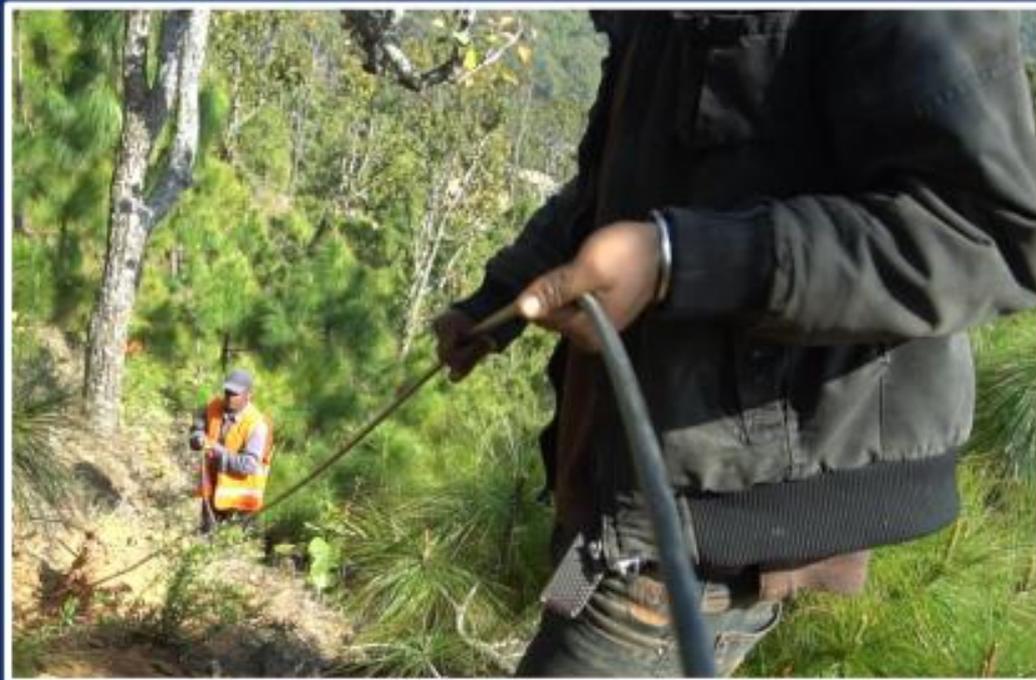


Affordable Broadband Optical Cable Solution and ITU-T Standards for Closing the Digital Divide



Haruo Okamura
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5G Era (2019~)

- High data rate
- Low latency
- Massive connectivity

2G



2.4kbps~
28.8kbps

3G



384kbps(CDMA2000)
~14Mbps(HSPA)~
110Mbps(LTE)

4G



50Mbps~
1Gbps

5G



1Gbps~
50Gbps

Rural Communications for 5G Era

Difficulties

Satellite	cost, capacity, latency
Microwave	cost, capacity
Optical Fibre	cost



Low-Cost Optical-Fibre
“Backhaul” Rural Connectivity

Typical civil works today for laying conventional optical cables



High Cost !!

Rural Communities
irritated by
super slow internet



“DIY”

They dig 7 miles of trenches
to install their own superfast broadband
after irritated by superslow internet
now it is fastest in Wales UK, June 2018

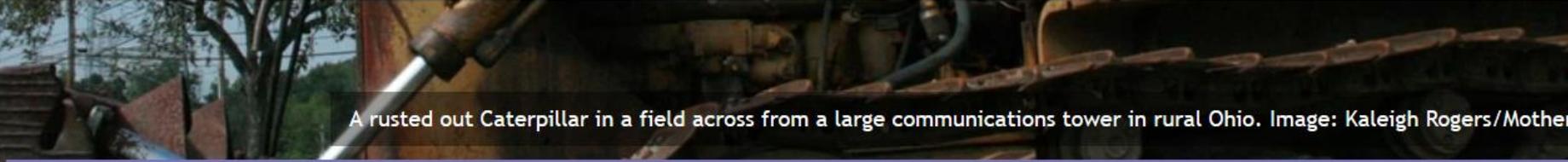


Local people said “This is the Ultimate”

Nov. 21, 2016



The idea was sparked in Wales in the village pub when villagers complaining about their slow Wi Fi connections



A rusted out Caterpillar in a field across from a large communications tower in rural Ohio. Image: Kaleigh Rogers/Mother

BROADBAND LAND | By [Kaleigh Rogers](#) | Aug 30 2017, 12:00am

Rural America Is Building Its Own Internet Because No One Else Will

Big Telecom has little interest in expanding to small towns and farmlands, so rural America is building its own solutions.

Affordable and Reliable Rural Connectivity Solution

- Affordability-First Concept
- Lightweight Robust Long Optical Cables
(Surface to Burial to Water to Air)
- DIY Installation by Local Communities



New ITU-T Standards now available

New ITU-T Standards for narrowing the digital divide 2016-2018





ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.1700

(06/2016)

Affordability-First Concept for Closing the Digital Divide

SERIES L: ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Requirements and framework for low-cost sustainable telecommunications infrastructure for rural communications in developing countries



Emerging Trends

November 21, 2016

New ITU standard can help bring broadband to rural communities

L.1700



ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.110

(08/2017)

Requirement for the Opt. Cable for Direct Surface Application(DSA)

SERIES L: ENVIRONMENT AND ICTS, CLIMATE
CHANGE, E-WASTE, ENERGY EFFICIENCY;
CONSTRUCTION, INSTALLATION AND PROTECTION
OF CABLES AND OTHER ELEMENTS OF OUTSIDE
PLANT

**Optical fibre cables for direct surface
application**

Broadband/Network | ICT4SDG | Infrastructure |
SDG10

June 30, 2017

L.110

Ascending Mount Everest with lightweight fibre-optic cable



ITU-T

**DIY Installation
of L.110 cable**

L.163

TELECOMMUNICATIONS
STANDARDIZATION SECTOR
OF ITU

(11/2018)

SERIES L: ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT.

Optical fibre cables – Guidance and installation technique.

Criteria for optical fibre cable installation with minimal existing infrastructure.

L.163

[Broadband/Network](#) | [ICT4SDG](#) | [Infrastructure](#) | [ITU-T Standards](#) | [SDG10](#) | [SDG9](#) | [Standards](#)

January 10, 2019

New ITU standards bring broadband to places as remote as Mount Everest

New ITU standards bring broadband to places as remote as Mount Everest

ITU-T L.163 “Most Popular”

All Multimedia Social media

Most Popular

Mon Mar 11 2019

ITU-T L.163
(11/2018)

ITU-T
Recommendations

Mon Mar 11 2019

ITU-T Q.4042.1
(12/2018)

ITU-T
Recommendations

Thu Jan 31 2019

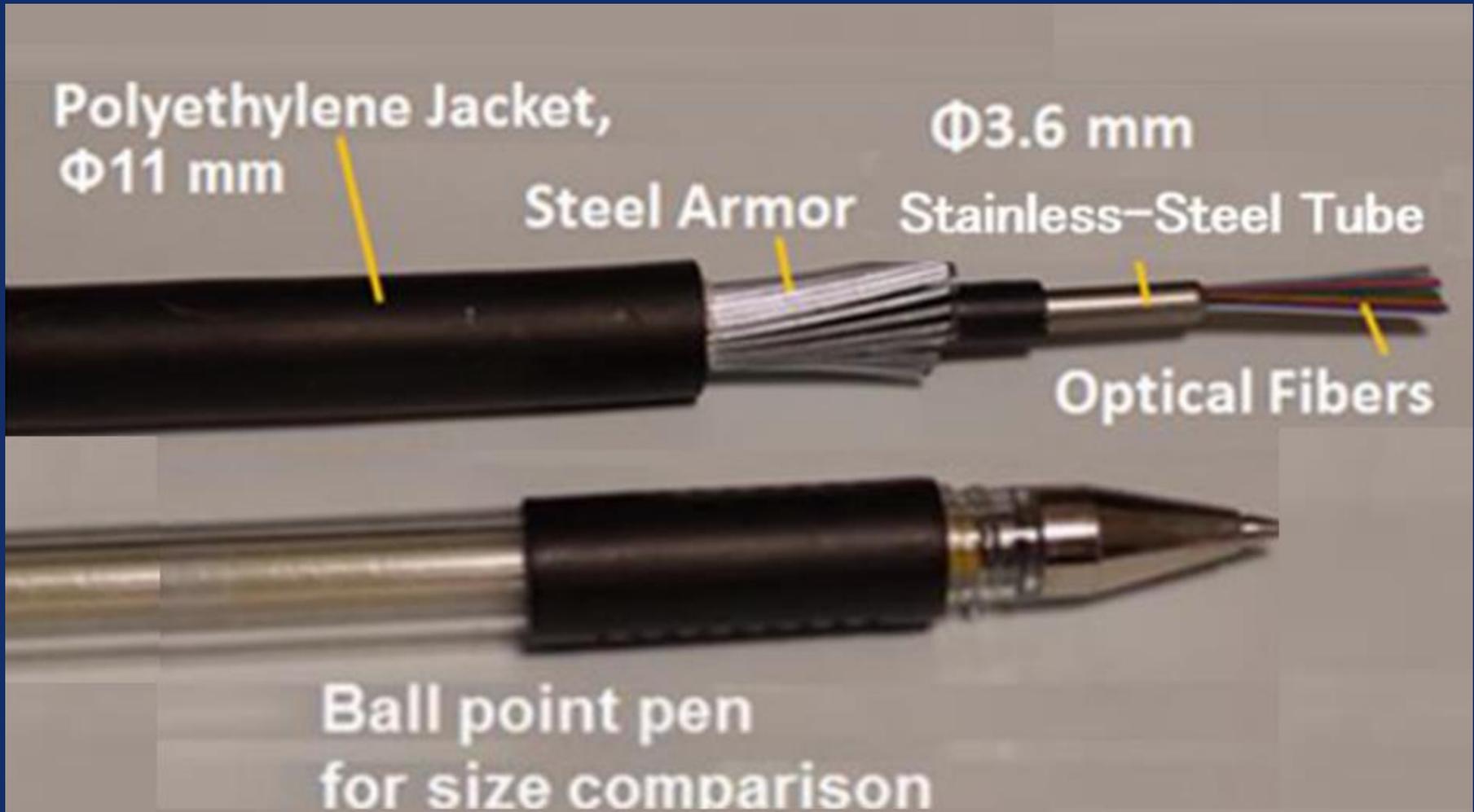
**ITU-R R15-
CPM19.02
Contribution 14**
(Addendum 6)

ITU-R Meeting
Documents

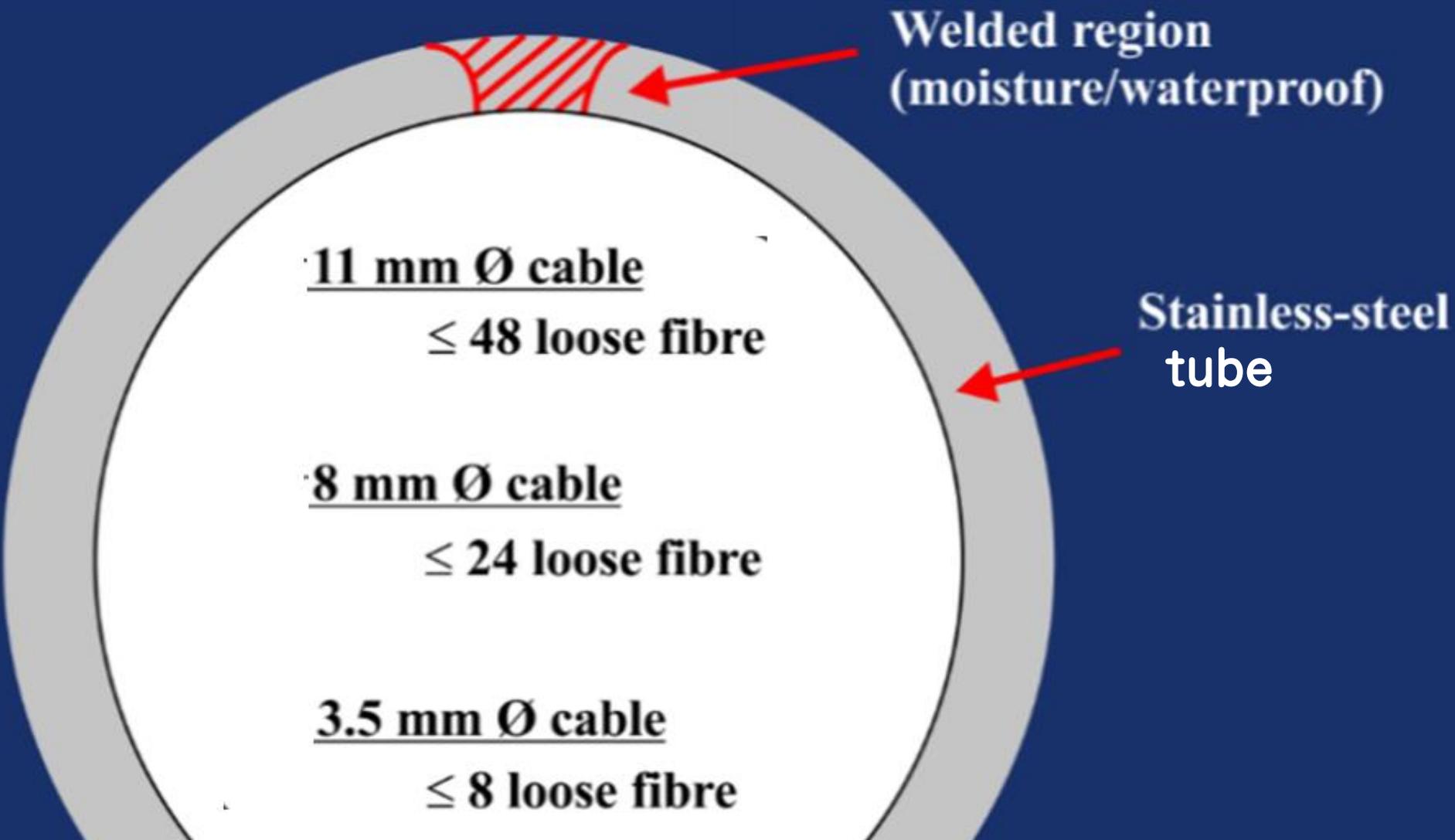
Proposed Solution And its deployment

Fully Meeting the ITU Standards

Lightweight, Thin and Robust Max. 12-km Optical Cable for Direct Surface Application



Cable core tube Cross section



Cable Robustness

Rodent Proof Test



Proposed Cable, survived



Conventional Cable, broken





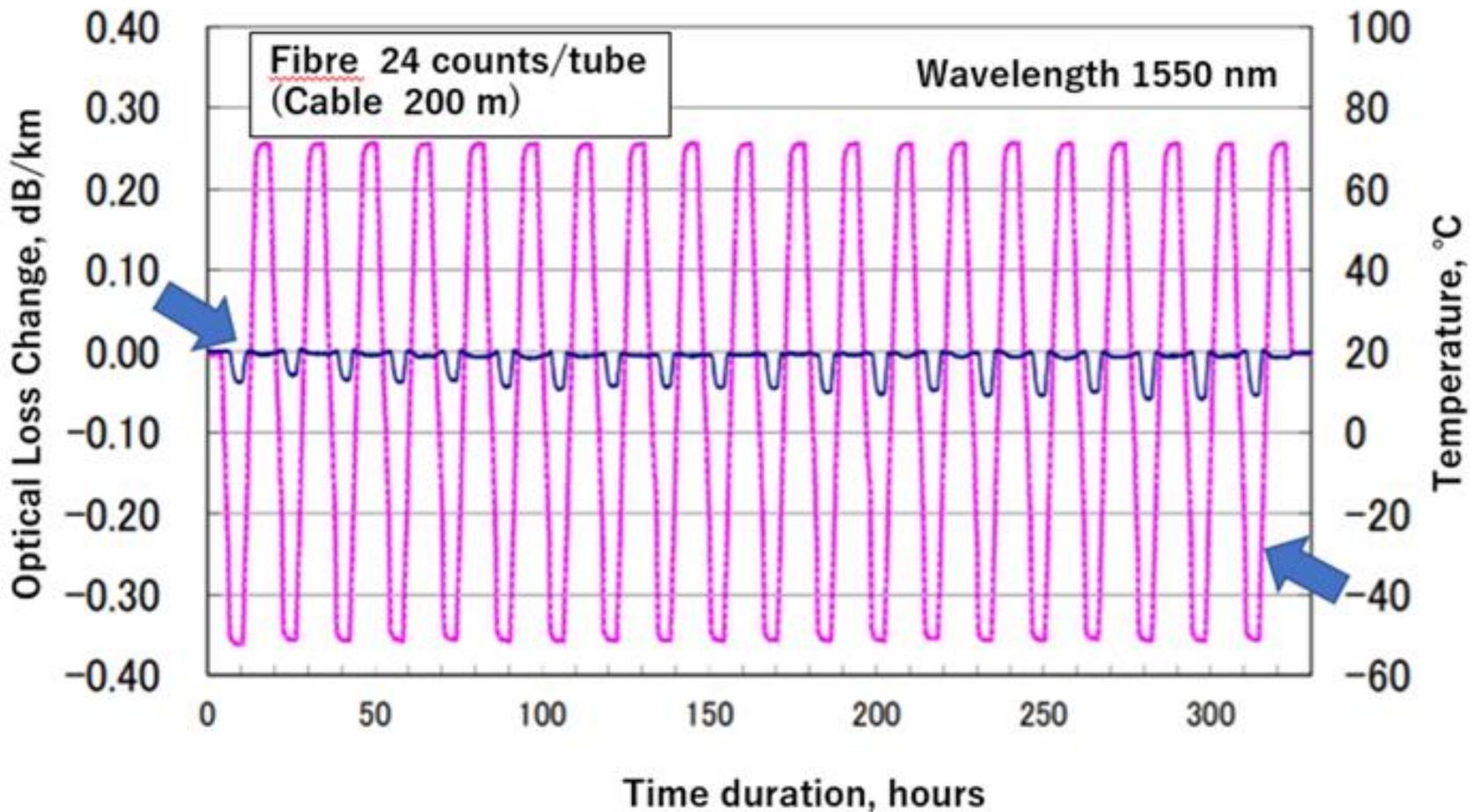
Cable Crush Resistance



Up to 2000 kg/100 mm

Heat Cycle Acceptable $-50\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$

DSA Cable with welded core tube and wire armor seen in [ITU-T L.110], Appendix I



1180°C, 15 min
Optical Loss <0.05 dB



DIY Cable Installation

Easy and Low Cost



On-surface



Shallow direct buried

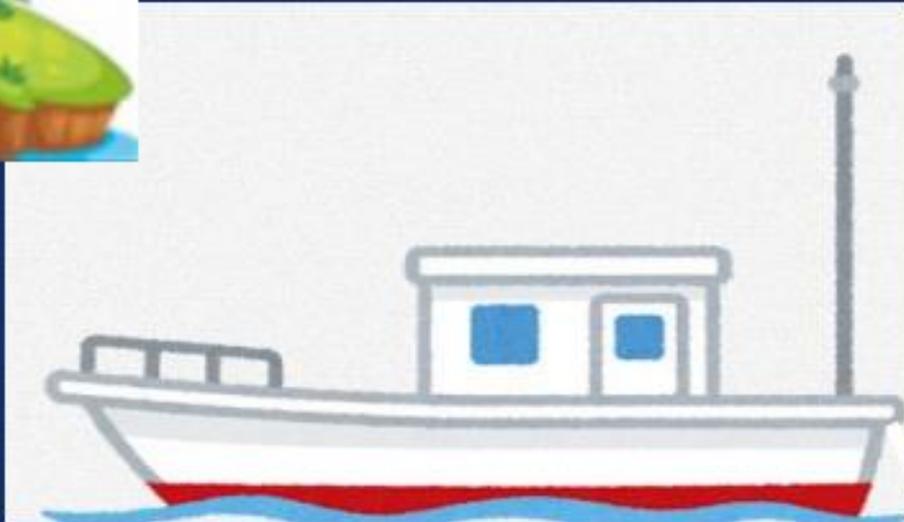


Air



Water (slow river lake)

- Cable length Max. 12 km
- Water depth 200 m
(Max. value implemented)



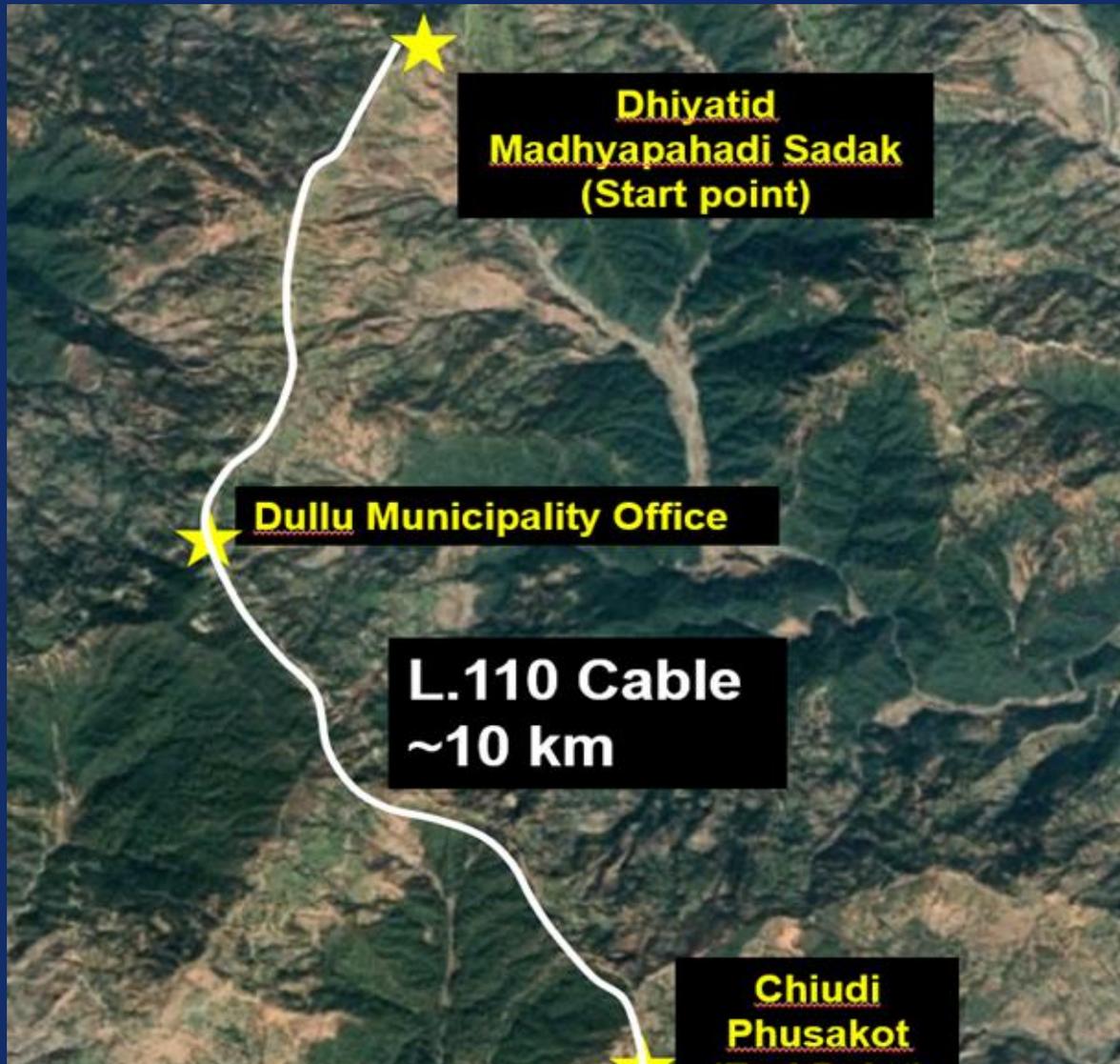


**As the final Resort
not yet verified**

Cable Installation West Nepal, Mar., 2019

Dullu Municipality Project

West Nepal, May 2019



Broadband Connectivity in Dullu Municipality

With

- Hospital
- Health Centers
- Municipality Office
- Ward Offices
- School
- Wi-Fi base stations

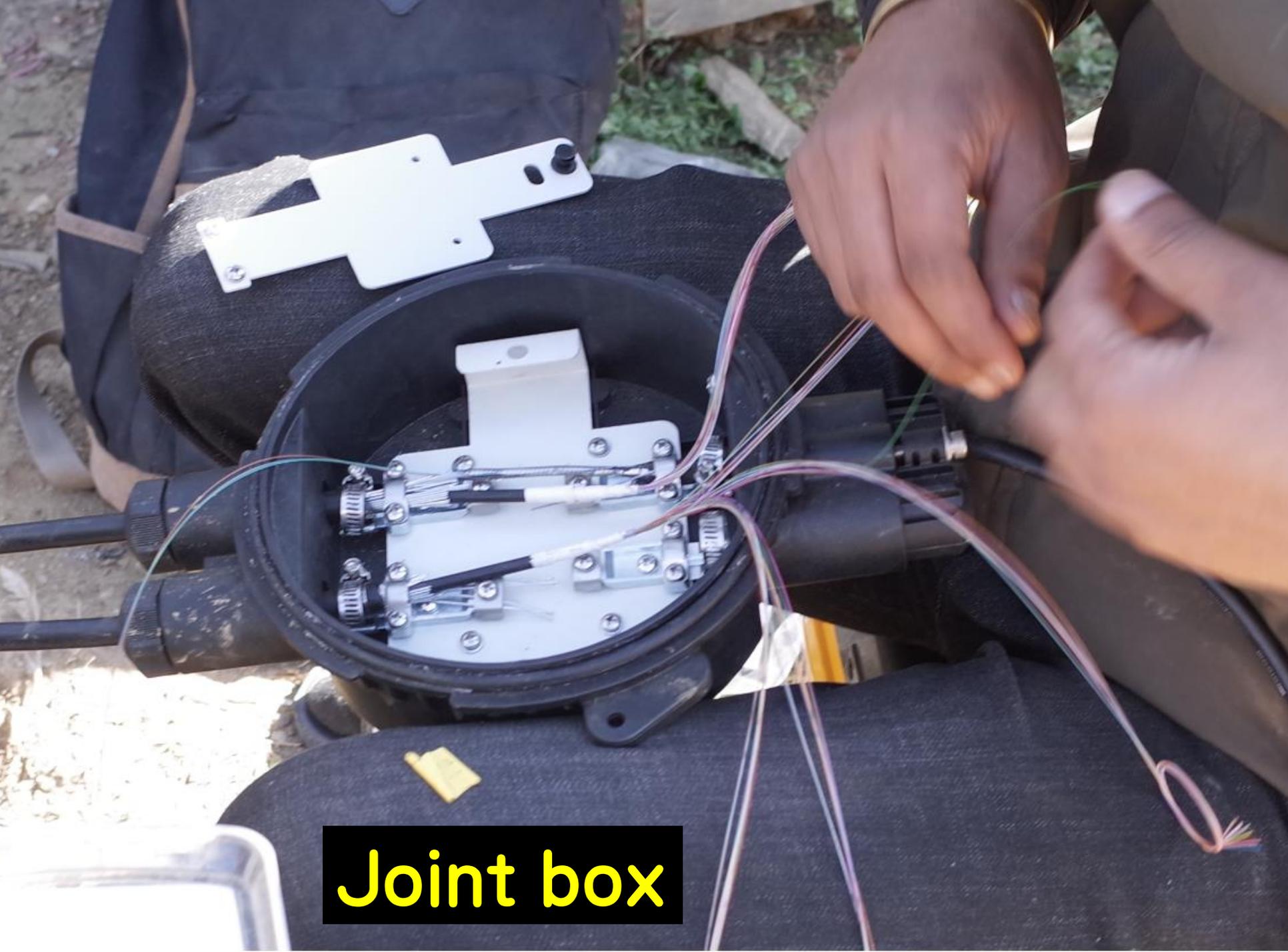












Joint box



Extra cable

Cable Installation Plan mulled By Nepal Telecom Authority

**Mt. Everest Base Camp
And**

Mt. Annapurna trekking trail

Feb. 8, 2017

Local Election 2074



News and Updates



NATIONAL

Govt mulls setting up free wifi zones at Everest, Annapurna regions



Post Report, Kathmandu



Feb 8, 2017-The government is planning to set up free wi-fi zones along the trails of Lukla-Everest Base Camp (EBC) area and Annapurna Base Camp. "In the initial phase we will set up free wi-fi zones along the Lukla-EBC area and Annapurna trail," said Jha, "We will expand this service in other areas too." Nepal Telecom Chairman Jha further informed that the service will operate on the Okamura Model. The model suggests use of low-cost optical cable for high-

An Example of CAPEX Reduction

By meeting ITU-T L.1700, L.110 and L.163



Civil works	58	k US\$/km
Cable	~ 1	k US\$/km
Manhole	4.8	kUS\$/km
Pipe	8.0	kUS\$/km

72 k US\$/km (data by Korea Telecom, at UNESCAP, Sept. 2013, Baku)



CAPEX Reduction



-Civil Works	3.3	k US\$/km
Wage	100	US\$/day/head
(at high-wage country like Korea)		
Progress	300	m/day (shallow burial)
by Ten Local People for DIY		
-Cable	4-5	k US\$/km
-Manhole	not needed	
-Duct	not needed	

8.3 k US\$/km using L.110 Cable and L.163 Construction

Conclusions

(1) ITU Standards Published

- Affordability-First Concept; L.1700
- Lightweight On-Surface Cable; L.110
- DIY Cable Installation; L.163

(2) Affordable Opt. Cable Backhaul Solution
for Closing Urban-Rural Digital Divide now available

(3) L.110 Cable Installed in West Nepal(12 km) and
Mongolia(4.8 km), 2019

(4) Other 2 plans(12 km and 43 km) in Nepal(2020)