Telecommunication Development Sector
Study Groups

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DELAYED CONTRIBUTION

Question 5/1:	**Telecommunications/ICTs for rural and remote areas**
SOURCE :	Waseda University (Japan)
TITLE :	Affordable and reliable optical cable backhaul solution and its implementation by following newly standardized ITU-T Recommendations

Reference to Document: 1/225

Action required :	The meeting is invited to consider the solution and include its substance in the Output Report.
Keywords:	*urban-rural digital divide, affordable, reliable, optical cable, backhaul, on the ground's surface*

Abstract:

This contribution shares the information about two practical implementation of optical fibre rural connectivity solution. The solution follows new ITU-T Recommendations L.1700, L.110 and L.163 that identify the requirements of the solution for affordably and quickly narrowing the urban-rural digital divide.

It is proposed that the substance of the information here be included, together with necessary key information in 1/225 (March 2019), in the Output Report of Question 5/1.

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1. Introduction

ITU Secretary General stated (January 15, 2019), "One of ITU's priorities is to connect the unconnected". By contrast, in December 2019, United States FCC was discussing 100 Mbps (four times faster) as the new definition of Broadband. Hence what is expected from the increasing urban-rural digital divide?

Optical cables come with a terabit capability, low latency and cost-effective upgradability/scalability needed for ever–growing demand toward 5 G era and beyond. However, it comes with a great deal of cost and complexity demanding different cables for duct, buried, lashed aerial or submerged needing specialized equipment, machinery and skilled labour.

To overcome such difficulties, ITU-T Recommendations L.1700 (2016), L.110(2017) and L.163 (2018) have been published that expressly aiming at affordably and quickly narrowing the urban-rural digital divide as reported in 1/225, March 2019, Waseda University.

One year later, the present contribution reports the fibre optic backhaul solutions deployed in Nepal and Mongolia, and some successive plans that all follow the above standards.

2. New ITU-T Recommendations for closing the urban-rural digital divide

ITU-T L.1700 (2016) identifies cost-effective implementation of the broadband connectivity as the top priority with reliability as the second most important attribute for closing the digital divide.

ITU-T L.110 (2017) identifies a new-concept optical fibre cable that should accept direct surface application. Requirements includes lightness, ease of manual handling, water/moisture tightness, robustness against rodent, crush and extreme temperature. The use of welded stainless-steel tube is recommended.

ITU-T L.163 (2018) focuses affordable installation of long-length L.110 cables on the ground's surface to shallow underground to wet land to underwater to air using everyday tools by non-skilled local people. Early 2019, L.163 was posted on the ITU site as "most popular Recommendation".

3. Terabit-capable backhaul solution meeting the three ITU-T Recommendations

The proposed solution uses a L.110 cable (Figure 1) that can be placed surface to underground to air to water without cable splicing nor major civil works and skilled engineers thus leading to DIY construction and major cost reduction, which addresses low income rural communities and various SDGs.

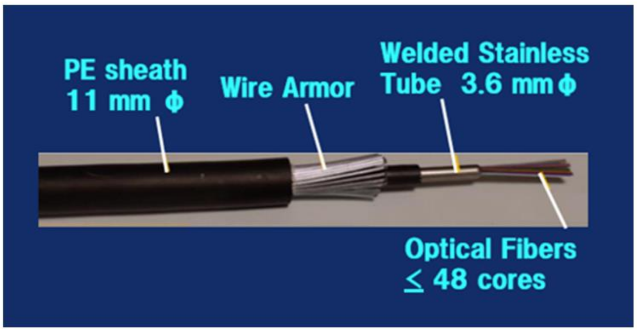

Figure 1: An example of L.110 optical cable

The cable has a welded stainless-steel tube (3.6 mm diameter at cable centre) to protect <48 fibre cores. The cable is thin (11 mm), long (12 km), lightweight (200 g/m) with ease of handling and excellent environmental durability. An example of >80% cost reduction is shown in Figure 2.

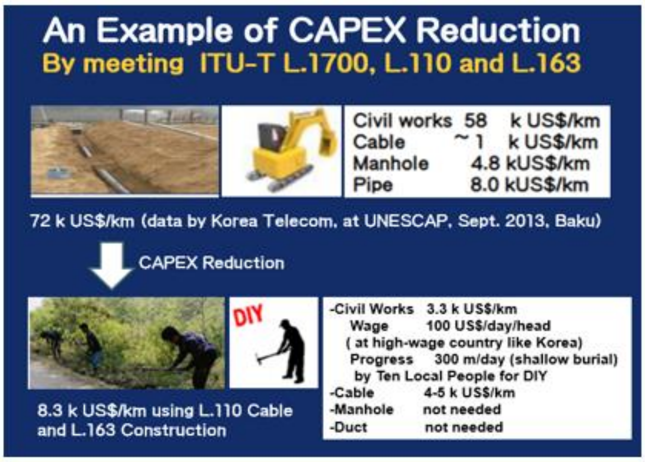

Figure 2 An example of cost reduction

4. Implementation of the solution

(1) Dullu Municipality, West Nepal

March 2019, L.110-compatible cable (Figure 1) of ~12 km was installed by following L.163 as an APT category II project with the project title "Effective Broadband Infrastructure for Development of Communities in Dullu Municipality, Nepal". The Municipality office is at the hill top (1300 m high) that is many hours walk from remotest and peripheral village settlements.

The project was conducted under Public-Private Partnership (PPP) model with Dullu municipality (Public), Nepal ICT4D (NPO) and Japanese companies and foundation (Private).

The network connected the Dullu Municipality Head Office, 13 Municipality Ward Offices, 3 High Schools, Dullu Land Mapping Office, and Dullu Hospital.

Along with the vehicle roads, the cable was mostly buried, ~10-20 cm in depth. For a short cut, a part of the cable was installed on the ground's surface in the unexplored jungle (Figure 3).

Figure 3: L.110 cable put on the ground's surface (Jungle) and shallow buried (roadside)

The PPP model well supported this solution through various sociological economic-service delivery factors. The cable used is the first product after publication of the three ITU-T standards but was felt applicable to similar regions in developed, developing, and least developed countries, although cost merit varies.

The project team felt that the solution would foster rural connectivity and provide an incubation platform for local businesses and services including agriculture, food processing, health delivery, online learning, and much more.

The CAPEX could be half or less than the solution using conventional cables with deep trenches, underground pipes and manholes.

(2) Arkhangai, Bayankhongor and Tereij, Mongolia

L.110-compatible cable (Figure 1) has been installed at three places (see below) in Mongolia (Figure 4) as an APT category II project under the title “Pilot installation and endurance test in most cold area and desert in Mongolia, of low cost optical fibre access network for vast tract of land, for improving life in depopulated area”.

– Arkhangai /province/ center with 4 km optical cable plus 11 ONU equipment to 50 users.
– Bayankhongor /province/ center with 5.8 km optical cable plus 11 ONU equipment to 50 users.
– Tereji area with 12 km buried optical cable for access internet and triple service/telephone, internet, WIFI, TV/ around 100 users by ONU/FTTH technology to 100 users.

Figure 4 Cable deployment sites in Mongolia

Cable installation speed was 3-4 km per day, where typically 50% was aerially suspended using existing poles, and 50% was buried.

Field-test was independently conducted exposing an 1 km cable (Figure 1) to the winter open air at Arkhangai at -40℃ to occasionally -50℃, a part of the cable was inserted in a metal tube (1-m long, 54 mm diameter, 5 mm wall thickness) filled with water that, after completely frozen, gave an uniform circumferential pressure to the cable from freeze expansion of water. No damages have been observed.

The key to the project recognized by the team was the easy quick construction of the cable enabled by the use of L.110 cable that well made the network affordable in rural Mongolia. The main social impact of the project was to have affordably and quickly provided telecom connectivity for some of Mongolia’s poorest and isolated rural citizens.

(3) Mt. Everest Area

Under the Asia@Connect funded Everest Fibre Project, the cable-deployment route survey of ~45 km has recently been conducted on foot and from helicopter by Nepal ICT4D and the Author from Namche Bazaar (altitude 3440m) to Everest B.C. area (Gorakhshep, 5300 m) along the narrow mountain path. Proper broadband connectivity is must here for life-saving of local residents, trekkers and tourists.

The survey suggested each cable spool be air-lifted to different locations and the cable be manually pulled downwards and laid where cable burial with handy tools was found not always easy for rocky high-altitude surfaces (Figure 5). The survey report has recommended the use of 45 km of ITU-T L.110 cable and L.163 installation.

Figure 5: Typical rocky trail on the route

5. Future project plans

- Contribution 1/225 (March, 2019) addressed the rural connectivity plans considered by Nepal Telecom Authority for Lukla-Everest Base Camp area and Annapurna Trekking trail using L.110 cable.
- Jan. 2020, APT adopted the new proejct as APT category II project entitled “Enhanced Delivery of Localized Centric Services over Smart Networks”. The Plan adds L.110 cable (12 km) to the existing cable network described in Section 4 (1) and provides access to various online community services for, e.g., disaster management, eHealth, eEducation and climate resilience.

6. Proposal

It is proposed that the substance of this contribution and 1/225 (Mar. 2019) be included in the Output Report of Question 5/1, for example, in Chapter 3 with the proposed title “available, affordable, accessible and sustainable solutions to connect rural and remote areas” (1/324, February 2020).

Q5/1 is encouraged to discuss how to support and facilitate local communities move forward with the proposed ITU-standard solution for affordably, quickly and globally closing the urban-rural digital divide.

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