



# Cable Solution for Route Shortage



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# Background



## Transmission Network Faces Major Resource Situation

With the rapid growth of coverage of full-service access network in recent years, the cable pipe resources are growing short. Compounded by poor upgrading conditions and high construction difficulty level, the expansion of business in the market is significantly hindered.

### A. Obstruction to construction

Materials have to be submitted to the city management department for approval to lay cable pipes under roads and various kinds of fees are required for all formalities, seriously delaying the process of pipe laying.

### C. Fierce competition in the market

Faced with the fierce competition in the informatization services of the market, more optical cable pipes need to be deployed. Services cannot be available without sufficient optical cable pipes, greatly dampening user experience.

### B. Pipes

Cable pipe shortage is present in the early stage. The network has been developing for decades, and all optical cable pipes are basically used up due to all kinds of services, so it will be difficult to further deploy more services in the existing optical cable pipes.

### D. Huge investment

Enterprises can barely afford the huge investment required in traditional pipe capacity expansion.



# Cable Solution for Route Shortage

## Micro Pipe and Micro Optical Cable

Quantity of cores	Outer diameter of micro optical cable (mm)	Outer diameter of GYTA optical cable
6	4.3	9.2
12	4.3	9.2
24	4.3	9.2
48	5.4	10.8
72	5.4	11.8
96	6.0(5.6)	13.6
144	7.6(7.2)	17
216	7.6(7.2)	20
288	9.1(8.0)	22
432	11.2	-
576	13.4	-

		Relation between silicon cored pipe and micro pipe					Relation between silicon cored pipe and micro pipes	
Silicon cored pipe (mm)		25/20	32/26	40/33	50/40	60/50	25/20	32/26
Micro pipe bundle	7mm	2	6	10	14	20	2	6
	10mm	-	2	5	7	10	-	2

		Optimal inner diameter of micro pipe that is suitable for micro cables with different diameters								Optimal inner diameter of micro pipe that is suitable fiber optics bundle with different diameters			
Micro cable	Quantity of cores	12f	24f	36f	48f	60f	72f	96f	144f	2f	4f	8f	12f
		Typical diameter	4.2	4.2	6.0	6.0	6.0	6.0	6.5	7.5	1.1	1.1	1.5
Inner diameter of micro pipe (mm)	6	√	√	-	-	-	-	-	-	-	-	-	-
	8	√	√	√	√	√	√	-	-	-	-	-	-
	10	-	-	√	√	√	√	√	√	-	-	-	-
	12	-	-	-	-	-	-	√	√	-	-	-	-
	2.1	-	-	-	-	-	-	-	-	√	√	-	-
	3.5	-	-	-	-	-	-	-	-	√	√	√	√



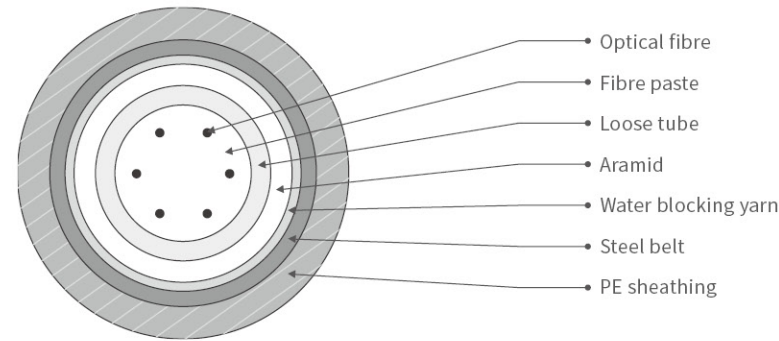


## Optical Cables in Micro Slot of Road

### Characteristics and structure of optical cables shallowly embedded in micro slot of road



- Small dimensions, easily-embedded
- To embed the optical cables, you just need to prepare a narrow slot on roads, embed the cables in the slot, backfill the slot and restore the pavement
- Light-weighted, soft, easy-to-embed, cost-efficient and fast



### Principles of pavement selection and requirements for slot cutting

- The path can go along or across the existing cement or asphalt pavement of city and communities
- And it shall avoid regions with complicated conditions and unstable road conditions
- Pavements that are convenient for maintenance and construction and pavements for non-motor vehicles are preferred
- Typically, the optical cable slot shall be prepared in one round of cutting by using the road cutting machine. The the corner of slot shall ensure that the radius of curvature of cables meets requirements once they are embedded
- The bottom of the cable slot shall be flat and smooth without hard bumps
- During long term usage, the static minimum radius of curvature of 10D is allowed



## Embedding Optical Cables in Shallow Trench of Pavement

- Use the concrete pavement joint cutting machine to prepare a slot with depth of 110mm and width of 20mm on the cement ground or asphalt pavement
- Apply a layer of 10mm thick yellow sand or PE foam stick with diameter of 20mm in the slot for cushion and buffering
- Embed optical cables in the slot
- Fix a PE foam stick with diameter of 20mm over the optical cable for buffering and separation
- The PE foam sticks shall be compacted one by one by using rollers before they are placed
- The slot shall be backfilled with cement or asphalt. If hot asphalt is used in backfilling, the emulsified asphalt binder is generally applied to the walls of slot first so that the asphalt will reliably bind with the slot before the asphalt is poured into the slot. After backfilling, the pavement structure shall be suitable for traffic



## Embedding Optical Cables in Shallow Trench of Garden and Lawn

- Encase optical cable with PVC pipe with diameter of 18mm and thickness of 1mm to avoid damages to optical cable during the construction
- Use shovel to prepare a 300mm deep and 50mm wide trench in the green belt
- Embed the PVC-pipe-protected cable in the trench
- Backfill the trench with fine-grained sands



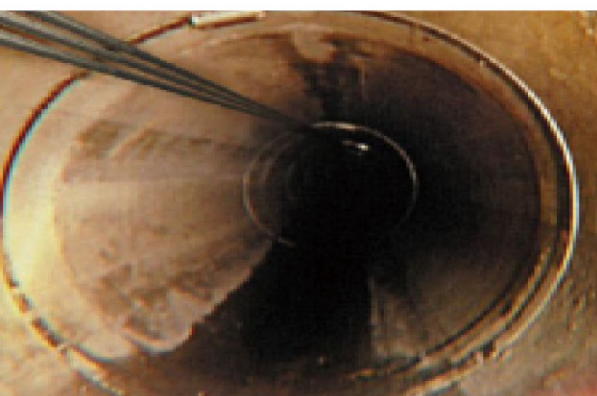
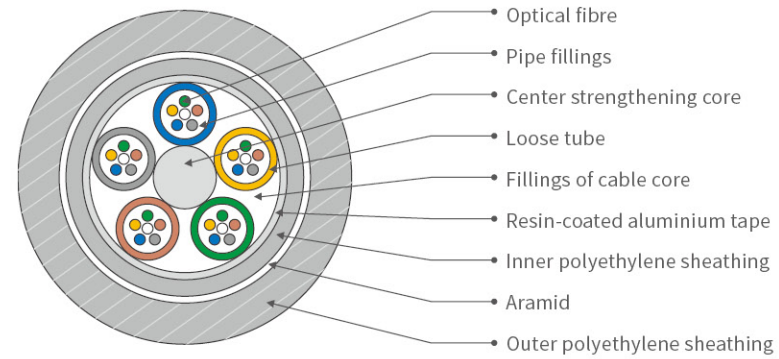


## Optical Cables Deployed in Rain Water Pipe

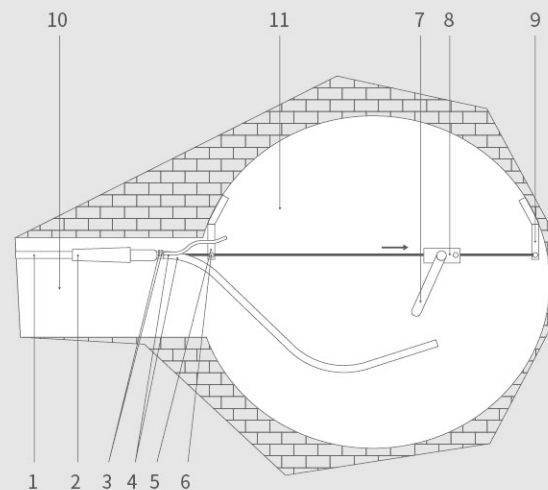
### Optical cables deployed in the rain water pipes



- Self-supporting optical cables deployed in rain water pipes or sewage pipes.
- Sound mechanical properties and moisture-proof properties.
- Chemical corrosion resistance
- Prevent mouses and ants
- Simple structure and low cost
- Two technologies, i.e.GYTA and ADSS, are perfectly fused in manufacturing the optical cables used in rain water pipes



1. Optical cable
2. Metal fittings
3. U-shaped steel strand
4. Stainless steel stranded wire
5. Fixed support A
6. Tension-fixed U-shaped steel strand
7. Torque spanner
8. Tightener
9. Fixed support B
10. Rain water pipe
11. Manhole

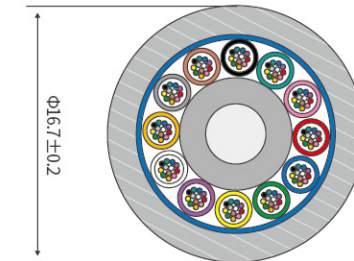


## Small Dimension Optical Cables

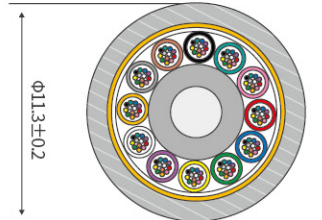
### Embedding optical cables in shallow trench of pavement

No. of cores of small dimension optical cables	Diameter of optical cables
12~72	8.3mm
96	9.4mm
144	11.3mm

Conventional GYTA-144 optical cable



The volume of small dimension GYTA-144 optical cable is reduced by 52%

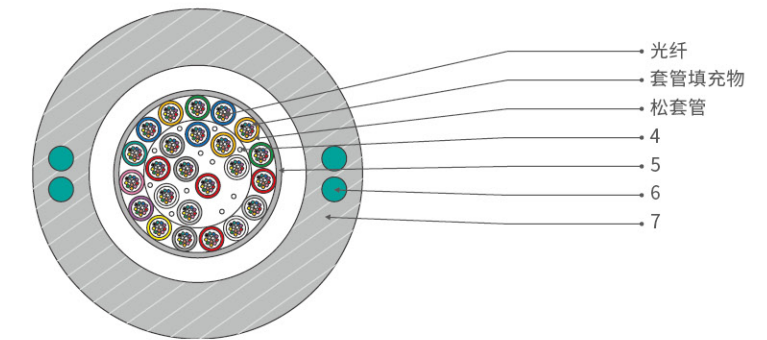


## Easily-bifurcated Optical Cable

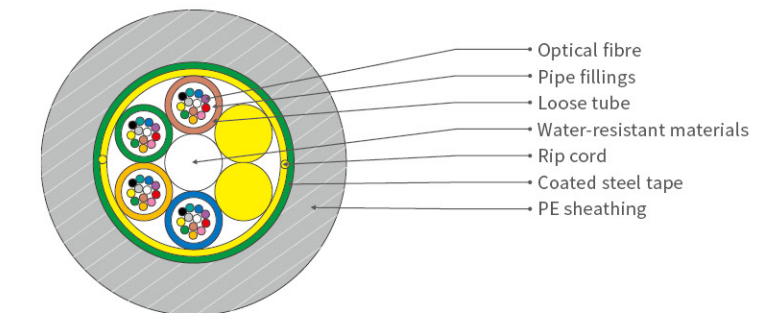
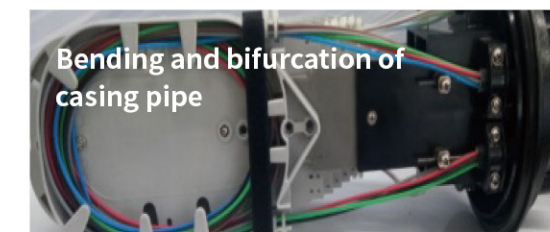
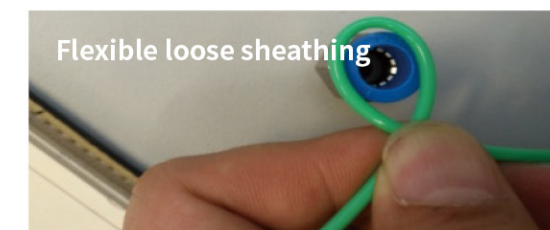
### Characteristics of easily-bifurcated optical cable products



- They can be bifurcated and extracted easily and connected to households and bent like optic fiber in the connector box
- The sub-units are super soft, and the cover sheathing can be easily removed with finger nails
- Small dimensions and light weight
- It is very suitable for overhead cable deployment in FTTH projects and pipe cable deployment



## Small Dimension Optical Cables with Flexible Sheathing





# Analysis and recommendation for promotion and pilot promoting



## Pilot Promoting

Select the position and scope of project to expand pipe capacity and meet the network demand based on the network and project needs of big and medium-sized cities

### Ideas and Steps



Selecting pilot projects and surveying



Select sections that are in urgent need of optical cable pipes.



Preparing the optical cable pipe expansion scheme



Prepare the optical cable pipe expansion scheme based on the actual conditions of the pilot projects and implement the pipe expansion project.



Project implementation



Manage and control the whole process of the project implementation, and follow the progress of the project at all times. Resolve all difficulties met in the project implementation.



Project inspection and summary



Check the project inspection and implementation for meeting expected results.



## Analysis and Recommendation for Promotion

### Innovation

#### Simple approval formalities

Simple approval formalities in municipality and Urban Management, minimum disturbance to surroundings in construction

- In previous schemes involving pavement excavation, to apply for the construction formalities, numerous municipal management departments have to be coordinate
- Additionally, the construction is prone to be blocked by the affected people, hindering the construction progress

#### Short construction period

The construction period is shorter than that of traditional construction method

- The traditional pipe construction scheme features long construction period and high cost
- The new solution uses new ideas, and it can be widely promoted

#### Convenient maintenance

The existing maintenance system is still applicable to the new solution, and the maintenance staff can easily maintain the newly-deployed optical cables.

- The maintenance habits for the new optical cables and traditional cables are consistent, and existing habits of the maintenance staff and equipment will remain
- Air-blown micro cable has been widely used in numerous scenarios, and relevant techniques has matured

### Comparison of Investment

#### Effect verification. Reasonable investment control

Application Scenarios	Current status	Recommended scheme	Main advantages
Inter-city connection	The existing optical cable pipe (with optical cables filled) resources along municipal roads are nearly used up	New optical cables	1. The number of optical cable pipes triples. 2. The pipe investment cost is saved indirectly.
	Pipe of optical cable splice box in the trunk road	New optical cables	3. The traditional pipe laying method is further used.
	Pipes without remaining cable space	Micro pipe and micro optical cable	1. Resolve the “the optical cable pipe is used up” problem that cannot be dealt with by using traditional techniques.
Community connection	Upgrading of old residence community and laying new pipes	Micro pipe and micro optical cable	1.The difficulty in laying pipes within short range without excavation in communities can be resolved. 2. Micro-cables and micro-tubes can be laid by air blowing technology, saving time and manpower. 3. Pipe resources can be configured flexibly based on needs. 4. The pipe resources can be tripled, and the investment cost in pipes can be lowered indirectly. 5. The pipe resources can be tripled, and the investment cost in pipes can be lowered indirectly.

It can be seen from comparison that the usage rate of pipes is improved by **38% - 51%** after implementing the pipe upgrading scheme.



### Recommendation for Promotion in Later Stage



#### Social Benefits

The pipe upgrading scheme ensures that the existing services will not be interrupted and the rights and interests of all users are protected, upholding the sound reputation of China Mobile.



#### Investment benefits

The pipe upgrading scheme significantly reduces the construction cost, promote effectively the full-scale implementation of lowering cost and improving efficiency and increase the benefits of investment in supporting products for informatization and competitiveness in the market.



#### Resource benefits

The implementation of the pipe upgrading scheme will increase effectively the capacity of optical cable pipes, release the tension in pipe usage and construction investment and improve the usage rate of core resources.