Standards

ANSI/TIA/EIA 569-A

Commercial Building Standard for Telecommunication Pathways and Spaces

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This section is not part of the original standards documentation. The purpose of this document is to provide an easy to understand, condensed version of the original document. A basic level of telecommunications is assumed. For further information on terms and definitions see our Glossary of Terms section. Whether you are renovating your existing cable plant or installing a new one, Cablingdb.com urges you to investigate a standards based solution. This document is not meant to replace the original standards developed by the various standards bodies and we urge you to purchase the original documents through www.tiaonline.com.

qd.tek
A member of Quang Dung Group

Head Office
Suite 202, The Colonnade Building, 27 Nguyen Trung Truc St.,
District 1, Hochiminh City, Vietnam
Tel: 84.8 823-1693 Fax: 84.8 823-1665

Hanoi Office
A11, 3/Fl., Horizon Hotel, 40 Cat Linh St.,
Dong Da District, Hanoi, Vietnam
Tel: 84.4 736-7055 Fax: 84.4 733-2470
Website: www.qd-tek.com.vn Email: info@qd-tek.com

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Addendums

ACCESS FLOOR

All fire-stop assemblies shall retain their integrity if penetrated by cables wires etc.

Access Floor Definition *A flooring system that consists of a raised floor, supported by a system of vertical and horizontal supports and removable tiles. The tiles allow access to the space under the flooring system for the storage and routing of cables.*

There is a variety of support equipment that may be located below the flooring such as raceway and tray for the placement of cables.

Types

Stringered

Stringers shall be fastened to the pedestal head.

definition *Access floor (raised) systems which employ a lateral bracing unit between the pedestal supports. Stringers allow frequent removal of panels by providing additional support.*

Free standing

Shall be restricted to finished floor heights of 300mm.

definition *A raised flooring system which employs pedestal supports as the only form of support. Free standing flooring systems are restricted to finished heights of no more than 150mm (6").*

Cornerlock

Shall have panels fastened to the pedestals at each corner.

Loading Performance and Testing

Loading performance parameters can be found in Annex B of the original standards document.

Panels and understructure shall be tested and meet the requirements of Ceilings and Interior Systems Construction Association (CISCA) test methods (Ref D.12)

Fire Rating

- Floor panels (not including covering) shall have a Class A flame spread rating.
- Panels shall be made of non combustible materials when cabling is not in conduit.
- Cutting of the panels shall not affect the flame spread rating.

Building Structure

Depressed Slab

definition *A construction technique where the initial floor level is lower than the finished floor. The depth of the depression is equal to the finished level of the floor.*

Normal Slab

Building codes shall be followed for both ramp and step assemblies.

Design Guidelines and Procedures for Access Flooring

Work Areas

Penetrations through the floor shall:

- Not be placed in a way so as to create hazards to the occupants.

- Take into consideration the type and number of work areas and may be located anywhere on the access floor.

Specific Design Information

Minimum Height

General office 150mm (6")

Telecommunications room 300mm (12") not less than 150mm (6")

Cable management

Shall be provided by one, or all of:

- dedicated routes
- zone distribution system
- raceway primary distribution
- cable tray

Installation

Layout

Floor layout shall be determined prior to the installation of any equipment or telecommunications cabling.

Linkage to Telecommunications Closet

Telecommunications closets and access florr area served should be located adjacent to each other and connected by threaded sleeves or conduits.

Service Fittings

The manufacturer shall be consulted to ensure compatability of the service fittings.

Grounding and Bonding Access Flooring

Consult the manufacturer's instructions. Also see Annex B.5 in the original standards documentation.

CABLE TRAYS AND WIREWAYS

Definition *The rigid support system that is used to route, support and protect both power and telecommunications cable.*

The tray usually has sides to prevent the cable from falling out. If power and data are to be run in the same tray, a separator must be used to minimize EMI on the data cable. In the past few years, a mesh tray has appeared that is easier to cut and route.

shall be installed in accordance with the applicable electrical code.

Types

Examples of cable trays and wireways are:

Channel Cable Tray A ventilated or solid bottom cable support system, usually not exceeding 150mm (6") in width.

Ladder Cable Tray A device resembling a section of ladder used to support communications and power cables. The structure comes in a variety of widths and heights, with fittings available to suite a variety of environments.

Ladder rack has almost become a generic term for a type of tray used in the communications industry because it resembles a ladder. There are various forms and names for ladder racking and a variety of manufacturers.

Solid Bottom Cable Tray A cable support system with side rails and a solid bottom used to route, support and protect cables.

Fittings such as "tees", corners and transitions are available for a variety of environments.

Ventilated or Trough Cable Tray A support structure with side rails cross members used to support, route and protect cables. The bottom portion is open to allow for air circulation. Generally this type of structure is greater than 100mm (4").

Spine Cable Tray A cabling support structure consisting of a rail or rails, from which horizontal "ribs" protrude that support the cable.

This cable tray comes in several styles depending on the amount of cables being supported. There may be one rail with ribs on one, or both sides, two rails held together with the ribs, or multiple levels of spines and ribes.

Fittings to change direction are also available.

Wireway A cable support structure with sides, bottom and a hinged top used to route, protect and support cables.

Accessories available may be covers, adapters and dividers.

Location

Trays and wireways may be located:

- above or below the ceiling
- within an access floor
- in a plenum or non plenum space

If non metallic products are located in a plenum area, they shall be plenum rated

General Horizontal Design Information

General design practices:

- assume 3 outlets per work area

- assume each work area is $10m^2$ ($100\ ft^2$)
- provide $650mm^2$ ($1in^2$) cross sectional area of the tray or wireway per $10m^2$ of usable floor space
- for increased outlet density, increase size accordingly
- there shall be no more than 50% fill ratio in tray or wireway.
- tray and wireway shall not cause cable to break bend radius rules

Support

Cable trays may be supported by:

- cantilever brackets
- trapeze
- individual rod suspension
- spacers in access floors to elevate trays above floor level

Supports shall meet load and span requirements of applicable electrical code.

Supports shall be placed on 1500 mm (5ft) centers.

Accessories

May be used to change direction of run, and include:

- elbows
- reducers
- crossovers
- tees

Installation

Cable Tray and Wireways shall:

- be free of burrs, sharp edges or other projections that may damage cable or personnel
- have abrasive supports within the tray protected with a smooth coating
- be one solid, unbroken piece when passing through a partition
- exceed fill ratios
- be properly fire-stopped when going through a fire rated partition
- have dividers between power and telecommunications cables as per applicable electrical code
- not be used as walkways
- have a minimum 300mm (12 in) of headroom above the tray

CEILING PATHWAYS

Ceiling distribution systems shall:

- not be permanently sealed, eg: drywall, plaster, locked in ceiling tiles
- use lay in type tiles
- have adequate space available
- use raceways where required by design or local code
- not permit cables to be laid on ceiling tiles or support structures
- provide a support mechanism from the telecommunications room to the serving area
- have a minimum vertical clearance of 75mm (3 in) above the ceiling tiles

Utility columns

- applicable codes shall be followed when power and communications are run in the same pole
- should be supported by main ceiling support channels, not transverse or short length channels
- when attached to main ceiling channels, the channels will be supported so as not to move vertically or horizontally

Zones

"Zoning" the serving area facilitates a structured distribution of pathways and cables.

Steps in Zoning:

1. divide the serving area in sections approximated $35m^2$ to $82m^2$, or use the space between 4 columns.

2. cable placement to each zone may be accomplished with, or without the use of raceway if permitted by code

3. conduit may be used when run from the telecommunications closet to the midpoint of the zone

4. cables then extend to utility columns and down to the work area.

Trays

When a tray is used in the ceiling area, conduits from the tray to outlets or zones shall be provided unless otherwise permitted by code.

Telecommunications Closet Termination

Trays and zone conduit shall

- protrude into a telecommunications room a minimum of 75mm (3 in) before the first bend.
- enter the telecommunications room at a minimum height of 2.4 m (8 ft)

Wall and Partition Cabling

Where partitions are used to conceal the cables, a snap-in panel or cover shall be provided, or, a hollow wall may be used to conceal the cable if an accessible space or conduit of sufficient size is provided.

Cable Supports

- shall be placed on 1220-1525mm (46-60 in) centers

- shall be designed to support the cable load
- may be attached to ceiling support rods provided the total weight of the cable does not exceed the loading rate of the rod
- may be attached to a T-Bar rail to support a cable load of 0.7 kg/m (0.45 lb/ft), and does not interfere with tile removal

CONDUIT

Types of conduit

- Electrical metallic and nonmetallic tubing
- Nonmetallic flexible conduit and nonmetallic flexible tubing
- Rigid metal conduit
- Rigid nonmetallic conduit; and
- Other types.

Conduit shall be permitted under the appropriate electrical codes.

Flexible metal conduit lengths should be less than 6m (20 ft) for each run.

Use of conduit

Conduit should be used when:

- it is required by code
- outlet locations are permanent
- device densities are low
- flexibility is not required

Design Guidelines

Minimum requirements

are found in the appropriate electrical codes

Pull Boxes and Bends

- the maximum conduit length shall be 30m (100 ft) between pull points
- a pull point shall be provided if there are more than 2 90° bends, or equivalent
- a pull box shall be installed if there is a reverse U-shaped bend
- the bend radius of a conduit shall be 6 times the internal diameter of the conduit

Sizing

		Maximum Number of Cables Allowed Based on Fill Rates								
		Cable Outside Diameter, mm(in)								
		3.3	4.6	5.6	6.1	7.4	7.9	9.4	13.5	15.8
Trade Size		(.13)	(1.8)	(.22)	(.24)	(.29)	(.31)	(.37)	(.53)	(.62)
16	1/2"	1	1	0	0	0	0	0	0	0
21	3/4"	6	5	4	3	2	2	1	0	0
27	1"	8	8	7	6	3	3	2	1	0
41	1.25"	20	18	16	15	7	6	4	2	1

53	2"	30	26	22	20	14	12	7	4	3
78	3"	70	60	50	40	20	20	17	7	6
103	4"	0	0	0	0	0	0	30	14	12
Note: This table does not represent all cable and conduit sizes. Check the original standards documentation for additional cable and conduit sizes.										

A conduit run

- shall serve no more than 3 outlet boxes
- should increase in size as it approaches the telecommunications room

Telecommunications Room Termination

Conduits protruding through the floor in a telecommunications room shall be terminated 25-75mm (1-3”) above the floor surface.

Wall-Mounted Public Telephone Locations

- minimum 21 (3/4”) trade size conduit should be provided from the telecommunications closet to serve each wall-mounted public telephone
- where it is necessary to conceal the outlet box directly behind a surface-mounted telephone, the center of the outlet box shall be placed 1220 mm (48 in) above the floor for recessed applications, the conduit and box shall be installed to suit the specific type of mounting

The Americans with Disabilities Act (ADA) should be consulted.

Hazardous Locations

If it is necessary to place conduit in a hazardous location, the applicable electrical code shall apply

Outdoor Locations

- Nonmetallic conduit shall be UV resistant and marked as such
- Do not allow moisture to collect in low spots which may freeze and damage the cable.

Installation

Conduit Termination

Conduits shall:

- be reamed to prevent sharp edges
- be terminated with an insulated bushing (metallic)

Conduit System Identification

ANSI/TIA/EIA-606 should be consulted for administration of the conduit system.

Pull Strings

Pull string or rope shall be placed in installed conduits

Outlet Boxes

maxmimum conduit trade size vs outlet box size.

Width x Height X Depth (mm)	Maximum Conduit Trade Size
50 x 75 x 64	21
100 x 100 x 57	27
120 x 120 x 64	35

Pull boxes

Pull boxes shall be used when

- Fishing the conduit run.
- Installing a pull string or cable.
- Pulling the cable to the box and then looping the cable to be pulled into the next length of conduit.

Pull boxes that are used within horizontal distribution shall comply with the pull box requirements of clause 5.2.3 in the original standards documentation.

ENTRANCE FACILITIES

Definition *The area of the building where public and private networks enter the building. The entrance facility includes the entrance wall and the entrance room/space.*

When outdoor cables enter the building, local codes must be followed in transitioning to indoor cables. The use of conduit may extend the distance outdoor cable may be brought into the building. Always check your local codes.

- shall meet seismic zone requirements

In determining entrance facility location, the designer shall:

- contact all telecommunication service providers to establish requirements
- consider location of gas, electrical and other building services
- provide an alternate entrance facility where security and continuous service are necessary
- avoid line of sight and signal interference with antennae

Service Entry Pathway

A service entry pathway shall be provided by:

- underground
- buried
- aerial
- tunnel

The designer should consider:

- type and use of building
- growth
- type and size of cables being installed, or which could be installed
- alternate entrance
- difficulty of adding future pathways

Entrance Pathway Methods

Underground planning shall include:

- land development
- grading of underground facilities for drainage
- venting of gases
- vehicular traffic to determine depth of cover and protection

Underground facilities should not be in the same vertical plane as other utilities.

Aerial

The designer should consider:

- aesthetics
- storm loading
- applicable codes

- clearances of all types
- protection
- span length
- building and pole attachments
- number of cables

Entrance Point

Definition The entrance point is a sub component of the entrance facility. While the entrance facility is the entire space that housed the incoming cables and services, the entrance point is the actual place within the entrance facility where the cables emerge from the wall, floor or end of a conduit run.

Conduit entrance consist of several 103mm (4”0) and 53mm (2”) trade size conduits. Conduits should be sized for the cables to be installed in them. Innerduct may also be used.

A minimum of three 103 (4) trades size conduits should be put at each entrance point.

The conduit shall:

- extend into undisturbed earth for a minimum of 600mm (24”) beyond the exterior foundation wall
- be reamed and bushed if terminated inside the building
- have a smooth bell shaped finish if terminated outside the building
- be securely fastened to the building
- slope downwards from the exterior of the building
- have a drainage box install if water problems are anticipated
- be plugged to prevent gas, water and animals from entering the building

A pull box shall be installed and used when:

- the building conduit is extended from the entrance conduit
- the conduit is too long
- the total quantity of bends is greater than two 90 degree bends.

See 5.2.3 and 5.2-2 of the original standard documentation.

Entrance Space

Definition

The entrance space is a sub system of the entrance facility, where the protectors are placed and terminated, and, where other network interface devices are placed.

The entrance space will be increased if other services are to be terminated, such as PBX or other terminal equipment.

The entrance space shall be sized for the services contained in the space, as per section 8 of the original standard documentation.

Pathway Sizes

he pathway between the entrance point and the entrance room shall be the same size as the entrance pathways.

Antenna Field Entrance Rooms

- shall be designed per applicable codes
- antenna pathway from the antenna field to the entrance space shall provide isolation for the antenna cables from the other backbone cables
- shall be located as close to the antenna field as possible.

Location

The entrance room shall be located:

- in a dry area not subject to flooding.
- close to the building entrance point
- next to the electrical service

Design

- If the building is larger than 2000m^2 (20,000 ft^2) should be in an enclosed room
- sizing shall meet the requirements of the protectors
- sizing shall take into account future requirements
- at least one wall shall be covered with a 20 mm (3/4") A-C plywood, void free and 2440mm (8ft) high
- the plywood should be fire retardant or covered with 2 coats of fire retardant paint
- lighting shall be a minimum of 50 lx (50 foot candles) when measured 1m (3ft) above the finished floor and mounted 2600mm (8.5 ft) above the finished floor.
- Lighting and telecommunications equipment should not be powered from the same electrical panel
- Dimmer switches should not be used and emergency exit lights should be used
- A false ceiling shall not be installed
- The doorway shall be a minimum of 910mm (36in) wide and 2000mm(80") high, and equipped with a lock
- Floors, walls and ceilings shall be treated to minimize dust
- A minimum of 2 dedicated 120V, 20 Amp, non switched, ac duplex electrical outlets on separate circuits shall be provided
- Access to the grounding system shall be provided

EQUIPMENT ROOM

Definition

The equipment room shall:

- house only equipment directly related to the telecommunications system and its environmental support systems.
- be designed for the applicable seismic zone requirements.

Design Considerations

Site Selection

Location of the equipment room should take into consideration:

- building elements such as elevators, core, fixed walls, both inside and outside
- accessibility for the delivery of equipment
- access to shared use space
- sources of vibration
- all planned equipment so the room can be sized properly

and shall:

- have access to HVAC system
- be located away from electromechanical interference such as transformers, generators, x-ray machines, radio transmitters and induction sealing devices.
- **Floor Loading**
- the minimum distributed load rating shall be 4.8 kPa(100lbf/ft^2)
- the minimum concentrated load rating of a least 8.8 kN (2000lbf)

Water Ingress

The equipment room shall:

- not be located below the water level
- not contain water or drain pipes that do not support the equipment within the room
- contain a floor drain if there is a risk of water ingress

Size

The guideline is to provide 0.07 m^2 (0.75 ft^2) of equipment room for every 10 m^2 (100 ft^2) of work space.

The equipment room shall have a minimum size of 14m^2 (150 ft^2)

If the building has multiple tenants the decision has to be made if all tenants will have their equipment in the equipment room. If so, the size will have to be increased.

Special Use Buildings (hotels, hospitals)

Equipment room floor space shall be based on the known number of work not on usable floor area.

Number of Work Areas	Area

	(m^2)	(ft^2)
Up to 100	14	150
101 - 400	37	400
401 - 800	74	800
801-1,200	111	1,00

Miscellaneous Equipment

Other equipment that is permitted in the equipment room

Environmental control equipment such as:

- power distribution
- conditioner systems
- UPS up to 100KVA (larger UPS systems should be located in a separate room)

Equipment not permitted

- equipment not related to the support of the equipment in the room
- ductwork, pneumatic tubing etc shall not enter or pass through the room

Provisioning

Layouts

Equipment rooms:

- should not have doors leading to other areas of the building
- shall have an overall height clearance minimum of 2440mm (8ft)
- shall be protected from contaminants and pollutants that could affect operation and material integrity of the installed equipment. If contaminants are present in concentrations higher than table then vapor barriers, positive room pressure or absolute filters shall be provided.
- shall be connected to the terminal space and telecommunications rooms via the backbone pathway.
- Should have noisy equipment located outside the equipment room.

Fire Suppression

The equipment room shall have

- sprinklers (if required) with cages over the heads
- drainage troughs under sprinkler pipes
- portable fire extinguishers maintained within the equipment room per applicable code.

Environmental Control

- shall be provided 24 hours per day 365 days per year by either the building system or a stand alone unit for the equipment room. If a standby power supply is available, consideration should be given to connecting the HVAC system to it

- shall provide continuous operating temperature range of 18 ºC –24 ºC (64ºF-75ºF) with 33%-55% humidity measured at 1.5 meters (5 ft) above the floor level
- positive pressure differential compared to surrounding areas should be provided
- adequate ventilation shall be provided if backup batteries are used

Interior finishes

- The floor, walls, and ceiling shall be sealed to reduce dust.
- Finishes shall be light in color
- Flooring materials shall have antistatic properties.

Lighting

Shall be:

- a minimum of 500 lx (50 foot candles), measured 1 m (3 ft) above the finished floor in middle of all aisles between cabinets.
- controlled by one or more switches (not dimmer switches) located near the entrance door(s) to the room.
- Lighting fixtures and telecommunications equipment should be on separate circuits.

Power

A separate supply circuit serving the equipment room shall be provided and terminated in its own electrical panel. Electric power provisioning for the equipment room is not specified herein because it is dependent upon the equipment load and supporting facilities.

If a standby power source is available in the building, the equipment room panel should be connected to the standby supply.

Door

Shall be:

- minimum of 910mm (36 in) wide and 2000mm (80 in) high, without doorsill
- fitted with a lock

Double doors should be installed if unusually large equipment is anticipated.

Equipment grounding

The telecommunications grounding shall be made accessible.

Main Terminal Space **definition**

The main terminal space shall:

- support two-level backbone topology
- only house facilities directly related to the telecommunications systems and its environmental control systems.
- Shall be increased in size if both the terminal and entrance facility are contained in the same area. The requirements of clauses 8.1, 8.2 and 9 of the original standards documentation must also be satisfied.

Design consideration

- shall be located as close as practicable to the vertical backbone pathways

- should be adequate to service large reels of cable
- should be controlled by the building owner in the case of multi tenant use.
- for special use buildings (hospitals, hotels, schools) the main terminal space shall be based on the known number of backbone cables to be terminated, together with any cable extending to the equipment room (not on usable floor area).
- Shall not have other building facilities not related to the MDF or cross connect terminals enter, pass through or be installed in or above it.

Water infiltration

The main terminal space shall:

- not be located below water level unless preventive measures against water infiltration are employed.
- Not have water or drain pipes above or within 1 m (3 ft) of the telecommunications main terminal
- Have a floor drain provided if there is a danger of water ingress.

Size

The main terminal space shall be sized to meet the known requirements of a specific main distribution frame or wall terminals based on

- incoming service provider cables
- interbuilding cables
- intrabuilding cables

Buildings with floor area greater than 10,000m^2 (100,000 ft^2) may require free-standing frames for cable terminations, otherwise, wall mounted terminations are acceptable.

Refer to tables 8.3.1 and 8.3-2 of the original standard for space requirements.

Provisioning

The main terminal space:

- shall have layouts verified for weight and distance requirements for all equipment
- should avoid having doors providing access to other areas of the building through the main terminal space.
- should have walls covered with rigidly fixed 20mm (3/4”) A-C plywood, preferably void free, 2440mm (8 ft) high, and capable of supporting attached connecting hardware.
- should not have suspended ceilings installed.
- shall be protected from accumulation of dust.
- shall have a minimum clear height in the space of 2440mm (8 ft) without obstructions.
- shall have sprinkler heads (if required) with wire cages installed
- shall have drainage troughs located under the sprinkler pipes
- shall have a minimum lighting intensity of 500 lx (50 foot candles}, measured 1m (3 ft) above the finished floor. (light switches should not be dimmers).

- should have an emergency exit light installed.
- shall have convenience duplex receptacles placed along the wall, spaced 1.8m (6 ft) and 150mm (6 in) above the floor.
- shall have a door with a minimum size of 910mm (36 in) wide and 2000mrn (80 in) high, without doorsill, and fitted with a lock
- have access to the telecommunications grounding system

Minimum Termination Wall Length				Minimum Floor Area			
Gross Floor Space Served		Wall Length		Gross Floor Space Served		Floor Area	
m^2	ft^2	mm	in	m^2	ft^2	mm	ft
1000	10,000	990	39	10000	100000	3660 x 1930	12 x 6.5
2000	20,000	1060	42	20000	200000	3660 x 2750	12 x 9
4000	40,000	1725	68	40000	400000	3660 x 3970	12 x 13
5000	50,000	2295	90	50000	500000	3660 x 4775	12 x 15.5
6000	60,000	2400	96	60000	600000	3660 x 5600	12 x 18.5
8000	80,000	3015	120	80000	800000	3660 x 6810	12 x 22.5
10,000	100,000	3630	144	100000	1000000	3660 x 8440	12 x 27.5

Backbone pathways

Backbone pathways shall:

- be connected to the main terminal space
- be the same size be the same size between the entrance space and main terminal space as the entrance pathway.
- have the quantity and/or sizes of conduits between the terminal space, telecommunications rooms and equipment rooms based on possible future requirements

INTRABUILDING PATHWAYS AND RELATED SPACES

Intrabuilding Pathways Definition

Interbuilding Pathways Definition

- bonding and grounding shall meet applicable electrical codes and standards and also ANSI/TIA/EIA-607.
- pathway specifications shall accommodate the applicable seismic zone requirements

Precautions should be taken to ensure that water will not penetrate the pathway system. See ANSI/NFPA-70 Article 100 for definitions.

Design Guidelines

The backbone pathway shall:

- be connected to the equipment room
- have conduits and trays(when applicable) that protrude into the closet from 25-75mm (1-3 in), without a bend, and above the 2.4m (8 ft) level.
- Not be routed through gaps between the floor or ceiling structure and a curtain wall.
- Not be located in elevator shafts
- Follow applicable rules for environmental air plenums

Pathway Design Guidelines

Pathways shall:

- *Be designed to handle all telecommunications media recognized by ANSI/TIA/EIA 568-A*
- *Be sized for current and future requirements*
- *Have additional conduits, sleeves, trays and slot installed if a large number of cables are planned for.*

Sleeves

Quantities:

There shall be one sleeve or conduit (Trade Size 4) for every 5000m^2 of usable floor space, plus 2 spares for a total of 3 sleeves or conduits. The sleeve shall extend 25-75mm above the floor.

If a slot is used it shall have a 25mm (1") curb around it.

Conduits

- Shall comply with 4.4 of the original standards documentation
- Backbone conduit fill should be based on the specifications identified in table 5.2-1 of the original standards documentation

Innerduct definition

- may be for installation of cable to facilitate subsequent placement of additional cable in a single pathway.

Cable Trays & Wireways:

When used as intrabuilding backbone pathways, their design and installation shall comply with the clause 4.5 of the original standards documentation.

The integrity of all fire-stop assemblies shall be maintained when penetrated by cable, wires, and pathways

Design Guidelines for Pull and Splice Boxes

Purpose

Pull boxes are used for

- Fishing the conduit run
- Installing a pull string or cable
- Acting as an egress point from the conduit where the cable is looped (sometimes called figure 8'ing), and then pulled into the next conduit run
- Pull boxes shall not be used for splicing cable
- Splice boxes are intended to be used for splicing in addition to pulling cable

Pull/Splice boxes shall

- be readily accessible
- not be placed in a fixed false ceiling space unless it is above a marked access panel
- be placed in a conduit run where:
    - the length is over 30m (100 ft)
    - there are more than two 90^{o} bends, or equivalent
    - there is a reverse (U-shaped) bend in the run.
- not be used to change direction of the conduit
- conduit fittings shall not be used in place of pull or splice boxes
- pull and splice boxes shall be labeled per ANSI/TIA/EIA-606.

Sizing

An outlet may be used as a pull box if the conduit is less than trade size 35 (1.25")

For Conduit Greater than 35 (1.25") Trade Size

For straight pull through, have a length of at least 8 times the trade-size diameter of the largest conduit.

Angle and U Pulls

Shall have:

- a distance between each conduit entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest conduit, and add to that the sum of the trade-size diameters of the other conduits on the same wall of the box.
- a distance between the nearest edges of each conduit entry enclosing the same conductor of at least
    - six times the trade-size diameter of the conduit; or
    - six times the trade-size diameter of the larger conduit if they are different sizes

For a conduit entering the wall of a pull box opposite to a removable cover, the distance from the wall to the cover shall not be less than the trade-size diameter of the largest conduit plus 6 times the diameter of the largest conduit.

Splice Boxes

Splice boxes used with conduit, shall be sized per table 5.2-3 of the original standards documents.

MISCELLANEOUS ITEMS

- All fire-stopping shall comply with applicable codes
- A 21 (3/4 in) trade size conduit shall be provided from the telecommunications room to a suitable device box for elevator telecommunications

Horizontal Pathway Separation from EMI Sources

Article 800-52 of ANSI/NFPA 70 shall apply for separation

- From power cables
- And barriers within raceways
- Within outlet boxes or compartments

Other Related Requirements

- The building shall be protected from lightning (see ANSI/NFPA 780, ref D.4)
- Surge protection shall be provided at the electrical service entrance
- ANSI/TIA/EIA 607 shall be followed
- Faulty wiring shall be corrected

Reducing Noise Coupling

The following additional precautions should be considered when locating close to large sources of potential noise

- Increase physical separation
- Branch circuit (line, neutral and grounding) conductors should be kept close together; ie: in their original sheath
- Use of surge protectors
- Use of fully enclosed, grounded, metallic raceway.

PERIMETER PATHWAYS

Definition

NOTE: See ANSI/TIA/EIA 569 A-1 (addendum 1) for revised information

Perimeter pathways shall comply with 10.3 of the original standards documentation which refers to EMI and power separation.

Types

Surface Raceway **definition**

Recessed Raceway **definition**

Molding Raceway **definition**

Multichannel Raceway **definition**

- dividers shall be bonded to ground

Design Guidelines and Procedures

Pathway Sizing

- practical fill capacity for perimeter raceway is 20%-40%
- fill capacity shall be the calculation of the cross sectional area of all cables in the raceway divided by the percent of fill

Physical Limitations

- metal and non metal shall be limited to use in dry locations

Miscellaneous

Undercarpet

Transition Points **definition**

- shall not be mounted in walls that could be moved

Design Guidelines

- conduit from the telecommunications closet serving the transition box shall be sized per table 4.4-2 of the original standards documentation.

Transition Boxes

Transition Boxes shall:

- be sized per table 4.8-1 of the original standards documentation
- have the bottom of the cover of the transition box immediately above the top of the baseboard molding
- have the bottom of the box placed within the wall cavity with the bottom of the box being open to the level of the floor.
- serve a usable floor area no larger than 80 m^2 (800 ft^2), based on the assumption of one work area per 10m^2 (100 ft^2).
- be located so as to minimize the crossover of electrical and telecommunications undercarpet cable. If they must be crossed, the telecommunications cable shall pass over the power cable

The wall shall have (from the floor level) a 25mm (2 in) high by the width-of-the-box cutout extending from the exterior wall finish to the interior cavity.

Consolidation Points **definition**

Consolidation points shall:

- be located in fully accessible, permanent locations.
- not be located in any obstructed area.
- not be installed in furniture systems unless that unit of furniture is permanently secured to the building structure.
- conform to applicable codes if used in plenum spaces used for environmental air
- follow administration procedures as per ANSI/TIA/EIA 606.
- serve a usable floor area no larger than the telecommunications zone as per section 4.6.2.4 of the original standards documentation

Suspended ceiling space or access floor space may be used for consolidation points, provided that the space is accessible without moving building fixtures, equipment, or heavy furniture and without disturbing building occupants.

Multi-user Telecommunications Outlet Assemblies definition

MUTOAs shall:

- be located in fully accessible permanent locations such as building columns walls or furniture.
- not be located in ceiling spaces, under access flooring, or any obstructed area
- not be installed in furniture systems unless that unit of furniture is permanently secured to the building structure
- be mounted in such a way that it does not obstruct the intended pathway cabling capacity
- be administered in the same manner as telecommunications cabling, hardware, pathways and spaces as described in ANSI/TIA/EIA-606.

Design Guidelines

See Design Guidelines for Consolidation Points

Interstud definition

Bushings shall be installed over sharp edges or objects.

Overfloor raceway, exposed cabling, and poke through systems are not covered by this Standard.

Note: Poke through devices are now covered by ANSI/TIA/EIA 569 A-4 (Addendum 4)

Pathways shall not be routed through gaps between the floor or ceiling structure and the curtain wall.

TELECOMMUNICATIONS ROOM

The Telecommunications Room:

- is the cross connect location for the horizontal and backbone cabling
- shall be able to contain telecommunications equipment, terminations and related wiring
- shall be located as close as possible to the center of the area served
- shall be the termination point for horizontal pathways for the area being served
- shall be seismic rated where applicable

Design

The telecommunications room:

- shall be dedicated to telecommunications related functions and should not be shared with electrical facilities
- shall not have duct work not associated to the telecommunications system pass through or enter the telecommunications room
- shall be interconnected with another telecommunications room on the same floor by a conduit (trade size 3), or equal.

Size and Spacing

There shall be one telecommunications room per floor except when:

- the floor area served is greater than 1000m^2
- the horizontal distance is greater than 90m

Add one Telecommunications Room for every of 1000m^2 floor area.

Floor Loading

Telecommunications rooms shall be located on floor areas designed with a minimum floor loading of 2.4 kPa (50 Ibf/ft^2)

Provisioning

Telecommunications Rooms shall:

- have a minimum of two walls should be covered with 20mm (3/4 in) plywood, preferably void free, 2440mm (8 ft) high, capable of supporting attached equipment. Plywood should be either fire-rated or covered with two coats of fire retardant paint
- have lighting that is minimum of 500 Ix (50 foot candles) measured 1 m (3 ft) above the finished floor, mounted 2600 mm (8.5 ft) minimum above finished floor and should not be powered by the same circuit as the telecommunications equipment. Dimmer switches shall not be used
- not have a false ceiling
- have a door which is 910mm (36”) wide and 2000mm (80”) high without a door sill. It shall open outward, side to side or be removable and lockable.
- have floors and ceilings treated to eliminate dust
- have 2 dedicated 120V, 20 AMP, non switched, ac duplex outlets located at 6ft intervals around the perimeter wall at a height of 150 mm (6”) above the floor
- have access to the telecommunications grounding system

- should have pulling sleeves and slots located next to the doorway (see 5.2.2.2 of the original standards documentation)
- have fire protection equipment as per local codes
- have sprinkler heads with wire cages
- have HVAC in its design to maintain a temperature equal to that of the adjacent offices.

UNDERFLOOR PATHWAYS

definition

General

- Pull boxes are part of pathways.
- All pathway designs shall be designed to meet ANSI/TIA/EIA 607, Grounding and Bonding. They shall also be designed to handle all approved cables in ANSI/TIA/EIA 568B.
- Horizontal pathways shall not be located in elevator shafts, and shall be located in dry areas to protect from moisture.

Underfloor Pathways

Underfloor Duct Systems **definition**

Flush Duct Systems **definition**

Multichannel Raceway **definition**

Floor Structure

The depth and type of pour affect the duct system that can be used.

- *Monolithic Pour* Install the duct system in the midpoint of the slab
- *Slab on Grade* Maintain the level of the UDS
- *Double Pour* Install the UDS on the structural slab and bury it with the second pour.
- *Post Tensioned* Preset inserts shall be used

When using prefab concrete members, the UDS is buried in the concrete topping.

Design

The standard assumes 3 devices per work area, and one work area per 10 m^2 (100 ft^2). The design criteria is to provide 650mm^2 (1in^2) of cross sectional underfloor duct per 10m^2 of useable floor space.

Duct Spacing

1520 -1825 mm (5-6 ft) separation at mid point

450 - 600 mm (18-24”) at perimeter walls

The above ducts are run parallel to each other.

Header ducts should be spaced 18m (60 ft), and enclosed header ducts shall connect the system to the telecommunications room.

Duct Types

Distribution Ducts **definition**

Header Ducts **definition**

Telecommunication header ducts shall terminate in the telecommunications room with a slot or elbow.

Trench Duct

- shall have removable cover plates through its entire length
- shall have access from the trench duct to distribution duct via the bottom or side of trenchduct
- shall have cover plates with a means for levelling to the intended finished floor surface and shall have a gasket to prevent moisture ingress.
- shall be installed when an enclosed header duct approaches the telecommunications room from a directions requiring horizontal bends into the closet.
- shall extend out far enough to allow access to enclosed header ducts

Handhole Access Unit **definition**

Access units shall

- be partitioned to allow separation of systems in a multiduct layout
- have cover plates with gaskets to prevent moisture ingress
- have a means of levelling it to surrounding floor level

Layout

After determining the quantity and distribution of all types of ducts, the allocation of enclosed header to distribution ducts shall be determined as follows:

1. Note the number of enclosed header ducts required to serve that floor area.

2. Note note the number of distribution ducts to be served.

3. Divide both quantities by their highest common factor so that the ratio of enclosed header ducts to distribution ducts are either: 1 to 1, 1 to 2 , 1 to 3, etc., or 2 to 3, and as a last resort, 3 to 4.

4. If the ratio does not meet the above, deduct 1,2 or 3 from the number of distribution ducts derived in step 2, then repeat step 3. In this case, the ducts deducted shall be treated as a separate unit to be served by additional enclosed header(s).

eg: Step 1 header ducts = 8

Step 2 distribution ducts = 24

Step 3 divide by highest factor (8) = 1/3

Where the number of enclosed headers in step 1 is greater than the distribution ducts in step 2

1. provide one or two enclosed headers to serve each distribution duct; and,

2. allocate the remainder required as in step 3,4 and 5.

Installation (underfloor duct)

Single and/or Two Level

Duct runs with preset inserts:

- shall be leveled so that the top of the insert is 3 mm (0.125 in) below-the finished pour
- marker screws identifying the duct runs shall be placed at each duct end, on either side of permanent partitions, and in the first insert adjacent to access units,

Trenchduct Header

- sections shall be coupled together and leveled making the top surface flush with the concrete pour
- openings from the base of the trench to the appropriate distribution duct shall be cut, and grommets shall be installed
- all openings and joints on the top cover plate shall be sealed with tape prior to concrete pour
- after the concrete pour, the trench top rail shall be leveled to the concrete finish.
- adjustable partitions shall be raised to the underside of the cover plate and tack welded in place to add support to the cover and assure complete separation of the systems. Tack welds shall be painted to prevent rusting.
- floor finish trim shall be installed

Inserts (underfloor duct)

Preset **definition**

Afterset **definition**

Capping **definition**

Service Fittings (underfloor duct)

General

f electrical power is one of the services in a combined fitting, the fitting shall be fully partitioned.

Dedicated in-Floor **definition**

Cellular Floor **definition**

Types (cellular floor)

Steel

Are available

- in 2 or 3 cell configurations
- in 38, 50 or 75 mm (1.5, 2 or 3”) depths
- in various cellular configurations

Concrete

Available

- in 2 or 3 cell configurations
- in 100, 150 and 200 mm (4, 6, or 8”) depths
- in circular or elliptical

Design Guidelines and Procedures (cellular floor)

General Design Information

Where the work area density is not known, the general practice is to assume 3 outlets per work area, and each work area is assumed to be 10m^2 (100 ft^2). The designer shall allow 650mm^2 (1^2 inch) of cross sectional cellular floor per 10m^2 (100 ft^2). If the density will be greater, then the design will have to be modified accordingly.

Service to Work Areas

- shall be on 4'-5' centers
- shall use a 50% blend of cellular and non cellular sections for flexibility

Distribution Cells (cellular floor)

General **definition**

Preset Inserts

- can be single or multiservice type preset inserts
- center-to-center spacing shall be a minimum of 600mm (24 in) along the length of the cell.

Blank Cell **definition**

Access to blank cells shall be provided by core drilling through the concrete and cutting through the top surface of the cell.

Header Duct (cellular floor)

General **definition**

- enclosed headers shall be provided separate ducts for electrical power and telecommunications services, or as a single trenchduct equipped with a barrier for each service.
- Access units shall be spaced to fall directly-above the selected cells.
- Jack-header ducts shall be provided to maintain coverage of floor areas that would otherwise be isolated, e.g., by stairwells or columns.

Flushduct

Flushduct shall have:

- a two piece flush header duct installed when used in concrete flooring system
- a bottom section that has pre punched holes to align with the channels directly below it
- a grommet inserted into a core drilled hole through the concrete
- a top section of a "top hat" design that comes with a means to level the section flush with the top of the floor
- access units located over the opening of each of the cells
- each service in a separate header duct

Buried Duct

Buried duct shall have:

- an enclosed header duct in steel cellular floor systems
- header ducts that are pre punched on the bottom with grommets installed
- header ducts with adjustable access units on top

- services types in separate header ducts

Trenchduct

Shall have:

- removable cover plates through the entire length
- access to the distribution cells through the holes in the bottom of the trench
- separate vertical dividers for different services
- a means of leveling the cover plates with the floor finish
- void closures installed if the trenchduct is bottomless

Underslab duct

Shall:

- Be rectangular with a hinged lid
- Be attached to the underside of cellular units
- Provide access via holes from the duct to the cell
- Have cable hangers to support the cabling
- Have fire-stop installed in all openings through fire rated partitions

Access or Handhole Units (cellular floor) **definition**

Shall prevent water ingress by way of a gasket on the cover plate

Layout (cellular floor)

Distribution Cells

- Should run the entire length of the building
- Shall have telecommunications routed in the largest cell, and electrical in the smallest cell (when multiple cells are used)

Enclosed Header Duct

Consider adding more header ducts when the length of distribution cells is greater than 18m (60 ft)

After determining the quantity and distribution of all types of cells, the allocation of enclosed header to distribution ducts shall be determined as follows:

1) Note the number of enclosed header ducts required to serve that floor area.

2) Note note the number of distribution ducts to be served.

3) Divide both quantities by their highest common factor so that the ratio of enclosed header ducts to distribution ducts are either: 1 to 1,1 to 2 , 1 to 3, etc., or 2 to 3, and as a last resort, 3 to 4.

4) If the ratio does not meet the above, deduct 1,2 or 3 from the number of distribution ducts derived in step 2, then repeat step 3. In this case, the ducts deducted shall be treated as a separate unit to be served by additional enclosed header(s).

eg: Step 1 header ducts = 8

Step 2 distribution cells = 24

Step 3 divide by highest factor (8) = 1/3

5) You may have to round up the number of enclosed headers in step one.

6) If the number of enclosed header ducts and distribution cells are nearly equal, it is usually more economical to increase the quantity of enclosed header ducts by 1,2 or 3 so that they are equal.

7) If step 1 is greater than step 2

a) provide one or two enclosed headers to serve each distribution cell; and,

b) allocate the remainder required as in step 3,4 and 5.

Installation (cellular floor)

Two Level - (cellular steel)

Shall have:

- header ducts installed on top of floor cells
- ducts secured by hold down straps
- marker assemblies installed
- access via a fitted grommet between the header duct and cell after the concrete is set

Trenchduct Header

Shall:

- be level with the top of the finished concrete
- have openings cut and fitted with a grommet
- have all openings sealed with tape prior to the concrete pour
- have a final leveling after the final pour
- have tack welds painted

Flushduct - (cellular concrete)

Shall:

- have be installed on top of the floor cells with pre-punched holes over the cells to be activated
- have holes fitted with a grommet
- be fastened to the cellular unit with concrete screws
- have knock out and access plates installed as required

Underslab Duct

Shall:

- have the top portion of the duct attached to the underside of the floor cells
- have the pre-punched holes fitted with a grommet
- have pre-punched holes centered under cells to be activated
- be fastened with concrete screws
- use cable hangers for support when the covers are open
- have all openings through fire rated partitions fire-stopped

Telecommunications Closet Termination

Inserts (cellular floor)

Preset insert definition

Afterset insert definition

Multiservice insert definition

Service Fittings (cellular floor)

Above Floor

Shall be fully partitioned if electrical service is present in the fitting

Dedicated in-Floor definition

Floor Boxes definition

Shall be fully partitioned if electrical service is present in the fitting

WORK AREA

definition

Outlet Density

One outlet should be provided for each work area and where future planning is difficult such as private offices, board rooms etc, a minimum of 2 outlets should be allowed for, and, in planning the layout for these areas, maximum flexibility should be allowed for; eg: putting outlets on opposite walls.

Outlet Location

Outlets should be located near electrical outlets and at the same height and in conjunction with the furniture layout.

Furniture Pathways and Spaces

Application Planning

There should be no conflicting pathway issues between electrical and telecommunications pathways and outlets. New distribution designs should be tested to ensure minimum bend radius, pathway fill rates and outlet placement are satisfactory.

Building Interfaces

Where the building pathway transitions to the furniture pathway, the designer should consider:

- Safety
- Reliability
- Aesthetics
- Access to other covers or junction boxes

Raceways should be provided between furniture pathways and:

- Wall and column pathways
- Horizontal floor pathways
- Ceiling pathways

Application Planning

The designer and installer should be aware of the following information:

Work Area:

- number, type, and location of cable connections
- diameter and minimum bend radius of each cable type
- number of work areas in each furniture cluster.

Furniture Pathways

- strategy for connecting building pathways to furniture pathways, including number, placement, and cross sectional area of the required interfaces.
- cross sections and cable capacities

Pathway Fill Factor

A rough guide is to take the total cable cross section and calculate that number as a percentage of the total pathway cross section. The result should be somewhere between 20%-40%. This however does not take into account the reduced useable cross sectional area of any fittings, such as corners.

Furniture Pathway Capacity

Vertical pathway cross sectional areas in furniture should be equal to the horizontal pathways cross sectional area and other pathways within the furniture should have a cross sectional area of 9.5 cm^2. These measurements are based on the assumption of each work cluster serving four people, each with 3 connections.

Using fishing and pulling techniques should be avoided if possible. Using a cable lay in method will avoid tight pulls and reduced fill capacities.

Access

Furniture should be arranged to ensure easy access to telecommunications pathways.

Furniture Pathway Bend Radius

Furniture pathways must adhere to bend radius and routing. No more than two 90 degree bends are equivalents are allowed between pull points, and if a U shaped bend is present, a pull box shall be installed.

The inside radius of a bend in conduit shall be 6 times the internal diameter of the conduit. If laying cable into the pathway is used, sweeping bends are not required.

The minimum bend radius shall not be less than 25mm (1 inch), but may be larger for larger cables.

Care should be taken if using hybrid cables and the designer should contact the cable manufacturer for minimum bend radii.

Power/Telecommunications Separation

The power and telecommunications pathways shall be separated as per clause 10.3 of the original standards document and those separators shall be bonded to ground.

Furniture Spaces

Furniture designed for MUTOAs or consolidation points should provide for adequate security to prevent unwanted or malicious changes. MUTOAs and consolidation points shall only be installed on permanent building fixtures, or fixtures that are permanently secured to the building structure.

Internal Spaces

Furniture that houses MUTOAs or consolidation points shall provide space for strain relieving, terminating, and slack storage for the planned horizontal cables to service the work area.

Furniture Types

Furniture types that may support horizontal cable are:

- Cabinets
- Furniture partitions
- Utility columns

Furniture Telecommunications Outlet/Connector

The telecommunications outlet shall be located so that:

- the bend radius requirements are maintained in termination

- the location, mounting, or strain relief of the telecommunications outlet/connector should allow pathway covers and trim to be removed without disturbing the cable termination.

NOTE - The federal Americans with Disabilities **Act (ADA)** may affect mounting locations in some instances.

Furniture Telecommunications Outlet Openings

Two standard sizes of openings are specified:

- NEMA-equivalent opening. (NEMA OS 1 (Ref D.l4),WD-6 (Ref D.15)) openings. In addition, a minimum depth of 30.5 rnm (1.2 in} should be provided.
- Alternate (furniture-size) opening. These openings should have dimensions as:
    - o Length 68.8 mm (2.71”)
    - o Height 35.1 mm(1.38”)
    - o Depth to first obstruction: 30.5 mm (1.2”)

Control Center, Attendant, and Reception Areas

Because of the special nature of reception areas, independent pathways or routes should be run directly back to the telecommunications room.

ADDENDUMS

ANSI/TIA/EIA 569 A-1

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 1 Perimeter Pathways

PERIMETER PATHWAYS DEFINITION

Shall comply with clause 10.3 of the original standard, and with all other applicable codes.

Construction:

Surface raceways consist of:

- Bases
- Covers
- Fittings to change direction
- Miscellaneous fittings

Surface Raceway shall:

- Have a divider separating power and data in a multichannel dual use raceway
- Maintain proper bend radius requirements and shall not have a bend radius less than 25mm (1”).

Design and Installation

Sizing

- The maximum fill rate design shall be a maximum of 40%, but up to 60% is allowed for unplanned moves adds and changes. This fill rate is based on the cross sectional area of all the cables, divided by the most restrictive cross sectional area of the raceway.
- Fittings shall take into account bend radius when calculated useable cross sectional area
- The useable cross sectional area is also reduced by outlets and connectors.

Installation

- All metal components of a metal raceway system shall be bonded and grounded as per ANSI/TIA/EIA 607.
- Power and telecommunications cables shall be installed in separate channels.

ANSI/TIA/EIA 569 A-2

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 2 Furniture Pathways

FILL FACTOR

- The maximum fill rate design shall be a maximum of 40%, but up to 60% is allowed for unplanned moves adds and changes. This fill rate is based on the cross sectional area of all the cables, divided by the most restrictive cross sectional area of the raceway.

Furniture Pathway Capacity

The minimum straight cross sectional area in a furniture pathway shall be 9.5 cm^2 (1.5in^2), for a typical fill rate of 33%.

- Vertical pathways should have a cross sectional area equal to the cross sectional area of the horizontal path feeding it, (based on 4 users with 3 outlets at each work station)

Installation

- Fish and pull techniques should not be used
- Furniture should be arranged so access to pathways is not blocked
- Bend radius requirements as per 4.4.2.3 of the original document shall apply where cable is expected to be pulled in around corners.
- Minimum bend radius is 25m (1”)
- Consult cable manufacturers for use and separation of hybrid cables.
- Separation between data and power cables shall meet the requirements of 10.3
- Any metallic dividers shall be bonded to ground.

ANSI/TIA/EIA 569-A-3

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 3 – Access Floors

Access Floors definition

- Pathways shall be firestopped according to local codes

Types of Access Floors

- Low profile
- Standard height profile
- Stringered
- Free standing
- Cornerlock
- Integral

Loading performance is provided in Annex B of the original standards documentation.

Testing shall be done as per CISCA test methods, reference D.11.

Building Structure

Depressed Slab

- the slab shall be depressed to a depth equal to the height of the floor.

Partially Depressed or Normal Slab

- provisions for ramps and/or steps shall be made in accordance with ADA. Steps and ramps shall meet local building codes.

Design Guidelines

Work Area Service Fittings

- shall not be placed in traffic areas
- shall not be placed where they could create a hazard for the occupants

Clearance

- under an access floor shall be 20 mm (.75 in) from the bottom of the access panel to the slab or original floor.
- A minimum of 645 mm^2 (1 in^2) cross sectional area shall be provided per work area
- A minimum of 20 mm (.75 in) between the top of an electrical raceway (if used) under the access floor and the bottom of the access floor.
- Finished floor height in a telecommunications room shall be at least 150 mm (6”).

Cable Management

- Some form of cable management shall be used, examples are:
    - Dedicated routes
    - Raceway distribution
    - Zone distribution
    - Cable tray

Installation

- No equipment shall be placed prior to the access floor layout being known
- Linkage to telecommunications rooms shall be provided
- Sizing shall be determined in accordance with the type and size of pathway used
- Fittings shall be compatible with the access flooring
- Grounding and bonding shall follow all applicable codes and manufacturer's specifications.

ANSI/TIA/EIA 569-A-4

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 4 Poke Through Devices

Poke Thru Devices

definition The penetrating of a floor or ceiling (depending on which way you are going), which will facilitate the installation of electrical or communications cable from one floor to the next.

The designer and installer must adhere to all firestopping rules when adopting this method of installation.

The designer should also remember that a Telecommunications Room is recommended on each floor where possible.

Types

- single – contains power or data.
- dual – contains both power and data
- flush – is flush with the finished floor, and consists of a stem or stub which protrudes to the underneath the existing floor to the open area below it, a mounting plate, a method to secure the unit and finish trim.
- pedestal/tombstone – extends above the finished floor area with a box to house the electrical and/or communications outlets, a stem to the open area below the floor, a trim plate and a method to secure the unit to the floor material.

Applications

- Mounting power and telecommunications
- Distribute power and telecommunications

Design and Installation

- Determine the fire rating of the floor
- Determine purpose of poke thru
- The manufacturer shall provide relevant cable information
- Abandon poke thrus shall by properly firestopped

Location and density shall:

- be determined by a structural engineer
- documented
- adhere to all codes

ANSI/TIA/EIA 569-A-5

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 5 In Floor Systems

General

Section 4.2 of the original standard is replaced by this document.

Underfloor Duct Systems

- ducts are manufactured in single or multi channel systems
- Junction boxes shall be used to permit changes in direction and provide access for pulling cables.

Single Level

- The minimum concrete depth is 64 mm (2.5") if placed on concrete slab, or other appropriate base.

Two Level

- The minimum concrete depth is 100 mm (4")
- Distribution ducts are usually on the upper level and feeder ducts on the lower level
- each two level junction box shall have only one type of service.

Flushduct *definition*

- Minimum concrete depth is 25mm (1")
- Shall not be over 102 mm (4") in width
- Shall be covered with linoleum or equivalent flooring that is not less than 1.6 mm (.625")

Multi Channel Raceway

Single Level

- Single level raceways may be used in concrete floors above grade and in slab on grade
- Minimum concrete depth is 75mm (3")

Two Level

- All access openings shall have a grommet installed
- See 4.2.1.6.2

Floor Structure Design

- In a monolithic pour, the top of the duct system shall be a minimum of 25mm (1") below the top of the slab. The underfloor duct shall be attached to the supporting surface below.
- In a double pour floor, the structural slab supports the duct system and the second pour contains the duct system.
- In a post tensioned pour, the underfloor duct shall not interfere with the post tensioned cables. Presets shall be used.
- In a precast environment, the underfloor duct is located within the concrete topping. The top of the duct system shall be located 25mm (1") below the top surface of the concrete.

General Recommendations

- Assume 3 devices per work area, and one work area per 10 m^2 ($100ft^2$)
- Provide a minimum of 650 mm^2 ($1in^2$) of cross sectional duct area per $10m^2$ ($100\ ft^2$) of usable floor space.
- If the quantity of devices in the work area is greater, increase the size as required.

Specific Calculation Method

Factors affecting raceway sizes:

- Area being served
- Quantity of work stations
- Size and quantity of cables
- Changes and future requirements

To calculate the distribution duct capacity:

1. calculate the floor area being served by multiplying the length X on center measurement of the duct

2. calculate number of work stations based on General Recommendations above, or from actuals.

3. moves adds and changes must be taken into account

4. multiply the cable diameter by the number of outlets at each work station

5. the result is the cross sectional area required to house the cables. Using a 40% fill rate, take this result and divide by .40 to get the overall cross sectional area required.

To calculate feeder duct capacity:

1. calculate the area being served by the feeder duct

2. calculate average workstation size

3. calculate potential moves

4. calculate cross sectional area of all cables serving workstations

5. divide by .40

Design and Layout Information

- distribution ducts for office buildings shall run on 1520-1825mm (5-6 ft)
- runs adjacent to exterior building walls shall be 450-600 mm (18-24”) from the walls or column lines.
- the service requirements and the area to be supplied determine the density and placement of feeder duct cross runs.
- spacing of feeder ducts shall not exceed 18m (60ft)
- spacing of trenchducts should not exceed 30m (100ft)
- underfloor ducts shall be placed to allow for a star toplolgy wiring scheme

Distribution Duct **definition**

Feeder Duct **definition** **See Header Duct**

Trenchduct

- Shall have removable cover plates
- In a single level system, access from the trenchduct to distribution duct shall be provided through the side of the trenchduct
- In a two level system access is provided through the bottom of the trenchduct
- Cover plates shall have a levelling means and gasket to prevent moisture ingress

Supplementary Feeders

Provide supplementary feeders when:

- Embedded ducts approaching telecommunications rooms require bends into the TR.

The trench duct shall

- Extend out from the telecommunications room far enough to connect all embedded ducts

Any fittings or tees shall have access openings

Jack Headers ***definition***

Access Units/Junction Boxes **definition** **see Handhole Access Unit**

- in multichannel units, there shall be a partition separating services
- the cover plate shall have a means for levelling
- the cover plate shall have a gasket to prevent moisture ingress

Installation

Duct runs shall:

- Be levelled so that the top of the preset insert is 3-9mm (.125-.375") below the finished concrete floor
- Have marker screws placed at, or near the end of the duct run which shall extend through the surface of the floor.
- be secured to the sub slab
- Have junction boxes set to concrete screed level prior to pouring the floor, and then levelled to the surrounding floor after the concrete is set.

Trenchduct or Trench Header

Shall:

- Be coupled and levelled so that the cover plates are level with the concrete floor
- Have openings from the base of the trench to distribution duct cut and have grommets inserted
- Have all openings that may allow concrete to enter them sealed prior to the concrete pour.
- Have partitions level with the underside of the cover plate and secured in place
- Have welds painted

Inserts for Underfloor Duct Systems

Preset Inserts ***definition***

Afterset Inserts **definition**

Multiservice Insert **definition**

Service Fittings

Provide access to one or more services.

Shall be partitioned if power is one of the services.

Abandonment Fittings

The deactivation of a preset or afterset insert upon removal of a floor service fitting.

Temporary Abandonment Fittings

Removable covers installed in the preset or afterset inserts that temporarily replace removed floor service fittings.

Permanent Abandonment Fittings

Plates that are installed in the preset or afterset inserts when the floor service units are removed. All cables must be removed for permanent abandonment.

Floor Boxes for Single and Multiple Services

Shall:

- Be fully partitioned if electrical power is one of the services in the floor box
- Have a piece of conduit run from the floor box to the junction box, and use a conduit adapter when serving an isolated location

Cellular Floor ***definition***

Types

Steel and Concrete

Design Guidelines

Size

Cellular sections 600mm (2ft) wide

Non cellular sections 600-900mm (2.0-3.0 ft)

Centers are located on 1220-1525mm (4-5ft) using 50% combination of cellular and non cellular sections.

System Capacities

- Provide a minimum of 650mm^2 (1in^2) of cross sectional area per 10^{2}mtr (100 ft^2) of usable floor space, based on 3 devices per work area of 10mtr^2 (10 ft^2)
- Increase size if planned density in greater than above

Specific Calculation Method

To calculate the distribution cell capacity:

1. calculate the floor area being served by multiplying the length X on center measurement of the duct

2. calculate number of work stations based on System Capacities above, or from actuals
3. Moves adds and changes must be taken into account
4. multiply the cable diameter by the number of outlets at each work station
5. the result is the cross sectional area required to house the cables. Using a 40% fill rate, take this result and divide by .40 to get the overall cross sectional area required.

To calculate feeder duct capacity:

1. calculate the area being served by the feeder duct
2. calculate average workstation size
3. calculate potential moves
4. calculate cross sectional area of all cables serving workstations
5. divide by .40

Design & Layout Information

Concrete coverage:

Cellular steel 64mm (2.5")

Cellular concrete 38mm (1.5")

Distribution Cells in Cellular Floor ***definition***

Preset Inserts

Shall not be spaced less than 600mm (24 in) on center.

May be single or multiservice

Blank Cell **definition**

An afterset insert and service fitting shall be used after core drilling through the concrete topping and cutting through the surface of the cell.

Feeder Systems for Cellular Floor ***(see Header Duct)*** ***definition***

Flush Header Duct ***definition***

- Access shall be provided by core drilling through the concrete to the cell, and then fitting the opening with a grommet
- Access units shall be located over the openings to the cells
- Each service shall be located in a separate header duct

Header Duct **definition**

- Pre-punched holes in the header duct shall be aligned with the appropriate cell and a grommet provided.

Trench Header

- Shall have removeable cover plates through its entire length

Jack Header **definition**

Layout of Cellular Floor

Distribution Cells

- Should span the longest length of the building
- The direction of the span is determined by the structural layout

Allocating Distribution Cells

- A 3 cell cellular floor section shall have the two outside cells for telecommunications and the center cell for electrical service

Feeder

- Shall allow for a star topology connection to the telecommunications room

Installation of Cellular Floor Systems

Cellular Floor

- Sections shall be installed as per manufacturer's specifications
- Centreline dimensions of cellular sections shall facilitate locations of preset and afterset inserts.

Header Duct

Shall be installed:

- On top of and perpendicular to the floor cells
- With access units over the cells being activated
- In a secure fashion
- With openings that may allow concrete to flow into the cells covered.
- With access units levelled and fitted with grommets between the header duct and the cell

Trench Header

Shall be installed:

- on top of and perpendicular to floor cells
- with the top surface being level with the finished concrete
- with openings from the base of the trench to the distribution cell cut and fitted with grommets
- with pre-punched holes fitted with a grommet
- so that all services are separated

Shall:

- Secured with welds or rivets
- Have openings sealed prior to concrete pour
- Have the partitions raised to the underside of the cover plate
- Have welds painted with a rust preventing paint

Telecommunications Room Termination

Raceways terminating in the telecommunications room shall:

- Terminate with a slot or elbow
- Have a flange opening in the cover plate for trench headers

Inserts for Cellular Floor Systems

Preset Insert **definition**

Afterset Insert **definition**

Multiservice Insert **definition**

Service Fittings

- Shall be fully partitioned if electrical service is provided.

Types

- Above floor
- Flush floor
- Recessed

ANSI/TIA/EIA 569-A-6

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 6 Multi-Tenant Pathways

Multi Tenant Pathways and Spaces

Are comprised of, but not limited to:

- Entrance room
- Access provider space
- Service provider space
- Common equipment room
- Common telecommunications room

References

The following documents should be referenced

- ANSI C95.2-1982, Reference 3
- ANSI/TIA/EIA-568-B.1
- FCC OET Bulletin 65

Definitions

Common equipment room (CER) **definition**

Common telecommunications room (CTR) **definition**

Entrance Facilities

- The construction of the entrance facility should take into consideration the facility and all telecommunications needs of the tenants.
- Services not directly related to the support of the entrance facility, such as water, electrical, ductwork etc, should not enter or pass through the entrance facility.
- Shall have controlled access

Telecommunications Service Entrance Pathway

- Shall be designed for initial and future requirements
- Should accommodate multiple service entrance points for multiple service providers

Wireless

- Wireless transmission/reception devices should be within line of sight of the target system.

Cable Pathways

- On towers should be consolidated from the transmission/reception devices to the service provider space.
- The route shall be the most direct route possible
- Cables should be isolated from pedestrian traffic, environmental damage etc, by placing them in conduit or cable tray.

Location

Transmission/reception devices may be located on:

- the building's rooftop
- outside walls
- lower roof setbacks or,
- inside the building

They should be mounted 2 mtrs (80") above foot traffic surfaces

Support Structures

- A structural engineer shall be employed in the design and placement of wireless support structures.

Towers

- May be installed on building rooftops
- Allow multiple access providers to share space on a single tower

Non Penetrating Wireless Device Mounts

- Light weight devices may be installed on mounts which are not directly attached to building structural members.

Examples:

- Sled mounts
- Ballast mounts
- Non penetrating wireless device mounts

The above mounts may be further secured by adding ballast weights based on wind and ice loading or by tethering.

Penetrating Wireless Device Mounts

- Consideration should be given to the effects of the environment on the structure and waterproofing of penetration points.

Design Considerations

Electrical Service

Shall:

- Be designed by an electrical engineer
- Be sized to support all functions such as, but not limited to:
    - Antenna lighting
    - De-cing
    - Motor operated functions
- Have standby power where required
- Have bonding and grounding systems meet applicable codes

Access Provider Spaces and Service Provider Spaces

- Shall be controlled by the primary or secondary organization

Location

The location of access provider and service provider spaces (including wireless):

- Shall be close to the CER
- Should be expandable
- Shall be accessible from common use corridors
- Shall not be close to electromagnetic interference, with special attention to power supply transformers, motors, generators, induction sealing devices etc.
- Adequate pathways should be provided:
    - From access provider spaces to CER
    - From service provider spaces to the CER
    - From access provider spaces to service provider spaces

Design

- Shared spaces should be partitioned
- A minimum of one wall should be covered with 20 mm (3/4") A-C plywood, void free, 2.4 m (8ft) high, fastened to the wall, and fire rated to applicable codes. The plywood shall be kiln dried to a maximum moisture content of 15%
- There shall be a minimum clearance of 3m (10ft) between the floor and the lowest point of the ceiling.
- Walls, floors and ceilings shall be treated to eliminate dust, and finishes shall be light in colour.
- Lighting shall be a minimum of 500 lx (50 ft candles), measured at 1 m (3ft) above the finished floor, and mounted 2.6 m (8.5 ft) above the finished floor.
- Suspended ceilings should not be installed
- Doors shall be a minimum of .9 m (36") wide, 2 m (8ft) high without a doorsill and hinged to open outward if it meets applicable codes, side to side or removable, and fitted with a lock.
- Minimum floor loading shall be 2.4kPA (50lbf/ft^2). A structural engineer shall verify floor loading conditions.
- Hazard warning signs shall be used where danger from exposure to radio frequency lectromagnetic fields may cause harm. These sign formats shall meet ANSI C95.2-1982
- Spaces shall be designed for seismic activity according to applicable codes.

Environmental

- Both access and service provider spaces shall be protected from contaminants and pollutants that could affect the operation of the equipment.
- Vapour barriers shall be provided if contaminants are present in greater concentrations than allowed in Table 2 of the original standards documents.

Heating Ventilation and Air Conditioning

- A guideline for air conditioning is to provide 9m^3 (300ft^3) of 12^{o}C (55^{o}F) conditioned air per 20 A dedicated circuit.

- HVAC requirements may exceed the above and should be calculated based on the heating and cooling of all equipment installed, or which may be installed in the access or service provider spaces.
- HVAC shall operate 24 hours per day, 365 days a year.
- A stand alone unit should be provided if the building cannot assure a continuous operation.

Access and service provider spaces should be kept at a continuous operating temperature of between 18°C (65°F) to 24°C (75°F) with a 30% to 55% relative humidity. Both temperature and humidity shall be measured at a distance of 1.5m (5ft) above the floor.

- A positive air pressure should be maintained.
- Proper ventilation shall be provided as per manufacturer's specification if back up batteries are installed.
- The structural engineer should design safeguards against building vibration.
- Mechanical fixtures such as ductwork, tubing, piping etc should not pass through or enter the space.

Electrical

- As a minimum at least one dedicated 20 A, 120Vac, non switched duplex outlet receptacle shall be located in each access provider and service provider space.
- Consideration should be given to connecting access and service provider equipment to a building standby power source if one is available.
- A UPS up to 100kVA shall be permitted in the access and service provider spaces. Larger UPS systems should be located outside the space.
- Access to the bonding and grounding system shall be provided.

Fire Protection

- Fire protection should be provided as per applicable code
- If sprinklers are used, wire cages shall be installed over the heads
- Drainage troughs shall be placed under sprinkler heads.
- Alternate fire suppression systems are allowed

Water Infiltration

- Access and service provider spaces should not be located below the water table unless proper measures are taken to prevent water infiltration.
- Only water and drain pipes associated with the support of the equipment are allowed in the space.
- A floor drain shall be provided.

Common Equipment Room CER

- Should only contain facilities that serve multiple tenants in a building
- More than one CER may be provided based on building size and facilities served
- Access shall be controlled by the primary or secondary organization

Location

- Should accommodate room expansion

- Should be as close as possible to the vertical backbone pathways
- Should be accessible through common use hallways and allow for the delivery of large cable reels.

Pathways

- Pathways should be provided for between:
- Access provider spaces and CER
- Service provider spaces and CER
- CER's and CTRs
- CERs to equipment rooms

Design

Shared spaces should be partitioned

If a building has less than 50,000 m^2 or less, the CER should have 12 m^2 of floor space. If the building has more than 50,000 m^2 the CER area should be increased by 10 m^2 increments for ever 10,000 m2. The minimum room width should not be less than 3m

A minimum of one wall should be covered with 20 mm (3/4") A-C plywood, void free, 2.4m (8ft) high, fastened to the wall, and fire rated to applicable codes. The plywood shall be kiln dried to a maximum moisture content of 15%.

There shall be a minimum clearance of 3m (10ft) between the floor and the lowest point of the ceiling.

Walls, floors and ceilings shall be treated to eliminate dust, and finishes shall be light in colour.

Lighting shall be a minimum of 500 lx (50 ft candles), measured at 1 m (3ft) above the finished floor, and mounted 2.6 m (8.5 ft) above the finished floor.

Suspended ceilings should not be installed

Doors shall be a minimum of .9 m (36") wide, 2 m (8ft) high without a doorsill and hinged to open outward if it meets applicable codes, side to side or removable, and fitted with a lock.

Minimum floor loading shall be 2.4kPA (50lbf/ft^2). A structural engineer shall verify floor loading conditions.

Hazard warning signs shall be used where danger from exposure to radio frequency electromagnetic fields may cause harm. These sign formats shall meet ANSI C95.2-1982

Spaces shall be designed for seismic activity according to applicable codes.

Environmental

Both access and service provider spaces shall be protected from contaminants and pollutants that could affect the operation of the equipment.

Vapour barriers shall be provided if contaminants are present in greater concentrations than allowed in Table 2 of the original standards documents.

Heating Ventilation and Air Conditioning

A guideline for air conditioning is to provide 9m^3 (300ft3) of 12^oC (55^oF) conditioned air per 20 A dedicated circuit.

HVAC requirements may exceed the above and should be calculated based on the heating and cooling of all equipment installed, or which may be installed in the access or service provider spaces.

HVAC shall operate 24 hours per day, 365 days a year.

A stand alone unit should be provided if the building cannot assure a continuous operation.

Access and service provider spaces should be kept at a continuous operating temperature of between 18°C (65°F) to 24°C (75°F) with a 30% to 55% relative humidity. Both temperature and humidity shall be measured at a distance of 1.5m (5ft) above the floor.

A positive air pressure should be maintained.

Proper ventilation shall be provided as per manufacturer's specification if back up batteries are installed.

The structural engineer should design safeguards against building vibration.

Mechanical fixtures such as ductwork, tubing, piping etc should not pass through or enter the space.

Electrical

As a minimum at least one dedicated 20 A, 120Vac, non switched duplex outlet receptacle shall be located in each access provider and service provider space.

Consideration should be given to connecting access and service provider equipment to a building standby power source if one is available.

A UPS up to 100kVA shall be permitted in the access and service provider spaces. Larger UPS systems should be located outside the space.

Access to the bonding and grounding system shall be provided.

Fire Protection

- Fire protection should be provided as per applicable code
- If sprinklers are used, wire cages shall be installed over the heads
- Drainage troughs shall be placed under sprinkler heads.
- Alternate fire suppression systems are allowed

Water Infiltration

- Access and service provider spaces should not be located below the water table unless proper measures are taken to prevent water infiltration.
- Only water and drain pipes associated with the support of the equipment are allowed in the space.
- A floor drain shall be provided.

Common Telecommunications Room

- Should contain only those facilities that serve multiple tenants
- Tenant customer premises equipment shall not be located in the CTR
- CTRs should be vertically aligned if possible
- CTR should be located central to the area served
- Access shall be controlled by the primary or secondary organization

Pathways

- Should take into consideration:
- Cable infrastructures shared by multiple tenants
- Intra-building connectivity
- Inter-building connectivity
- Wireline access/service provider bypass needs
- Wireless access/service provider bypass needs.

Design

- The design should be based on current and future needs
- A typical CTR should be $6m^2$ ($80ft^2$)
- More than one CTR should be provided if the serving area is greater than $2000m^2$ ($20,000ft^2$)
- A minimum of one wall should be covered with 20 mm (3/4") A-C plywood, void free, 2.4 m (8ft) high, fastened to the wall, and fire rated to applicable codes. The plywood shall be kiln dried to a maximum moisture content of 15%.
- There shall be a minimum clearance of 3m (10ft) between the floor and the lowest point of the ceiling.
- Walls, floors and ceilings shall be treated to eliminate dust, and finishes shall be light in colour.
- Lighting shall be a minimum of 500 lx (50 ft candles), measured at 1 m (3ft) above the finished floor, and mounted 2.6 m (8.5 ft) above the finished floor.
- Suspended ceilings should not be installed
- Doors shall be a minimum of .9 m (36") wide, 2 m (8ft) high without a doorsill and hinged to open outward if it meets applicable codes, side to side or removable, and fitted with a lock.
- Minimum floor loading shall be 2.4kPA ($50lbf/ft^2$). A structural engineer shall verify floor loading conditions.
- Hazard warning signs shall be used where danger from exposure to radio frequency electromagnetic fields may cause harm. These sign formats shall meet ANSI C95.2-1982
- Spaces shall be designed for seismic activity according to applicable codes

Heating Ventilation and Air Conditioning

A guideline for air conditioning is to provide $9m^3$ (300ft3) of 12^oC (55^oF) conditioned air per 20 A dedicated circuit.

Electrical

- As a minimum at least one dedicated 20 A, 120Vac, non switched duplex outlet receptacle shall be located in each access provider and service provider space.
- Consideration should be given to connecting access and service provider equipment to a building standby power source if one is available.
- A UPS up to 100kVA shall be permitted in the access and service provider spaces. Larger UPS systems should be located outside the space.
- Access to the bonding and grounding system shall be provided.

Fire Protection

- Fire protection should be provided as per applicable code
- If sprinklers are used, wire cages shall be installed over the heads
- Drainage troughs shall be placed under sprinkler heads.
- Alternate fire suppression systems are allowed

Water Infiltration

- Access and service provider spaces should not be located below the water table unless proper measures are taken to prevent water infiltration.
- Only water and drain pipes associated with the support of the equipment are allowed in the space.
- A floor drain shall be provided.

Intrabuilding and Interbuilding Pathway Requirements

Intrabuilding Pathways

Slot Quantity and Configuration

- The location of slots shall be determined by a structural engineer
- Depths shall be 150-600mm (6-24”), with a preference to the narrower slots

Size

- One slot of .04m^2 (60in^2) for up to 4,000m^2 (40,000ft^2) of usable floor space
- Increase by .04m^2 (60in^2) for each 4,000m^2 (40,000ft^2)

Sleeve Quantity and Configuration

- The location and configuration shall be approved by a structural engineer
- There should only be 2 rows of sleeves where possible
- There should be 4 sleeves with an additional sleeve for growth for every 4,000m^2 (40,000ft^2)

Common Pathways and Spaces Bypass **definition**

Interbuilding Pathways

- Should be sized taking into account wireline and wireless access and service provider bypass requirements, intra tenant connectivity needs and pathway requirements associated with cable infrastructures in multiple tenant environments.

ANSI/TIA/EIA 569-A-7

Commercial Building Standard for Telecommunications Pathways and Spaces

Addendum 7 Cable Trays and Wireways

The intent of this addendum is to update sub-clause 4.5 to reflect changes in cable fill issues.

Cable Trays and Runways **definition**

Types

Ladder Cable Tray

Ventilated Bottom Tray

Solid bottom tray

Cable Channel

Single Rail Cable Tray (see Spine Cable Tray)

Wire Cable Tray

Intermediate Mesh Tray (see Mesh Tray)

Cable Runway

Location

- May be located above or below ceiling, within an acess floor in either plenum or non plenum spaces.
- Applicable electrical and building codes shall be followed.

Design Information

Cable trays shall:

- Be designed for a maximum of 50% fill ratio for a maximum tray depth of 150mm (6”).
- A lower initial fill ratio is recommended to accommodate future expansion and changes

Calculation of Fill Ratio

1. Calculate cross sectional area of one cable

2. Calculate cross sectional area of all cables to be located in tray

3. Calculate usable cable tray area (maximum 50%) where either width or depth may be a known value.

Cable Runway

- Cables shall not be stacked higher than 150mm (6”) on a cable runway

Support

- The support span shall be installed as per manufacturer’s specifications
- Tray supports should be located so that the connections between trays fall between the support and ¼ the distance of the span.
- Supports should be located within 600 mm (24”) on each side of a bend, tee or cross.
- See also NEMA-VE2

Fittings

Installation

- Cable trays shall:
- be installed according to applicable electrical codes.
- have no burrs on the inside of the support system
- have protective coverings installed on threaded or rough support rods
- have penetrations through fire rated walls properly fire stopped
- not have a fill ratio exceeding clause 4.5.3 of the original standard
- not be used as walkways
- have power and telecommunications physically separated
- have 300m (12”) clearance above the raceway