Section 17130 Intra-building Communication Pathways

PART 1 – GENERAL

1.01 Horizontal pathway system. A pathway system will be installed in campus buildings to route and protect all horizontal telecommunications cabling from the BDF/IDF to the outlets in all work space locations.

1.02 Riser pathway system. A pathway system will also be installed in campus buildings to route and protect all riser telecommunications cabling linking the BDF with all IDFs in the building. This system will be installed between BDF/IDFs whether they are vertically stacked or not. Open floor sleeves between floors will not constitute a sufficient pathway system.

1.03 Enclosed system. Each of these pathway systems shall be a completely enclosed, metallic system. Although a variety of materials may be used based on site conditions encountered, typically the horizontal pathway system will consist of a network of wireways and conduits installed in the ceiling areas of the building. The riser pathway system will typically consist of a series of 4” conduits.

1.04 Aesthetics. Generally, all visible elements of the pathway system should be painted to match surrounding surfaces. Elements installed in locations not visible by building occupants do not require painting. Typically, these include wireways and conduits installed above acoustic tile ceilings or in mechanical rooms. Ideally, all elements of the pathway system except for the actual outlet boxes in work spaces will be completely hidden from view. However, in many retrofit projects, this is not possible. In these cases, the designer should carefully determine routing, components used, and supporting methods to minimize the negative aesthetics impact that the installation of the pathway system will have on a building.

In some instances, false columns, soffits, and archways have been constructed to conceal wireways and conduits in especially sensitive areas of buildings. These structures should be installed in a manner consistent with the visual architecture of the building, while still allowing access for installation of cabling.

1.05 Fire safety considerations. The installation of the pathway system shall comply with all applicable fire safety and electrical codes. In general, the N.C. Dept. of Insurance determines the compliance of these systems with codes, and they reserve the right to inspect and approve/disapprove their installation. Since the pathway system is a metallic, enclosed system, non-plenum cables will be installed within it. All wireway and conduit penetrations of rated walls and floors shall be firestopped per applicable UL assembly.

1.06 Horizontal pathway sizing. The designer should determine the cross-sectional area required for each separate section of the horizontal pathway system, and specify these on the drawings. All horizontal cabling is run in a star topology (homerun) from each outlet back to the nearest IDF. Therefore, the required cross-sectional area of the system increases as it gets closer to the IDF. The capacity requirements are smallest at the farthest distances from the IDF. A general rule of thumb is to plan for 1 sq. in. of cross-sectional area for each outlet to be installed. The area should be increased an additional 25% for anticipated growth.

1.07 Riser pathway sizing. Typically, two 4” conduits will suffice for up to two IDFs in a “stack”. If additional IDFs are to be constructed, a third 4” conduit should be installed.

1.08 Support mechanisms. A variety of structures may be used to provide mechanical support for the pathway system components. Usually, these are trapeze structures supported from the deck above or wall mounted “L” brackets. The design of the support mechanisms should be based on the structural and architectural composition of the surrounding building structures. In certain...
locations, aesthetics concerns and limited available space may impact the support systems selected.

1.09 Non-recommended systems. While a variety of pathway system technologies are commercially available, some are not generally recommended for use at NC State. These include underfloor duct systems, trench duct systems, cellular floor systems, underfloor conduit systems, multidrop conduit systems, and access (raised) floor systems. None of the above systems should be used without approval from NC State Comtech.

1.10 Construction details. An array of detail drawings describing many of the typical pathway components is available for download and modification by designers at the Comtech website. The designer is encouraged to utilize these and create additional custom details as required for inclusion in the project drawings.

PART 2 – DESIGN GUIDELINES

2.01 Quality assurance.

- Standards. All work shall be in accordance with the latest edition of all applicable campus, State, and Federal regulations and codes. Special considerations should be made to comply with NEC, NFPA, and NC Dept. of Insurance requirements. All work shall also be in accordance with the 2003 BICSI TDMM manual, 10th edition (chapters 5, 6, 11, and 13), with the TIA-569 standard and all addenda, and with the manufacturer’s recommendations.

2.02 Materials.

- Substitutions. The materials used for this system are generally NOT manufacturer and part number specific. Equivalent, high quality materials may be utilized without submittals to Comtech. However, the university reserves the right to reject materials that are considered of substandard quality.

- Standard items. The material lists below are meant to only convey the typical pathway system items often installed in campus buildings. It is not meant to be exhaustive or to limit a designer’s options. Especially in retrofit projects, a wider array of materials is likely to be used.

- Typical UWS outlet components. These may include the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet conduit</td>
<td>1” EMT conduit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlet flex conduit</td>
<td>1” flexible conduit, steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduit coupling</td>
<td>1” EMT compression coupling, steel</td>
<td>RACO</td>
<td>2924</td>
</tr>
<tr>
<td>Conduit connector</td>
<td>1” EMT compression connector, steel</td>
<td>RACO</td>
<td>2904</td>
</tr>
<tr>
<td>Locknut</td>
<td>1” locknut, steel</td>
<td>RACO</td>
<td>1004</td>
</tr>
<tr>
<td>Flex/EMT transition coupling</td>
<td>1” rigid conduit coupling (2” long)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flex/EMT transition connector</td>
<td>1” straight squeeze connector, malleable</td>
<td>Madison</td>
<td>ML-42-3</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Outlet conduit</td>
<td>¾” EMT conduit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlet flex conduit</td>
<td>¾” flexible conduit, steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduit connector</td>
<td>¾” EMT compression connector, steel</td>
<td>RACO</td>
<td>2903</td>
</tr>
<tr>
<td>Locknut</td>
<td>¾” locknut, steel</td>
<td>RACO</td>
<td>1003</td>
</tr>
<tr>
<td>Flush mounted outlet box – new work</td>
<td>4” square outlet box, 2 1/8” deep, with ¾” KO’s, steel</td>
<td>RACO</td>
<td>233</td>
</tr>
<tr>
<td>Plaster ring for new flush outlet box</td>
<td>Square cornered tile wall cover for 4” square box, single device capacity, raised ¾”, steel</td>
<td>RACO</td>
<td>773</td>
</tr>
<tr>
<td>Flush mounted outlet box – old work</td>
<td>3 ½” deep gangable switch box with ¾” KO’s, steel</td>
<td>Steel City</td>
<td>CY-3/4</td>
</tr>
<tr>
<td>Surface mounted outlet box</td>
<td>Two gang extra deep device box, surface mounted outlet box, steel, steel</td>
<td>The Wiremold Co.</td>
<td>V-2444-2</td>
</tr>
<tr>
<td>Conduit strap</td>
<td>1” EMT conduit strap, one hole, steel</td>
<td>RACO</td>
<td>2084</td>
</tr>
</tbody>
</table>

- Typical wall telephone/special use lines outlet components. These may include the following:

  - Typical tombstone and floor outlet components.
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor outlet box (one power and one telecom)</td>
<td>8”x9”x5.25” floor box w/ one single-gang and one double-gang opening</td>
<td>FSR, Inc.</td>
<td>FL-710</td>
</tr>
<tr>
<td>Floor outlet box cover (brass)</td>
<td>8”x9” watertight cover with brass flange</td>
<td>FSR, Inc.</td>
<td>FL-710-BLP</td>
</tr>
<tr>
<td>Floor outlet box cover (aluminum)</td>
<td>8”x9” watertight cover with aluminum flange</td>
<td>FSR, Inc.</td>
<td>FL-710-SLP</td>
</tr>
<tr>
<td>Tombstone outlet box</td>
<td>525 Series, aluminum service fitting, housing and base plate only</td>
<td>The Wiremold Co.</td>
<td>525HB</td>
</tr>
<tr>
<td>Tombstone box back plate</td>
<td>525 Series faceplate - blank</td>
<td>The Wiremold Co.</td>
<td>500B</td>
</tr>
</tbody>
</table>

- Typical wireway components. These may include the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>8x8 wireway</td>
<td>NEMA 1, 8”x8” wireway, screw cover, gray powder coating, 10’ section</td>
<td>The Austin Co.</td>
<td>AB-88120SW</td>
</tr>
<tr>
<td>8x8 wireway hardware</td>
<td>45 degree elbows, tees, reducers, universal connectors, and end caps in above product line</td>
<td>The Austin Co.</td>
<td>Various</td>
</tr>
<tr>
<td>6x6 wireway</td>
<td>NEMA 1, 6”x6” wireway, screw cover, gray powder coating, 10’ section</td>
<td>The Austin Co.</td>
<td>AB-66120SW</td>
</tr>
<tr>
<td>6x6 wireway hardware</td>
<td>45 degree elbows, tees, reducers, universal connectors, and end caps in above product line</td>
<td>The Austin Co.</td>
<td>Various</td>
</tr>
<tr>
<td>Threaded rod</td>
<td>3/8” hanger rod, continuous thread, 10’ section, steel</td>
<td>Kindorf</td>
<td>H-193-3/8-10</td>
</tr>
<tr>
<td>Horizontal trapeze</td>
<td>1 ½” x 1 ½”, 12 gauge channel, 10’ section, steel</td>
<td>Kindorf</td>
<td>B-905-10</td>
</tr>
<tr>
<td>Wall mount bracket</td>
<td>9” “L” bracket, steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic edge channel</td>
<td>Durostrip, plastic edge channel, gray, 4’ section</td>
<td>Richco, Inc.</td>
<td>DSC-1</td>
</tr>
</tbody>
</table>

- Typical Wiremold (surface perimeter wireway) components. These may include the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-outlet wireway</td>
<td>V6000, two piece steel surface raceway, 3 9/16” x 4 ¾”, ivory color</td>
<td>The Wiremold Co.</td>
<td>V6000</td>
</tr>
<tr>
<td>Multi-outlet wireway hardware</td>
<td>Elbows, tees, end caps, and couplings in above product line</td>
<td>The Wiremold Co.</td>
<td>Various</td>
</tr>
</tbody>
</table>
Typical riser raceway components. These may include the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riser conduit</td>
<td>4” EMT conduit</td>
<td>RACO</td>
<td>2956</td>
</tr>
<tr>
<td>Conduit coupling</td>
<td>4” EMT compression coupling, steel</td>
<td>RACO</td>
<td>2946</td>
</tr>
<tr>
<td>Conduit connector</td>
<td>4” EMT compression connector, steel</td>
<td>RACO</td>
<td>2946</td>
</tr>
<tr>
<td>Locknut</td>
<td>4” locknut, steel</td>
<td>RACO</td>
<td>1016</td>
</tr>
<tr>
<td>Conduit bushing</td>
<td>4” plastic insulating bushing</td>
<td>RACO</td>
<td>1416</td>
</tr>
<tr>
<td>Grounding bushing</td>
<td>4” threaded insulated grounding bushing, steel</td>
<td>RACO</td>
<td>1296</td>
</tr>
<tr>
<td>Conduit strap</td>
<td>4” EMT conduit strap, two hole, steel</td>
<td>RACO</td>
<td>2242</td>
</tr>
<tr>
<td>Trapeze strap</td>
<td>4” channel conduit strap, steel</td>
<td>Kindorf</td>
<td>C-105-4</td>
</tr>
<tr>
<td>Riser clamp</td>
<td>4” conduit support</td>
<td>Kindorf</td>
<td>C-210-4</td>
</tr>
<tr>
<td>Threaded rod</td>
<td>3/8” hanger rod, continuous thread, 10’ section, steel</td>
<td>Kindorf</td>
<td>H-193-3/8-10</td>
</tr>
<tr>
<td>Horizontal trapeze</td>
<td>1 ⅛” x 1 ⅜”, 12 gauge channel, 10’ section, steel</td>
<td>Kindorf</td>
<td>B-905-10</td>
</tr>
</tbody>
</table>

2.03 Design parameters.

- Topologies. The horizontal pathway system will consist of a series of enclosed wireways radiating from each IDF or BDF. Larger wireways will be installed from the IDF/BDF to provide access to all general areas of its geographic zone. Smaller, lateral wireways will branch off from the larger wireways to extend the pathway system to all occupied areas of the building.

The riser pathway system will usually consist of a series of 4” conduits originating at the BDF and extending to all of the IDFs. The design of the system is based on the geographic location of the BDF and IDFs. Ideally, all of the IDFs will be stacked vertically directly above the BDF. In this scenario, conduits will be installed through the ceiling of the BDF, and stubbed up through the
floor of the first IDF. Additional conduits would be installed through the ceiling of the first IDF, and stubbed up through the floor of the second IDF. This pattern would be repeated until the last IDF was reached. However, in many buildings it is not feasible to have such a single stack layout. In these cases, the designer should specify routes to interlink the BDF to all IDFs in the most efficient manner possible, requiring the least amount of conduit to be installed. Riser conduits should not be installed through intermediate IDFs. All conduits should be stubbed into and terminated in each IDF. The cables that are destined for IDFs farther along the stack will merely be routed through the intermediate IDF using ladder rack or cable management rings.

- **Maximum horizontal pathway length.** Modern data communications technologies require that the maximum length of the horizontal cable channel is limited to 295 ft. (90m). Since this channel includes patch cords at the outlet and in the IDF and also the cable slack loop installed in the IDF, the actual length of the horizontal pathway is somewhat shorter. A good rule of thumb to use in designing these pathways is the “250 ft. rule”. The pathway run from the outlet box farthest from an IDF back to where the wireway penetrates the wall of that IDF should not exceed 250 ft. It is imperative that this calculation includes allowances for the vertical conduit run from the wireway to the outlet box and for the vertical and horizontal deviations in the wireway routing which are common in construction projects.

- **Routing.** Typically, wireways are routed in corridors or other publicly accessible areas of the building. Normally, they are routed in the ceiling areas, above acoustic tile ceilings when available. Routing of wireways through occupied spaces is discouraged. This is to prevent disruption caused when an additional outlet is installed after occupancy. To install cabling, the wireway must be opened up along its entire run, creating a situation where the installation of a new outlet for one occupant disrupts other occupants in the building. In certain cases, however, there is no choice but to route wireways through occupied spaces. As much as possible, this should be limited to lateral wireways farthest from the IDF where the disruptive impact is less due to fewer occupants being further “down the line”. Individual 1” conduit runs to outlets may be run wherever feasible. For aesthetics purposes, surface mounted conduits should be routed in less visible spaces (closets, storage rooms, etc.) when possible. Installing a surface outlet box in one room with the conduit routed from the back of the box through the wall to an adjacent room is an acceptable practice.

Riser conduits may be routed anywhere in a building since they are almost never accessed by technicians. It may even be advantageous to route these in spaces other than corridors since corridor ceilings are usually crowded with a variety of ducts, piping, and conduits.

Also, there are areas of buildings that should typically not be used for wireway or conduit routing. These include:

1. Stairwells.
2. Elevator shafts and equipment rooms.
3. Outdoor areas (including covered breezeways) where moisture may be present. The cabling to be installed has no water resistance characteristics. Even areas protected from rain, but subject to dew or other condensation sources should not be used for these pathway systems components.
4. Wet areas inside buildings such as shower facilities, equipment wash down areas, steam rooms, etc.
5. Hazardous locations. Since the wireways need to remain accessible for technicians to install cabling on an ongoing basis, routing through areas exposing personnel to dangerous heights, high voltage equipment, hazardous chemicals, etc. should be avoided. Likewise, areas housing equipment or activities that are particularly susceptible to damage by technicians installing new cabling should also be avoided. These may include research labs, clean room environments, animal rooms, and the like.
6. Locations with excessive heat. The cabling to be installed in these pathway systems is not designed to withstand excessive heat. Wireways and conduits should be routed to avoid heat.
sources hot enough to cause sheath deformation over time in the cables. These include steam lines, boilers, etc.

7. Confined spaces. Wireways should not be routed in spaces that are designated as campus confined spaces requiring special permitting or safety precautions for entry.

8. EMI sources. Wireways and conduits should be located away from sources of electromagnetic interference (EMI). While the bonded and grounded wireway and conduit system will eliminate considerable EMI effects, it is still prudent to route these components away from potential sources. Potential sources on campus include electrical transformers, large motors, x-ray equipment, radio broadcast equipment, etc. Lighting ballasts do not seem to create significant EMI effects in cables housed in enclosed pathway systems.

- Access. In areas of buildings where acoustic tile ceilings are present, the wireway system is typically installed between the top of the grid and the deck above. In these applications, the bottom of the support structure (trapeze) should be installed at least 3” above the grid, independent from ceiling grid. In areas without acoustic tile ceilings, the wireway system should be installed exposed with the bottom of the support structure at least 8’- 6” AFF. Wireways should not be installed above inaccessible (hard) ceilings.

The wireways should be installed to maximize accessibility for future cable and conduit installations. Unlike some building systems that are rarely accessed, the wireway system is accessed fairly routinely for the installation of additional outlets. A minimum of 24” accessible workspace should be maintained in front of the wireway cover. Also, at least one side panel of each 45 degree elbow should be accessible for removal and for cable installation.

Where wireways penetrate walls or other obstructions preventing their removal, the covers should be cut to allow maximum access to the interior of the wireway. Sharp edges and burrs should be filed smooth on edges of cut covers to prevent damage to cables or injuries to technicians installing these cables. It is also acceptable to install the cover on one side of one section of wireway and install the cover on the opposite side of the next section of wireway to maximize access. This should only be done when accessibility is significantly increased, since such reversal of covers increases the cable installation time for technicians.

All telecommunications junction boxes should remain accessible. Likewise, wireways and conduits should be installed so as not to block access to other building system components. Some of the access requirements are addressed by codes (electrical junction box covers, breaker panels, exit signs, fire alarm horns and strobes, etc.). Access requirements for other components, while not specifically addressed by codes, should be determined by “common sense” evaluation of system function and ergonomics. These components include water valves, light fixtures, drain clean-outs, HVAC damper controls, and other similar items.

- Outlet location. Typically, all outlets are installed at 18” AFF. For aesthetics purposes in new construction, the bottom of the outlet box should be installed even with the bottom of electrical receptacle boxes. Outlet boxes may be mounted higher if necessary to be located above furniture, counter tops, or equipment.

Outlet boxes should not be located too close to wet areas such as sinks where water could splash onto faceplates or where patch cords could come into contact with water. Boxes also should not be located too close to sources of excessive heat, dust, chemicals, or EMI.

Outlet boxes should also be located so that they will be accessible to technicians for patch cord installation or for faceplate retermination even after furniture and equipment is installed. A balance should be maintained between “hiding” outlets for aesthetics purposes and keeping the faceplates accessible. Boxes should not be installed behind heavy equipment or modular furniture panels.
Ergonomics and egress factors should be considered when planning outlet locations. Outlets should be located so as not to require telephone or data patch cords to be installed across doorways, aisles, or other “people” traffic areas. It is worth noting that in many work areas, telephone sets and computers are not located near each other.

- Outlet quantities. Since the cost ComTech infrastructure of a building is directly proportional to the number of outlets installed, careful planning of outlet quantities and locations is essential. While each project is unique, the following guidelines may assist in determining outlet quantities:

  1. Connections. The standard UWS outlet (three Category 6 jacks) designates one jack for voice service connections and two jacks for data service connections. Each outlet can support up to four telephone devices (telephones, modems, fax machines, etc.) using the single voice jack with splitters plugged into that jack. Each of the two data jacks can be used for a separate connection to the campus data network.

  2. Offices. Typically, a single occupancy office is equipped with one telecommunications outlet. Due to the ergonomic and egress issues addressed above, some offices may require a second outlet. Normally, the outlet is located near the corner of the room farthest from the door. While outlet locations may be specified to coincide with the furniture layout of a room, it should be noted that the occupant and the furniture layout of an office is likely to change several times over the life of ComTech infrastructure. Usually, it makes better sense to locate the outlet to fit the space, not necessarily the current occupant’s furniture layout.

  3. Modular furniture. Typically, one outlet per cubicle workspace is installed.

  4. Very high-density office space. Overall space shortages on campus regularly dictate the creations of office space with a very high number of occupants per unit space. This is especially true for office space assigned to graduate students. In these locations, installing one outlet per person workspace is impractical. Normally, these spaces are equipped with one outlet for every two people.

  5. Classrooms (traditional). Traditional classrooms are those without the capability to support networked computers at each desk. Usually, two outlets are installed in each classroom. See Section 17320 for information on the interface of the communications wiring with audio/visual A/V systems and Section 17650 for general information on classroom wiring.

  6. Classrooms (wired to the desk). These classrooms are equipped with special furniture, power, and telecommunications wiring to allow each student to access the campus network from his/her desk. See Section 17650 for detailed requirements.

  7. Conference rooms. Usually, two outlets are installed in each conference room, one at each end of the room. This is to allow maximum flexibility in the arrangement of the room for particular presentations. In rooms equipped with higher-end A/V systems, additional outlets may be required in a similar manner to the traditional classrooms described above.

  8. Computer labs. These are rooms where desktop computers are permanently located in the room (as opposed to classrooms where students may bring in laptop computers). Design of outlets for these student computer labs requires careful coordination with the furniture and computer equipment layouts of the room. See Section 17650 for more detailed information.

  9. Teaching and research labs. Locating outlets in these rooms requires a case-by-case design with input from the campus personnel who will be managing each particular lab. In general, a UWS outlet should be installed in each office-type workspace in the lab where a telephone and/or computer is likely to be located. In addition, outlets should be installed where equipment or monitoring devices are to be installed which need access to the campus data network. Direct interconnection of lab equipment within the room should be accomplished with a separate internal wiring system.

  10. Auxiliary spaces. An additional UWS outlet is required for many building spaces not addressed above. These include: the main mechanical room in each building (for connection of energy monitor controller equipment), vending machine areas, copy machine areas, main janitorial rooms which serve as office space for custodial staff, etc.

- Outlet box type. The type of wall construction present determines the outlet box type to be installed.
Flush mounted outlet boxes should be installed in all walls of gypboard and standard stud (3 5/8” deep) construction. In some retrofit projects, the presence of cross members (purlins) in the walls may complicate or even prohibit the installation of flush mounted outlet boxes. The top and bottom flanges (ears) of old work boxes should be adjusted so that the box itself does not protrude at all beyond the surface of the gypboard. In general, flush mounted outlet boxes should be installed exactly straight (perpendicular to walls and floor) and flush with the surface of the gypboard (after plaster ring installation). No gaps between the edge of the faceplate and the gypboard should be present after final installation. Conduit is to be installed so as to come into the top of the box, into one of the back knockouts.

Surface mounted outlets should be installed onto all other wall types (masonry, plaster, prefabricated wall panels, etc.). In most cases these outlets will consist of the standard welded telecommunications outlet box with a surface mounted 1” conduit routed up the wall to the ceiling area. The conduit and outlet box should be painted to match the surrounding wall surface. In cases where a surface mounted outlet is required, but aesthetics are of concern, the 1” conduit may be replaced with Wiremold 2400 metal raceway. This ivory colored raceway already matches the color of the standard outlet box. The raceway and box may or may not be painted to match the surrounding wall surface. For cleanest appearance, a bead of latex caulk may be applied between the wall and each side of the 2400 raceway. In these cases, the raceway and box should be painted.

- Floor boxes/tombstone boxes. Floor boxes and tombstones should be used when wall outlets are inadequate to meet connectivity needs. The boxes selected must support University Wiring Standard double gang faceplates and hardware. Each floor box faceplate will have three UWS standard Category 6 jacks. Numbering schemes for floor box faceplates will be identical to faceplates used on wall mounted outlets. The covers on the floor boxes used must be able to close completely when in use without removing patch cords so that jacks are not exposed.

The designer should specify the exact floor box to be used with no equals accepted. Unless using the box listed in Section 2.02 above, the designer should provide Communication Technologies with product specification sheets (and a sample, if requested) for approval.

Use of tombstone boxes should be kept to a minimum. Tombstone boxes should support either standard UWS double gang faceplates or support Krone 4-port Walker Monument 525 Series faceplates.

Generally, floor boxes and tombstone boxes should be fed using 1” conduit, not with underfloor duct systems. A threaded conduit nipple with locknut and plastic bushing should be used to attach conduit to tombstone base plate. If possible, conduit feeds should be routed to a wireway that supports the wall outlets in the rooms where the floor boxes and tombstone boxes are located. The goal is to have all outlets in the room/area wired back to the same IDF. Poke-thru type devices should not be used.

- Conduit requirements. All conduits should be installed neatly, maintaining the appropriate bend radius for the size of conduit used. The length of flexible conduit installed in the ceiling area should be minimized. Flex conduit should be transitioned to EMT immediately after it exits the hollow wall with the flex conduit supported at its exit from wall. Conduits should be installed with appropriate offsets (box kicks) where they are connected to outlet boxes and junction boxes to keep surface mounted conduits flush against walls and decks.

A maximum of 180 degrees between pull points should be maintained in all conduit runs. This does not include the box kicks described above. No LB-type (or similar) condulets shall be used.

For horizontal pathway system conduits, use junction boxes to create pull points. These should be placed in straight sections of conduits where possible, but may be used to replace conduit bends.
where bends are impractical. When junction boxes are used in lieu of bends, the conduits should be connected to the junction box with maximum separation to allow the maximum cable radius within the box as possible.

For riser pathway system conduits, install 48” long sections of 6”x 6” wireway in straight sections of the conduit runs to create pull points. The 4” conduits should be connected to the end cap of each end of the above wireway sections. Plastic bushings are required on all conduit ends. These pull points should be located to provide the maximum possible access for cable installation by technicians (usually with covers facing down). Junction boxes should not be installed in lieu of conduit bends without the approval of ComTech.

Only compression connectors and couplings shall be used in all conduit runs. No set screw connectors and couplings shall be used. Install plastic bushings on all conduits larger than 1”. Install a 1/8” diameter polypropylene pull rope in each conduit in which permanent wiring is not installed. Install with 12” minimum at each end.

- Wireway requirements. All wireways should be installed with as few turns as possible. 90 degree turns in the wireway should be installed using two 45 degree elbows. Wireway runs with a significant number of turns and offsets should be enlarged to the next trade size to maintain cable carrying capacity. Screw cover wireway is to be used in all locations. The cover should be installed on either side of the wireway (not on the top or bottom sides). Conduits from outlets should be connected to either the top or the back side (side opposite the cover) of the wireway. Conduits should not be connected to the bottom or directly to the cover of the wireway without the approval of ComTech. If conduits are connected to the wireway cover, the cover should be cut 3” to each side of conduit, deburred, and screwed shut. All covers to be installed with hand tightened screws. No power drills or screw drivers to be used.

- IDF penetrations. Wireways should penetrate into IDFs horizontally at 7’- 6” AFF minimum. The ideal penetration height for wireways is 8’- 6” AFF. Each wireway should be stubbed into the room approximately 4” and turned down with a single 45 degree elbow installed onto the end of the horizontal wireway. This provides smooth factory wireway edges to protect cabling and allows smooth flow of cables onto ladder racks (installed at 7’- 4” AFF). If installation of this elbow is not practical, plastic channel should be installed to all four edges of the wireway end with permanent glue. Wireways serving floors below should be stubbed into the IDF 4” AFF. Wireways serving floors above should penetrate the ceiling of the IDF and terminate vertically at 8’- 6” AFF. The wireways should be bonded and grounded in the IDF per Section 17110.

Riser conduits that penetrate the floor of the IDF from below should be stubbed into the IDF 4” AFF. Riser conduits that penetrate the ceiling of the BDF/IDF from above should be terminated vertically at 9’- 6” AFF. Riser conduits that penetrate the wall of the BDF/IDF horizontally should do so near the corners of the room to facilitate cable routing. These conduits should penetrate the room 4” and terminate (not be turned down). Grounding bushings should be installed on all conduit ends and bonded and grounded per Section 17110.

- Perimeter wireway systems. In certain locations (usually labs with large numbers of outlets) metallic perimeter wireway systems may be used. The system used most frequently on campus is the Wiremold V6000 series wireway system. This can be mounted horizontally at any height needed (above 12” AFF) with UWS faceplates installed directly onto the front of the wireway (using a device plate). The wireway can also be installed vertically to create power pole units described above, again with UWS faceplates installed directly onto the front of the wireway (with device brackets). The system can be painted as needed to match surroundings. Perimeter systems should not be shared with electrical power wiring, even when compartmentalized.

- Direct conduit systems. By default, 1” conduit runs from outlets should be connected to the wireway system and not be directly routed to the IDF. However, for IDFs serving a very small number of outlets or a very small geographic zone, a wireway system may not be necessary. In
these cases, all of the 1” conduits would be installed in a homerun fashion directly back to the IDF. The conduits should penetrate the wall of the IDF and be terminated with a conduit connector (no plastic bushing needed). As much as possible, the conduits should be terminated near the corners of the IDF to facilitate cable routing. Conduits that penetrate the IDF between 7’- 4” and 8’- 6” may be terminated horizontally on the wall. Conduits that penetrate above 8’- 6” should be turned down vertically and terminated above 7’- 4”. Conduits that penetrate below 7’-4” should be turned up vertically and terminated above 7’-4”.

Occasionally, with IDFs equipped with a wireway system, it is impractical to route a particular 1” conduit to the wireway. These can be routed directly to the IDF per the above guidelines. The number of these at a particular IDF should be kept to a minimum.

- Wall telephone outlets/special use lines conduits. Wall telephone outlets are to be installed flush mounted when wall construction allows. They are to be similar to flush mounted UWS outlets except that ¾” conduit and a single-gang outlet box is used instead. Wall telephone outlets which are surface mounted should use Wiremold V500 series boxes and wireway to reach the ceiling area where they are then transitioned to ¾” conduit.

2.04 Support structures.

- Overview. The structures installed to support the pathway systems must be adequate to support the weight of the pathway components, the weight of the cables, and the force exerted on the pathway system during cable pulling operations. The support system must be adequately anchored into the surrounding building structure. A variety of support structure components may be used as dictated by site specific conditions. However, all components shall be supported per NEC codes or per these guidelines, whichever is stricter.

- Methods. The most common methods of supporting wireway are:

  1. Trapeze. These structures consist of 1 ½” steel channel installed below and fastened to the wireway and supported with two 3/8” threaded rods run vertically from the channel to the deck or support beams above. One threaded rod is run on each side of the wireway.
  2. Wall brackets. These are “L” brackets fastened to the bottom of the wireway and to an adjacent wall.
  3. Others methods. Site conditions may require other, more sophisticated support structures to be implemented.

Outlet conduits are usually fastened to nearby walls or decks with one-hole straps. Surface mounted conduit hangers “mineralac straps” will not be used where visible. Conduit hangers with threaded rod used for overhead support may be used.

Riser pathway conduits that are run horizontally will be supported with the same trapeze type structure described above. Riser conduits run vertically will be fastened to 1 ½” channel which, in turn, will be fastened to an adjacent wall.

- Requirements. Wireways and riser conduits shall be supported at intervals not exceeding 5’. Wireways will be supported within 18” of 90 degree turns. Each 10’ straight section of wireway shall be support at least twice.

Each outlet conduit shall be supported within 3’ from where it connects to a wireway, junction box, or outlet box. The conduit shall be supported at intervals not exceeding 5’ in the remainder of its run. Multiple conduits may be supported by a trapeze.

No conduit or wireway shall lie directly on top of an acoustic tile ceiling grid or be supported by the grid or the grid supports. No conduit or wireway shall be supported by the same system used to support any other conduits, piping, ceiling structures, ductwork, or other building system or
equipment. No non-telecommunications system components should ever be supported by the telecommunications pathway support system.

Pathway systems that are larger than those typically found originating from an IDF or BDF should be supported by a system designed by or approved by a licensed structural engineer.

- **Anchoring.** Suitable anchoring methods must be utilized to fasten pathway support components to the building’s structure. These must be matched to the various structural and architectural elements found in campus buildings. Careful research may be required by the designer to determine the existing conditions of university buildings. Since these buildings were constructed over a 100+ year timeframe, existing structures vary widely in type of construction and in quality (due to deterioration). Following are some general guidelines regarding anchor installation:

1. Masonry walls, decks, and beams. Masonry structures provide perhaps the ideal system for anchor installation. This system involves installing appropriate metal anchors into solid concrete decks or beams or into masonry walls. These anchors may be installed by drilling or by use of powder actuated tools.
2. Steel beams and trusses. Threaded rods installed vertically up to beam clamps that are fastened to overhead steel structural elements is an acceptable anchoring practice.
3. Stud walls. Normally, wireways and riser conduits are not supported from gypboard/plaster and stud construction walls. However, if no overhead support is possible, “L” brackets may be fastened securely to the wall studs. Brackets should not be fastened to the wall surface material only.
4. Hard ceilings. Ceilings that are not suspended acoustic tile (gypboard, tongue and groove tile, spline type, etc.) shall not be used to support wireways or riser conduits. Threaded rods may pass through ceilings of this type to reach structural elements above. If these ceilings form part of a fire rated barrier, they must be completely restored to maintain the originally designed rating.
5. Outlet conduits. 1” conduits run between wireways and outlet boxes may be fastened to a variety of surfaces using one-hole straps and anchors. The anchors must be suitable for the material to which they are fastened. These straps may be fastened to concrete decks and beams, masonry walls, or surfaces of gypboard/plaster ceilings and walls. They also may be fastened to steel beams and trusses using beam clamps and threaded rod. They may not be attached to ceiling tiles or grids of any type, including acoustic tile, tongue and groove, spline type, etc.).
6. Toggle bolts. In general, toggle bolts should not be used for support of any pathway component larger than a 1” conduit.

2.05 **Firestopping.**

All locations where wireways or conduits penetrate rated walls or floors shall be firestopped per the applicable UL assembly. The designer shall be responsible for inclusion of the proper assemblies in the design drawings. However, a table of typical assemblies used on communications infrastructure projects at NC State is available as a resource at on Comtech website for view or download.

2.06 **Installation checklist.**

The standard checklist below has been developed to govern the installation of the various pathway system components commonly installed at NC State. Some of the items are described above in greater detail. These items should be included in the designer’s inspection prior to the final acceptance of the system. This list is to be used as a guide only. It is not intended as a substitute for the drawings, specifications, applicable codes, or good work practices.

- **Surface outlets.**
  - **Is the outlet box level?**
- Is the outlet box painted to match wall (if required)?
- Are proper conduit offsets (box kick) installed?
- Is the conduit painted to match surrounding surface?
- Is the conduit strapped within 3’ of outlet box?
- Is the conduit strapped or supported every 5’?
- Are junction boxes located between every 180 degrees of conduit bends?
- Are all junction box covers screwed shut?
- Is a pull string installed with minimum 12” at each end?
- Are penetrations of rated walls firestopped properly?
  - Is the firestopping installed on both sides of the wall?
  - Does it meet the appropriate UL assembly requirements?
  - Is the annular space around the conduit within UL limits?
- Are visible penetrations of all walls patched and painted properly?
- Is the conduit connected to the top or back of wireway (unless approved otherwise)?
- If conduit connects to the wireway cover, is the cover cut, deburred, and screwed shut?
- Are plastic bushings installed on conduits larger than 1”?

### Flush outlets.
- Is the outlet level?
- Is the outlet flush with the gypboard surface?
  - Are the box ears or plaster ring adjusted to recess box into wall?
  - Are the center (device screw hole) tabs cut into gypboard?
- Is the outlet secure, with jiffy clips tight?
- Is the locknut secure?
- Are all junction box covers screwed shut?
- Is a pull string installed with minimum 12” at each end?
- Is the flex penetration hole patched?
- Is the flex securely strapped as it exits the hollow wall?
- Is the flex to EMT connection installed properly?
- Is the conduit strapped or supported every 5’?
- Are junction boxes located between every 180 degrees of conduit bends?
- Are penetrations of rated walls firestopped properly?
  - Is the firestopping installed on both sides of the wall?
  - Does it meet the appropriate UL assembly requirements?
  - Is the annular space around the conduit within UL limits?
- Are visible penetrations of all walls patched and painted properly?
- Is the conduit connected to the top or back of wireway (unless approved otherwise)?
- If conduit connects to the wireway cover, is the cover cut, deburred, and screwed shut?
- Are plastic bushings installed on conduits larger than 1”?

### Wireway.
- Are all couplings attached with screw heads facing inside of wireway?
- Are all cuts deburred?
- At nonrated wall penetrations, are covers cut and deburred 6” from wall and are the covers screwed shut through the penetrations?
- Are all screws installed with the screw head inside the wireway?
- Are penetrations of rated walls and floors firestopped properly?
  - Is the firestopping installed on both sides of the wall/floor?
  - Does it meet the appropriate UL assembly requirements?
  - Is the annular space surrounding the wireway sleeve within UL limits?
- Have all metal filings from cuts or conduit installation been removed?
- Are all covers screwed shut (without excessive torque) with all screw holes used? (no power drills or screw drivers)
- Is visible wireway primed and painted to match surrounding area?
- Are wireway penetrations into IDFs turned down with a single 45 degree elbow?
- If wireway is not turned down, has plastic channel been installed on all edges?
- **Riser conduits.**
  - Are conduits properly fastened to trapeze channel?
  - Are wireway section pull points installed between every 180 degrees of conduit bends?
  - Are penetrations of rated walls firestopped properly?
    - Is the firestopping installed on both sides of the wall?
    - Does it meet the appropriate UL assembly requirements?
    - Is the annular space around the conduit within UL limits?
  - Are visible penetrations of all walls patched and painted properly?
  - Are grounding bushings installed on all conduit ends in BDF/IDFs?
  - Are plastic bushings installed on conduits larger than 1”?
  - Are pull strings installed with minimum 12” at each end?
  - Are vertical runs secured properly to walls?

- **Trapeze supports.**
  - Are threaded rods properly secured to anchors?
  - Are anchors properly installed and secured to the building structure?
  - Are the trapeze channels level (horizontal)?
  - Are threaded rods cut flush with bottom of channel and deburred?
  - Are supports installed every 5”?
  - Are wireways connected to channels securely and with bolt heads inside of wireway?
  - Are nuts and washers installed both above and below the channel?
  - Are covers accessible, and able to be removed and reinstalled?
  - Are conduit channel straps secured?

- **Wall bracket supports.**
  - Are “L” brackets properly secured to walls?
  - Are wireways securely connected to brackets?
  - Is proper (3” min.) clearance maintained between wireways and wall?
  - Are visible brackets painted to match surrounding area?

*End of Section*