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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 for quickly and reliably closing the digital divide and stopping the Pandemics.
Action required:	Participants are invited to consider this document as a case-study input to the output report for Question 5/1.
Keywords:	*urban-rural digital divide, pandemics, affordable, reliable, optical cable, ITU-standardized optical backhaul, on the ground's surface*

Abstract:

A lightweight optical cable backhaul solution is presented that is developed unprecedentedly for closing the urban-rural digital divide (and stopping the pandemics). The solution is affordable, reliable, green, scalable, and quickly implementable, whose requirements are standardized as ITU-T Recommendations L.1700, L.110 and L.163. Its feasibility and practicability are confirmed in rural areas in Nepal and Mongolia.

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1. Urgent Need of optical cable backhaul solution for closing the urban-rural digital divide and stopping the Pandemics

The UN Secretary General stated, "Digital Divide 'a Matter of Life and Death' amid COVID-19 Crisis" (June 17, 2020). Yet the UN estimates 46% of the world's population is not connected to the internet, with digital divides existing in better-connected countries, too.

It is now clear that telemedicine, distant learning, and remote work, are critical to stopping the Pandemics. Since 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, Optical fibre communications infrastructure must be scaled, and lots (and lots) of fibre must be penetrated particularly into unconnected and less-connected areas worldwide. See also SG1RGQ/328-E.

Connecting the unconnected contributes to reciprocally exchanging knowledge, one that benefits us all. Advanced countries have a great deal to learn from distant cultures, which have preserved values, traditions and knowledge now forgotten by many modern societies.

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

To suppress a great deal of cost and complexity for the optical fibre rural connectivity, different cables should not be used for duct, buried, lashed aerial or submerged: today the cost of optical cable installation is typically 70 to 80 percent of the entire CAPEX of the network.

The following ITU-T Recommendations have been unprecedentedly developed that expressly aiming at affordably and quickly narrowing the urban-rural digital divide with excellent reliability.

ITU-T L.1700 (2016) identifies the affordability as the top priority with reliability as the second most important attribute for the broadband connectivity for closing the digital divide. See ITU NEWS.

ITU-T L.110 (2017) identifies optical cables that allow direct surface application in a DIY (do it yourself) manner. The cable identified is lightweight, thin and easy for manual handling with robustness against crush, rodent and extreme temperature. The use of a welded stainless-steel tube is recommended to completely block the water/moisture ingress. See ITU NEWS.

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

3. Terabit-capable affordable and reliable backhaul solution meeting the ITU-T Recommendations

The proposed solution **BIRD** (**B**roadband **I**nfrastructure for **R**ural-Area **D**igitalization) uses an L.110 cable (Figure 1) that has a welded stainless-steel tube to protect 48 standard optical fibers. This cable for terrestrial use is designed based on the submarine-cable technologies with an excellent mechanical durability. The cable has been used in Japan under harsh environment for over 20 years and 20,000 kms.

The total expenditure for this cable (cable cost and its installation cost) could be reduced by more than 80% from when using conventional cables as shown in Figure 2.

Figure 1. Example of L.110 cable (upper one) used for the solution BIRD

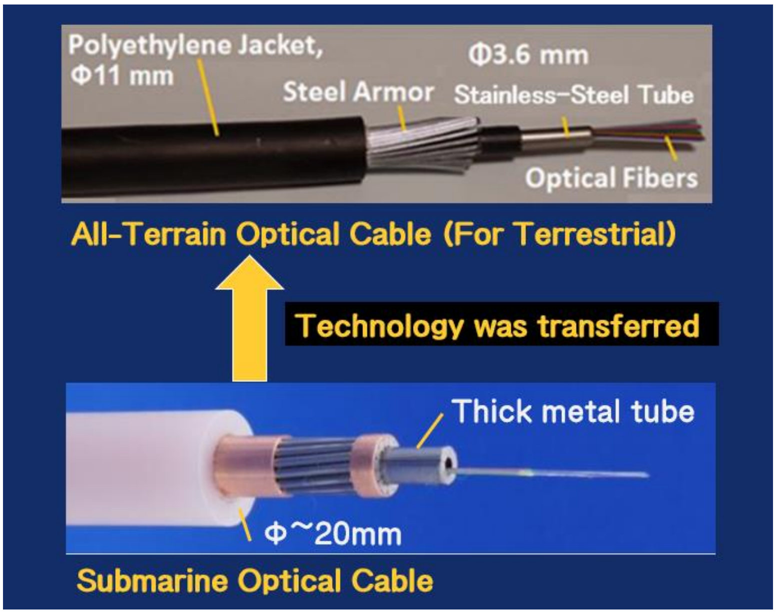
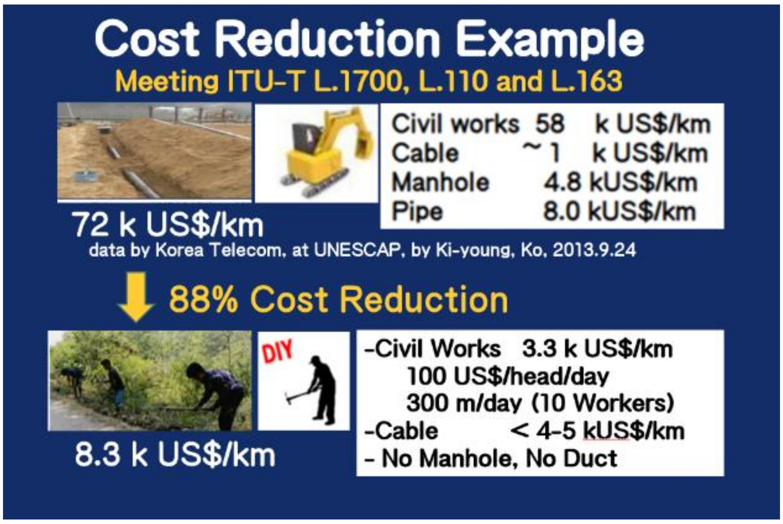


Figure 2. Cost Reduction example of L.110 Cable and its construction



4. Implementation of the solution

(1) Dullu Municipality Project, West Nepal

March 2019, the 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 hilltop (1300 m high) which is many hours walk from remotest and peripheral village settlements.

The project was conducted under the 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 motor vehicle road, 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 placed on the ground's surface (Jungle) and shallowly buried (roadside)

The PPP model well supported this solution through various sociological economic-service delivery factors. The cable used is the first product after the 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, health delivery, online learning, remote tourism, on-line sales of valuable local products, 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 Project, 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. L.110 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 a 1 km cable (Figure 1) to the winter open-air at Arkhangai at -40°C to occasionally -50°C, 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.

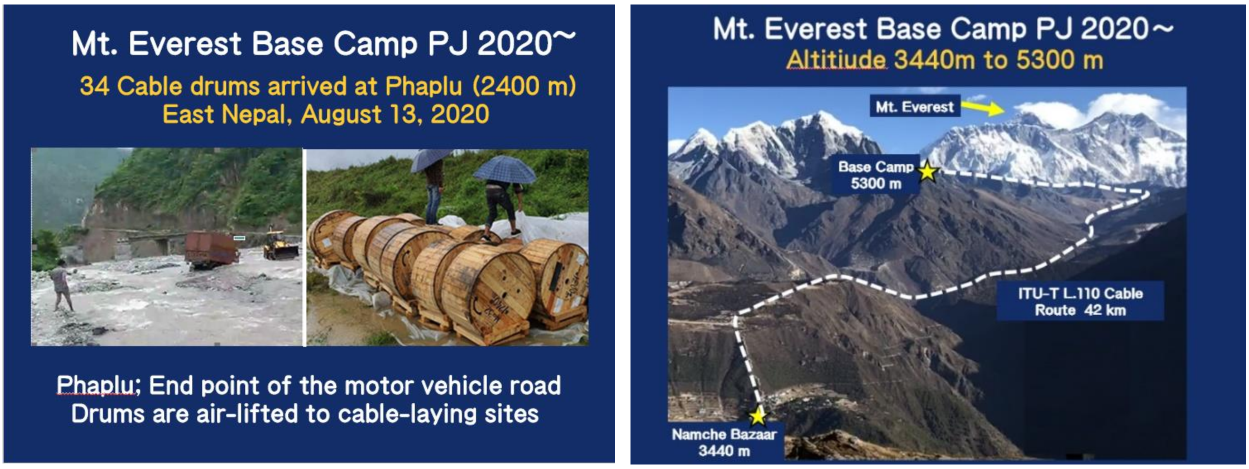
The key to the project recognized by the team was the easy quick construction of the cable enabled by the use of L.110 cable that well made the network affordable in rural Mongolia. The main social impact of the project was to have affordably and quickly provided telecom connectivity for some of Mongolia's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

(3) Mt. Everest Base Camp Project, East Nepal

Under the Asia@Connect-funded Everest Fibre Project, the cable-deployment route survey of ~45 km was conducted on foot and by helicopter; Namche Bazaar (3440m) to Everest B.C. area (Gorakhshep, 5300 m). The survey suggested each cable drum be air-lifted to each designated point and the cable be manually installed downwards from the drum. The survey recommended the use of ITU-T L.110 cable and L.163 installation. Figure 5 is the cable route. Proper broadband connectivity is a must here for the lifesaving of trekkers and tourists. Moreover, on-line health care and online learning, for example, can support local residents along with the cable route.

A total 42 km of L.110 cable was separately wound up on the 34 cable drams and brought into Phaplu (heliport), the endpoint of the motor vehicle road. The cable is waiting for air-lifting as of Sept. 7, 2020.

Figure 5. The cable drums arrived at the site, and the cable route



5. Future plans

As press-release by the chairman of Nepal Telecom Authority, the government of Nepal announced to set up free wi-fi zones along the trails of Lukla-Everest Base Camp area and Annapurna Base Camp.

Jan. 2020, APT adopted the new 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, online health care and online learning, and climate resilience.

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