Multi-Dwelling Unit (MDU) Fibre Construction Servicing Guidelines

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1. The SaskTel Fibre Optic Network

Migration from copper to the new Fibre Optic Network will take several years to complete. For new builds, arrange to install one category 5e cable and one bend insensitive fibre from the building entry/electrical room to each multi-dwelling suite Optical Network Terminal (ONT). The ONT is described on page 11.

If you have questions regarding the type of wiring to use in new builds, contact SaskTel Building Industry Consulting Service (BICS) by email at Communication.DistributionDesign@sasktel.com.

Over the past 100 years, SaskTel has provided its residential and business customers with telecommunication services using primarily copper based telephone wire/cable systems to carry the signals to the homes and businesses.

Although this is still very effective and will continue to be utilized for some time to come, as with most other infrastructure systems, it requires continued maintenance and rebuilding. With the increasing price of copper as a non-renewable mineral and the ever increasing costs of fuel and materials to provide maintenance, infrastructure is a common issue throughout the telecommunications industry.

SaskTel was a pioneer in the field of fibre optics back in the 1980's; it again looks at fibre as a solution to this infrastructure question. For the past 20 years, partners within telecommunications have been working towards a viable solution using fibre optics to replace the expensive copper transport systems. **G**igabit **P**assive **O**ptical **N**etwork (**GPON**) fibre systems represent the result of that 20 year development path.

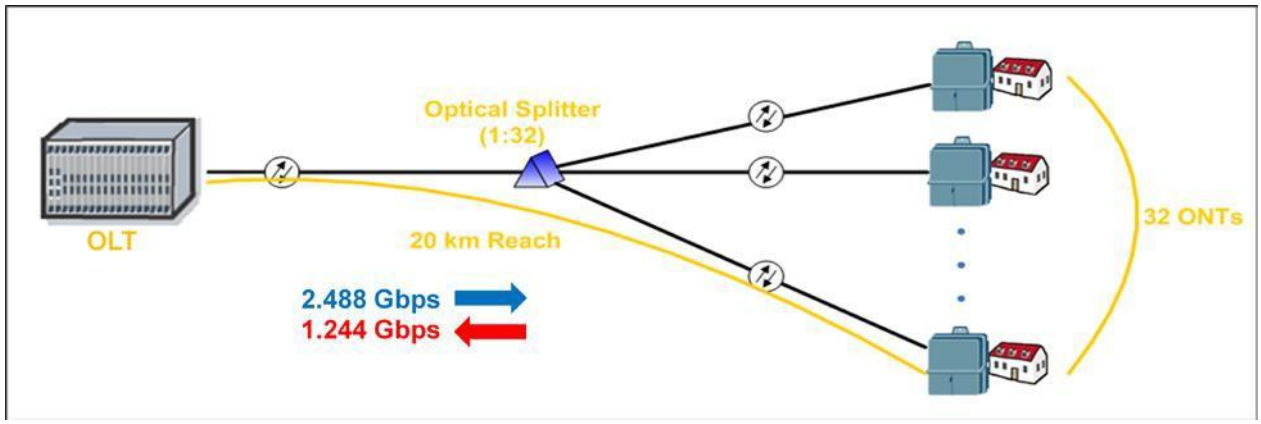
The SaskTel Fibre Optic Network will be GPON - based. A PON is a fibre-based transmission network containing no active electronics, providing gigabit speeds that provide individual services for up to 32 customers, per fibre.

Passive components reduce the need for power consumption, greatly reducing the cost of running the network. Also, a single fibre run from one of our central offices can feed up to 32 homes or living units with the use of a GPON 1/32 splitter.

Using splitters reduces the overall cost of deployment by reducing the need for very large cables and construction costs that were incurred with copper builds of the past.

The physical reach of GPON from OLT (located at SaskTel's office) to ONT (placed in the home) is 20 km maximum and practically about 14 km, which will help SaskTel reach out to service the expanding nature of land development and Saskatchewan's economy without the ongoing burden of ever increasing infrastructure costs.

GPON Network



1.1 Components of a SaskTel MDU Distribution System

Distributing SaskTel Fibre Optic Network throughout an MDU property requires several stages of equipment between the SaskTel facilities and each type and size of residential building.

- Fibre Distribution Hubs (FDH) required for larger buildings with approximately 45 units or more.
- Fibre Splitter Box (FSB) required for buildings with typically 24 to 44 units.
- Fibre Distribution Terminals (FDT) required for smaller buildings of less than 24 units.
- Fibre Drops
- Optical Network Terminal (ONT)
- Uninterruptable Power Supply (UPS)

1.2. Interior or Indoor Fibre Distribution Hub (buildings typically sized 45 units and larger)

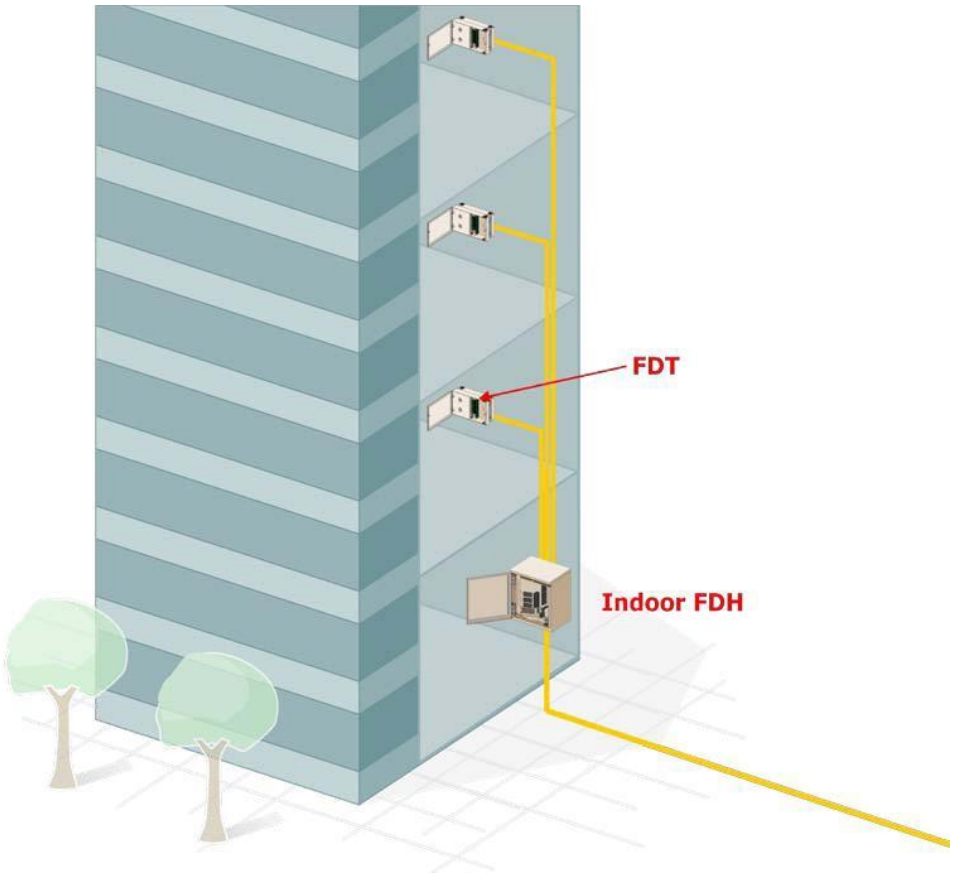
If a property has enough customers, an Interior or Indoor Fibre Distribution Hub (iFDH) would be installed into the property and have a direct fed fibre and optical fibre splitter device.

An interior or indoor fibre distribution hub is an (FDH) cabinet where the SaskTel fibre cabling gets connected to the property and is located in the main telephone room of larger multi-dwelling unit buildings (MDUs), or clusters of multiple MDU buildings.

Within the iFDH there are Optical Splitters which are used to feed the optical signals to a number of Fibre Distribution Terminals at secondary telephone rooms, if such rooms exist. Like the FDH the iFDH contains only fibre cabling and passive optical splitters, so it does not require electrical power or ventilation.

FDH's are important pieces of equipment that service multiple customers and therefore they need to be secure and easily accessible by SaskTel at all times for installation and repair purposes.

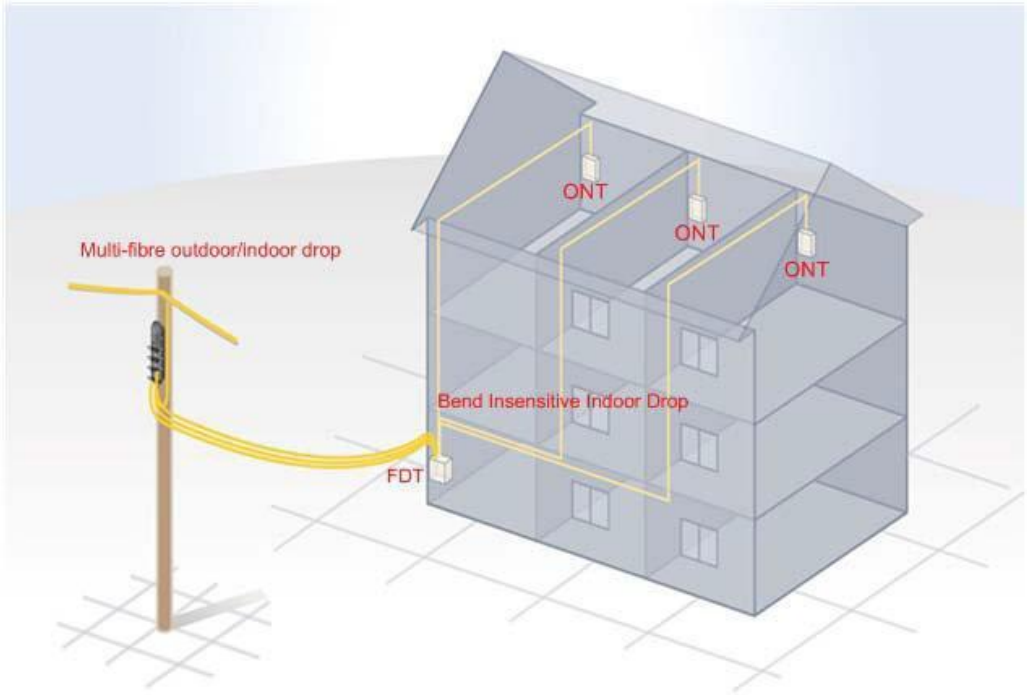
For smaller MDU`s, a smaller fibre splitter box (**FSB – buildings typically 24-44 units**) would substitute, where a full sized iFDH would not be required.



1.4. Fibre Distribution Terminal (buildings typically sized less than 24 units)

Fibre Distribution Terminals (FDT) are used to connect the fibres feeding the site from the neighborhood FDH to individual suite ONT's. FDTs are smaller cabinets, and are usually located in a common area at each MDU property.

The FDT only contains fibre cabling and connectors, so it does not require electrical power or ventilation. However, FDT's are important pieces of equipment that service multiple customers and therefore need to be secure and accessible by SaskTel at all times for installation and repair.



FDTs can be used in conjunction with an iFDH in large buildings, if required. (Refer to iFDH and the example picture from the previous page.)

For very large MDUs with vertical layouts (i.e. large high rise buildings), FDT are used to connect the fibres feeding the site from the FDH to individual floor terminals. These FDTs are smaller cabinets, and are usually located in secondary telephone rooms at each MDU property.

The FDT only contains fibre cabling and connectors, so it does not require electrical power or ventilation. FDT's are important pieces of equipment that service multiple customers and therefore need to be secure and accessible by SaskTel at all times for installation and repair purposes.

The use of FDT's in this manner would not be a preferred practice but does provide for flexibility in cabling a building when SaskTel deems it would be required or advantageous to do so, according to the cabling requirements of the structure.

1.4.1 Spaces required for Fiber Entrance Equipment

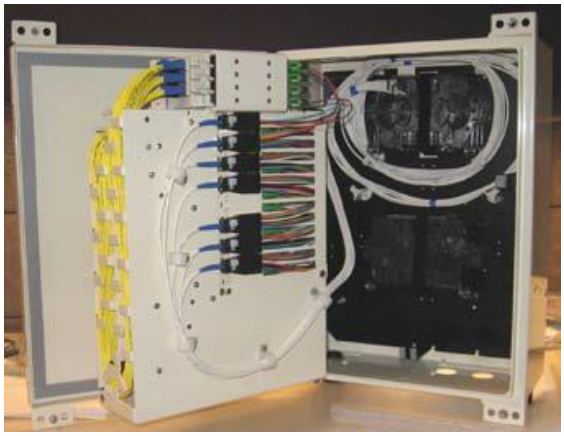
SaskTel requires spaces, suitable for the installation and maintenance of the Fibre Optic Network equipment, that are safe, secure and easily accessible. For the installation of connection equipment, (FDH, FDT, and FSB), the following points should be considered:

- ease of access by SaskTel,
- secure from damage or tampering,
- having adequate lighting,
- dry and free from moisture damage,
- clean and free of dust of vaporous chemicals, and
- will not cause an obstruction hazard.

1.4.2. FDH

Indoor FDH's come in different sizes to supply services to different sized buildings.

72 unit iFDH - 19"h x 13" w x 7"d



288 unit iFDH – 33"h x 24"w x 17" d

Choose a space with a backboard 4'W x 8'H x ¾" D, though there may be some consideration given according to the size of building and units being installed.

Larger units can be wall or ground mounted and require a recommended 12" spacing around the FDH for access and 30" front access. Though the device itself may be deemed small for the space, working clearance for easy installation, maintenance and repair is always necessary.

Consult SaskTel BICS by email at **Communication.DistributionDesign@sasktel.com** for more information.

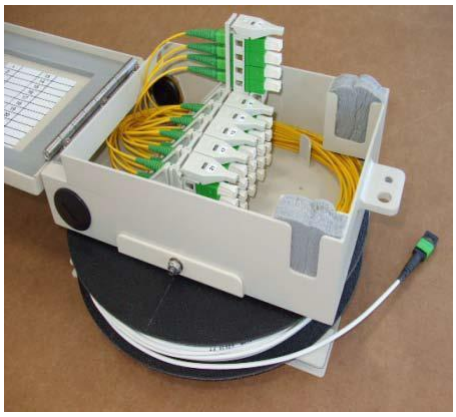
1.4.3. FDT or FSB

Multiple different versions exist to accommodate the different building requirements found though-out different MDU's. **The following is a sampling** of interior and exterior devices to provide an idea as to size and space requirements.

FDT

6-24 unit – 15"h x 8"w x 6"d

6-24 unit – 17h"x 16"w x 6"d



12- 24 unit – 6"h x 9"w x 4"d

iFSB's
32 unit – 8"h x 13"w x 5"d

Choose a space with a backboard 2'W x 2'H x ¾"D in accordance with local, provincial, and federal codes. These devices can only be mounted and are designed to be mounted at a standing work height.

The recommended spacing is 6" around the FDT for access and 24" front access. Contact SaskTel BICS by email at **Communication.DistributionDesign@sasktel.com** for more information.

1.6. Drop Cabling

Exterior Drop Cables are fibre optic cables that feed from the telecommunications distribution access point (pole or pedestal) into the fibre termination on premise. SaskTel uses fibre cabling rated for both interior and exterior use, making the installation of fibre into the premise easier.

Interior Drop Cables are fibre optic cables run from the iFDH or FSB to each suite directly or via the FDT located at the secondary telephone rooms or from the main telephone room, if no secondary telephone rooms exist, to the individual suits where the fibre signals will be converted to traditional voice, video, and data signals. This drop contains ***"bend insensitive fibre"*** therefore the cable can be installed using Cat5e placing procedures.

Please refer to the special note at the beginning of Section 1 on page 4.

1.6. Optical Network Terminal

The Optical Network Terminal (ONT) is the device where the fibre signals are converted to electrical signals **that can feed telephones, television sets, and computers.** The ONT is located in the suite. In Single-Family Units (SFU's), there is a separate ONT for each suite/home.

There are two options in which the ONT can be placed within the Living Unit: (See section 7).

1. The preferred option is the placement of the ONT and associated components in a recessed wall cabinet (for example a Multimedia cabinet) at the common wiring location within the residence. The use of a recommended cabinet, allows for the neat and proper installation of all the required fibre devices and wiring into a location that is unobtrusive and secure.

2. The other option is to surface mount the ONT and associated components at the common wiring location within the home

MDUs use the same ONT as used in single family detached units. It is designed to interconnect with conventional Structured (Cat5e) Wiring in each Unit. The multimedia cabinet does require **local electrical power** and a ground connection (i.e. grounded power receptacle) in each unit.

The ONT is to be placed in a heated environment **where there is no risk of the ambient air temperature falling below 0° (zero) Celsius**. A garage is NOT a suitable location. The preferred location is in at the common wiring location be it in the HVAC room, utility closet, or laundry room etc.

1.7 Uninterruptable Power Supply

The uninterruptable power supply (UPS) is an electrical apparatus that provides emergency power, via a backup battery, to the ONT when the power fails. This is important to power the ONT - enabling telephone service in power blackout situations.

The UPS contains a sealed maintenance-free lead-acid battery that has a life expectancy of about 5-8 years. The battery is 7.2 Ahr which translated means approximately 8hrs of phone service in the event of an extended power failure.

It also has a 20% battery remaining emergency call feature that during an outage will power down to conserve the last 20% of the battery. This allows the customer to make emergency calls past the 8hr period. The UPS also has an audible alert to warn of bad battery or battery replacement.

1.8 HomeNet Gateway Device and Network Switch

For customers that have SaskTel TV and Internet services, they will require network equipment to receive those services. The HomeNet gateway enables you to create a wired or wireless home B/G/ N-network. With HomeNet, you can:

- Network the computers in your home or small office.
- Simultaneously access the internet on multiple computers, and share documents and printers from any of your networked computers.
- Protect and manage online experience by: restricting access by day of week and time of day and control access to different sites and services.
- Keep your computers secure with automatic firewall updates for all the devices connected to your network.

2. SaskTel Responsibilities for New Construction

SaskTel will provide, install, terminate and maintain all SaskTel property up to and including the building entry. This would include, but not be exclusive to; the Fibre Entrance/Distribution Cables; FDHs; FDTs; and associated hardware.
NEW - SaskTel will now work with the developer/building management to install, terminate and maintain all SaskTel fibre optic property inside the buildings. This would include, but not be exclusive to; inside fibre cables and fibre riser cabling; terminations; ONTs; UPSs; and associated hardware.

In the past, the **developer/complex owner** was solely responsible for the cabling between the main telephone entry room and each end unit.

SaskTel is has now taken the responsibility and ownership for this portion of the telecommunication cabling in regards to “fibre optics” feeding SaskTel FTTP equipment. Therefore all developers should contact SaskTel to discuss the options available for their individual scenarios.
SaskTel will request, from the developer/manager/owner, permission to install communication equipment and facilities on the property.

Please refer to the special note at the beginning of Section 1 on page 4.

3. Property Owner Responsibilities

These guidelines are generic and the type, quantities, and location of network components will vary based on the layout of the MDU complex. All components will be placed in locations mutually agreed upon by SaskTel and the MDU owner/developer.

The purpose of these guidelines is to assist owners and builders by informing them of the considerations of:

- provisioning interior and exterior pathways and entries,
- providing adequate spaces for the installation of equipment, and
- the installation of types of fibre optic cabling inside the premise.

Please refer to the special note at the beginning of Section 1 on page 4.

3.1. Service Entrances into Buildings

In many MDU properties being served by traditional copper cabling, all incoming services terminate at a single location at the property, and are distributed from there to the various buildings and units. This location is usually a Telecommunications Room or other central location.

Although this distribution architecture is necessary for most copper distribution systems, it is not required for a fibre distribution design. The Passive Optical Network does not contain any exposed electrical conductors that present the lightning and fire hazards associated with copper and therefore do not require the extensive shock and voltage isolation with fire protection typical of traditional Main Telecommunication Rooms.

The Fibre Distribution Terminals (FDT) and Fibre Distribution Hubs (FDH) are relatively small cabinets that contain only optical components and so do not need A/C power access or conditioned rooms (although they do need to be accessible to SaskTel, so a safe and secure working environment is required).

If an MDU property will be served by traditional copper services as well as SaskTel Fibre Optic Network services, the FDT and FDH cabinets may be co-located with the copper facilities in the facility entrance location. Also, if copper facilities from SaskTel are required along with fibre services, they may be terminated at the entry location.

A service entrance pathway shall be provided. The basic methods for provisioning are underground, buried, aerial pathways, and tunnels.

In determining the total number of pathways required, the MDU owner should consider the following needs:

a) type and use of building,
b) growth,

c) difficulty of adding pathways in the future,
d) alternate entrance,
e) type and size of cables likely to be installed,
f) UG access would require 4” conduits from property line to inside the MDU, and
g) all duct requirements must meet minimum 36” bend radius requirements.

Please refer to the special note at the beginning of Section 1 on page 4.

3.1.1 Aerial

An aerial facility is a component of the entrance facility consisting of poles, cable-support strand, and support system. Aerial access would require a rigid service mast and building attachment with a weather-head. When contemplating the use of aerial facilities, consider:

- aerial access would require building attachment capabilities and entrance hole,
- where the wall will be penetrated and the space of the service entry,
- Ground Clearances and separation for electrical,
- number and size of cables involved with the corresponding conduit, and
- future expansion.

3.1.2 Buried

Underground facilities consist of buried cables, and conduit/ducts, into the premise from SaskTel poles, pedestals or manholes. **Ducts** can vary in size depending on the cable being installed.

The rule of thumb without further detail is that ducts need to be 4” (100mm) metal, fibre or PVC and be graded to meet SaskTel facilities in order to permit drainage. The installation is to be installed to a sufficient depth considering vehicle traffic. Consult SaskTel BICS.

It is recommended that underground telecommunications facilities not be in the same vertical plane as other utilities, such as water or power that share the same trench. Utility services should be located horizontally with respect to each other, in compliance with applicable code.

Direct burial of cable without the use of conduit, although more economical initially, cannot be reinforced or replaced easily, and therefore the use of conduit is the preferred method of installation.

3.2. Pathways/Conduit throughout the MDU

“Pathway Creation” in the typical form of conduit routes is the responsibility of the builder.

“Pathways” or conduit is required between all telephone rooms where SaskTel Fibre Optic Network equipment will be located and the telephone rooms, either main or secondary, and to the multimedia panel in the individual suite.

With any conduit that is not filled with cable, a labelled rope or pull-string is to be inserted and secured to prevent its accidental removal.

3.2.1 Riser

In the situation of stacked telephone rooms, sleeve conduit or slots against the running wall shall be placed for access between these riser communication room/closets. Sleeves need to be 6” x10” with a curb of 1” or conduit of 4” with a curb of 1-3”.

3.2.2 Horizontal

Conduit is typically 25 mm [1"] EMT, or rigid PVC conduit (per building codes) to the suite wall box or media panel in each individual unit from floor telephone room. Flexible ENT can be considered so long as it meets all applicable codes and does not introduce more than 2 -90 degree bends between pull boxes. Depending on building structure, the conduit may be placed horizontally and/or vertically.

Conduit fill is determined by adding together the cross-sectional areas of all cables to be installed in a conduit. This total cable area is then compared with the cross-sectional area available in the conduit.

A traditional rule of thumb is to follow the NEC which specifies that for three or more cables in a conduit, the total cross-sectional area of the cables must not exceed **40%** of the available area in the conduit. For one or two conductors in a conduit, the maximums are 53% and 31%, respectively. Determining the maximum allowable conduit fill for a specific installation requires either reference to a table *or* a mathematical calculation.

If fibre runs are installed in a multi-drop or multi-point system, where one larger conduit feeds off to successive units vs. having individual home run conduit, then the conduit at the beginning of the run should be of a larger diameter to accommodate the multiple single cables to each suite. The conduit sizing should conform to the following chart.

This table provides a guide for conduit sizing when there are multiple cable in the conduit and is as per ANSI/TIA 569-B & 570-B.

Cable Outside Diameter mm (in)										
Conduit ID mm (in)	Trade Size (in)	4.6 (0.18)	5.6 (0.22)	6.1 (0.24)	7.4 (0.29)	7.9 (0.31)	9.1 (0.37)	13.5 (0.53)	15.8 (0.62)	17.8 (0.70)
16 (0.62)	1/2	1	1	0	0	0	0	0	0	0
21 (0.82)	3/4	5	4	3	2	2	1	0	0	0
27 (1")	1	8	8	8	3	6	2	1	0	0
35 (1.25")	1 1/4	14	12	10	6	4	3	1	1	1
41 (1.5")	1 1/2	18	16	16	7	6	4	2	1	1
53 (2")	2	28	22	20	14	12	7	4	3	2
63	2 1/2	40	36	30	17	14	12	6	3	3
78 (3")	3	60	50	40	20	20	17	7	6	6
90 (3.55)	3 1/2	-	-	-	-	-	22	12	7	6
103 (4")	4	-	-	-	-	-	30	14	12	7

3.2.3 Fire-stopping

It is imperative that, in addition to the material presented here, the owner consult local authorities and follow federal, provincial and local codes concerning fire stopping.

The function of a fire-stop is to prevent fire, smoke, or water from passing through a barrier or penetration. In many cases, fire-stop seals are required to perform secondary functions, in acting as environmental protection seals as well as sealing around penetrations which may reach high temperatures or may move axially or laterally. These requirements must be taken into consideration in the application of fire stops.

Commercial buildings are divided into fire zones by fire-rated barriers which are architectural structures (e.g., walls, floors, and ceilings). The perimeters of the fire zones are established in accordance with the building codes and construction requirements.

Any disruption in the continuity or integrity of the surface of a fire-rated barrier nullifies the performance rating of the barrier. All penetrations shall be protected by approved fire-stops. Penetrations are openings made in fire-rated barriers.

There are two kinds of penetrations:

- "Membrane Penetrations" which pierce or interrupt the outside surface of only one side of a fire-rated barrier; and

- "Through Penetrations" which completely transit a fire-rated barrier, piercing both outside surfaces of the barrier.

Penetrations are made to install building elements (e.g., conduits, cables, piping, fixtures, boxes, ducts, etc.) and must be fire-stopped to return the barrier to its intended fire rating.

No additional fire-stopping is needed for electrical apparatus such as boxes, junction boxes, and fixtures which have been tested and approved for use in fire-rated assemblies other than normal patching where the item penetrates-a fire-rated assembly.

If there are any further questions or concerns about fire-stopping consult SaskTel BICS. Please refer to the special note at the beginning of Section 1 on page 4.

3.3. Spaces (see previous on spaces required for fiber entrance devices)

SaskTel requires spaces, suitable for the installation and maintenance of the Fibre Optic Network equipment, that are safe, secure and easily accessible. For the installation of connection equipment, (FDH, FDT, and FSB), the following points should be considered:

- ease of access by SaskTel,
- secure from damage or tampering,
- having adequate lighting,
- dry and free from moisture damage,
- clean and free of dust of vaporous chemicals, and
- will not cause an obstruction hazard.

3.4. Inside Fibre Cable

There are various types of **bend insensitive** interior cables available for use. The style of pathway used typically determines the type of fibre. Though most can be used with different pathway designs, each has its own particular intended uses.

Every inside cable contains 900um tight buffered bend insensitive fibre optic glass. The fibre optic glass is rated to a G.657 b2 level which has a reduced acceptable bend radius of 7.5mm with low or no power loss.

What differentiates types of fibre are the jackets used to protect the glass and its bend radius. **Indoor ruggedized 3.0mm fibre –** This is typically 3.0mm fibre in a riser rated thin tuff jacket. Its light weight and small diameter along with amarid yarn make it ideal for single cable to unit conduit use.

Indoor/outdoor 5.0mm fibre – This bend insensitive fibre is typically a 5.0mm riser rated fibre that is weather hardened for interior and exterior use. It's flexible but very thick jacket make this cable ideal for non-conduit installations where the cable is to be stapled to wood framing.

Indoor/outdoor Crush Resistant Fibre - This is a bend insensitive fibre that is jacketed in its own riser rated corrugated 3.0mm conduit. Though it is more expensive, having its own conduit is ideal for applications requiring durability & protection against cutting crushing and kinking. Suggested use in non-conduit installations, especially where there is an increased possibility of nicks or cuts, as in metal stud construction.

Indoor Riser Cable – this cable contains multiple strands of bend insensitive 250um or 900um tight buffered fibre. Though the common versions come with a typical thin ft-4/6 rated jacket, there is a version that can be ordered with an interlock armored jacket similar to the ruggedized

3.0mm fibre for one-step installation. This fibre is ideal for units requiring more than one fibre drop per unit, with or without conduit.

Please refer to the special note at the beginning of Section 1 on page 4.

3.4.1 Buildings Designated as Fibre Fed

From the electrical room to the suite install an inside fibre cable of a type that best matches the layout and design of the property.

If this route consists of either a single shared conduit with multiple drop-offs into consecutive units, or no conduit but fibre drop between the studs, then the fibre for all the suites must be place simultaneously by the owner/developer during building construction.

Contact SaskTel BICS at Communication.DistributionDesign@sasktel.com to find-out:

- if the building is designated as fibre only,
- **Partnering Opportunities / Marketing Agreements for Cost Sharing**

Please refer to the special note at the beginning of Section 1 on page 4.

4. Living Unit Wiring

The living unit wiring should be done in a “star configuration” where the individual set runs from each telephone jack and TV location and collect at a **“common location”** within the suite. Daisy Chained style communication runs are unacceptable.

Common Location (distribution device): is the central location where all communication wiring is wired to and cross-connected to the network feed facility. The facility feed runs to this common location and is then distributed though-out the residence via a distribution device.

All new residential wiring standards including the North American TIA-570-B recognize the increasing complexity of residential wiring. As such these standards call for higher grade wiring with larger outlet numbers and wire run counts inside the residence. This is consistent for coax, UTP (unshielded twisted pair) and optional fibre-optic cabling.

- Basic grades of residential cabling are RG-6 (tri-shield 100% braid) coax, 4 pair category 5 UTP (for both basic voice and data), and 900 micron tight buffered bend insensitive fibre encased within a standards approved jacket. **The industry standardized “minimum” count inside each communication outlet is 1 coax and 2 cat.5e UTP per outlet.**
- These higher cable counts require a separate distribution panel space, at a “**common location**”: such as beside the electrical panel box. This panel can consist of a ¾” sheet of plywood to mount devices, or can be a dedicated “multimedia enclosure”.

  In any instance the minimum working space of this panel is (24”w x 36”h) for plywood,

and (14.35”w x 30”- 42”h) for a multimedia enclosure. These are the industry standardized sizes for distribution panels accommodating 9 to 16 terminated cables of any type (coax, UTP, fibre) and to account for any additional required communication equipment.

- In addition to the panel, a 15 A, 120 VAC nominal, non-switchable duplex electrical outlet shall be provided within 1.5 m (5 ft) of the panel. The height of the electrical outlet should be appropriate for the panel and any associated equipment being installed. Alternatively, the distribution panel can have its own outlet.

  This is an industry requirement for all panels that will be providing more than basic telephone, satellite, or community basic cable. To name a few, these advanced residential communication services can be VoIP telephony, high-speed internet, high definition television receivers and multi tuner HD personal video recorders, digital interactive video, Internet Protocol Television.

  All these are readily available today in the Saskatchewan marketplace, from all telecommunication, cable and satellite companies.

Historically a 4 inch x 4 inch unit communication wire wall box has been the standard, though suites with an abnormally high number of outlets may require a larger box; however a multimedia panel is preferred.

Note: It is important to remember that the numbers of cables recommended are “minimum guidelines”.

The actual number cables and types needed for each individual communication outlet are determined by the “actual” number and type of devices each outlet will feed.

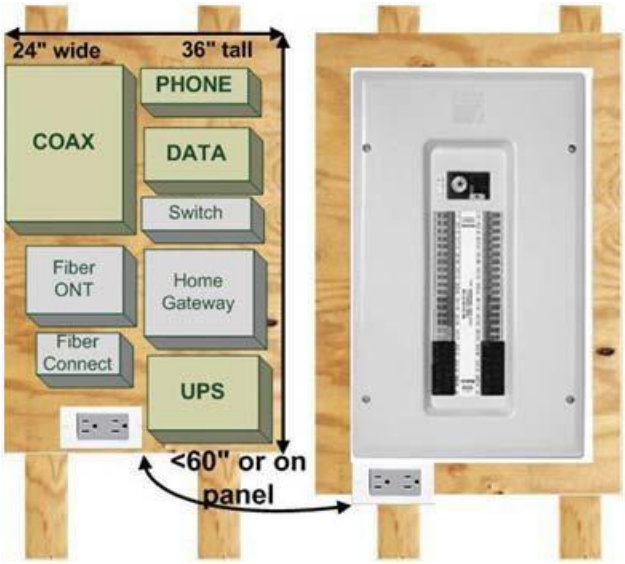
Telephones, computers, IPTV boxes, media server boxes, gaming systems, etc. each require a minimum of 1 run of CAT5e for each such device at that location.

Furthermore, satellite receivers, cable digital boxes, etc require a minimum of 1 run of RG6 for each such device.

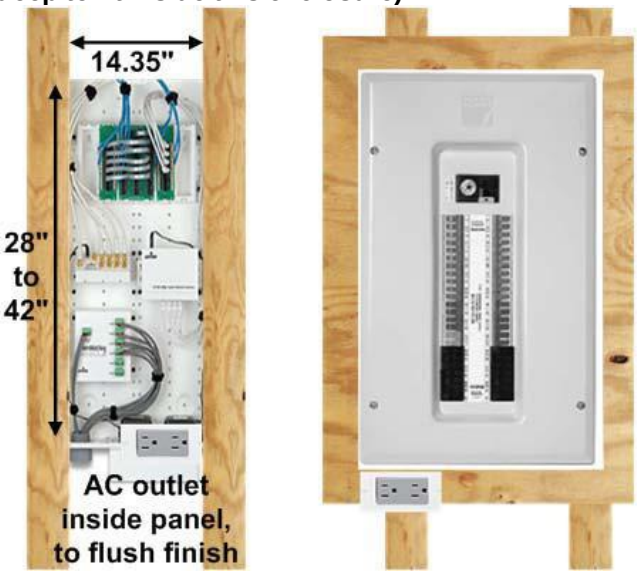
If a unit communication wire wall box is used then SaskTel will surface mount the termination equipment on the wall adjoining the wall box. As seen in the distribution panel examples this will require quite a large surface area. Whereas if a multimedia media panel is used the termination equipment will be mounted within it. The termination equipment consists of ONT, Power Supply, UPS Battery Backup, gateways routers switches etc.

Diagrams of the Distribution Panel and Multimedia Enclosure at the Common Location

- **Example of a distribution panel mounted beside the electrical panel**



- **Example of a multimedia enclosure flush mounted in between the standard stud spacing (note some UPS's may be too deep to fit inside this enclosure)**



*Note, when using the media panel and installing an A/C outlet, the panel must be bonded to the A/C ground.

Please understand SaskTel is transitioning its network to Fiber Optics, for the benefit of all residences and businesses involved, throughout Saskatchewan:

Remember that once a service address is cut over to fiber optics, it will remain on fiber optics going forward. As the neighbourhood is transitioned onto the going forward fiber optic network, the abandoned copper equipment will be removed, recovered, and recycled. Fiber optic is a permanent installation; SaskTel will install using decisions that reflect such an installation. Therefore, choosing the right location and properly installing fiber and materials at the common location is very important for the residence's services, over the upcoming years.

Today we are installing a device that can handle 2.4Gbps. Though, SaskTel present services developed run at 200Mbps. That is faster than many business data services installed today throughout North America. SaskTel needs to treat the install with the respect it requires.

The common location will consist of all the required equipment to install a fiber voice, internet and television service.

Therefore, it can require a large amount of space, for mounting the ONT and UPS, the Broadband Ethernet Gateway (Actiontec), potentially multiple Ethernet switches, plus all the wiring and terminations required.

This is a picture that has been given to homebuilders stating the minimum size requirements for the installation of a FTTP “common location”, and a picture from an actual customer residence following SaskTel recommended space guidelines.

Mounting devices into a multimedia Cabinet

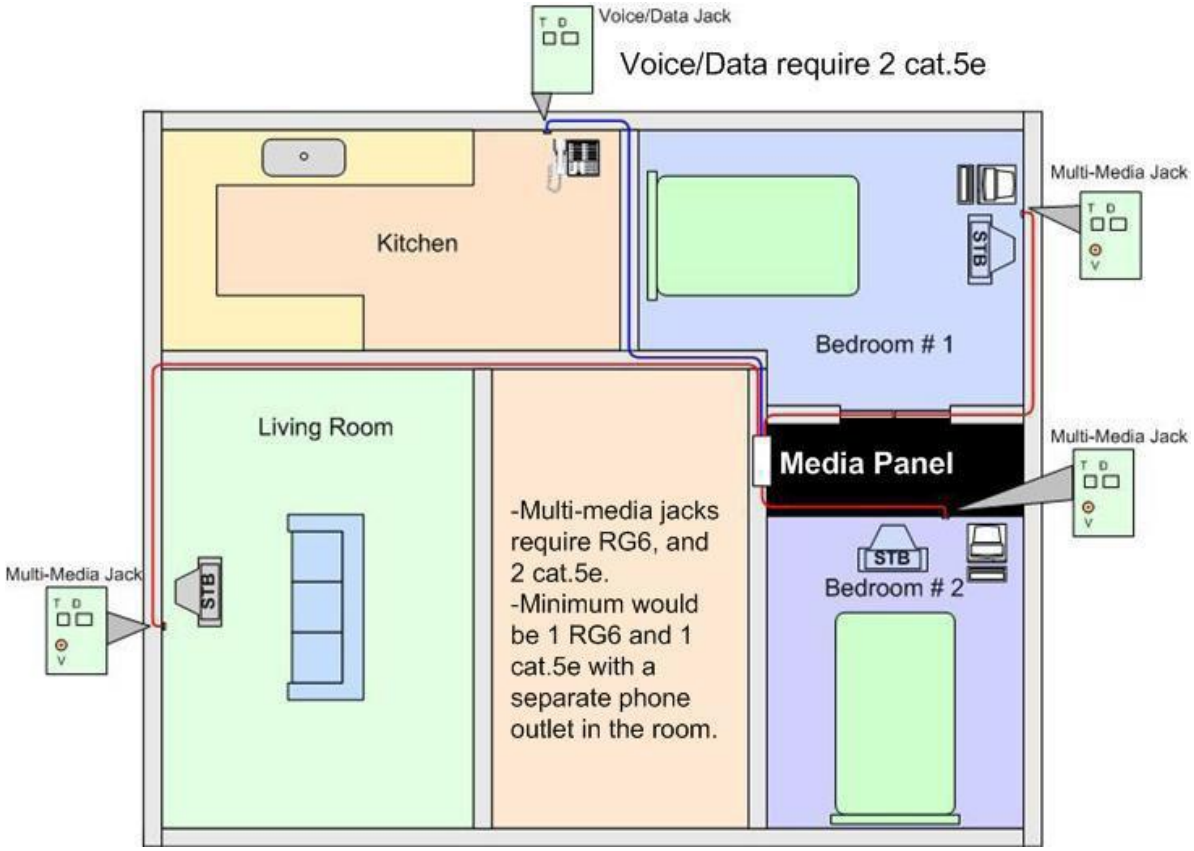
SaskTel is recommending space be designed and built into all new homes, apartments and condos. Enough to fit all communication equipment (both SaskTel and other companies: cable/satellite, alarm companies, etc).

The installation of a multimedia box such as shown below, is designed to fit in between the 16” joist spacing and allows equipment to be housed and hidden in an enclosure that is flush to the wall it is installed upon. A soft ABS or plywood backed multimedia box is needed to flush mount equipment into these devices.

- ONT
- Gateway
- UPS
- Data terminations
- Voice termination
- Coax termination
- Fibre termination

4.1 Wiring and location considerations

- Take into consideration present and future needs (e.g. second line, children's line, computer modem, fax machine, television, security system, internet devices, fridge, TV's, etc.). In large rooms, place for functionality of the room.
- Take into consideration ease of accessibility, traffic and furniture placement. Jack locations should be accessible and in areas where they won't be damaged by furniture or normal activities.
- Recommended locations for communication service are master bedroom, spare bedrooms/den, living room, kitchen, dining room, family room, deck and garage.
- As per Canadian Electrical Code, communication outlets cannot be placed within areas that may provide a shock hazard; this applies to media outlets as well (i.e. Inside bathrooms, next to kitchen sinks).
- A communication jack should be installed with any coax outlet. This will allow for future television requirements such as satellite television or other entertainment service.
- All communication outlets should be within 6' of an A/C outlet.
- Where the ONT/media panel is placed, is to be in a heated environment **where there is no risk of the ambient air temperature falling below 0° (zero) Celsius**. A garage is NOT a suitable location. The preferred location is in HVAC room, utility closet, or laundry room etc. Builder/Owner will provide One (1) duplex 15A non-switched power receptacle dedicated to networking equipment at this location.
- If a unit wiring drop box is placed as well as a Media panel these should be joined by running a 25 mm [1 inch] EMT or ENT (per building codes).



4.2 Labelling

The contractor shall label all communication cables at both ends in a clear and legible manner.

For example, the cabling between the suite and the telephone room shall be labelled at both ends with the function and Unit Number.

At the communication/telephone room end, a typical label would read, “TELCO1 - UNIT 102”. At the suite end, the label would read “TELCO1 – IN”. The label shall be located within 12” of the likely termination point after trim so the label will not be cut off.

Both sides of a dual cable shall be labelled.

4.3 Testing

4.3.1 Optical fibre cable

Even though bend insensitive fibre and the specified jackets aid in protecting them, fibre optic cable is still glass and can be damaged. Therefore, all fibre drops installed must be tested during the installation phase to allow replacement if necessary.

Continuity testing with a ruby red visual fault locator (VFL) is only acceptable for pre-wiring and map/labelling.

All final testing shall be done with light sources and loss meters at 1550 nm.

Using a fibre’s final permanent termination connector for testing purposes would only be necessary if that termination is completed in the permanent housing for the finished fibre unit (e.g. a media panel fibre jack or IFDT/FSB/FDH). This is because fibre terminations cannot be taken apart and are expensive to use as an interim test point.

In lieu of a permanent termination, temporary solutions can be implemented depending on the tools on hand.

The acceptable interim fibre connector methods are:

- Temporarily fusion splicing a pigtail SC/APC connector, or a longer one side pre-terminated patch cable onto the end of the fibre runs, then cutting and reusing it for another test.

- Using the same pigtail or fibre patch cable, terminate using a 3M Fibrlok 2 , which can be taken apart and reused multiple times. (See 3M guidelines for number of reuses).

- If using a permanent connector (outside of the finished housing): collect, cut, fan and terminate the ends to equal and adequate lengths to be fed and finished into the permanent housing at a later date. It is a sound practice to protect these ends by gently coiling and bagging the loose fibre and connector ends into a temporary collector box or bag; then securing the bog to the location where the fibre housing will be placed.

There should be approximately no loss for the installed bend insensitive fibre. Readings shall be done at the 1550 nm or 1580 nm wavelength if source and meter are capable. Loss should exist within the termination of end connectors.

Acceptable levels for connectors 0.2 dB per connector end and no more than 0.5dB when passing through a bulk head connection (i.e. two connectors plugged together and cleaned properly should never exceed 0.5 dB.)

4.3.2 Telephone and Data Wire

All cables must be tested for proper wire mapping, opens, shorts, crossed and split pairs, and maximum cable length, as well as proper location and identification.

All suite cabling shall be tested from the modular jacks on the distribution panel to the modular jacks on each outlet.

Full category 5e certification is desirable but not required.

Simple continuity testing is not an acceptable alternative, except during pre-wiring.

5. Other Services

Some factors affect a customer's ability to have special **voice services** on the SaskTel Fibre Optic Network.

In general, any device that is designed to plug into a conventional telephone outlet will work properly with telephone services provided via the SaskTel Fibre Optic Network.

It's imperative to note, that the ability to provide services via fibre will depend upon the end location of the ONT and its accessibility to fibre optic drops and the quality of inside wire.

5.1 Special Circuits

Some special communications circuits may not work on the fibre optic network: business circuits (ground-start PBX, leased line alarm/monitoring circuits, etc.). These must be served with conventional copper circuits, although SaskTel Optical circuits may still be installed at the same premises for other voice applications.

Contact SaskTel for more information on possible service limitations.

Note: the ability to provide any circuit depends on the accessibility to fibre optic drops and the quality of inside wire.

5.2 Internet

Similarly, any device designed to connect to conventional Internet access providers should work properly on SaskTel services; however, services that are proprietary to a specific Internet Service Provider may not be available.

Note: the ability to provide any circuit depends on the accessibility to fibre optic drops and the quality of inside wire.

5.3 Alarms

Intrusion and Medical Alert Alarm monitoring systems will generally operate on SaskTel circuits; although the systems should be tested to ensure compatibility. Note that most of these systems require a working telephone line for monitoring, so residents must have telephone service if they want alarm systems to be monitored.

In locations where residents are not subscribing to land-line telephone service, owners may want to consider alarm systems that use Internet monitoring, or radio-based monitoring systems.

5.4 Enterphone

There are two basic types of enterphone designs:

- **An intercom style, door entry system that is designed to interface with residents' telephone connection at a central Telephone Room.** This service requires copper phone wiring to be run throughout the building, in addition to the fibre. This is because the enterphone is its own closed circuit service.

  However, SaskTel offers a product that can be installed at the common location in each unit that can automatically switch residents' telephone outlets from fibre services to an enterphone door call, via a "call waiting" operation.

- **A door entry device that calls residents via its own telephone line.** This system works with fibre when the correct equipment is installed. SaskTel is willing to work with various enterphone systems. In most instances this type of enterphone will require the resident to have a telephone line although there are some cases where cellular phone usage is possible.

5.5 Additional Service Providers

Where there is a need to accommodate other telecommunications service providers, or to offer residents a choice of providers in addition to SaskTel, it will be necessary to install additional copper cabling and infrastructure for the alternate service provider. Please contact that provider for details.

6. Responsibilities

6.1 Customer responsibilities in regards to services

Customers are responsible for notifying SaskTel of any proposed communications devices that may be installed at the property that may not be suitable for connection to SaskTel circuits, so engineers can determine if additional copper circuits are required and then provision the installation of those circuits.

Customers should verify the presence of such systems with:

- mechanical/electrical/plumbing (MEP) engineers,
- fire contractors,
- elevator contractors, and
- any code authorities having jurisdiction (AHJ) in their municipality.

6.2 SaskTel responsibilities in regards to services

SaskTel will install copper facilities as required, but additional costs may be incurred, particularly if these circuits are required post installation.

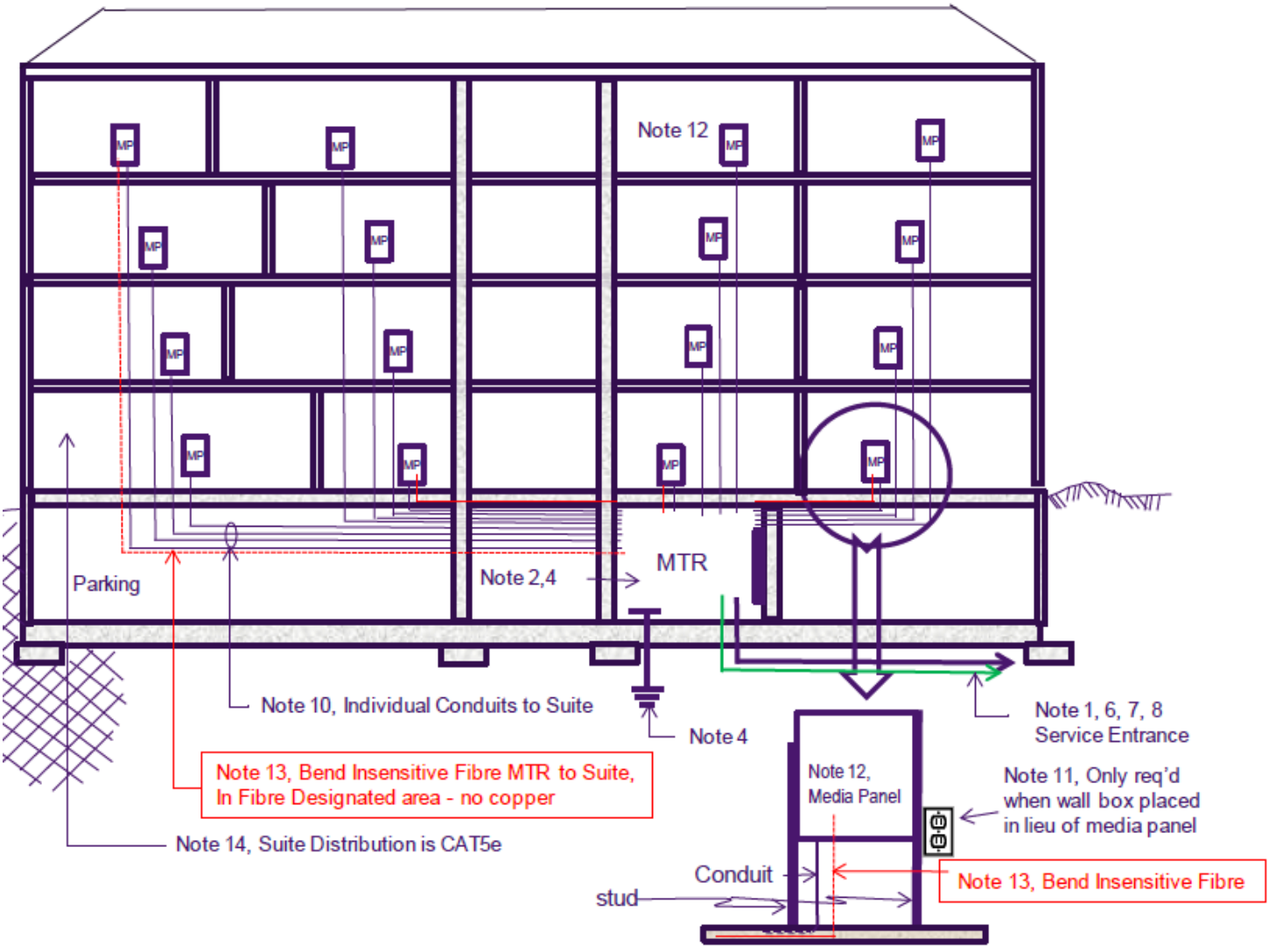
7. Representative Cabling and Pathway (Conduit) Routing

The following diagrams are representative of the various in-building scenarios and do not specifically represent the location of the suite's home-run conduit location (i.e. floor or ceiling) or quantity of such.

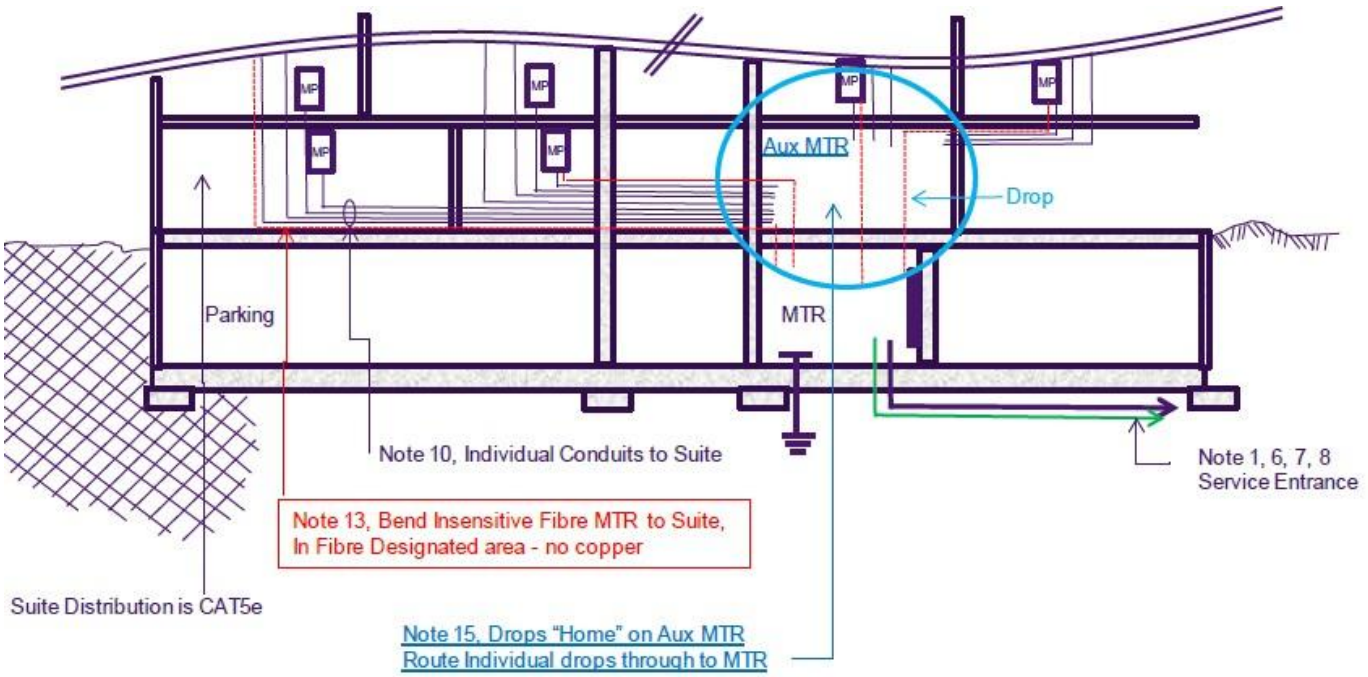
Please refer to the special note at the beginning of Section 1 on page 4.

7.1. Vertical MDUs

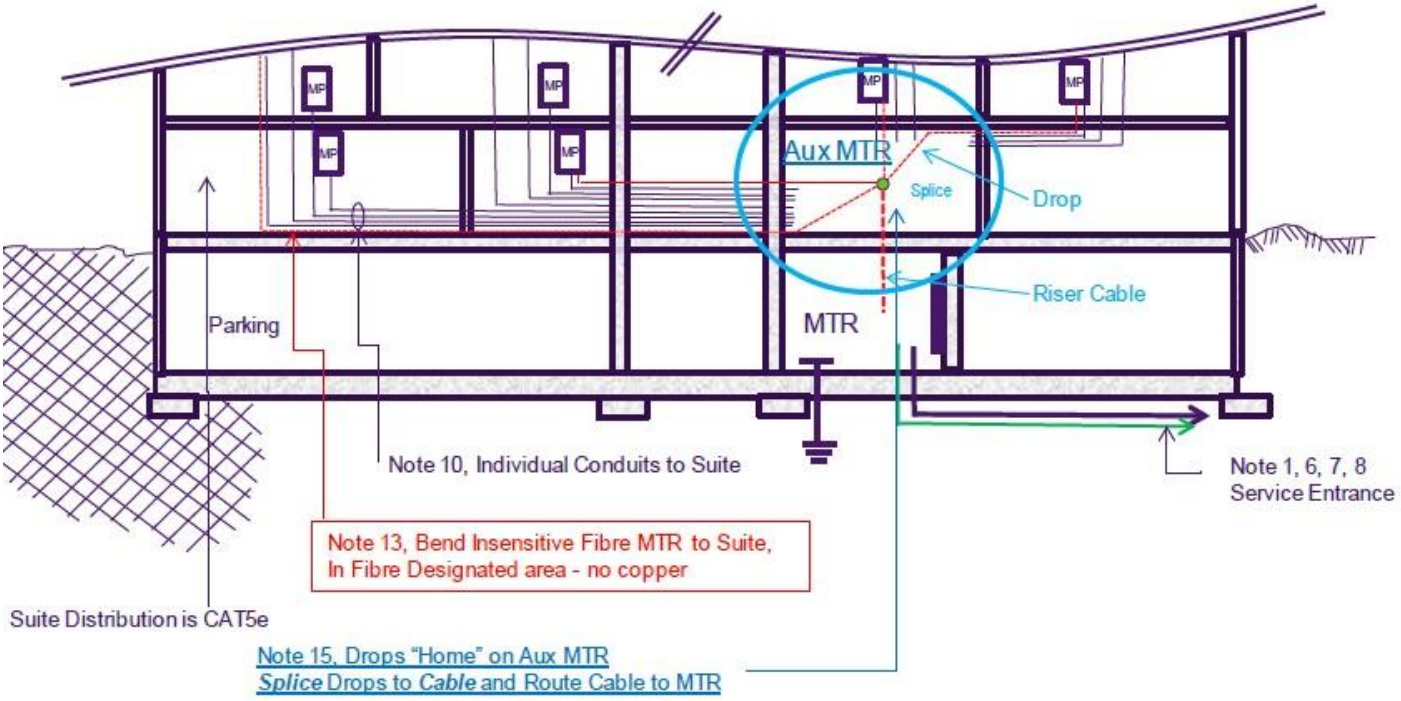
7.1.1. Individual Raceway from Main Telephone Room (MTR) to Suite for Suite Run



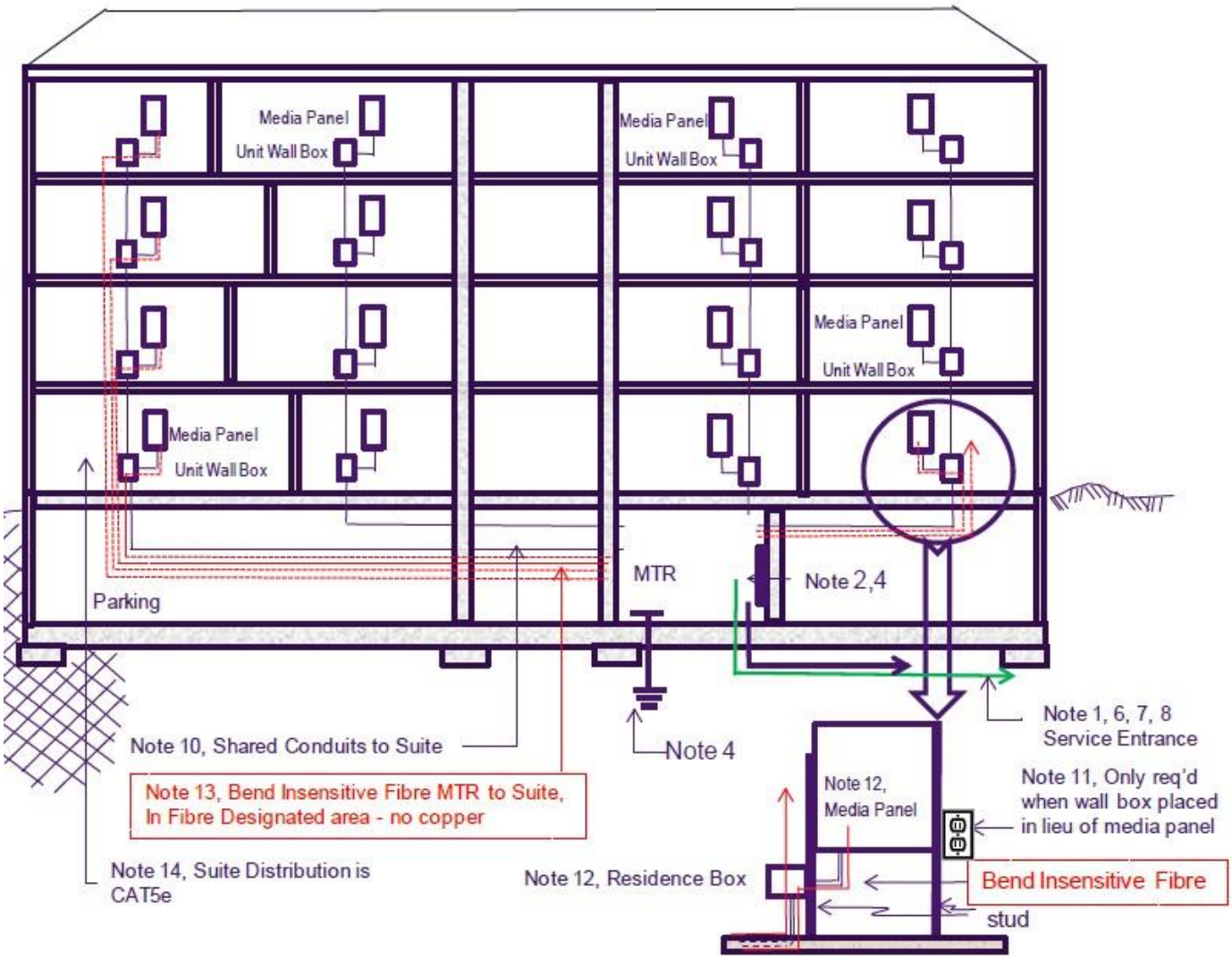
7.1.1. Option 1: Common Raceway from Main Telephone Room to Auxiliary MTR (Aux MTR) then Individual Raceway to Suite for Suite Run. Routes Drops to MTR



7.1.1. Option 2: Common Raceway from Main Telephone Room to Auxiliary MTR (Aux MTR) then individual Raceway to for Suite Run. Splice Riser in Aux MTR and Route Riser to MTR



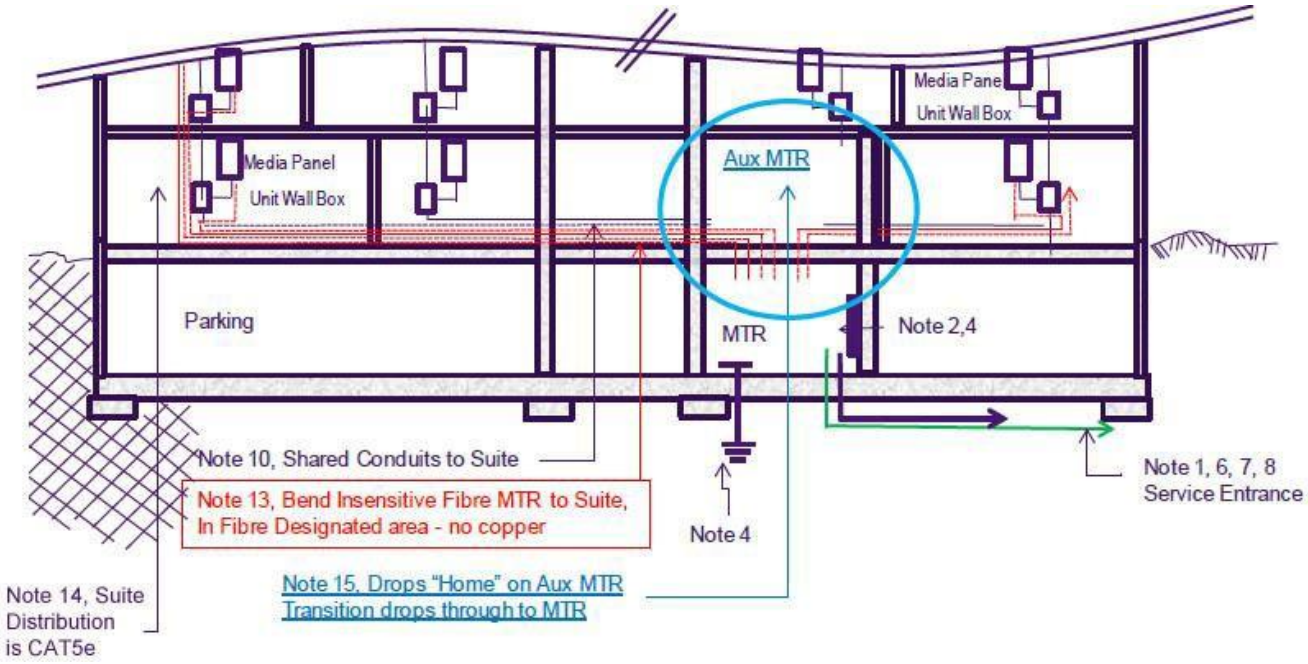
7.1.2. Common Stacked Raceway from Main Telephone Room (MTR) to Suite for Suite Run



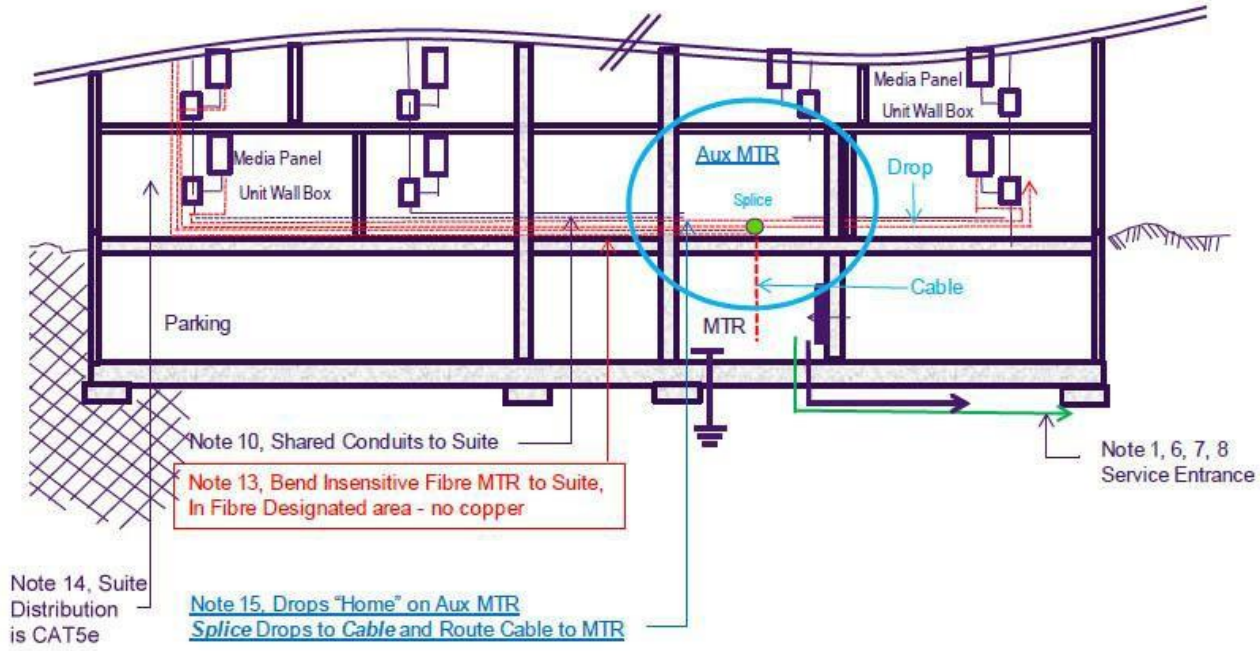
As the conduit is shared between suites the fibre drop must be placed simultaneously (i.e. not individually at time of service request) by the owner.

Contact SaskTel regarding arrangements about providing the fibre drop.

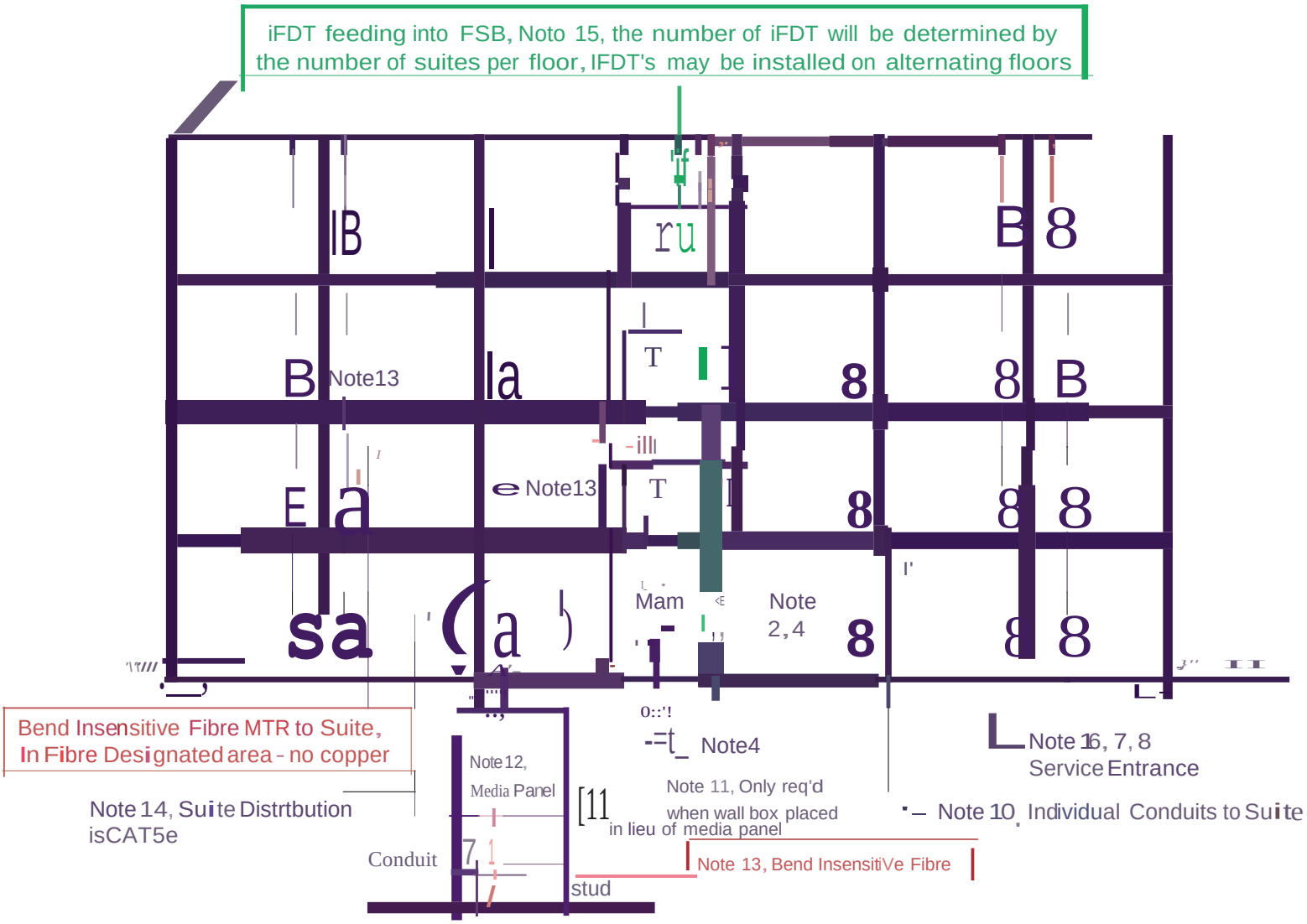
7.1.2. Option 1: Common Raceway from Main Telephone Room to Auxiliary MTR (Aux MTR) then Common Stacked Raceway to Suite for Suite Run. Routes Drops to MTR



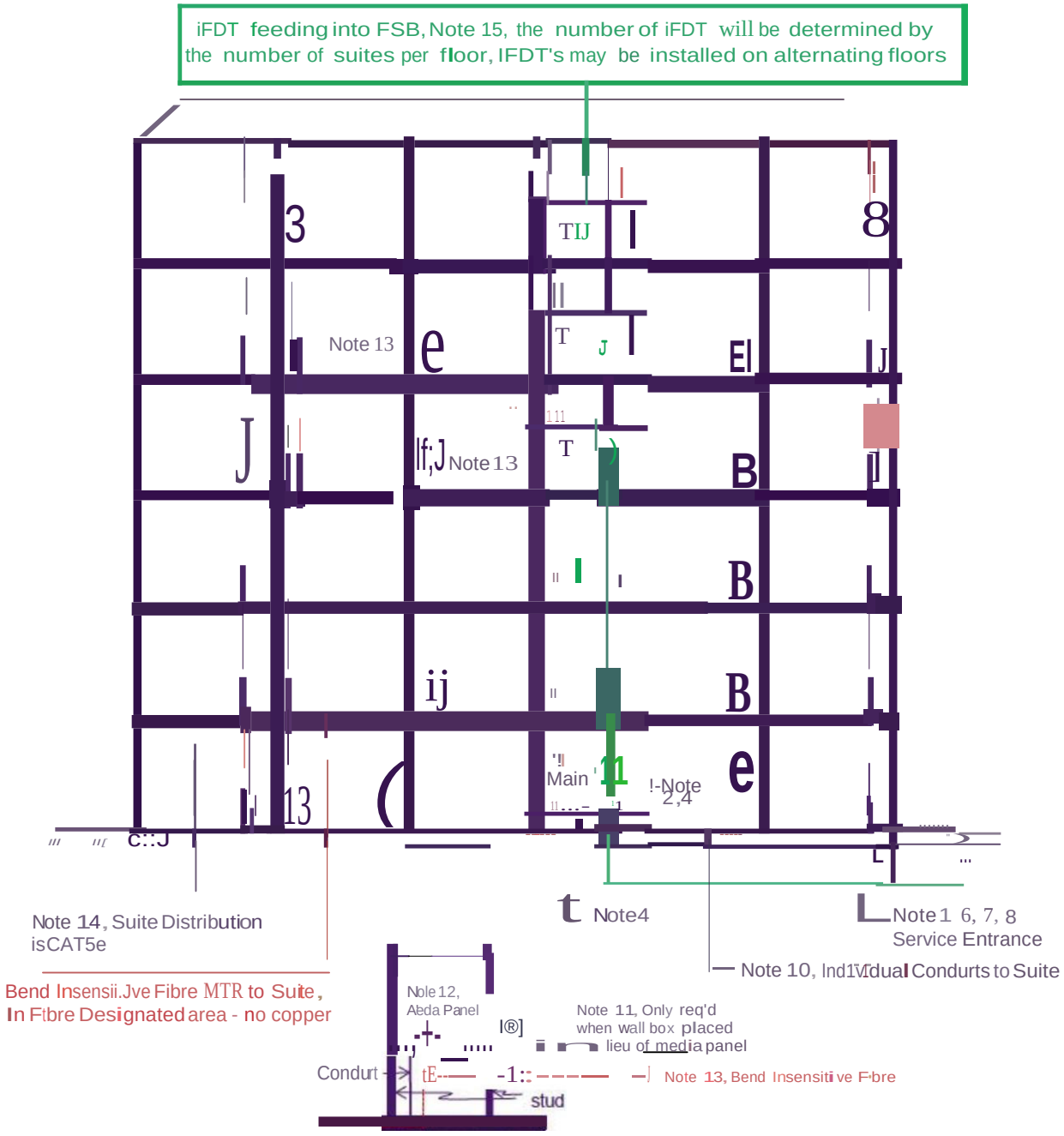
7.1.2. Option 2: Common Raceway from Main Telephone Room to Auxiliary MTR (Aux MTR) then Common Shared Raceway to for Suite Run. Splice Riser in Aux MTR and Route Riser to MTR.



7.1.3 Common *Riser* Raceway from Main Telephone Room (MTR) to Secondary Telephone Room (STR), then STR to Suite for Suite Run

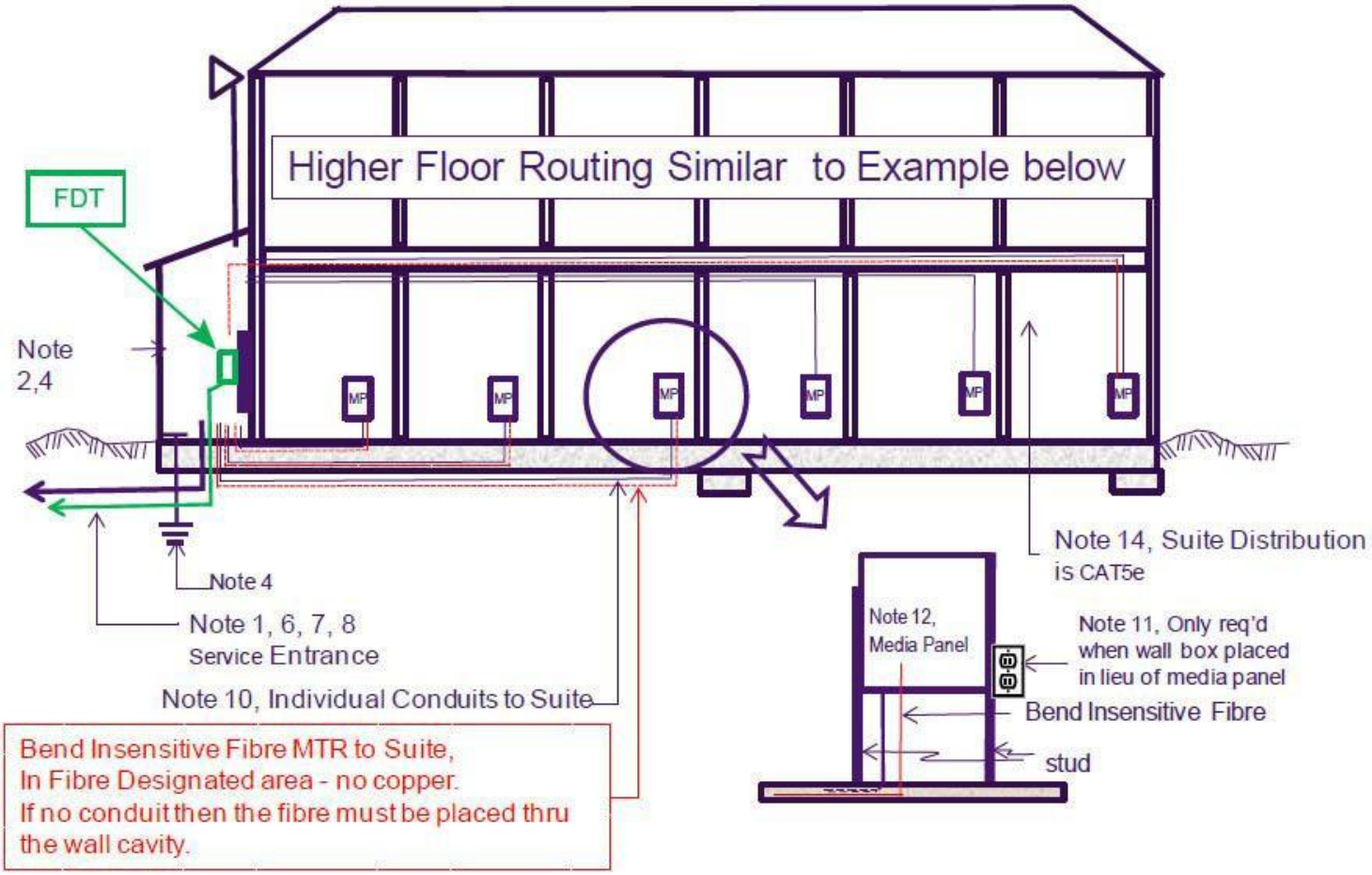


7.1.4. High Riser: Common *Riser* Raceway from Main Telephone Room (MTR) to Secondary Telephone Room (STR), then STR to Suite for Suite Run



7.2. Horizontal MDUs, Part of Town House / Condominium Complex

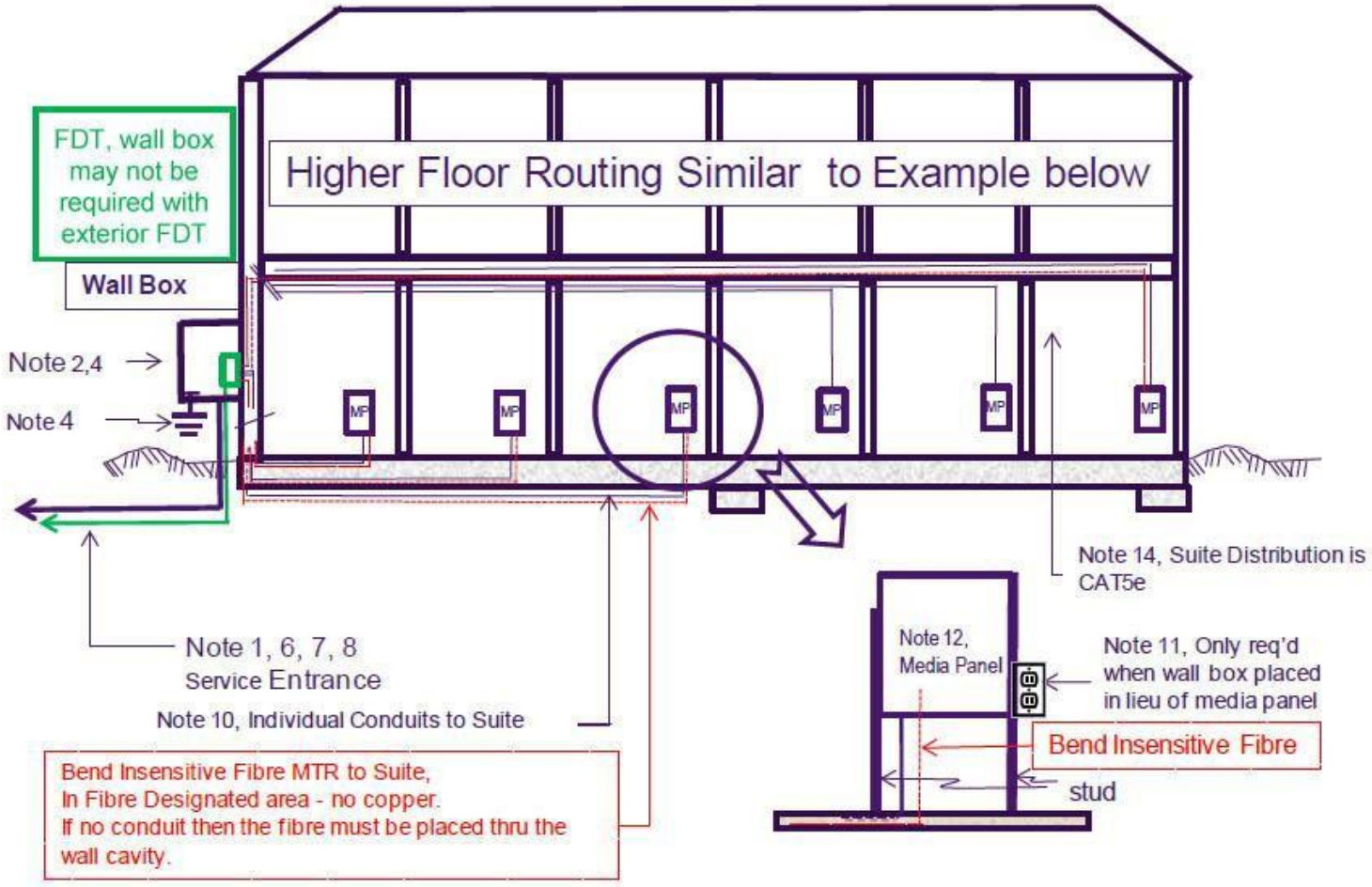
7.2.1 Unit Cluster with Individual Raceway from Telephone Room (TR) to Suite for Suite Runs



If there is no conduit between the telephone room/closet and the suite but cabling is intended to be placed through the stud wall, then the fibre must be placed through the wall cavity to each suite by the owner prior to enclosing the wall.

Contact SaskTel regarding arrangements about providing the fibre drop.

7.2.2 Unit Cluster with Individual Raceway from Wall Box to Suite for Suite Runs

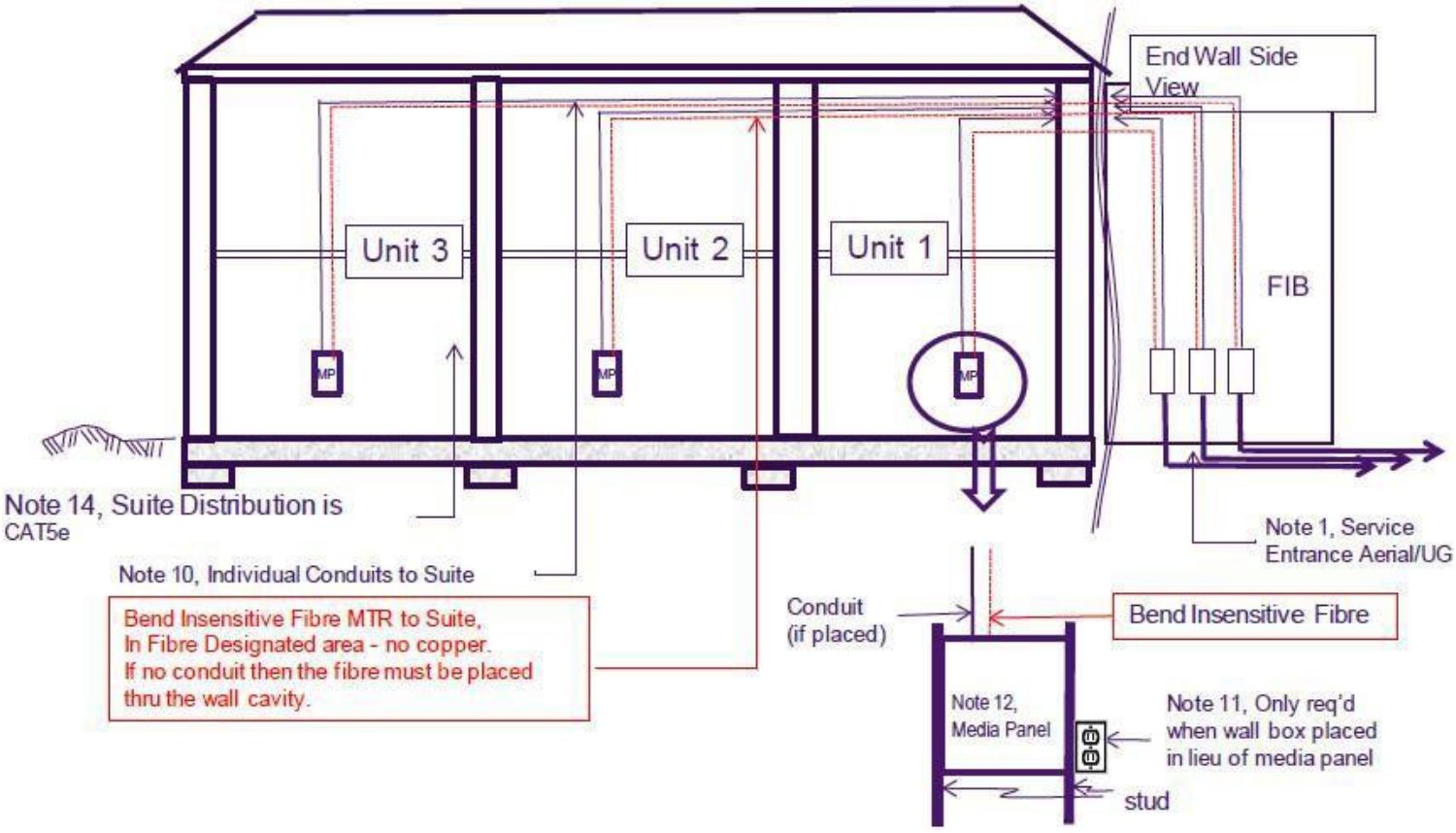


If there is no conduit between the wall box and the suite but cabling is intended to be placed through the stub wall, then fibre must be placed through the wall cavity to each suite by the owner prior to enclosing the wall.

Contact SaskTel regarding arrangements about providing the fibre drop.

7.3 Row House / Duplex

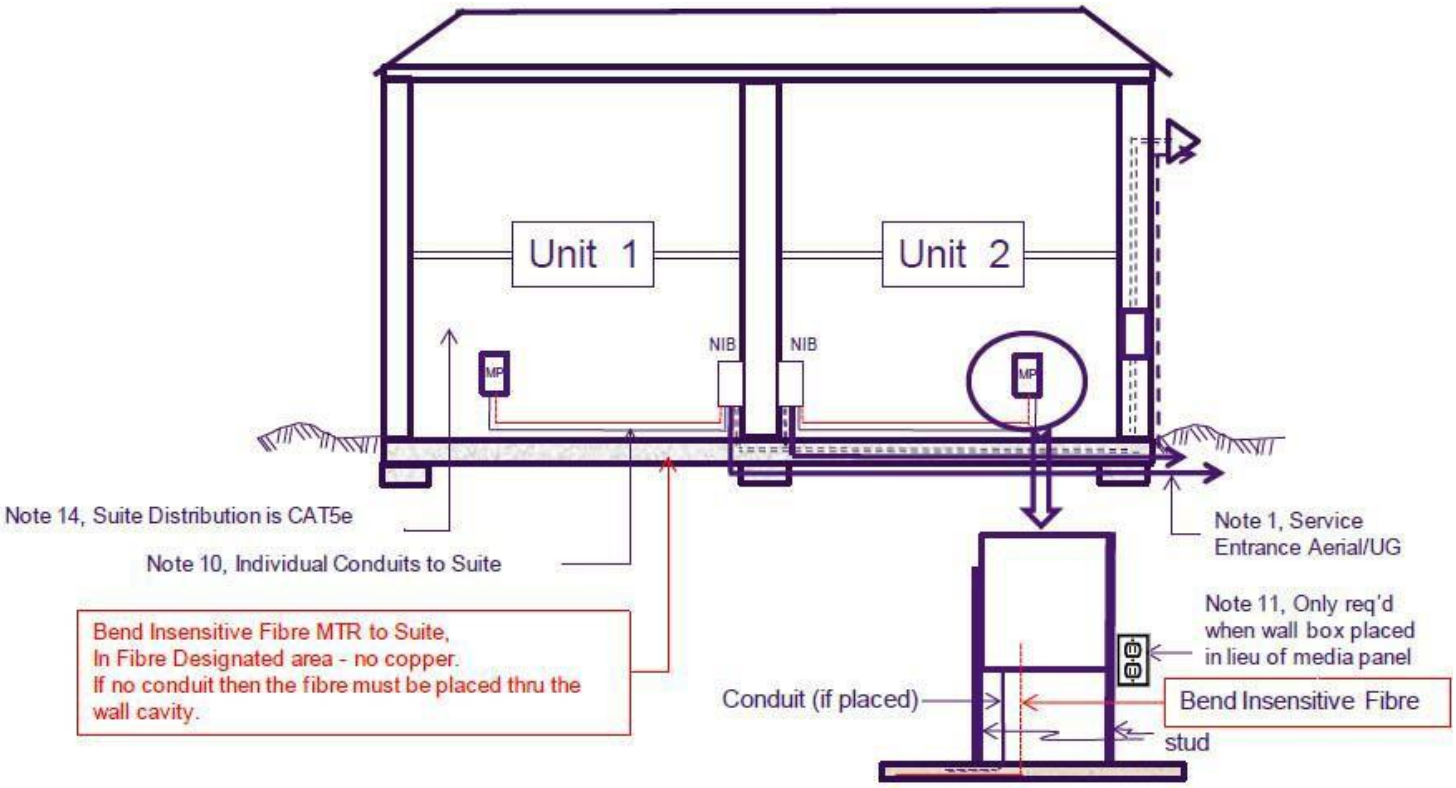
Individual Raceway from Fibre Interface Box (FIB) for Suite Run Multi Units



If there is no conduit between the FIB and the suite but cabling is intended to be placed through the stub wall, then fibre must be placed through the wall cavity to each suite by the owner prior to enclosing the wall.

Contact SaskTel regarding arrangements about providing the fibre drop.

7.4 Duplex



If there is no conduit between the Fibre Interface Box and the suite but cabling is intended to be placed through the stub wall, then fibre must be placed through the wall cavity to each suite by the owner prior to enclosing the wall.

Contact SaskTel regarding arrangements about providing the fibre drop.

7.5. Notes

SaskTel standards up to demarcation equipment

1. Location and size of Service Entrance as determined by SaskTel. If aerial drop, it is to be concealed in wall cavity, supply and install a minimum size 25mm (1") EMT conduit in wall - cavity for SaskTel only.
2. Main terminal space-size to be determined by SaskTel.
3. Telephone Backboard size to be determined by SaskTel.
4. CATV should be in separate system beyond main Tel. room. If in the same conduit the diameter must be increased.
5. The main electrical panel ground must be accessible. If main electrical panel ground is not present in the same room as the main telephone terminal, provide 25 mm [1"] rigid conduit to main electrical panel with an approved #6 green ground wire as specified in CEC-60-706.
6. Provide and install all ducts and conduits with a waterproof pull-cord.
7. All cable and wiring installed by SaskTel.
8. Size and number of conduits to be determined by SaskTel.

Suggested Standards on the Subscribers Side of the Demarcation Equipment

9. Home run of 25 mm [1"] EMT, Flexible ENT or rigid PVC conduit (rated acceptable by applicable codes) to the residence unit box or media panel in each individual unit from telephone terminal room. Depending on building structure, the conduit may be placed horizontally and/or vertically.

If fibre runs are installed in a multi-drop or multi-point system, where one larger conduit feeds off to successive units vs. having individual home run conduit, then the conduit at the beginning of the run should be a larger diameter to accommodate the multiple single cables progress to each suite. The conduit sizing should conform to the following chart.

This table provides a guide for conduit sizing when there are multiple cable in the conduit and is as per ANSI/TIA 569-B & 570-B

		Cable Outside Diameter mm (in)								
Conduit ID mm (in)	Trade Size (in)	4.6 (0.18)	5.6 (0.22)	6.1 (0.24)	7.4 (0.29)	7.9 (0.31)	9.1 (0.37)	13.5 (0.53)	15.8 (0.62)	17.8 (0.70)
16 (0.62)	1/2	1	1	0	0	0	0	0	0	0
21 (0.82)	3/4	5	4	3	2	2	1	0	0	0
27 (1")	1	8	8	8	3	6	2	1	0	0
35 (1.25")	1 1/4	14	12	10	6	4	3	1	1	1
41 (1.5")	1 1/2	18	16	16	7	6	4	2	1	1
53 (2")	2	28	22	20	14	12	7	4	3	2
63	2 1/2	40	36	30	17	14	12	6	3	3
78 (3")	3	60	50	40	20	20	17	7	6	6
90 (3.55)	3 1/2	-	-	-	-	-	22	12	7	6
103 (4")	4	-	-	-	-	-	30	14	12	7

10. The unit communication wire wall box installed is to be a min. 200 x 200 mm (8 inch x 8 inch, similar to RB8 box) deep outlet box. Suites with an abnormal number of outlets may require a larger box.

The location of the unit box and media panel is at switch level height in a **heated environment where the ambient air temperature will NOT fall below 0º (Zero degrees Celsius)** such as in the utility closet. This box must be readily accessible. When a unit box is placed in lieu of a Media Panel then an external non-switch 120VAC electrical outlet is required to be within 45cm (18 inches) of the box.

11. The Multimedia Panel Box. Where the ONT/media panel is placed, is to be in a heated environment **where there is no risk of the ambient air temperature falling below 0° (zero) Celsius**. A garage is NOT a suitable location.

    The preferred location is in HVAC room, utility closet, or laundry room etc. Builder/Owner will provide One (1) duplex 15A non-switched power receptacle dedicated to networking equipment at this location. If a unit wiring drop box is placed as well as a Media panel these should be joined by running a 25 mm [1 inch] EMT or ENT (per building codes).

12. Developer/Owner to install communications wiring in wall cavity, either in conduit or through the studs if no conduit installed.

    a. **Buildings Designated as Fibre Fed,** from the electrical room to the suite install an inside fibre drop cable of a type that best matches the layout and design of the property.

    If this route consists of either a single shared conduit with multiple drop-offs into consecutive units, or no conduit but fibre drop between the studs, then the fibre for all the suites must be placed simultaneously by the owner/developer during building construction.

    Contact SaskTel BICs to find-out if the building is designated as fibre only.

13. Suites Runs: all suite runs from Medial Panel to the outlet jack in the suite must be CAT5e four pairs twisted 24AWG solid copper wires.

14. If the drops “home” on Auxiliary MTR, then there are (2) options determine the conduit capacity between the Auxiliary MTR and Main MTR.

    If conduit capacity allows for the large number of single drops, then continue the drops through to the MTR – this is the preferred arrangement. If conduit capacity does not allows for the large number of single drops, then do a transition splice and route a short piece of riser cable from the Auxiliary MTR to MTR.

    Contact SaskTel to determine the final method as other options may still be available

The use, number and location of iFDTs, if ever required, will be determined by SaskTel. This is because iFDTs come in set number counts and, to reduce wastage, may be installed on alternating floors to properly fill the devices. The builder should then be prepared to run the floor fibre drops up or down one floor to meet the iFDT location, and this should be discussed with SaskTel prior to installation of the indoor fibre drops.