

27 05 36 Raceways for Communication Systems
(Revision date: 10/12/11)

1.0 Purpose

- A. These guidelines provide requirements for designers to incorporate into bid documents. They are part of the University Wiring Standard (UWS), version 3.0.

2.0 General Requirements

- A. Pathway systems. A horizontal pathway system will be installed in campus buildings to route and protect all telecommunications cabling from the BDF/IDF to the outlets in all work space locations. A network of wireways installed throughout the interior of campus buildings is part of this system. A separate riser pathway system will be installed to route and protect all telecommunications cabling to link the BDF to all IDFs.

3.0 Materials and Standards

- A. Materials. The materials used for this system are generally NOT manufacturer and part number specific. Equivalent, high quality materials may be utilized without submittals to NCSU ComTech. However, the university reserves the right to reject materials that are considered of substandard quality. See Section 27 06 00 Schedules for Communications Systems for a list of materials acceptable for use in NC State University projects.
- B. Construction details. Detail drawings describing various raceway components are available for download and modification by designers at the NCSU ComTech website.
- C. 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 North Carolina State Construction Office requirements. All work shall also be in accordance with the latest versions of the BICSI TDMM manual and TIA-569 standard, and with manufacturer's recommendations.
- D. Fire safety considerations. The installation of raceways and conduits shall comply with all applicable fire safety and electrical codes. In general, the North Carolina State Construction Office determines the compliance of these systems with codes, and they reserve the right to inspect and approve/disapprove their installation. The horizontal pathway system shall be a completely enclosed, metallic system from the BDF/IDF to the outlet. The riser pathway system shall be a completely enclosed metallic conduit system between the BDF and all IDFs. Both will be used to house non-plenum rated cables. All conduit penetrations of rated walls and floors shall be firestopped per applicable UL assembly.
- E. Horizontal pathway sizes. Typically the horizontal pathway system will consist of a network of wireways installed in the ceiling areas of the building with 1" conduits run to each work space outlet. See Section 27 05 33 Conduits and Outlet Boxes for Communication Systems. The designer should determine the cross-sectional area required for each separate section of wireway, and specify sizes 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. 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 20% above initial installation for anticipated growth.

- F. Riser pathway sizes. The riser pathway system connecting IDFs to the BDF will typically consist of a series of 4" conduits. For a building with a BDF and a "stack" of three IDFs or less, two 4" conduits are adequate. For larger installations additional conduits will be required. Cabinet type IDFs will require a single 2" conduit from the BDF.
- G. Horizontal system topology. 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.
- H. Riser system topology. The riser pathway system will usually consist of a series of 4" conduits originating at the BDF and extending to all of the 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 is 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. 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 be routed through the intermediate IDF using ladder rack.
- I. Maximum horizontal pathway length. 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.
- J. 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 possible. Routing of wireways through occupied spaces is discouraged, but may be required due to utility conflicts or hard ceilings.

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

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.
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.

- 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.
 - 7. Confined spaces. Wireways should not be routed in spaces that are designated as confined spaces requiring special permitting or safety precautions for entry.
 - 8. EMI sources. Wireways and conduits should be located away from extraordinary sources of electromagnetic interference (EMI).
- K. 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. 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. 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. 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.

- L. 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 are to be used.
- M. Conduit requirements. A maximum of 180 degrees between pull points should be maintained in all conduit runs. For 4" riser 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. Junction boxes should not be installed in lieu of conduit bends without the approval of ComTech.
- N. IDF penetrations. Wireways should penetrate directly into IDFs horizontally (without transitioning to conduit) at 8'- 0" AFF minimum. The ideal penetration height for wireways is 9'- 0" 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. 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 directly into the IDF 4" AFF (without transitioning to conduit). Wireways serving floors above

should penetrate the ceiling of the IDF and terminate vertically at 9'- 0" AFF. Plastic channel should be installed on all non-factory (cut) edges.

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 10'- 0" AFF.

- O. Cabinet connections. For cabinet type IDFs, all conduits should be connected directly to the junction box (shared with horizontal cables) mounted above the cabinet.
- P. 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.
 - 1. Wireway. The most common methods of supporting wireway are:
 - a. 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.
 - b. Wall brackets. These are "L" brackets fastened to the bottom of the wireway and to an adjacent wall.
 - 2. Riser conduits. 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.
 - 3. 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 supported at least twice. 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 (wire). No conduit or wireway shall be supported by the same system used to support any other conduits, piping, ductwork, or other building system or equipment. In addition, no non-communications system components should ever be supported by the communications pathway support system.
 - 4. Anchoring. Suitable anchoring methods must be utilized to fasten pathway support components to the building's structure. Following are some general guidelines regarding anchor installation:
 - a. Masonry walls, decks, and beams. This system involves installing appropriate metal anchors into solid concrete decks or beams or into masonry walls.
 - b. Steel beams and trusses. Installing threaded rods vertically up to beam clamps that are fastened to overhead steel structural elements is an acceptable anchoring practice.
 - c. Stud walls. Normally, wireways and riser conduits are not supported from gypsum/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.
 - d. Hard ceilings. Ceilings that are not suspended acoustic tile (gypsum, 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.

- Q. Aesthetics. Generally, all visible system elements should be painted to match surrounding surfaces. Elements installed in locations not visible by building occupants do not require painting. Ideally, all elements of the horizontal and riser pathway systems will be completely hidden from view. However, if this is not possible, the designer should carefully determine routing and components used to minimize negative aesthetics impacts. Historically, 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.
- R. Perimeter wireway systems. In locations requiring a high number of outlets on a single wall, metallic perimeter wireway systems may be used. The system used most frequently on campus is the Wiremold 6000 series wireway system. This can be mounted horizontally at any height needed 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, 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. These wireways should be linked with 2" conduits (one per four outlets) to the nearest corridor wireway.
- S. Installation checklist. The standard checklist below has been developed to govern the installation of raceways and riser conduits. It is not intended as a substitute for the drawings, specifications, applicable codes, or good work practices.

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?
- Have all metal filings from cuts or conduit installation been removed?
- Are all covers screwed shut (without excessive torque) with all screw holes used?
- 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?
- Are visible penetrations of all walls patched and painted properly?
- Are grounding bushings installed on all conduit ends in BDF/IDFs?
- 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?
Are visible brackets painted to match surrounding area?

End of Section