

Best Practices for Underfloor Cable Management

Modern data centers contain large quantities of electrical and communications cables. The organization and support of these cables can significantly affect the day-to-day operation of the data center, as well as its ability to change and grow over its lifetime. Designers make many important decisions as they plan the data center. They must answer questions such as:

- What type of services will the data center provide?
- How will I power the equipment?
- How can I efficiently cool the data center and keep airflow consistent?

A cable organization plan must also be created for the enormous amount of cables that serve as the veins and arteries of the data center. The basic function of the data center requires proper equipment connections and proper pathways for both power and low voltage cables. Good cable organization ensures optimal performance and simplifies cable maintenance, reducing downtime.

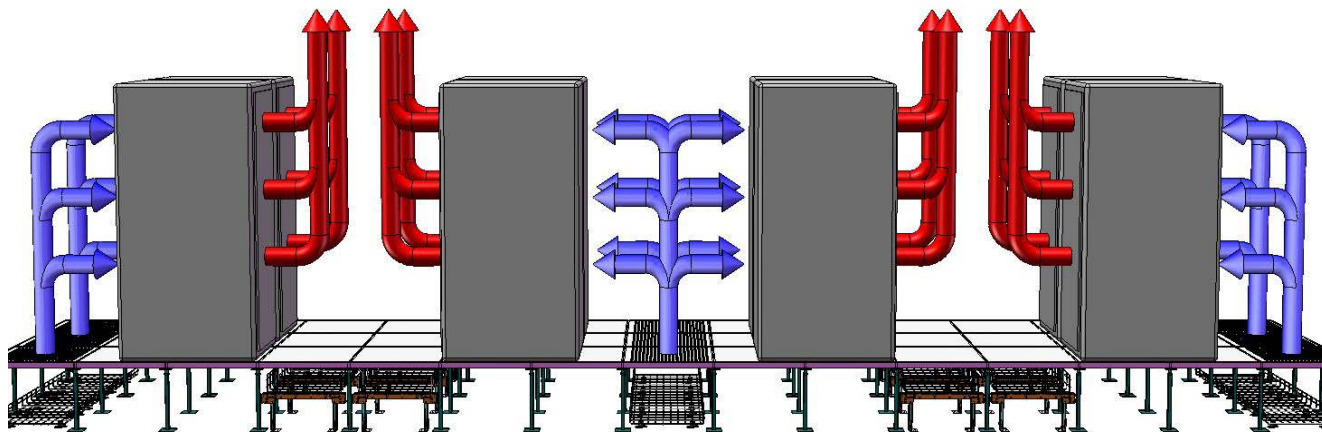
All cables should be supported in cable tray that is run overhead, above the equipment or under the raised floor. This paper addresses the routing of cable pathway beneath a raised floor.

Design of Cable Pathways

The following basic principles that should be followed when determining how and where to route the cable pathways:

- Separation of telecommunications cables from power cables to minimize signal interference
- Routing of pathways to minimize the obstruction to air flow
- Adherence to the standards of the American National Standards Institute (ANSI), Telecommunications Industry Association (TIA), and Electronic Industries Alliance (EIA)
- Use of pathways classified by Underwriters Laboratories (UL)
- Compliance with the National Electric Code (NEC)

The picture below shows a common data center layout with hot & cold aisles. The cable pathways shown indicate typical pathways for power and communications cables. Communications cables are run just below the raised floor and to the rear of the equipment cabinet, in the hot aisle. Power cables are run close to the floor in cable tray located in the cold aisle, underneath perforated floor tiles. Arranging the cables in this way provides horizontal separation by allocating different rows of tiles in the main aisles for power and telecommunications cabling, and also provides vertical separation.



Another benefit to placing communications cables just below the raised floor is easy access to these cables for maintenance. Standard ANSI/TIA/EIA 942 indicates that the top of the tray should be no greater than .75" (20mm) below the floor. Placement of the power cables close to the floor in the cold aisle allows air to flow freely through the perforated tiles above.

Choice of Cable Trays

The most common type of cable support found in data centers is wire basket cable tray. Wire basket is sturdy enough to support large cable quantities, and its open structure provides adequate cable ventilation and does not block airflow. Per the ANSI/TIA/EIA-942 standard, cable tray should have a maximum depth of 150 mm (6 in). Deeper cable trays can adversely affect manageability and administration of cables. If more than 6" (150mm) of cable depth is required, trays should be installed in multiple layers to provide additional capacity. Since many data centers do not start at full capacity, cable tray systems are frequently designed to accommodate growth. Often the initial installation is a single layer, and further layers of cable tray are installed as the data center infrastructure grows. If the initial cables will not be accessed after installation, a complete cable tray structure may be installed over the initial structure. If regular access to the initial cables is required, a cantilever system should be installed. Designers should keep in mind that the NEC requires the removal of cables not currently in use and access to the base structure may be required. See ANSI/TIA-569-B for further cable tray design considerations.



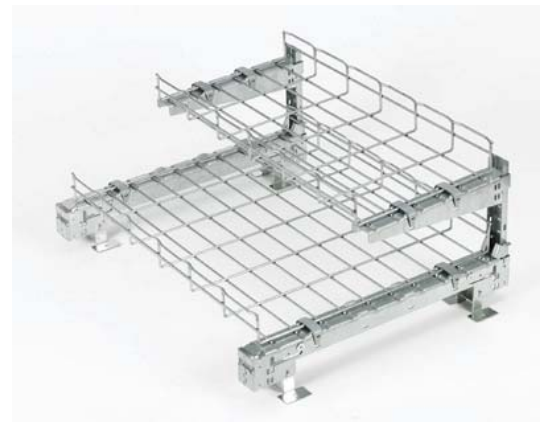
Cables installed in a raised floor.

Cable Tray Installation

In an ideal situation, the cable tray system should not affix itself to the raised floor. A support system that is independent from the floor structure eliminates unnecessary load and strain on the flooring grid. When possible, there are advantages to installing the cable tray prior to the installation of the raised floor, including reduced labor time and a shorter project construction timeline. Installers will frequently choose the length of the tray pieces installed. Congested floor subspace and raised floor stringers often require the tray to be only 2' long. However, if these obstructions are not in place, the installation of 4' or even 10' sections can reduce installation time. In addition, longer lengths require fewer supports and result in lower material costs.

Fiber and copper cabling in cable trays and other jointly used pathways should be separated to improve data center administration and operation and to minimize damage to smaller diameter fiber cables. Cable trays should be sized to accommodate various media, and dividers should be used as necessary.

The tray system should be flexible enough to be adjusted on site to avoid the many unforeseen obstructions under the raised floor such as chilled water pipe. As a rule of thumb, changes in the vertical height of the tray should be limited to a one inch change in vertical per one foot of horizontal.



Self-supporting cable management system.

Grounding

Metallic cable tray should be bonded to the data center grounding infrastructure per the requirements of ANSI/TIA/EIA 942. The most common method of grounding is to run a ground wire with the cable tray and bond it to each section of the cable tray. The wire itself must also be bonded to the raised floor ground. All ground components and bonding methods should be UL approved per ANSI/TIA/EIA-J-STD-607-A.

Post-Installation Procedures

Designing, selecting, installing, and grounding cable tray properly allows the equipment in the data center to function at its best. An important final step is to create ongoing cable management procedures to be followed and updated throughout the lifespan of the data center. Proper procedures will simplify changes, increase efficiencies and reduce downtime.