Last Mile Microduct Solution to help “Rural Broadband” project

Background

Many governments, communities are working on bringing broadband to the local, mainly rural area. Digital technologies are essential for the sustainability of rural regions.
Have broadband support generational renewal by making rural areas fit for the future and making it possible for people to have equal access to the Opportunities in urban areas.

There are many different types of initiative projects such as RODF(Rural Digital Opportunity Fund) in the USA, ‘Vision 2021: Digital Bangladesh’ goals in Thailand, Action Plan for Rural Broadband in EU and UBF (Universal Broadband Fund) in Canada, etc.

One of the advanced deployment technology is microduct solution, and this white paper will show you why Microduct fits for rural broadband deployment and how you can implement..

knet
Provides Solutions for Next

Microduct

The microduct is a bundle of small diameter ducts (microtube) that can accommodate optical fiber or cable for telecommunication purposes. It shows several distinctive benefits compared to conventional cabling in optical network investment, construction, and maintenance.

KNET provides various microducts that meet every application, including direct bury, pull into a duct, aerial, and indoor installation. A permanent solid lubricant is applied on each microtube's inside wall to get the maximum blowing performance. So this layer drastically increases the distance between fiber splices that can make a more reliable and cost-effective network..

Benefit

Cost-effective optical wiring technology
Access network construction requires a frequent and flexible connection from the node to subscribers. Microduct is the best solution in realizing a complicated access network.

Efficient utilization of infrastructure
Microduct occupies a small cross-sectional area than the conventional duct system.

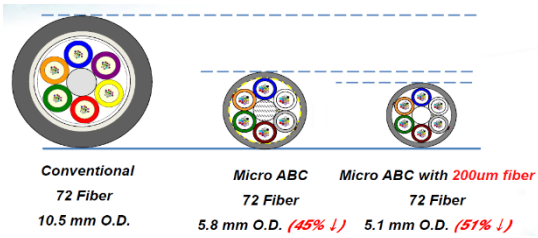
Deferred investment
Supply of in-time fiber demand reduces initial CAPEX and enables cost-efficient operation.

Less splice and enhanced reliability
Long-distance blowing enables less splice of fiber cables.

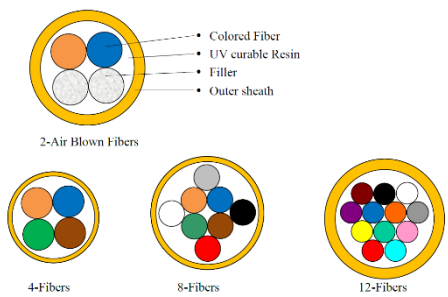
Future-proof technology
Replacement of existing fiber cable to a new one is accomplished by simple blowing.

Air Blown Cable (Micro Cable) & ABF (Air Blown Fiber)

The ABC is a loose buffered lightweight, smaller diameter optical cable. Unlike legacy loose tube cable that commonly uses steel wire as a strength member, ABC adopts GRP (Glass fiber Reinforced Plastic). Those early days of microduct without high count fiber cables like ABC, design, and microduct system installation were limited due to the small count of fibers in ABF. But since the introduction of ABC, the microduct system has excellent flexibility in its utilization to cover from the long-distance network, city backbone to customer premises.



The ABC is usually installed for the feeder or distribution network that requires many fibers. Nowadays, 144 core ABC is widely used and its diameter is around 8mm. 2 different outer jacket materials of polyethylene or nylon are commonly used.



ABF bundle

ABF (Air Blown Fiber)

Typically, ABF does not contain strength member, so careful handling is required not to break or kink. Instead, its flexibility and lightweight are significant advantages in deploying in building networks that have many bends.

Bundles of 2, 4, 8, to 12 cores with 1~1.6mm outer diameter are widely used and 1~2km blowing distance in 3.5mm microtube can be generally accepted (blowing distance is varied depending on many conditions). So main application of ABF is to connect distribution or drop networks that this range is acceptable.

Sometimes hybrid bundle that has both single-mode and multimode could be used for MDU wiring.

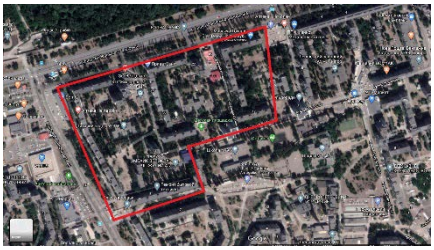
Installation – Microduct & Micro cable

Cable installation by using high speed air flow combined with additional mechanical pushing force is called as “blowing or jetting”. Cable blowing is the process of installation of optical fiber cable into a microduct. Compressed air is injected in the microduct inlet after few hundred meters of cable is pushed into the duct. Compressed air flows at high speed through the duct and along the cable.

The pushing force is applied mainly near the cable inlet by a pushing device. Standard optical fiber cables (like uni-tube, multi-tube, unarmored & armored), microduct cables, and micro-ducts can be installed by using this method. It is possible to install microduct cable using blowing method in continuous lengths of more than 2000 meters depending

	ABF			ABC					
Fiber Type	250μm, G652D / 200μm G657 A1			250μm, G652D / 200μm G657 A1			200μm, G657 A1		
Fiber Count	2 & 4 F	8 F	12 F	Up to 72 F	96 ~216 F	288 F	Up to 144 F	288 F	432 F
Cable Diameter(mm)	1.2	1.4	1.6	5.8	6.5 ~ 8.0	10.2	5.1~ 6.4	7.9	8.7
Tube Size (ID/mm)	2.1, 3.5, 4.0			8	10	12	8	10	12

Microduct Network Design



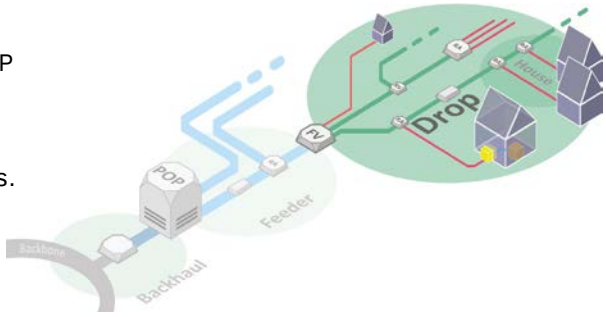
When considering microduct network, understanding the differences of duct and fiber networks is important. Make a well-prepared microduct network first, and then blow fiber cable into it. So you can imagine, you should join both cables of microduct and fiber optic by using different methods. The tube connector is for microducts and the fusion (sometimes mechanical) is for fibers.

Construction of telecommunication network costs very high because it is related to civil works. So to lessen financial pressure, utilizing existing infrastructure must be considered first. As many rural areas have existing infrastructure, it is essential to use it. Microduct can be inserted into an existing duct, installed on poles, or buried directly. A thorough survey for both physical site and accessible data on the desktop to find available routes will make a better design result.

The network designer who tries to make a plan with microduct needs to understand each system components’ characteristics and application. This section that describes the design differences from conventional cable will help make an optimal result.

FTTH Deployment Technology Using Microduct solution

The demand for subscriber's connection has been increasing, which causes network provider and ISP companies to expand network and FTTH coverage for better services with reasonable cost. Accordingly, Microduct and Air Blown Solutions have been adopted to save initial installation costs.

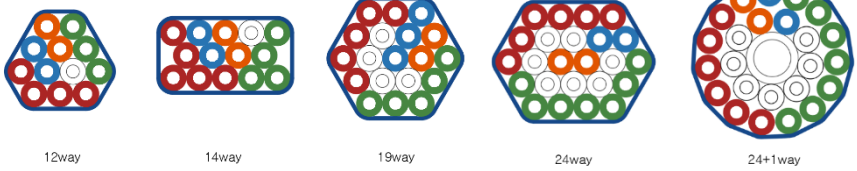


Rural Broadband Network Design using Microduct

Distribution network

For flexible distribution network depending on subscribers' request with minimal time and installation: . For these purposes, the small size of Microtube has been widely deployed for the distribution network.

Distribution 7/4mm or 7/3.5mm or 4/2.1mm Series



12way 14way 19way 24way 24+1way

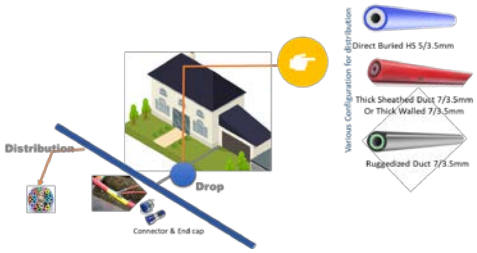
Branch Unit Closure
Feeder to Distribution or Distribution to Last mile

Straight Connector 14/10mm

Reducer 16mm to 10mm

Last mile/Drop/SDU

All subscribers' management can be done in FDH by installing splitter and connecting fiber(generally 2 Core) to each subscriber. You can install **Ruggedized** duct**, Thick DB, or DB HS 1way** to protect fiber, which connects the distribution point and each subscriber.

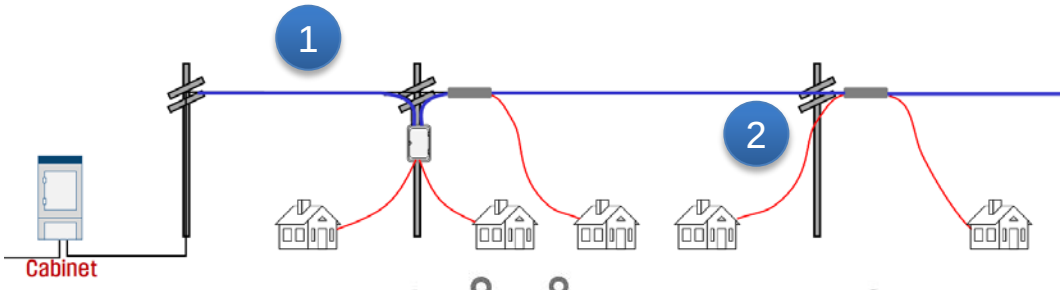


Drop 7/4mm or 7/3.5mm, 4/2.1mm Series

1way 3way 4way

Aerial Solution for Rural Area

Microduct may be installed above ground along aerial pole lines when underground installation is difficult due to rocky soil or where freezing makes the ground impossible to dig during long periods.
Knet aerial microducts are self-supporting with either a dielectric fiberglass strength member or steel strength member preinstalled.Fibers are installed and protected through microtube path.
So, the chance of fiber splice is minimized as well as diminishes possible damages caused by rodents.Microduct and cable blowing are combined, allowing to have future growth at a considerably lesser cost.

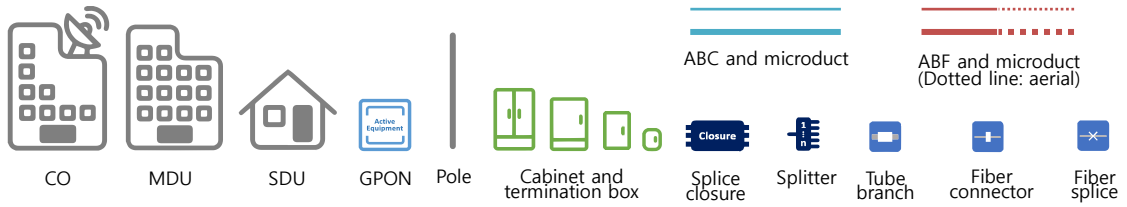


12/10mm tubes are networked with high fiber counts cable(ABC) and 5/3.5mm tubes are connected to subscribers at each pole. From the pole cabinet to the subscriber, it is connected by ABF.

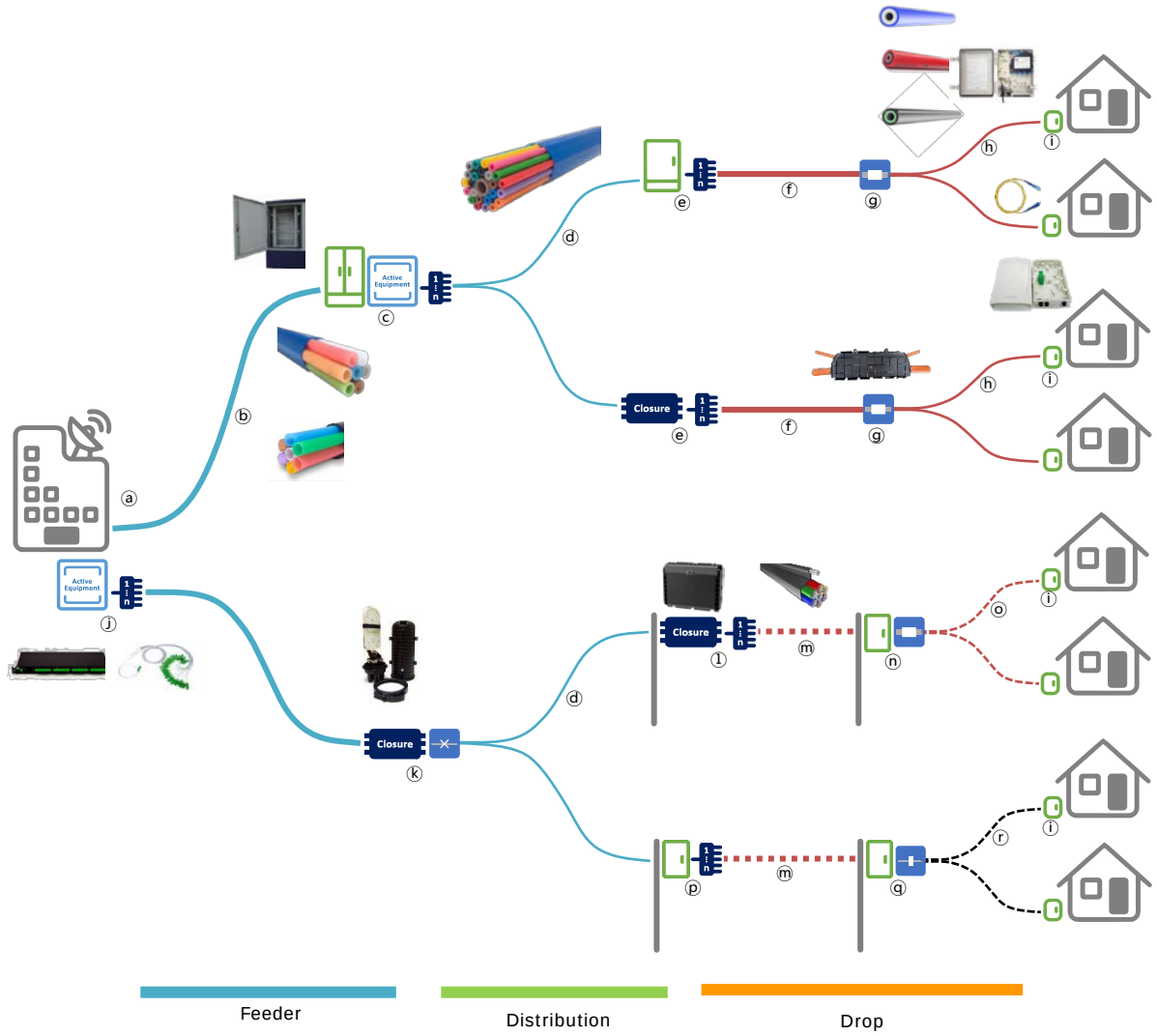
1 Distribution Network

2 Drop Network

SDU design models



Symbols for design models



Location	Description	OSP product
ⓐ, ⓙ	Optical distribution system	Rack, shelf, splitter (ⓙ), patch cord, pigtail
ⓑ	Feeder cabling	ABC, microduct (DI, DB, TWD), tube connector
ⓒ	Remote access node	Cabinet, splitter, rack, shelf, patch cord, pigtail
ⓓ	Distribution cabling	ABC, microduct (DI, DB, TWD), tube connector
ⓔ	Fiber concentration point	Street cabinet, splice closure, splitter, patch cord, pigtail
ⓕ	Drop cabling	ABF, microduct (DI, DB, TWD), tube connector
ⓖ	Drop node	Branch unit, tube connector
ⓗ	Drop cabling	ABF, single tube microduct (DB, TWD, Ruggedized), tube connector
ⓘ	Subscriber fiber termination	Termination box, patch cord, pigtail
ⓚ	Fiber concentration point	Splice closure
ⓛ, ⓟ	Fiber concentration point (Pole)	Splice closure, cabinet (ⓟ), splitter, patch cord, pigtail
ⓜ	Drop cabling (Aerial)	ABF, aerial microduct
ⓝ, ⓠ	Drop node (Pole)	Cabinet, tube connector, patch cord (ⓠ), pigtail
ⓞ	Drop cabling (Aerial)	ABF, single tube aerial microduct
ⓡ	Drop cabling (Aerial conventional)	Drop cable, push cable, fiber preinstalled single microduct

Cases in Europe

For high speed broadband projects in rural and remote areas, here are the cases that using FTTH deployment as core technology [1]

- Net4all Italy The infrastructures are based on fibre optic cables and are FTTX1.
- Bóly Hungary Based on optical fibre (Fibre-to-the-Home (FTTH)) “The contractor designed an FTTH network that adapted to the existing network, in order to provide fast and cost-efficient implementation.”
- Fryslân Ring Netherlands All homes have been connected point-to-point and with use of a fibre pair. CAI Harderwijk Gelderland, Netherlands , Fibre-to-the-Home (FTTH)

1 - Source : Broadband Handbook 2020

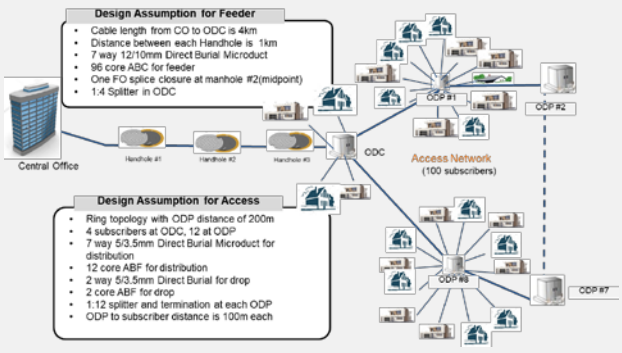
Conclusion – Fiber is the answer

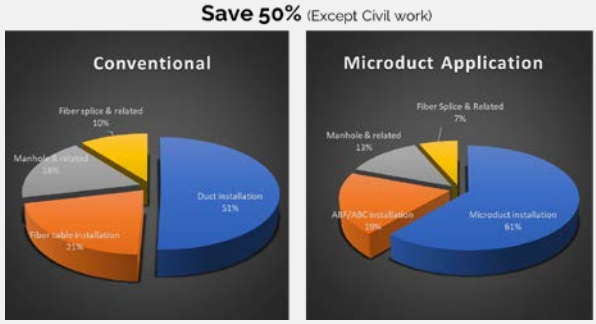
During the COVID-19 pandemic, the end-users required a fast broadband connection like never before. Working from home is new normal, especially in rural areas and remote area, a lot of Customers ask for a FTTH connection. FTTH connection becomes “critical infrastructure.”

Many countries’ governments have been working with local municipalities and local corporations to bring broadband to achieve fast internet service and boost industry, especially agriculture. We see many cases of IoT to adapt for the agriculture industry. Fiber is the key technology to implement this activity.
Microduct solution is one of the outstanding solutions for FTTH. For years, Knet has been helping the customer who had Rural broadband project in Europe, Asia, North America, and other parts of the world.

FTTH Network Design Sample – 100 homes

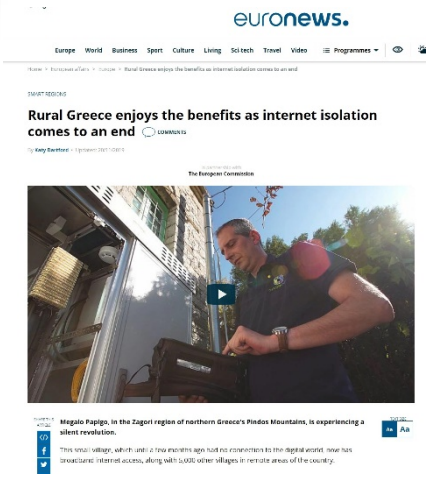
Microduct Application saves up to 50% costs





Reference

https://ec.europa.eu/digital-single-market/en/news/broadband-handbook-facing-challenges-broadband-deployment-rural-and-remote-areas



https://www.euronews.com/2019/11/18/rural-greece-enjoys-the-benefits-as-internet-isolation-comes-to-an-end

Thailand will become a full-fledged broadband nation by the end of 2019 by providing Internet access to an additional 50,000 villages this year, Minister of Digital Economy and Society, Pichet Durongkaveroj, told reporters.

For example, there is limited broadband access in the rural areas, especially in the countries with a vast population such as Thailand, Indonesia and the Philippines, where Internet connectivity remains relatively poor," he said.

https://www.nationthailand.com/business/30362658

The Federal Communications Commission's **Rural Digital Opportunity Fund (RDOF)** broadband initiative is the single largest distribution of Universal Service Fund (USF) dollars made available to communications service providers in US history. This truly transformational program is divided into two phases:

•**Phase 1**: Will provide up to $16.4 billion
•**Phase 2**: Will provide at least $4.4 billion

RDOF is a once-in-a-lifetime funding opportunity that is projected to dramatically improve quality of life for rural communities.

https://rdof.com/rdof

UBF (Universal Broadband Fund)

The Universal Broadband Fund is part of the Government of Canada's coordinated plan to connect all Canadians: High Speed Access for all: Canada's Connectivity Strategy.

https://www.ic.gc.ca/eic/site/139.nsf/eng/h_00006.html

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