» New Products

24-Fiber Aerial Distribution Optical Fiber Cable for Rural Area

1. INTRODUCTION

The number of the Fiber To The Home (FTTH) subscribers reached 27million in the year 2015 and it is forecasted that it will be increasing steadily. The conventional FTTH networks have been improved mainly in the urban areas to answer the demand of the optical communication, but it is necessary to build the FTTH networks not only in urban areas but also in rural areas in response to the further demands.

Figure 1 shows the example of the FTTH network deployment. The underground optical fiber cables from the central office are installed in the underground conduit lines and lifted up to the aerial area at the Feeder points. In the aerial area, the aerial distribution optical fiber cables, that have dozens or hundreds of the fibers, are installed between utility poles and connected to the drop cable in an optical closure and then wired to the subscriber's residences.

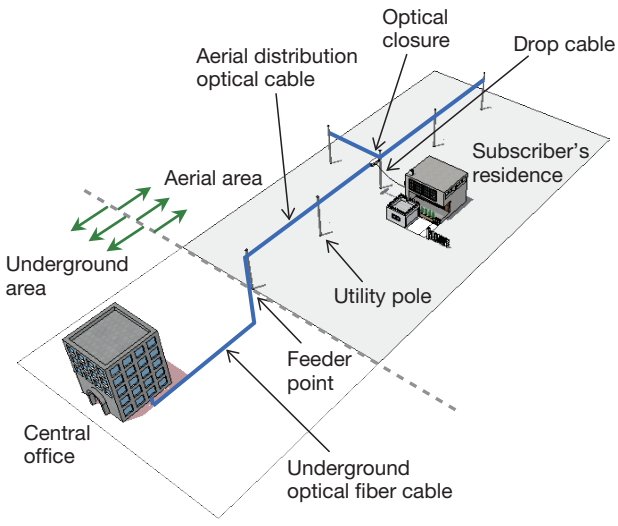

Figure 1 Typical FTTH network in Japan.

Since the subscribers spread widely in the rural areas and the density of the subscribers is lower and the length of the cable installation tends to be longer comparing to the urban areas, it is necessary to install the optical fiber cables easily and efficiently by fewer workers. To achieve the efficient cable installation suitable for the rural areas, we have developed a 24-fiber aerial distribution optical fiber cable that has a small diameter, a light weight and a superior handleability.

2. FEATURES OF THE DEVELOPED CABLE

2.1 Rollable optical fiber ribbon

The structure of the 4-fiber rollable optical fiber ribbon is shown in Figure 2. The structure of the 4-fiber rollable optical fiber ribbon is that single optical fibers are aligned in parallel and the adjacent two fibers are adhered longitudinally at intervals. Since the ribbon form can be changed easily, it is possible to install the ribbons at the highest level in density according to the crevice geometry in the cable and it contributes to achieve a higher density, a smaller diameter and a reduced weight of the optical fiber. Moreover, since the rollable optical fiber ribbon is restored to ribbon form when it is taken out, the mass fusion splicing is possible similar to the conventional 4-fiber ribbon. It is also possible to separate the fiber easily by removing adhesive resin with a brush.

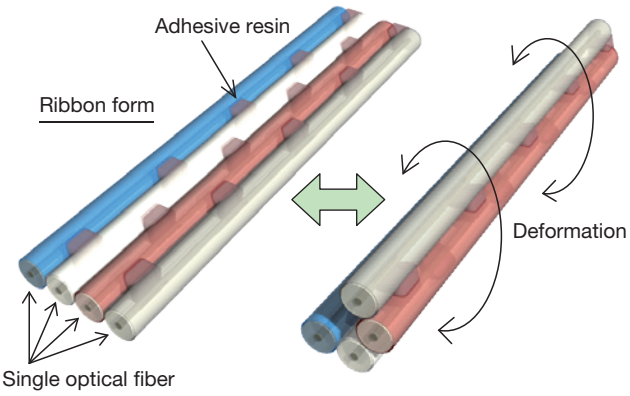

Figure 2 Structure of 4-fiber rollable ribbon.

2.2 Structure of the optical fiber cable

The structure of the developed 24-fiber optical fiber cable is shown in Figure 3. Its structure is so that, to make a 24-fiber cable, 6 units of 4-fiber rollable optical fiber ribbon are wrapped around by protection inclusions to avoid contact with the outer sheath resin and then also covered by polyolefin resin with two strength members and an overall suspension member. The notch location is also designed in consideration with its compatibility with an existing outer sheath separator.

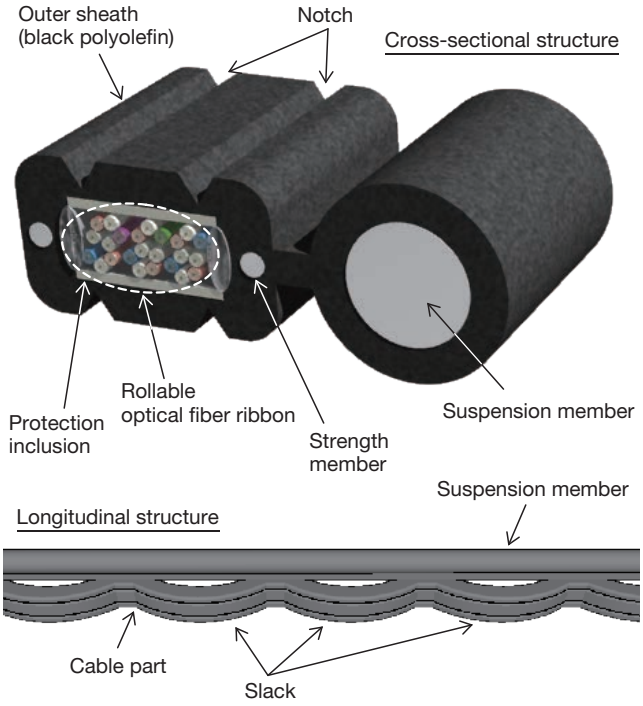

Figure 3 Structure of 24-fiber aerial distribution cable (Self support type).

The longitudinal structure of the 24-fiber optical fiber cable is a self-supported structure where slacks are added to the cable part with respect to the support member and it has the advantages that it can have an excess cable length at the mid-span branching and it has a higher wind resistance. Moreover, we have also developed the cable structure that has no wire as shown in Figure 4 for the installation method that bundles a messenger wire and the optical fiber cable by a spiral hanger.

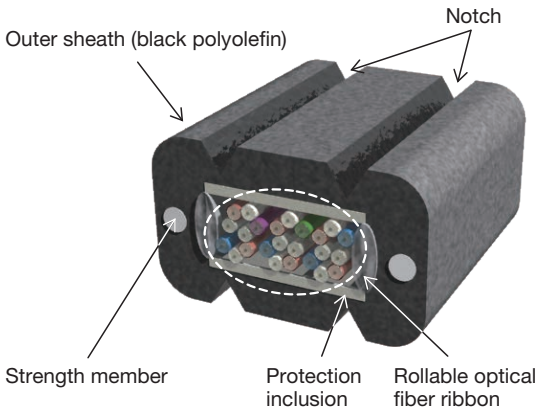

Figure 4 Structure of 24-fiber aerial distribution cable (Non-self support type).

2.3 Mid-span branching technique

The mid-span branching technique of the developed 24-fiber optical fiber cable is shown in Figure 5. Take a required length of slits at the cable notches with an existing outer sheath separator that has two pairs of blades. When the slits reach the protection inclusions, the outer sheath and other structural parts are separated and therefore it will be possible to take out the rollable optical fiber ribbons after cutting off unnecessary parts.

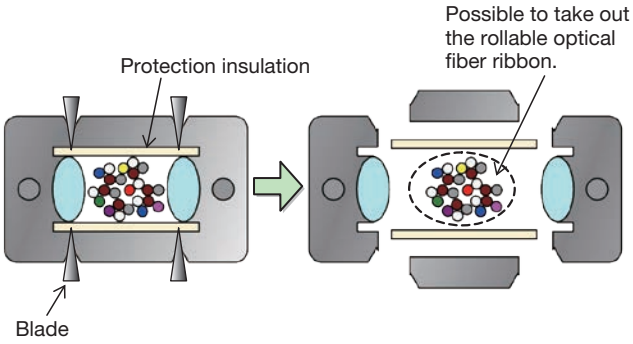

Figure 5 Method of the mid span branching.

2.4 Reducing diameter and weight of the cable

Figure 6 shows the comparison of the conventional 24-fiber slot-less aerial distribution optical fiber cable and the developed optical fiber cable. The developed optical fiber cable of 11 mm height and 0.07 kg/m weight has achieved reductions of approximately 35% in diameter and of approximately 56% in weight compared to the conventional cable.

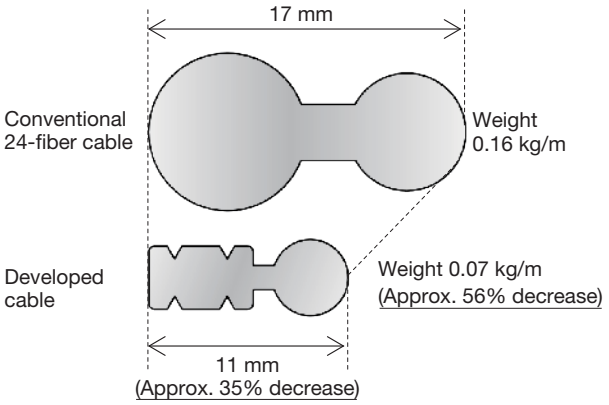

Figure 6 Comparison of cable height and cable weight in 24 fiber count.

2.5 Optical fiber cable characteristics

The characteristics of the developed optical fiber cable are shown in Table 1. We have achieved the 24-fiber aerial distribution optical fiber cable for rural area which is superior in its transmission, its mechanical and its temperature characteristics and has superior workability at the mid-span branching.

Table 1 Characteristics of optical cable.

Test item		Test condition	Result
Transmission loss		Test wavelength: λ = 1.31 μm	< 0.37 dB/km
		Test wavelength: λ = 1.55 μm	< 0.25 dB/km
Mechanical characteristic	Bending	R= 100 mm x 10 cycles	< 0.1 dB
	Lateral pressure	1960 N/100 mm	< 0.1 dB
	Impact	Weight: 2.94 N, Drop height: 1 m	< 0.1 dB
	Twist	± 90° / m	< 0.1 dB
	Squeezing	R= 250 mm, Tensile: 700 N	< 0.1 dB
Temperature cycle		-30℃ - +70℃ , 3 cycles	< 0.1 dB/km
Workability at the mid-span branching		Sampling interval: 1 msec[*1]	Loss fluctuation: < 0.5 dB

Note: Mechanical & temperature characteristics and workability at the mid-span branching are measured at λ = 1.55 μm.
Note: The characteristics values in the above table are representative values.
Note 1: Sampling interval: 1 msec.;
Measuring the loss fluctuation at the interval of 1 msec. by oscilloscope.

3. CONCLUSION

Using rollable optical fiber ribbons, we have developed a 24-fiber aerial distribution optical fiber cable which has achieved reductions of 35% in diameter and of 56% in weight compared to our conventional cable (slot-less).

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