. Refer to Division 01, Construction Schedule

B. In addition to the requirements in the above referenced section, the following milestones shall be referenced in the Project construction schedule (at a minimum, include line items as placeholders):

1. Start/completion of continuity-of-service work
2. Completion of outside cable plant infrastructure
3. Pre-installation walk-thru of Router Room
4. Completion of rough-in of the Router Room
5. Pre-installation walk-thru of MDF/IDF Rooms
6. Completion of rough-in of the MDF Room
7. Completion of rough-in of IDF Rooms
8. Activation of temporary elevator phone and other building systems (BAS, Fire Alarm, Card Access, etc.)
9. Completion of cable tray, conduit, and outlet box installation
10. Final inspection of raceway system
11. Elevator inspection date

[**A&E: During the normal construction process, the need often arises for communications service prior to substantial completion of infrastructure and prior to cable plant installation. Typical situations include elevator inspection, building controls, temporary occupancy, etc.**
Evaluate these needs and make accommodations with infrastructure and cable plant to ensure these services can be provided. Early discovery and timely notification will be critical.
A minimum of one month prior to any active service date, all related infrastructure and cable plant shall be complete and service provider notified.]

1.7 INSPECTION AND SUBSTANTIAL COMPLETION

A. Refer to Division 01, Contract Closeout

1.8 CONTRACT CLOSEOUT

A. Refer to Division 01, Contract Closeout.

PART 2 - PRODUCTS

[**A&E: Customize the following product section. Collaborate closely with C&C to select appropriate raceway devices for the project.**]

Except as specifically noted below, the cable tray, conduit, and other materials constituting the raceway system shall conform to Division 26 Product Sections.

No "custom" items (e.g., to meet unusual physical requirements of the installation site) shall be used except as specified in the Contract Documents or as reviewed and approved by the Architect**,** the Engineer**,** and the Owner's Representative).

2.1 VAULTS

A. Strength of lid shall reflect environmental locations (car traffic).

B. Junction Vaults

1. The utility maintenance hole shall be pre-cast concrete with round access and labeled "Communications."
   a. Required Product:
   b. Utility Vault 506-LA with round access

C. Pull Vaults

1. Pull vaults shall be a minimum 18 inches x 18 inches x 18 inches pre-cast concrete.

2.2 COMMUNICATIONS CABLE TRAY

A. Size

1. Minimum cable tray size shall be 6-inches by 4-inches deep.

B. Type

1. Only solid-bottom tray (with smooth interior floor surface) or ladder tray (with rounded rungs spaced no farther than 6 inches apart) shall be used.

2. Cable tray in MDF and IDF Rooms shall be ladder tray.
3. Required Product:
4. Solid-Bottom Tray: B-Line 14ASB Series

5. Ladder Tray: B-Line 14AO6 Series

C. Side rails

1. Side rails shall be of sufficient thickness to prevent damage to the tray caused by repeated support of ladders or other equipment and personnel.

D. Surfaces

1. All surface finishes and section joints shall be smooth to the touch to eliminate cable chafing.

E. Corner Sweep

1. Corners shall have generous factory-manufactured curved sweeps -- 90-degree angles are unacceptable.

F. Elevation Changes

1. Where changes in elevation are unavoidable, a transition piece is required.
2. NO 90-degree transitions shall be used.
3. Dropouts (not vertical elbows or "turn downs") shall be provided at elevation changes and cable tray dead-ends.

2.3 CONDUIT

A. Conduit types and sizes shall be used only as specifically noted in the Contract Documents and specified herein.

B. Flexible Conduit

1. Flexible conduit shall not be used.

C. Outside Cable Plant Infrastructure

1. Outside cable plant infrastructure shall be a minimum 4-inch PVC conduit, unless noted otherwise.

2.4 SURFACE MOUNTED RACEWAY (SMR)

[**A&E: Develop the specifications for the following products.**]

A. Capacity

1. Sections of SMR that provide less than the equivalent capacity of a 1-inch conduit shall not be used.

B. Bends

1. Any bends made using SMR shall accommodate optical fiber manufacturer's bend radius specifications, whether or not fiber has been specified as part of the cable plant.
2. Required Products:
   Wiremold V2400 (raceway, covers, and device boxes)
   Wiremold 3000 (raceway [**specify divided or not**] and covers)

bridge mounting device extension bracket #G-3046
Wiremold 4000 (raceway [**specify divided or not**] and covers)
device plate (cover and bracket) #G-4007C-1
Wiremold 6000 (raceway [**specify divided or not**] and covers)
device plate #G-6007C-1

Isoduct 300

raceway:	Isoduct AL 3000
cover:	Isoduct DDC-300T Double Duplex (specify 12”/18” length)
blank cover:	Isoduct BC AL3000
end caps:	Isoduct EC 3000
slide connectors:	Isoduct SC 3000
inside corner:	Isoduct IC 3000
outside corner:	Isoduct OC 3000
flat elbow:	Isoduct FE 3000

Isoduct 452

raceway:	Isoduct AL 4520
cover:	Isoduct DDC-300T Double Duplex (specify 12”/18” length)
blank cover:	Isoduct BC AL4520
end caps:	Isoduct EC 4520
slide connectors:	Isoduct SC 4520
inside corner:	Isoduct IC 4520
outside corner:	Isoduct OC 4520
flat elbow:	Isoduct FE 4520

2.5 OUTLET BOXES

[**A&E: Specify extra-deep device boxes for all communication systems. Include the following device box types as required.**]

A. Wall Outlet Box

1. Communications Voice, Data, and Multimedia outlet boxes concealed within a wall or surface-mounted shall be a 4-inch by 4-inch box with a minimum depth of 2.125-inches. Provide a 4-inch by 4-inch mud ring for all 4-inch by 4-inch boxes.
2. Wall-mounted telephone boxes concealed within the wall shall be a 2-inch by 4-inch box with a minimum depth of 2.125-inches.
3. For situations where oversized conduit is used or a standard 4x4 box is inadequate for the terminations required, use
   a. Required Product:
   b. Spider Recessed Wall Mounted 2 Gang #WSCS-MMO-2

B. In-floor Outlet Box

1. Provide two separate co-located in-floor outlet boxes - one dedicated for communication service, the other for power.
2. Required Products:
   Walkerbox 880CS2

Walkerbox Brass Carpet Flange 524-BRASS
Walkerbox Brass Duplex Cover Plate 828R
Spider 4 Gang Concrete Floor #CFB-301
Spider 8 Gang Concrete Floor #CFB-501
WireMold Power/Communications Pokethru [**Owner pre-approval required**]
RC4 Flush Quad
Com50 Adapter
See Section 2.6.3 for multimedia applications in under-floor outlet boxes.

C. Podium Floor Box

1. Provide power/communications and multimedia boxes side-by-side with concrete pour boxes as required.

2. Required Products:
   a. Power/Communication Box: SMI Spider Access Floor Box (Cat No. AFB-704)
   b. Contractor provides standard 4x4 outlet boxes installed inside Spider Box
   c. Multimedia Box: SMI Spider Data/Data Access Floor Box (Cat No. AFB-706-DT)
   d. Spider Concrete Pour Box for Access Floor #AFB-701-PB

2.6 MOUNTING BACKBOARDS

A. The backboards in the Router/MDF/IDF Rooms shall be 3/4-inch ACX Douglas fir plywood.

B. All exposed backboard surfaces shall be painted with two coats of fire-resistant matte white paint.

C. Flame-spread rating shall be no greater than 25 when tested according to ASTM W84.

2.7 EQUIPMENT GROUND BUS BAR

A. The equipment ground bar shall be 1/4-inch copper, minimum 4-inches high by

B. 10-inches wide, mounted with 4-inch stand-off brackets

C. Required Product: CPI Chatsworth 10622-010

2.8 TEMPORARY ELEVATOR PHONE SERVICE

[**A&E: C&C SHALL be contacted for additional elements needed to support activation of elevator phone service.**]

A. Required Products:

1. Cable
   a. Lucent Technologies Cat 5e Station Cable, CM rated 1061C,
   b. CommScope 55N4
2. Phone Unit
   a. Elevator Telephone - RAMTECH R733-924M.

PART 3 - EXECUTION

3.1 DOCUMENT INTERPRETATION

A. The Contract Documents provide the primary definition of the work to be completed. They are, however, schematic and are not intended to show all components required but only to aid the Contractor in providing a complete communications infrastructure.

B. The design represented has been coordinated with other disciplines and shall not be substantially altered without prior approval by the Owner's Representative.

C. The locations of the outlet symbols shown in the Contract Documents represent a close approximation of the exact location where the outlet shall be installed. This location may be shifted left or right eight inches to allow for stud alignment or coordination with electrical outlet locations. The Architect shall approve more extensive adjustments of outlet location.

D. Outlet Schedule

1. Refer to the outlet schedule contained herein or in the Contract Documents for outlet mounting height, device box size, and station conduit size.
2. In order to reference a particular outlet to the Outlet Schedule, each outlet symbol located in the Contract Documents is labeled with a unique, 2-part ID number indicating the outlet number within that room. (At times, the outlet symbols may be labeled with only the sequential number if the room number is clearly marked on the drawing.)

3.2 SERVICE INTERRUPTIONS

A. The contractor shall be responsible for identifying any possible service interruptions. Coordination with Owner's Representative shall be required to develop a plan.

B. The Contractor shall maintain continuity of existing voice, data and multimedia service in the construction area and for building occupants not otherwise affected by the Project throughout the demolition and construction phases, unless prior arrangements have been negotiated.

C. The Contractor shall notify the Architect in writing of all voice, data, and multimedia communications cables (which are serving occupied spaces) that must be relocated. The Contractor shall be responsible for relocating existing cables that are to remain in service after consultation with Owner's Representative.

D. The Contractor shall prevent interruption of service by identifying and providing temporary supports and protection of all existing communications cables, cross-connect blocks, and equipment throughout demolition and construction.

E. Upon disruption of telephone, data and multimedia service, the Contractor shall notify the University Construction Coordinator immediately so that a repair crew can be assigned to correct the problem.

3.3 TEMPORARY ELEVATOR SERVICE

A. General

1. Coordinate installation with General and Elevator Contractors.

2. Provision of other major building communication components need to be in place for temporary activation of the elevator car(s).

B. Infrastructure

1. Contractor shall provide permanent infrastructure to elevator machine room for elevator phone activation during construction.

C. Installation

1. Install per manufacturer's instructions.
2. Opening in elevator cab shall accommodate phone unit specified in Contract Documents.

D. Cable Plant

1. A station cable shall be pulled from the elevator equipment room back to the appropriate IDF.

E. Activation

1. Contractor shall arrange with Owner's Representative to provide temporary elevator telephone ACTIVATION for elevator use during construction. Elevator telephone shall be activated prior to elevator inspection. Coordinate activation schedule with Owner's Representative.

3.4 COMMUNICATION ROOM (RR/MDF/IDF) PROVISIONING

A. General

1. The Contractor shall follow the placement of elements within the Router, MDF and/or IDF Room as shown in plan, elevations, and details contained in the Contract Drawings.

[NOTE: **Prior to installation, Contractor shall schedule a walk-through with Owner and the Engineer for final placement.**]

2. Cable Tray

   a. Install cable tray six inches from the wall: minimum 7-feet 6-inches AFF, maximum
   b. 9-feet AFF.

3. Plywood Backboard

   a. Install plywood on all walls of the closets extending from 1-foot AFF to 9-feet AFF using standard 3/4-inch thick 8-foot sheets.
   b. Additional plywood may be required based on final location of conduits and sleeves. (All future cable shall be supported vertically and horizontally at every four feet along the path.)
   c. Plywood shall be void-free and treated with two (2) coats of matte white fire-resistant paint on all exposed backboard surfaces.

4. Lighting Fixtures

   a. Lighting fixtures in the MDF Room and in each IDF Room shall be located above the 9-foot 6-inch level or ceiling-mounted in such a manner as not to block cable tray within the room or conduit penetrations or otherwise interfere with cable routing and equipment installation.
   b. The light switch shall be located just inside and to the right of the doorway. When access to the MDF or IDF is possible by more than one set of doors, there shall be a 3-way light switch system located by all doorways.

5. Electrical Outlets

   a. Locate electrical outlets at the corners of the main backboard, just above the top edge. An additional utility outlet should be located 18-inches AFF aligned below the light switch.
   b. Electrical outlet boxes and conduit shall not block or restrict use of the backboards. The conduit shall be tightly routed at the intersection of the back wall and the side walls. Faceplates shall be flush with the finished surfaces.

6. Grounding

   a. The ground bus bar shall be located near the main voice riser floor terminations. Coordinate exact placement with Owner's Representative.
   b. When the resistance to ground is 10 ohms or less, an additional ground is mandated.
   c. A communications system equipment grounding conductor (EGC) shall be installed in the MDF and continue up through the vertical riser system. It shall be terminated in each IDF on a ground bus bar.
   d. The EGC shall be a minimum 6-AWG insulated wire, continuous and without splices. It shall be connected at a single point to the ground bus end of the building neutral bonding jumper via a readily accessible connection (NEC 250-53a). If splices are necessary, they shall first be approved by the design engineer, then cad welded. The EGC shall be bolted to the ground bus bar in each MDF/IDF with a pass-through clamp. The connection between the EGC and the service entrance equipment shall be such that the resistance measures 5 ohms or less.
   e. The location and installation of the EGC and bus bars shall conform to NEC requirements. They shall be located at least six inches away from any electrical conductors to minimize induced voltages and routed at edges/corners of backboard

to provide the shortest, most direct, continuous path to the ground electrode system.

B. Router Room

[**A&E: Edit for Router Room specific requirements.**]

C. MDF/IDF Rooms

[**A&E: Edit for MDF/IDF Room specific requirements.**]

3.5 COMMUNICATIONS PATHWAYS

A. Outside Plant Pathways

1. Utility Trench

a. Provide buried PVC conduit in utility trench/tunnel for inter-building pathway. Refer to construction documents for trench pathway size and conduit quantity.

[**A&E: Provide trench routing and cross section on plan sheets and details.**]

2. Utilidor Provisioning

a. Provide two stacked cable trays along utilidor wall below power distribution tray. Communication cable tray shall be 12 inches below power tray and second communication tray shall be a minimum of 10 inches from bottom of tray above, to top of tray below.
b. Provide a minimum 5-inch clearance between power and communication tray side-rails and utilidor wall for vertical communication cable pathway.

3. Junction and Pull Vaults

a. Maintenance holes and handholes shall be located flush in ground and at every
b. 270-degrees of bend or 200-feet of conduit run.

[**A&E: Coordinate installation of manholes and handholes with civil engineer and landscape architect.**]

B. Cable Tray Pathways

1. Mounting

a. Cable trays shall be mounted or hung in a manner that ensures a 12-inch minimum vertical clearance above and a minimum 18-inch continuous horizontal clearance on at least one side to allow for future access..
b. There shall be 6” clearance between the bottom of the cable tray hangers and removable ceiling tiles.

2. Transition

   a. Cable trays shall be mounted between 9- and 12-feet AFF.
   b. Provide gradual sloping raceway transition sections where changes in horizontal mounting height are unavoidable.

3. Routing

   a. Cable tray shall be routed so as not to interfere with installation of other systems or access to these systems for maintenance. Coordination with other systems shall be maintained so that where these systems traverse above or below the tray, there shall be direct access and unrestricted clearance 12 inches above and 18 inches to one side of the tray.

4. Installation

   a. Cable tray shall be installed as a continuous raceway system connected to the building ground in compliance with NEC 318.
   b. When assembling tray, rounded heads of fasteners shall be placed in the interior of the tray.

C. Conduit Pathways

1. Penetrations

   a. Vertical riser conduit/sleeves between floors shall be "stacked" (i.e., aligned vertically from floor to floor). They shall be located on the side wall of the space, most often to the right of the main backboard wall. They shall be clustered as close to the wall as possible and out of the way of foot traffic.
   b. Horizontal conduit/sleeves shall be grouped to one side of door at the 9-foot 6-inch level.
   c. Where conduit does not homerun, it shall either end at tray or when there is no tray it shall stop at the wall or floor.
   d. Where conduit/sleeves penetrate horizontally HIGH through the wall (above three feet from top edge of tray), they shall be provided with a turn down and stop between 1½–3 feet above the top edge of the tray or top of the backboard in the Riser Room.
   e. Where conduit/sleeves penetrate horizontally LOW through the wall (below three feet from top edge of tray), they shall stop at the top edge of the tray closest to the conduit/sleeves.
   f. Where conduit/sleeves penetrate horizontally LOW through a wall when there is no tray, they shall stop as flush as possible with the wall.
   g. Where conduit/sleeves penetrate horizontally HIGH through a wall when there is no tray, they shall turn down and extend downward at the top of the backboard in the Riser Room.
   h. Where conduit/sleeves penetrate vertically down through the ceiling, they shall extend from between 1½-3 feet to either the top edge of the tray or top of the backboard in the Riser Room.

i. Where conduit/sleeves penetrate vertically up through the floor, they shall stop
j. 3-inches AFF.

2. Bushings

   a. Provide conduit/sleeve end bushings on all riser and horizontal distribution conduits.

3. Bonding

   a. All conduits shall be bonded to the tray with a grounding strap, bolted lugs, and green insulated grounding wire.

4. Bends

   a. Three bends may be allowed if:
      1) Total conduit length is not more than 33 feet
      2) Conduit is increased to next trade size

   b. Conduit bends shall conform to accepted radii for the size of conduit used. There shall be no more than 270-degrees of bend in any one conduit run without inclusion of a pull box.
   c. No 90-degree fittings shall be used.

5. Pull boxes

   a. Pre-approval by Owner's Representative and the A&E is required for installation of intermediate junction boxes or pull boxes. These boxes shall be noted on the Contractor's Field Drawings.
   b. Pull boxes shall be installed in accessible areas 8- to 12-feet AFF. Provide 30-inch clearance in front of the pull box for maintenance and pull space. The location of each box shall be clearly marked on Field Drawings. The color purple has been designated to identify Communications pull boxes from other utility pull boxes.
   c. Conduits entering or leaving pull boxes or outlet device boxes shall be centered in the body of the box, unless noted otherwise in Contract Documents. Where multiple conduits penetrate into one side of pull box, conduits shall be evenly spaced and centered in the body.

6. Unused Sleeves

   a. Thread and cap.

7. Pull Lines

   a. A 3/32-inch-diameter, 200-pound-strength polyethylene pull line shall be installed in all raceway and conduit runs and secured at each end.

8. Fire Stopping

   a. In situations where cable tray, conduit, or sleeves extend outside the construction area into occupied portions of the building, they shall be fire-stopped in accordance with NEC 300-21 throughout the duration of the Project.

9. Labeling

   a. All station drop conduits shall be permanently marked with an outlet ID at the tray or in the MDF or IDF when directly routed to a Riser Room.

D. Riser and Horizontal Distribution Pathways

1. All building entrance conduits and vertical/horizontal interconnecting riser conduits and sleeves shall be four inches in diameter.

E. Station Drop Pathways

1. Sizing
   a. All station drop conduits to outlet device boxes shall be 1-inch diameter minimum except as specifically noted in the Contract Documents.
   b. Dedicated multimedia station drop conduits from cable tray to outlet boxes shall have a 2-inch diameter.
   c. All station drop conduit to SMR shall be minimum 1-1/4 inch diameter except as specifically noted as larger on the Contract Documents.

2. Flexible conduit
   a. Flexible conduit is not allowed in plenum air spaces. (See also 2.4.1.)

F. Surface Mounted Raceway (SMR)

1. SMR Feed

   a. Communications SMR shall NOT be installed through walls.
   b. In divided SMR, the upper channel is reserved for communications cable and the lower channel for electrical wiring.
   c. Conduit connections to SMR shall be provided by an intermediate 2-inch by 4-inch junction box installed within the wall aligned horizontally behind the communications channel of the SMR. Refer to the details in the Contract Documents.
   d. No 90-degree junctions may be used. Factory-manufactured curves are required for these transitions.

2. SMR Device Plates and Covers

   a. Two of the SMR manufacturer's device brackets and single-gang device plates shall be co-located on-line at each outlet location with a 2-inch separation to accommodate faceplates.

b. In divided raceway, wherever communications and/or electrical outlets are closely co-located, a minimum of 2 inches of horizontal separation between device plates shall be provided.
c. The SMR front cover shall be cut and installed in a manner that provides a short (12-inch) fixed section of cover where the end of an SMR segment abuts a wall, corner, structural deviation, etc.

G. Outlet Box Installation

1. Outlet Box Mounting

a. Height: Unless noted otherwise in the Outlet Schedule, all communication outlet boxes shall be installed at the same height as electrical outlets, except wall-mounted telephone outlets which shall be installed so that the highest operable part on the actual telephone instrument is no higher than 48-inches AFF.
b. Co-located Spacing: All wall-mounted phone boxes shall have 12" clearance from adjacent boxes.

2. Underfloor Outlet Boxes

a. Position box so closed lid shall be flush with finished surface.
b. Allow sufficient clearance between co-located boxes to accommodate installation of box flange and cover plates.

3. Podium Floor Boxes

a. Carefully coordinate placement of conduit to both line up with the knockouts dedicated for communications vs. power and to function under the custom-built podium.

4. Outlet Boxes and Mud Rings - Finish Work

a. Care shall be exercised during mounting of outlet boxes to ensure that the mud ring face shall be flush with the surface of the finished wall and "square" with the floor. All joint compounds shall be wiped clean while soft so as not to cover mounting holes in the mud ring or box.

END OF SECTION 27 13 00