SECTION 16650
TELEPHONE / DATA ELECTRICAL SYSTEM

PART 1 – GENERAL

1.00 DESCRIPTION

A. Furnish and install a complete Telephone/Data Electrical System, as specified, including all Raceways to accommodate the installation of all Telephone/Data System Transmission Media Types (Twisted Pair Copper, Fiber Optic, Wireless), and all Electrical Equipment and Circuits needed for the Telephone/Data System.

1.01 RELATED DOCUMENTS


C. Drawings and general provisions of the Contract, including General and Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 RELATED SECTIONS

D. Refer to the following sections for additional requirements:

2. Specification Section 10019 – Space Identification-Standard
4. Specification Section 16130 – Boxes (Sizes, Styles and Types).
5. Specification Section 16630 – Rescue Assistance Telephone System.
7. Specification Section 16651 – APPENDIX-A (Approved Products).
8. Specification Section 16651 – APPENDIX-B (Glossary of Terms).
10. Specification Section 16651 – APPENDIX-D (EWU Station Cable Record).
14. Specification Section 16680 – Clock System.
1.03 SUBMITTALS
   
   A. Contractor shall submit product description information for acceptance by Owner prior to installation of product.

   B. Contractor shall provide proof of appropriate State Labor and Industries Electrical licensing for each on site employee.

   C. Contractor shall provide proof of appropriate State Labor and Industries Electrical and Installation Work Permits.

1.04 MANUALS
   
   A. The Contractor shall furnish to the Owner a complete set of printed system documentation which includes “as built” drawings that show station location and labeling information, all pathways and closet or cross connect locations product and equipment brochures and manuals shall be included in the Operations and Maintenance (O & M) Manual.

   B. In addition to the printed documentation the Contractor shall supply drawings in an Auto-CAD 2006 format, which show pathway type and routing and placement, station outlet location.

   C. The printed documentation shall be furnished in bound volumes.

   D. Contractor shall provide original Warrantees.

1.05 DESCRIPTION
   
   A. A complete telephone and data distribution raceway system shall be provided as indicated on drawings and as specified herein and in related Specification Sections.

   B. The system shall include the following items:

      1. Telephone/data distribution raceway system, including conduit, tray, outlets and pull boxes.
      2. Telecom Room electrical systems to include electrical service panel, distribution outlets, and lighting.
      3. Grounding system for raceways and Telecommunications Rooms.
      4. Code compliant fire stopping for all penetrations, trays, and unused conduits.
      5. Electrical Transformers shall NOT be located in any Telecom Room.

1.06 REQUIREMENTS
   
   A. Contractor shall submit a list of similar telecommunications electrical systems that have been installed under the supervision of the person who will be assigned to oversee the telephone and data electrical system work on this project.
B. Projects shall have been operating for at least one year, but not more than three years. Provide name of person to contact for each project and phone number for verification.

C. Contractor shall provide all communication pathways to include conduit, trays, wire-ways, penetration sleeves, outlet and pull boxes, the pathway grounding system, and support structures for all pathway systems.

D. Contractor shall provide a completed grounding system to each Telecom Room and shall include bonding points for racks, equipment, and cable bonding connections.

E. Contractor shall provide and install lighting fixtures in all Telecom Rooms, as specified herein.

F. Contractor shall provide and install a **100-amp service panel** and electrical distribution system in each Telecommunications Room, as specified herein.


   1. This Telecommunications Room, called the Building Entrance Terminal (BET), shall distribute services to other Telecommunications Rooms within the building, which are called Intermediate Distribution Facilities (IDF’s).
   
   2. Each building shall have a dedicated room that is accessible from common areas such as a hallway that will serve as a main telecommunications distribution point for the entire building.
   
   3. These rooms shall house both data and telephone networking equipment, serve as a termination and distribution point for incoming telecommunication services to the building, and serve as a common distribution point for starred topological type distribution network cables to other Telecommunications Rooms or distribution points within the building.

H. A building generator or “emergency” power sources shall support electrical service to both the BET and IDF’s and any associated environmental system.

I. HVAC systems shall operate independent of building systems and shall be supported electrically from independent or emergency power systems.

J. Telephone service **Over-voltage Protection Devices** shall be located in the BET, **AAAA1, Room nnn, on Dwg. Sht. E-nnn.** Two Four inch conduits shall be provided from this room through the basement to the cable tray in the utility tunnel on the (Location) side of this project building. This conduit run shall contain pull boxes after every 180 degrees of transition and/or 100 linear feet.

K. All workmanship shall be warranted for a period of 1 year starting at substantial completion of installation.

L. All non-SYSTIMAX® products shall carry at least a 5-year performance warranty, all SYSTIMAX® products shall carry a 20-year performance warranty.

M. Data communications to the building may be via point-to-point wireless LAN. EWU will provide all wireless LAN electronics and associated hardware. Contractor shall provide pathway from wireless antenna to the BET and the **mast for a weather proof wireless antenna.** The **Mast** shall be six feet tall, located on the building roof at a location to be determined by the owner, the location shall be close to a corner of the building.
N. The mast shall be sized as a minimum 2 inch ID rigid conduit, and shall be equipped with an appropriate weather head.

O. The telecommunications environmental support systems (including electrical, HVAC, security) shall be supplied or derived from sources independent of other building systems.

1.07 PATHWAYS AND CONDUIT.

A. Pathway from the BET to any subsequent IDF Rooms shall be tray or multiple 4-inch conduits of sufficient size and number to provide for a 100 percent growth.

B. Trays and conduits shall have no more than 60% fill upon completion of this project. This shall be factored into the pathway design capacity.

C. Trays may feed multiple closets on a floor but the total cross sectional area shall be inclusive of the total numbers of cables, allowing for 100 percent growth and not exceed 60% fill.

D. Pathways between floors shall be 4-inch conduits with a 200 % capacity of the tray system they serve. This % capacity shall be based upon calculated useable end areas of trays and conduits.

E. All conduits that feed multi-floor tray systems shall originate in the BET or pass into IDF’s that are directly stacked above the BET.

F. Horizontal transitions between IDF’s and the BET, conduit, sleeves, or tray systems shall be made either in a telecom space or in a hallway.

G. ALL vertical cable transitions between floors shall be made in an IDF. For Telecommunications Rooms that are out of vertical alignment to the BET or other horizontally placed IDF stacks, or feed remote parts of the building, station cable distribution tray shall be used as pathway provided tray capacity would not be exceeded.

H. Pathway between floors or IDF Rooms that run above inaccessible areas, fire rated ceilings, or stair wells shall be conduit of sufficient size to provide required capacities.

I. Tray pathway that serves both riser and station cable distribution over congested areas or other non-lay-in type ceilings (spine or locking tile) shall have access to the pathway at regular intervals of no more than 10 linear feet with 2-foot square openings.

J. Pull boxes may serve as transition points.

K. Pull boxes shall be a minimum of 24-inches square by 8-inches deep or 8-inch square by 24-inch long gutter box, fitted with a screw cover plates for 4 inch conduit, and proportionately sized as per EIA/TIA Standards for other conduit sizes.

L. Pull boxes if required for the Information Outlet’s 1 inch conduit shall be a 4 11/16 inch by 4 11/16 inch by 2 1/8 inch deep box.

M. Pull boxes shall be placed in such a location as to be accessible. HVAC ductwork, other electrical conduit, and piping or structural members shall not eclipse them.
N. All connecting conduit shall be reamed and free of burrs prior to assembly.

O. Plastic bushings shall be placed on all box connectors and grounding bushings at the termination of the pathway run.

P. All pathways, including any entrance tray or conduit, shall be bonded together.

Q. All Telecommunications Pathway Conduits shall have no more than 180 degrees of transitions between any sources, pull boxes, and/or destinations.

1.08 SPECIFIC REQUIREMENTS

A. The Contractor shall coordinate all work with system vendors and the subcontractor for Telephone/Data Distribution System, as necessary to insure that complete conduit rough-in and electrical wiring requirements are fulfilled.

B. All Contract Drawings are diagrammatic. Outlet and pathway placement is only representative of a general location. Do not scale from drawings in order to place an outlet or pathway, since the Contract Drawings may not represent the actual location.

C. It is the responsibility of the Contractor to place these outlets and pathway such that they offer full functionality without hindrance from casework, furniture, windows and doors, HVAC and other building systems.

D. Contractor shall obtain and use the proper room and space numbers or names. If the Contractor receives, from the Owner any shop drawings or "as built" construction prints that do not contain proper room or space numbers, the Contractor shall obtain the correct numbers. The Contractor shall provide correct numbers on all drawings and related records it provides to the Owner.

E. Damage to equipment, service outages, and schedule delays caused by the Contractor shall be both the financial and restorative responsibility of the Contractor.

F. The Owner shall not accept any cable plant or pathway installation until it passes a physical and performance inspection. All cable not installed to manufacturer specifications shall be rejected regardless of electrical and performance testing.

H. The Contractor shall be responsible for removing all construction debris and unused cable, boxes, and shipping containers. The work areas shall be swept clean and wet mopped prior to floor sealants or tile work.

I. The Contractor shall remove all unused and replaced cables in trays and conduits and shall turn scrap cable over to the Owner.

J. Only water-based, propylene glycol or clay-based lubricants shall be acceptable as cable lubricants. Ideal brand Yellow 77 or similar soap based cable lubricants shall not be acceptable and shall not be used for fiber or copper cable installation.

K. Contractor shall be required to secure all permits, post at Jobsite, and provide a copy to the owner prior to the beginning of any work.
L. Contractor shall be required to arrange for all inspections by the appropriate authority.

PART 2 – PRODUCTS

2.01 GENERAL

A. The contractor shall provide a 4 11/16” square by 2 1/8” deep box with single-gang outlet ring for each Standard Information Outlet (telephone/data), and Telephone Only type outlet boxes.

B. The contractor shall provide a 4 11/16” square by 2 1/8” deep box with a double-gang outlet ring for all 8 jack position locations.

C. The contractor shall provide 1” or larger conduit from each Telecommunications Information Outlet box to the cable tray system, as indicated in Table-03 of this Section.

D. Bends in conduits shall be large radius sweep bends with a minimum radius of twenty (20) times the conduit diameter, or as specified in the EIA/TIA Standards Table.

E. The contractor shall provide ground lug plastic end bushings on all conduit terminations at the tray system, these conduits shall be bonded to the cable tray system.

2.02 CONDUIT

A. Conduit size for station runs from tray to outlet shall be sized as per Table-03 in this section.

B. Conduits that serve as sleeves for open wiring systems within office suite areas shall be no less than 2-inch electrical metallic conduit (EMT) or ridged metallic conduit pipe (RMC).

C. Conduits for fiber optic service entrance cables shall be sized as per the EIA/TIA Standards, based upon the size of the specified entrance fiber optic cable, and no less than 1-inch EMT or RMC. All conduits that are installed underground for Fiber Optic Cable shall be equipped with a 10 AWG Green Jacketed CU trace cable in all locations that are not located in a Utilidor, Tunnel, or Cable Tray System.

D. Conduits for copper telephone service entrance cables shall be shall be sized as per the EIA/TIA Standards, based upon the size of the specified entrance copper cable, and no less than 2-inch EMT or RMC.

E. Conduit that functions as wall or floor penetration sleeves that serve tray or ladder racking shall be no less than 4-inch EMT or RMC.

F. Underground, below slab, or at grade inter-building conduit shall be no less than 4-inch schedule 40 PVC. These conduits shall be encased in a minimum of 3 inches of concrete. All conduits that are installed underground for Fiber Optic Cable shall be equipped with a 10 AWG Green Jacketed CU trace cable in all locations that are not located in a Utilidor, Tunnel, or Cable Tray System. All 4-inch conduits shall be equipped with three each 1-1/4 Inch Corrugated Innerducts.
G. Conduits for wireless antenna coax feeds shall be no less than 2-inch EMT.

H. Conduits that serve classroom podiums/lecterns shall be no less than 2-inch EMT or PVC depending on the installation and placement. For additional requirements, see Specification Section 16710.

I. Conduits for support of classroom ceiling mounted Video Projectors shall be no less than 2-inch EMT. For additional requirements, see Specification Section 16710.

J. Conduits that support classroom ceiling mounted Audio reinforcement systems shall be no less than ¾-inch EMT. For additional requirements, see Specification Section 16710.

K. All Surface Mounted Raceway (SMR) shall be metallic.

L. All Surface Mounted Raceway shall be Ivory colored Wiremold 700 or 2000 Series.

M. Sleeves or conduit extensions to or from surface mounted raceways shall be no less than 1-inch EMT or RMC.

N. For locations where Conduit Runs are inappropriate, acceptable Surface Mounted Raceway (SMR) and connection parts shall be Metallic Wiremold as follows:

By Information Outlet Type:

(See This Section, 3.04, I, 1, Table-03, EWU Telecommunication Information Outlet Configuration Table)

1. V700® Series, Ivory Color Only, for single 4 pair cable runs Telecommunication Information Outlets only.
   a. The following table contains a partial list of V700® Series Parts, all 700 parts are approved for use on only Type-2 and Type-3 Telecommunication Information Outlets. The Contractor shall verify all part numbers with supplier.
Table-01

<table>
<thead>
<tr>
<th>Wiremold No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V700</td>
<td>700 Raceway 10’ Lengths</td>
</tr>
<tr>
<td>V5748</td>
<td>700 Single Gang Device Box 1.75” Deep.</td>
</tr>
<tr>
<td>V5745</td>
<td>700 Single Gang Device Box for 0.5” Conduit Runs.</td>
</tr>
<tr>
<td>V5703</td>
<td>700 Support Clip for Raceway Runs.</td>
</tr>
<tr>
<td>V704</td>
<td>704 Strap 700 1 or 2 Hole Strap to support Raceway Runs.</td>
</tr>
<tr>
<td>V706</td>
<td>706 Cover Clip 700 Connection Cover for joints in Raceway Runs.</td>
</tr>
<tr>
<td>702</td>
<td>702 Bushing 700 Bushing to prevent burrs.</td>
</tr>
<tr>
<td>5701</td>
<td>5701 Coupling 700 Coupling to join two sections of Raceway.</td>
</tr>
<tr>
<td>V711-90</td>
<td>700 90º Flat Elbow for right angle turns on same surface.</td>
</tr>
<tr>
<td>V712-45</td>
<td>700 45º Flat Elbow for diagonal turns on same surface.</td>
</tr>
<tr>
<td>V717</td>
<td>700 Internal Elbow for inside surfaces at right angles.</td>
</tr>
<tr>
<td>V718</td>
<td>700 External Elbow for outside surfaces at right angles.</td>
</tr>
</tbody>
</table>

2. V2000® Series, Ivory Color Only, for two to six 4 pair cable runs.
   a. The following table contains a partial list of V2000® Series Parts. The Contractor shall verify all part numbers with supplier.

Table-02

<table>
<thead>
<tr>
<th>Wiremold No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000WC</td>
<td>2000 Wire Retainer Clip</td>
</tr>
<tr>
<td>V2000BC Chnl</td>
<td>2000 Channel, Base and Cover 5’ lengths</td>
</tr>
<tr>
<td>V2001 Cpling</td>
<td>2000 Coupling to join two sections of Raceway</td>
</tr>
<tr>
<td>V2006 Clip</td>
<td>2000 Cover Clips for joints in Raceway Runs</td>
</tr>
<tr>
<td>V2010A2 Ent. Ft.</td>
<td>2000 Entrance Fitting</td>
</tr>
<tr>
<td>V2011 Flat Elbow</td>
<td>2000 90º Flat Elbow</td>
</tr>
<tr>
<td>V2015 Tee</td>
<td>2000 Tee</td>
</tr>
<tr>
<td>V2017TC Int Cnr.</td>
<td>2000 Internal Corner</td>
</tr>
<tr>
<td>V2018 Ext. Cnr.</td>
<td>2000 External Corner</td>
</tr>
<tr>
<td>V2048-2 Dbl. Dplx.</td>
<td>2000 Double Gang Box</td>
</tr>
<tr>
<td>V2048 Snegl. Box</td>
<td>2000 Single Gang Box</td>
</tr>
</tbody>
</table>

3. Contractor shall use only Wiremold manufactured metallic parts for Surface Mounted Raceway (SMR) installations.
4. Contractor shall reference Table-03, the “EWU TELECOMMUNICATION INFORMATION OUTLET CONFIGURATIONS” table for use of surface mounted raceway.

2.03 TRAYS
A. Trays shall have a minimum cross sectional area of 24 square inches.
B. Side flanges of any tray shall be 2-inches or more.
C. Spacing between tray rungs shall be 6-inches or less.
D. All transitions shall use factory-manufactured parts compatible with the tray system.
E. All Cable Tray shall be bonded and grounded per Electrical Codes, Manufacturers
Installations, and these EWU Standards and Specifications.

F. All “Solid Bottom Cable Tray” shall be considered “NON-COMPLIANT” by
the Owner.

2.05 FIRESTOPPING (Also see Specification Section 07841 – Through-Penetration Fire Stop
Systems).

A. Tray intersection with walls or other fire-rated barriers shall employ the use of reusable,
fire-rated pillows. The use of fiberglass insulation is not approved for this purpose.

B. All conduit, sleeves, and floor boxes shall be fire-caulked using recognized UL 1479 and
UL 2079 Elastomeric fire rated caulk. The use of latex or silicon products that do not
conform to ASTM E-814 rating shall not be used (See Specification Section 07841).

C. All rated caulk shall be red or reddish-brown in color.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall coordinate all work with system vendors and the subcontractor for
Telephone/Data Distribution System, as necessary to insure that complete conduit rough-
in and electrical wiring requirements are fulfilled.

3.02 INSTALLATION

A. Telecommunications Room Electrical

1. Each room shall have a dedicated electrical panel with minimum capacity of 100
amps, which is derived from switched emergency electrical sources.
2. Each panel shall contain main disconnect breakers (no main lug type) and shunt
tripping main breakers are not required.
3. This panel shall provide both 120 and 208-240 volt power.
4. Panel shall be located in the space it serves.
5. This panel shall be placed adjacent to the Telecommunications Room door or in
such a location as to maximize the available floor and wall space.
6. The panel shall carry oversized neutral and grounding conductors.
7. A grounding system shall be placed at the bottom edge of the plywood backboard
wall, above the electrical receptacle conduits. Specifics for this are covered
herein.
8. The TR shall be fitted with wall-mounted; isolated, dedicated 20 amp, 120-volt
receptacles placed 18 inches above the floor at the top of the outlet box, around
the room at four linear foot intervals.
9. Branch circuits shall be run in their own ¼ inch conduit and shall enter the
electrical distribution panel from below or behind backboards.
10. Conduits shall not run across the backboards, but shall be placed at the bottom edge of the backboards.
11. **Electrical Service Power** for equipment racks shall be mounted on the rack (Coordinate with the Telephone/Data Distribution System Contractor).
12. Electrical conduits shall not pass through the trays or be run with station or fiber cables.
13. Each Equipment rack shall be wired for (1) each 20 amp, 120-volt single duplex receptacle, and provide one additional electrical circuit as specified to accommodate the proposed UPS. These outlets shall be mounted on the rack, in a space approved by the owner.
14. Equipment/Patch Panel Combination Racks shall be wired for (1) each 20 amp, 120-volt single duplex receptacles, and provide one additional electrical circuit as specified to accommodate the proposed UPS. These outlets shall be mounted on the rack, in a space approved by the owner.
15. Patch Panel Racks do not require electrical circuits.
16. Rack mounted 20 amp, 120 volt power distribution outlet strips shall be provided and installed by the Telecommunications Contractor (See Specification Section 16651-Appendix A for approved products).
17. These rooms shall be lighted in such a way as to provide a minimum of 5 watts per square foot, which shall illuminate the walls equally.
18. Lighting fixtures shall be centered above the aisles in front of and behind the Equipment/Patch Panel Racks, placed approximately 2 feet from the walls running parallel to the racks.
19. These lighting fixtures shall be at least 8 feet above the finished floor.
20. Each room shall be fitted with lighting that is served from emergency lighting circuits or have self-contained power supplies.

3.03 **ENTRANCE CABLE PATHWAY**

A. **Sleeves**

1. Pathway floor sleeves between Telecommunications Rooms shall be no less than 4-inch steel and represent 200% cable fill capacity of the extending pathway they serve. (A 12-inch tray requires 4 sleeves).
2. Sleeves shall be placed no more than 2 inches from the wall and be grouped in one row.
3. Sleeves shall be fastened to the wall using Unistrut and clamps or similar attachment product.
4. Sleeves shall extend 4 inches minimal from the floor surface, be fitted with grounding bushings on the topside and plastic bushing on the bottom. In cases where physical damage may occur to cable running through floor sleeves from movable equipment, carts and hand trucks, the sleeves shall extend a minimum of 24-inches above the floor. Sleeves shall be firestopped between conduit and floor slab using approved products (See Specification Section 07841 on firestopping).
B. Conduit

1. Entrance fiber shall be placed in a minimum 1-inch conduit that will run continuous from the point of the foundation penetration or tunnel tray system to the BET. This conduit shall contain pull boxes after 180 degrees of transition or run exceeding 100 feet in length. All conduits that are installed underground for Fiber Optic Cable shall be equipped with a 10 AWG Green Jacketed CU trace cable in all locations that are not located in a Utilidor, Tunnel, or Cable Tray System.
2. Pull boxes may serve as transition points.
3. Pull boxes shall be a minimum of 12-inch square by 4-inches deep, fitted with a screw cover plate, and be sized according to conduit diameter size.
4. Pull boxes shall be placed in such a location as to be accessible.
5. Pull boxes and cable tray shall not be eclipsed by HVAC ductwork, electrical raceways, piping or structural members.
6. All connecting conduit shall be reamed and free of burrs prior to assembly.
7. Grounding bushing with plastic insert shall be placed on all box connectors and at the termination of the pathway run.
8. Copper telephone and video service cables shall be placed in pipe due to plenum issues.
9. A minimum of one 4-inch pipe shall be installed for the copper entrance cable and shall follow the guideline as the fiber pathway.
10. A 4 inch conduit shall be installed to the new tray system in the tunnel, to accommodate the installation of the entrance cable.
11. All trays, conduit, and other cable supportive appurtenances shall be installed as per NEC and manufacturer’s specification for each product.
12. Cable pathway system shall be continuously grounded from origin to station drop destinations.
13. Pathway floor sleeves between closets shall be no less than 4-inch steel and represent 200 % cable fill capacity of the extending pathway they serve. (A 12-inch tray requires 4 sleeves).
14. Sleeves shall be placed no more than 2 inches from the wall and be grouped in one row.
15. Sleeves shall be fastened to the wall using Unistrut and clamps or similar attachment product.
16. Sleeves shall extend 4 inches minimal from the floor surface, be fitted with grounding bushings on the topside and plastic bushing on the bottom. In cases where physical damage may occur to cable running through floor sleeves from movable equipment, carts and hand trucks, the sleeves shall extend a minimum of 24-inches above the floor. Sleeves shall be firestopped between conduit and floor slab using approved products (See Specification Section 07841 on firestopping).

3.04 STATION CABLE PATHWAY

A. Sleeves

1. Pathway floor-sleeves between closets shall be no less than 4-inch steel and represent 200 % cable fill capacity of the extending pathway they serve (A 12-inch tray requires 4 sleeves).
2. Sleeves shall be placed no more than 2 inches from the wall and be grouped in one row.
3. Sleeves shall be fastened to the wall using Unistrut and clamps or similar attachment product.
4. Horizontally placed floor sleeves shall extend 4 inches minimum from both the top and underside surface of the floor structure or floor surface and shall be fitted with grounding bushings on the topside and plastic bushing on the bottom.
5. Sleeves shall be fire stopped between conduit and floor slab using approved products (See Specification Section 07841).
6. All vertically placed beam and wall penetration sleeves shall have a 200% cable fill capacity or the extending pathway they serve.
7. The sleeves shall be stacked or grouped in a 3X2 arrangement.
8. Each sleeve shall be bushed at both ends and grounded to the tray system.
9. One of the sleeves in the group shall carry a #6 stranded green jacketed CU conductor that will bond the sleeve assembly and all pathway extensions.

B. Cable Trays

1. Tray transitions in ladder type tray systems shall not be field fabricated with the exception of basket or spine-rib type systems.
2. Tray shall be placed in such a way as to offer 6 inches or more between the top of the tray and any obstacle such as duct work, piping, structural members, or ceilings.
3. Tray shall have 24 inches of separation from steam lines.
4. Trays that serve both telecommunication needs and those of building control systems and power distribution shall have a barrier strip or separator installed in the tray.
5. The tray shall be sized in order to maintain the tray capacity for the telecommunications section of the tray.
6. No other cables shall utilize the telecommunication section of the tray except those that are part of the telecommunication system including station and riser fibers and copper cables.
7. Trays shall have rungs or support ribs placed on 6-inch centers.
8. All trays shall have sufficient structural strength to prevent deformation by cable installation efforts from ladders, pulls, strains, and personnel accessing the tray.
9. All tray shall be a minimum of 6 inches wide by 4 inches deep and be supported using the manufacturer approved devices or methods.
10. The support structure shall be ridged to prevent the tray from deflecting or moving during cable installation.
11. The tray shall be bolted to the support structure and not be allowed to deform or shift as a result of pulls or strains.
12. All trays shall not to be placed more than 12 feet from the floor without prior approval from the Owner.
13. Tray shall be supported using a combination of trapeze, wall bracket or center support rods and all supportive rods and bolts must be cut off flush with the supportive member at the bottom of tray.
14. All tray shall be continuously grounded but will not act as a grounding conductor.
15. All tray shall carry a #6 stranded green jacketed CU conductor. This conductor will bond each section of tray or rack together. Only approved bonding clamps or lugs shall be used for the purpose of bonding.
16. There shall be **NO Cable Tray** installed in any Telecommunications Room. That type of cable support shall be Cable Runway of the ladder type manufactured by Chatsworth Products Inc., and shall be installed by the Telecommunications installer.

C. Conduit

1. Conduit for copper service entrance cables shall be no less than 4-inch and labeled.
2. Conduits for entrance fiber and Cable TV coax cables shall be no less than 1-inch and labeled.
3. Conduits longer than 100 feet or which have more than 180 degrees of transitional bends shall require a pull box to be placed in an accessible location, preferably at a transition point.
4. Station distribution conduits shall comply with the EWU Telecom Information Outlet Configuration Table in this section.
5. **Conduits shall not chain together or provide pathway for more than one Telecom Information Outlet (TIO).**
6. Wall-hung pay telephones, courtesy telephones, stairwell telephones, or emergency call boxes may use ¾ inch conduit providing there is only one single Four Pair Cable to be installed.
7. Up to (2) separate telephone locations, placed side-by-side, may share a common one inch conduit run to the tray system, providing that the locations are within five linear feet.
8. The use of flex is strongly discouraged and its use shall be **pre-approved** by the Owner prior to installation. Flex connections to conduit shall employ an accessible outlet box at the union.
9. All conduits shall be reamed and free of burrs prior to assembly.
10. Station cable conduits shall terminate at the station end on a 4 inch square by 2 inch deep outlet box. This box shall be fitted with outlet mud rings per the Table-03 in this Section, 3.04, I, 1, EWU Telecom Information Outlet Configuration Table.
11. All conduit terminations shall carry a box connector and an inside pipe plastic bushing at each outlet box, and a threaded outside plastic bushing on a box connector at conduit stub ups.
12. All conduits shall be bonded to connecting pathway components such as trays, sleeves, or outlet boxes.
13. Station conduit feeding trays shall be placed such that it allows easy access to the end of the conduit, maintains the bend radius for the media placed from the tray to the conduit, and shall not pass through the tray or eclipse other conduits feeding into the tray.
14. Conduits shall not impair the placement of other station cables or access to tray system, HVAC systems, valves, or other mechanical systems in the ceilings.
15. Each station conduit shall carry a label at the intersection with a tray or any pull box that identifies the destination room and jack number.
16. All conduits shall be sized for cable use capacity according to EIA/TIA Standards
D. Surface Mounted Raceway

1. Surface mounted raceway shall be Ivory painted metal, Wiremold 2000 or approved equal product, and shall be attached to walls using fasteners suited for the wall material.
2. Plastic surface mounted raceway shall not be allowed.
3. The use of sheetrock screws for anchorage shall not be allowed.
4. Transitions in the raceway shall be factory-manufactured and suited for the purpose, and shall maintain the media bend radius.
5. Raceway shall not exceed 60% fill ratio.
6. All conduit attachments to the raceway shall provide access to the union using an outlet box or raceway fitting that maintains the cable bend radius.
7. Conduits shall not enter the back of the raceway unless an outlet box is placed at the transition point.

E. Furniture Raceway

1. Cable placed into factory-manufactured furniture shall have pathway suited for the purpose.
2. Barriers shall be used to separate line power from telecommunications cables.
3. Cable routing from walls or floor penetrations to furniture panels shall use water tight flex conduit.
4. Cable entrance to furniture chase-ways shall be protected from misalignment or crushing from other furniture components.

F. Floor Monuments

1. Floor monuments shall be flush mounted and connected to tray or other distribution systems by 1-inch or larger conduit. See Table-03 in this section.
2. The monument shall be suitable for telecommunication use and be equipped with a supplier's designer faceplate to accommodate a SYSTIMAX® SCS M108FR3, three port faceplate bracket, (also See Specification Section 16651 APPENDIX-A).
3. Box shall be fire-caulked at the union with the floor.
4. Floor boxes for telecommunications shall have a conduit from this box to the tray or other distribution system, which shall be bonded.

G. Wall Mounted Telephone Outlet Boxes (All Public accessible locations shall comply with ADA Requirements, all non-public accessible locations shall be installed as specified).

1. Pathway for pay and house phones may use ¾-inch conduit, providing there is only one single Four Pair Cable terminated in a recessed single gang outlet box.
2. Up to (2) separate phone locations, placed side-by-side, may share a common one inch conduit run to the tray system, providing the locations are within five linear feet.
3. Each house or pay phone location may require ¾ inch conduit to the tray system.
4. Pathway for elevator service may use ¾-inch conduit providing there is only one single Four Pair Cable and shall be separate from other elevator control wiring.
5. Some elevator machine rooms may require a service phone and separate phone lines or cables to each car or control unit. The elevator machine room service phone is to be a wall-hung unit placed 54 inches above finished floor floor, on vertical center adjacent to the egress door. This pathway may be extended to the elevator control panel using EMT or flex as needed for a clean and neat installation.

6. Pathway to stairwell egress call stations may use ¼-inch conduit terminated in the enclosure that will house the reporting unit, these locations shall meet ADA Requirements.

7. Pathway for “Code Blue” or outside emergency use phone devices require a one inch conduit. Pathway extensions for such devices shall change to PVC conduit at foundation/outside transitions provided an outlet box is placed at the transition from EMT to PVC.

8. Any conduit that penetrates an outside wall, which runs up from a slab in an outdoor location shall be sealed after the cable is installed to prevent the accumulation of condensation.

9. Wall-mounted phones, elevator, fire panels, and stairwell outlets shall terminate in the BET on distinct blocks adjacent to the service entrance and riser cables.

10. Wall non-public accessible telephone locations shall have a separate cable for each outlet, installed 54 inches above the finished floor on vertical center. Elevator phone line cables shall terminate in the elevator equipment control panel serving each elevator.

11. Fire reporting panels shall have one voice cable placed into the cabinet.

12. Record vaults or secured areas shall have a wall phone or similar device and shall be placed in the space at the entrance.

13. Stairwell rescue assistance or evacuation phones or notification devices shall have a separate cable to each location. Specific type of Phone is specified in Specification Section 16630, in accordance with ADA specifications.

14. Mechanical spaces shall have one wall-mounted telephone outlet plus voice/data service to the building EMS panel.

H. Telecommunication Information Outlet (TIO) Boxes

1. TIO boxes shall be metallic, 4 -11/16 inches square, by 2-1/8 inch deep box, fitted with a single or double gang outlet mud ring as indicated in the EWU Telecommunication Information Outlet Configurations Table in “I” following this sub-section.

2. TIO boxes shall be attached to wall framing and placed on the same plane as the electrical service outlets.

3. TIO outlets shall be placed within 12 inches of the electrical service outlet.

4. Outlet boxes that serve as access points or raceway transition points shall be of sufficient size to maintain cable bend radii, not less than 4 inch by 4 inch by 2 inches deep.

5. These boxes shall be accessible and may be used as outlet and access points to other outlet locations. Conduit used in such cases shall be sized accordingly.

6. One outlet box may serve a station outlet on the backside of a common wall provided that fire spread separation or framing member separation can be maintained. The two boxes are interconnected using 1-inch conduit. Pathway back to the tray or principal distribution system from the first outlet box shall be sized accordingly to the total number of station cables, see Table-03 in this section.

7. An Electrical Outlet shall be supplied adjacent to each TIO. This electrical outlet shall be a single gang duplex 120 Volt 20 Amp Circuit.
I. Telecom Information Outlet Box Configurations By Type Of Outlet.

1. The following table illustrates the requirements for telecom information outlets that shall be incorporated into the Work by the Contractor:

Table-03

EWU Telecommunication Information Outlet Configurations

<table>
<thead>
<tr>
<th>Outlet Type</th>
<th>Information Outlet Quantities</th>
<th>Faceplate Required SYSTIMAX®</th>
<th>Required Mud Ring, By Gang</th>
<th>Minimum Conduit Size</th>
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<td>26</td>
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<td>M16MMO</td>
<td>Single</td>
</tr>
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</table>
J. Lecterns and Podiums

1. Pathways to the various equipment and presentation locations need to be as flexible as practical. This may include the use of 3 each two inch conduits, floor duct, trough, or raised flooring systems from podium locations to equipment closets.
2. An Electrical Outlet shall be supplied a double gang duplex 120 Volt 20 Amp Circuit.

K. COMPUTER LABS AND COMPUTER CLASSROOMS

1. Each room shall have no less than one Standard Information Outlet, this outlet shall be located on the wall below the white board and projection screen. Locate these Information Outlets at the standard height for electrical outlets.
2. Information outlets designated to serve data distribution only shall contain only data cables. They may be in clusters ranging from one to eight jacks. Each location shall be identified with the volume of cables on the 100% Drawings.
3. Selected outlets may contain Fiber Optic Cable and Copper Cables. These outlet locations shall be identified with appropriate volumes and types of cables on the 100% Drawings.
4. Each Information Outlet location shall have an Electrical Outlet located on the same plane and be adjacent to each other.

L. TECHNOLOGICALLY EQUIPPED CLASSROOMS

1. Each Technologically Equipped classroom shall have its own Special Equipment Closet located in the room, see Specification Section 16652 – Requirements For Telecommunications Rooms.
2. Pathways shall be installed from this closet to the Lectern/Podium. The pathway shall consist of three each 2 inch conduits.
3. Each equipment closet shall require (4) duplex power outlets derived from two separate 120Volt 20 Amp, branch circuits.
4. Outlets shall employ rack-mounted power strips installed at the mid point elevation of each rack.
5. Ceiling mounted projectors shall have provisions for two data cables connecting to the Data Network, this dictates that a one inch conduit be installed to the tray system.
6. Ceiling mounted projectors shall have a separate single data cable provided to the Special Equipment Closet located in the room. This shall be a one inch conduit in a separate outlet box.
7. Ceiling mounted projectors shall have a two inch conduit homerun to the Special Equipment Closet for the projector controls.
8. Ceiling mounted projectors shall have a single duplex electrical outlet installed adjacent to and on the same plane as the Data Information Outlet in the ceiling.
9. Sound reinforcement locations shall be homerun to the Special Equipment Closet, and shall be one inch conduits.
10. Each classroom shall have at least one each Standard Information Outlet, it shall be located on the wall below the white board and the projection screen in the front of the room and shall have a single duplex electrical outlet placed adjacent to the SIO.

11. Each classroom shall be fitted with Wireless Access Information outlets as described in section “N” following this section.

M. LARGE SPACE AREAS (i.e., Lobbies-Multi-purpose Rooms-Auditoriums)

1. Each Large Space Area shall have no less than one Standard Information Outlet, in the instance of Multi-purpose Rooms and Auditoriums, this location shall be located on the wall below the white board and projection screen adjacent to the electrical outlet.

2. Service counters that are constructed within large open areas shall have a conduit system installed in the counter, the conduit system shall be 1 inch conduit and be extended to the tray system or home run to the nearest serving telecommunication closet.

3. Multi-purpose rooms and Auditoriums shall be equipped with Multi-media presentation and performance services. The same requirements as the Technologically Equipped Classrooms.

4. All of these rooms/areas shall be fitted with Wireless Access Information Outlets as indicated in section “N” immediately following this section.

N. Wireless Access Outlets (WAO) Inside of Buildings

1. Wireless Access Outlet (WAO) boxes shall be mounted on a plane at one foot below finished ceiling level, on Vertical Center of the box, on all locations with Hard Pan Solid Ceiling. The WAO boxes on all locations with a Dropped/Suspended Ceilings shall be mounted one foot above the Ceiling Grid on Vertical Center of the box. The Information Outlet box shall be fed by no less than a ¾-inch conduit to the tray system.

2. Wireless Information Outlet locations shall be identified by the Owner on the Drawings.

3. There shall be two WAO’s installed in Lobbies, Non-Office Rooms, and Classrooms with 999 square feet of floor space or less, both in the front two corners of the room.

4. There shall be four WAO’s installed in Lobbies, Non-Office Rooms, Multi-purpose Rooms, Auditoriums, and Classrooms with 1,000 square feet of floor space or more, one in each corner.

O. Pull Boxes

1. Pull boxes shall be anchored or supported independent of the raceway.

2. Pull boxes and condolets(with a minimum of eight inches of access) shall be accessible and shall not eclipse or block access to other distribution systems, HVAC, valves, or other mechanical device.

3. Pull box covers shall be labeled “Telecom” and shall note the source and destination of connected conduits.

4. Boxes with hinged covers shall be placed in such a way as to allow the full swing of the door. Hinged box covers and doors shall be free to fully open.

5. Boxes that serve cable that is supported by rings or other non-continual system, shall have the ground cable bonded to the box using an approved grounding lug or connector. No bolts and washers shall be used as a bonding device.
6. The use of electrical gutter as an access device shall be permissible provided the length of the gutter allows for the placement of intended media without exceeding the bend radius.

P. Fire Stopping (See Specification Section 07841)

1. All trays, sleeves, and cable bundles that pass through floors, walls, and ceilings shall be fire stopped using approved methods and products.
2. Conduits that pass through floors, walls, ceilings, and floor boxes shall be fire-caulked between the core hole or opening and the outside wall of the conduit or box.
3. All trays shall use a metallic sleeve that surrounds the tray as it passes through the opening. This sleeve shall extend 4 inches beyond the surface of the wall in both directions and shall be fire-caulked between the sleeve and the wall material on both sides of the wall.
4. Tray and cable bundles that pass through walls shall be fire blocked using pillows with a rating, which does not compromise the fire rating of the wall.
5. All unused, vertically rising, conduits and sleeves shall be plugged and sealed at the top end, using a knock out cover plug placed over the conduit bushing and sealed using a fire rated caulk.
6. All unused horizontal tray sections shall be fire stopped by placing pillows or similar fire rated material at the ends of the tray.
7. Tray containing cables shall use pillows or other approved removable, reusable, fire-rated material. Conduit sleeves containing cable shall be stopped by using rock wool or other approved removable, reusable, fire-rated material.

3.05 GROUNDING AND BONDING

A. System Grounding and Bonding

1. All cable pathways shall form a continuously bonded system that shall be grounded to the building electrical service ground using a #6 stranded green jacketed CU conductor.
2. Pathways that utilize rings or other non-continuous or conductive pathways and extend or make connection to metallic or other non-conductive raceway shall carry a #6 stranded green jacketed CU conductor for the bonding of the extended pathway. This would include sleeves and other wall or floor penetrations.
3. Individual, surface-mounted, station drop conduits fed from a ring or open distribution pathway, need not be grounded nor do they need to carry a ground conductor provided they do not exceed 10-feet in length.
4. Each section of tray, equipment rack, and wire managers shall be bonded together as a system using #6 stranded green jacketed CU conductor or straps connecting to bonding clamps or lugs that have been placed on each piece of rack and tray. From one point on a rack or tray, a ground connection shall be made to the closet grounding system using a #6 ground conductor.
5. Straps or other bonding conductors, such as grounding screen, bonding riser and entrance cables, racks, wire-way ladder, main cable pathways and trays shall have the same ampacity as a #6 stranded green jacketed CU conductor.
6. Bonding conductors for 1-inch EMT station conduits shall be #10 AWG Green Jacketed copper wire or approved strap or clamp.
B. Sources of Grounding System

1. All communication grounding points shall derive from one source, which shall be the building grounding electrical service ground. In some cases where ground mats and other sources of ground may be employed to provide an adequate service ground, the main connection of these systems shall be used as grounding source for the communications ground.

2. Grounding from closets may be collected and sourced back to the main ground using individual cables of sufficient capacity.

C. Grounding Conductors

1. All grounding conductors for racks, lightning protection, backboard buss bars, conduits and sleeves, entrance and riser cable sheaths, shall use #6 stranded green jacketed CU conductor.

2. Trays shall carry a continuous #6 stranded green jacketed CU conductor the extension from this conductor to the grounding buss bars or service ground shall be a #6 stranded green jacketed CU conductor.

3. Attachments to aluminum parts or equipment shall use a dielectric compatible lug rated for copper to aluminum (CA/AL) rating along with anti-corrosion paste.

D. Ground Plates, Buss Bars and Rack Grounding

1. Ground bars shall accommodate at least eight #6 conductors and shall be firmly attached to backboards using screws placed on each end of the bar.

2. Grounding buss bars shall be placed horizontally and in such a position as not to interfere with other cables and pathways.

3. Each backboard shall have one or more buss bars placed 6 feet from any corner or 12-foot on center provided this location does not interfere with vertical run cables emerging from conduit or support rings.

4. All buss bars grounding conductors shall be chained together and shall be run at the bottom edge of the backboard.

5. Ground Plates shall be installed to accommodate the Ground connection from the electrical service/building ground.

E. UPS and Equipment Grounding

1. Un-interruptible Power Systems equipment will utilize line power grounding.

2. Network equipment will derive case ground from electrical power source.

3. Rack mounted fiber optic termination panels which contain metallic sheath cables will have a #6 stranded green jacketed CU conductor attached to the ground lug on the enclosure and run back to the backboard grounding bar. This ground is independent of the rack grounding conductors.
3.06 MASTER CONTROL PANELS

A. Master Control Panels Data Network Access Provisioning (Fire Alarm and Access Control).

1. A single one inch conduit shall be required from Each master control panel (Fire Alarm and Access Control) located in the Basement Electrical Room, identified as Room nnn on Plan E-nnn, to the BET, AAAA1, Rm. #nnn on Dwg. Sht. E-nnn. Conduits are to terminate at the Cable Ladder Rack Raceway installed in the BET, to provide route to the FODU (Fiber Optic Distribution Unit) located in the appropriate Equipment Rack.

2. These conduits shall connect directly to the panel boxes.

3. Conduits shall be routed in such a way as to maintain minimum bending radii of the Fiber Optic Cable (Nothing less than normal one inch conduit 90 degree sweeps are acceptable).

4. The conduits shall be fitted with a “conduit to innerduct” splice fitting at the BET termination point to facilitate the attachment of innerduct to route to the FODU.

3.07 LABELING REQUIREMENTS

A. Pathways

1. All conduit, tray, inner-ducts, poles and sleeves shall be labeled showing the following information based on type, source and destination:

a. Conduits are defined by a letter “C” for EMT conduits of any size:

   “RMC” for rigid metallic conduit or pipe of any size.
   “FC” for Fiber or Orangeburg fiber/tar conduit of any size.
   “PVC” for Poly Vinyl Chloride conduit of any size.

b. Trays are defined as to type such as:

   “ST” for spine tray.
   “RT” for rung or vented bottom tray.
   “PT” for Plenum rated tray.

c. Sleeves are sequentially numbered in each space such as “S1” or “S2”.
d. Source and Destination are by Building Room Codes, for example: SNRA1 to SNRA2.

B. Electrical Circuits

1. Panels

a. All circuit breakers shall be labeled with the location of the outlets.
b. Locations shall be machine printed black ink on the breaker schedule provided with the panel.
2. Outlets
   
a. All outlets shall be labeled with the Panel Name and Breaker Number.
b. Labels shall be machine printed black ink on 3/8 inch wide white label tape.
c. Labels shall be printed horizontally and placed vertically on the left side of the outlet so that the label is readable looking to the left.

3.08 CUSTOM TEMPLATES
   
   A. A custom specification shall be prepared for each major project by the owner, utilizing this Master Template

END OF SECTION 16650