

# Microduct Network Design

## Distribution

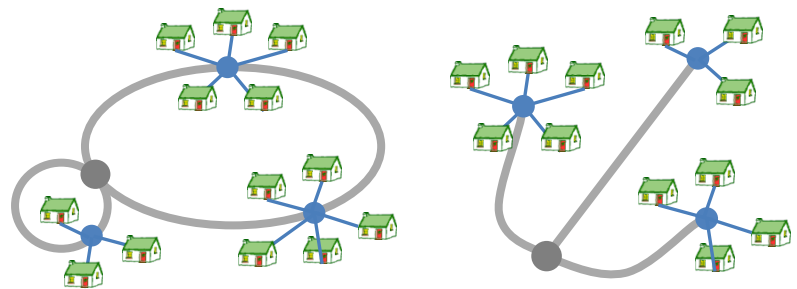
Distribution section locates between feeder and drop network. The scale of the access network is small, or the distance from a central office to the customer is short; the function of the distribution and drop cabling merges. Generally, cabinet or closure as FCP locates at both terminals of distribution cable. The FCP accommodates lots of fiber splices, connectors, adapters, splitters, and others to deliver the optical signal to customers.

### Loop and star topology

The distribution coverage is extensive, and expect customer increase; the loop structure would be better for absorbing future demand.

However, the star topology constructed with the non-decreasing branch toward customers still has flexibility compared to the decreasing one. It is easier to convert to a loop structure for future expansion.

So except for the distribution of detached area, the design of either loop or non-decreasing star is recommended.



The loop (left) and star topology

The planning of distribution with conventional fiber cable supplies 120~150% fiber cores of current demand (to cover unexpected demand change).

With microduct system, around 20% additional fibers would be enough for FTTH implementation. A more important consideration is the construction of microtube network should be either loop or non-decreasing star structure.

The feeder covers a wide area, while the length of distribution section is short compared to the feeder. Most of this section could be within one pass blowing distance of ABC, so cabling without intermediate splice is possible except for some remote areas.

For both future expansion and flexible provision, avoiding decreasing star structure is desirable. The fiber count of ABC will be small because its function is to deliver the multiplexed signal to each branch from the feeder.

In some cases, the aerial microduct can be used as distribution though this applies not in the city center but for remote areas. ABF could be blown, but this is considered as a merged case of distribution and drop.



Non-decreasing (left) and decreasing branch installation



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## Distribution

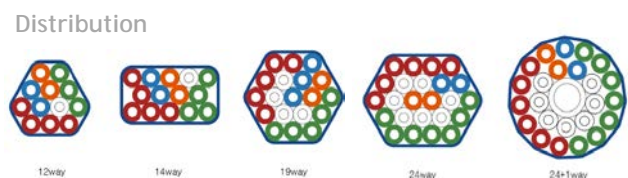
The products for microduct distribution network cabling are listed below.

### Microduct

- DI for pull into duct, TWD or DB for direct bury
- Aerial can be applied for remote area connection or temporary provision
- Microtube count should be more than 2 times of current demand for future expansion
- Supply enough microtubes at initial construction not to dig again
- Except such area as fixed demand, always try to build with loop or non-decreasing star topology

### Fiber cable

- ABC: up to 48 core or more
- ABF: up to 12 or 24 core
- G.652 etc.



### Tube joint and protection

- DI: use straight connector inside manhole, handhole or branch unit
- TWD: use DBL or covered straight connector
- DB: use straight connector with protected branch unit
- Aerial: use straight connector with UV protection
- Span between microtube joints varies on site condition or work progress



### Manhole span

- Around 500m or less is good for future branch and maintenance

### Splice span

- Usually, FCP to FCP blowing will be possible, so fiber splice is not necessary

### Microduct installation

- Pulling DI into duct or installation on poles
- For TWD or DB, either micro- or mini-trench is recommended
- Depth depends on each country's regulation

### Blowing distance

- Around 1km (one pass): many bends are made in city area
- Can be increased by cascade or bidirectional blowing

# Microduct Network Design

## Drop and premises

The drop wiring connects to the end customer in FTTH. You can use both aerial and underground cabling, and the length is short compared to feeder or distribution. Most PON systems operate on the bidirectional transmission that only one core is enough for a subscriber but usually adds one core. So for general house customers, ABF in a TWD microtube or DB one-way installation is recommended. On the contrary, one or two cores are insufficient for MDU (Multi Dwelling Unit) or business buildings. So ABC cabling in TWD or DI will be necessary. For inside buildings, it requires LSZH for fire safety.

### Drop

A split signal from splitter delivers to a subscriber in FTTH. It is possible to connect 1~2km length with ABF, so blowing into a small diameter tube is common for drop cabling. The splitter has many branches up to 32 or even 64 that connecting from a splice closure is difficult (multi-stage split can be used to accommodate the splitter inside closure).

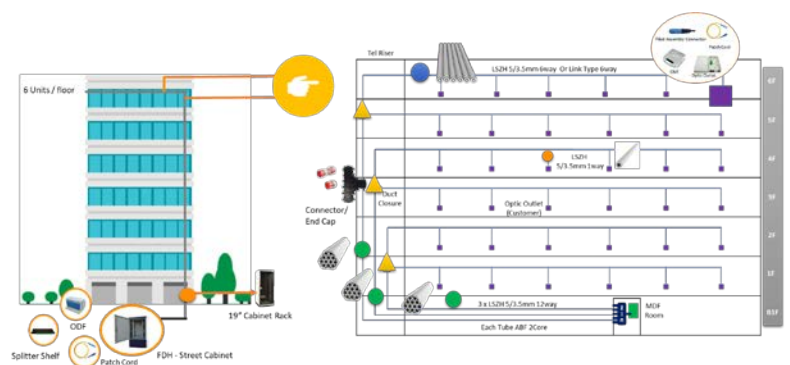
Many branches will be from a splitter; then, they should be located in a cabinet or branch box. Aerial drop with ABF is another solution. The strength member of the cable keeps the inside fiber bundle safe. Underground optical wiring, even in drop section, is always desirable. Because the inherent harshness of the aerial environment caused by the wind, ice loading, UV radiation, traffic intervention, and temperature change is the major risk factor that disturbing stable network operation.



### Premise's wiring

ABC or ABF in LSZH duct goes and branches to each floor of MDU. Each subscriber is connected to the output port of splitter through ABF in a separate microtube. Then the fiber is terminated with a connector in an optical outlet.

The cabling distance in an MDU or SDU (Single Dwelling Unit) is very short but it has many sharp bends, so the G.657 fiber will be a better solution to avoid bending loss.



# Microduct Network Design

## Drop and premises

The products for microduct drop and premises network cabling are listed below.

### Microduct

- Drop: TWD microtube, DB or aerial microduct is normally used
- Premises: LSZH microduct or microtube is recommended



LSZH Link 6way

### Fiber cable

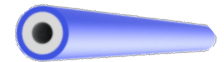
- ABC: up to 12 core or more for an MDU.
- ABF: 2 or 4 core for a SDU
- G.652, G.657 etc.



LSZH 12way

### Tube joint and protection

- Use straight connector for joint or branch in each floor
- Aerial: use straight connector with UV protection
- Bulkhead connector is used in the tube branching box



Direct Buried HS 5/3.5mm

### Microduct installation

- Aerial installation on poles (drop)
- LSZH installation along cable tray



Thick Sheathed Duct 7/3.5mm  
Or Thick Walled 7/3.5mm

### Blowing distance

- Around 1km (one pass): many bends may decrease reachable distance



Ruggedized Duct 7/3.5mm



Aerial Drop Duct