WSIS FORUM 2022
Starting on 15 March
Final week 30 May - 3 June

Advanced technologies for smart optical infrastructure maintenance

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Agenda

1. Recent situations surrounding infrastructure maintenance
2. Sustainable smart maintenance
3. Advanced technologies
4. Maintenance in ITU-T Recommendations

FTTH with huge amount of facilities…(in Japan)

FTTH Subscribers: 35 million

Poles: 14 million

Cable: 2.3 million-km

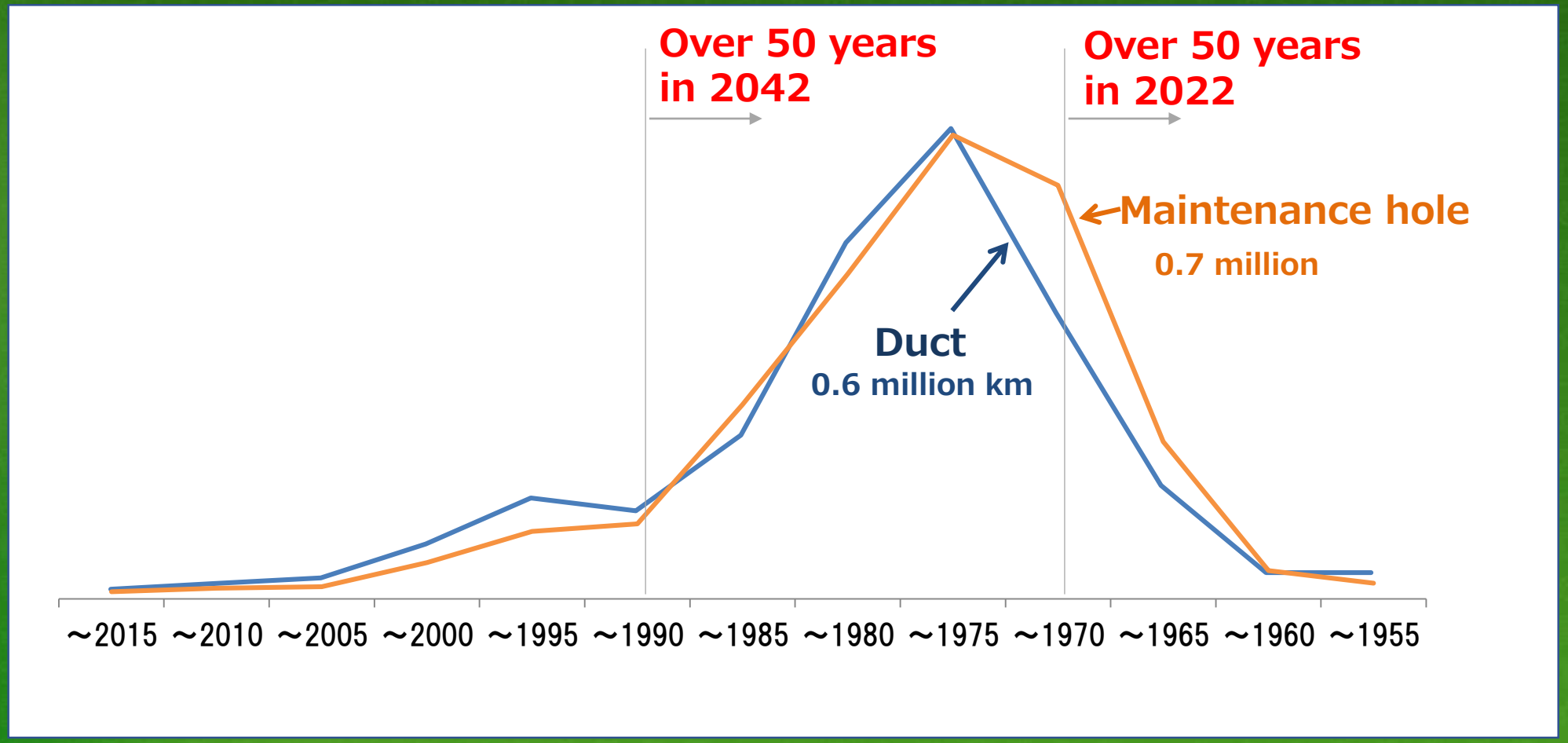
Duct: 0.6 million-km

Tunnel: 650 km

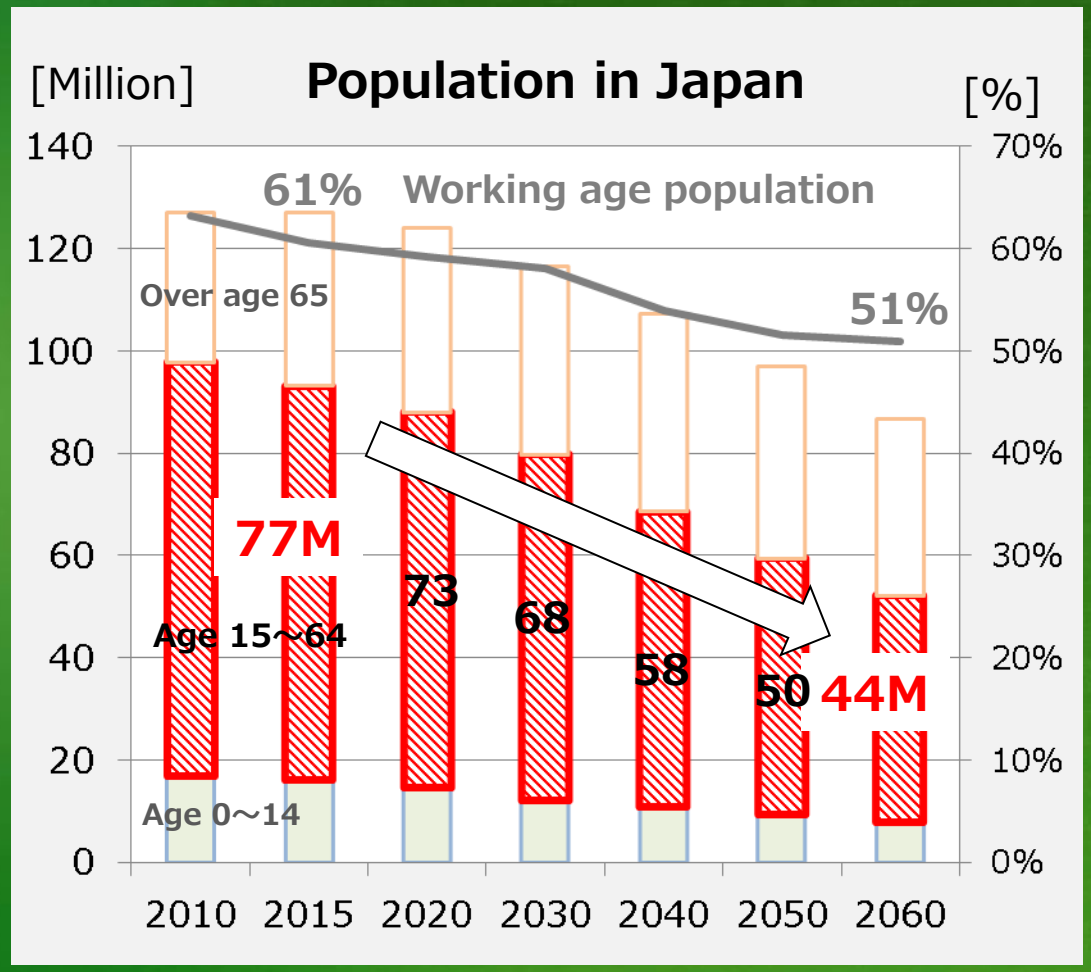
Maintenance Hole (MH): 0.7 million

Aging facilities (of NTT's infrastructures)

- ✓ Construction dates from the 1960s to the 1980s (as well as other social infrastructure)
- ✓ 20 years later: 85% of the facilities will be more than 50 years



Decline in the labor force (in Japan)



NTT IR report (2021)

Maintenance in COVIT-19 pandemic

Life

Work

Sustainable smart maintenance

Optimize maintenance cycle

- Inspection
- Repair
- Renewal

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- Preventive maintenance

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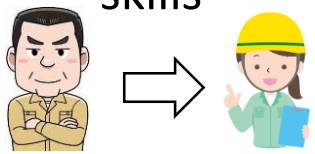
Organization

Transmission of skills



Sharing labor force

Consolidation of site and business

Cooperation with inhabitants

＋

Developing techniques

Advanced technologies

Utilizing digital data

→

Sustainable smart maintenance

Sustainable smart maintenance

Optimize maintenance cycle

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- Repair
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- Preventive maintenance

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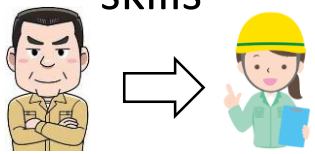
Organization

Transmission of skills



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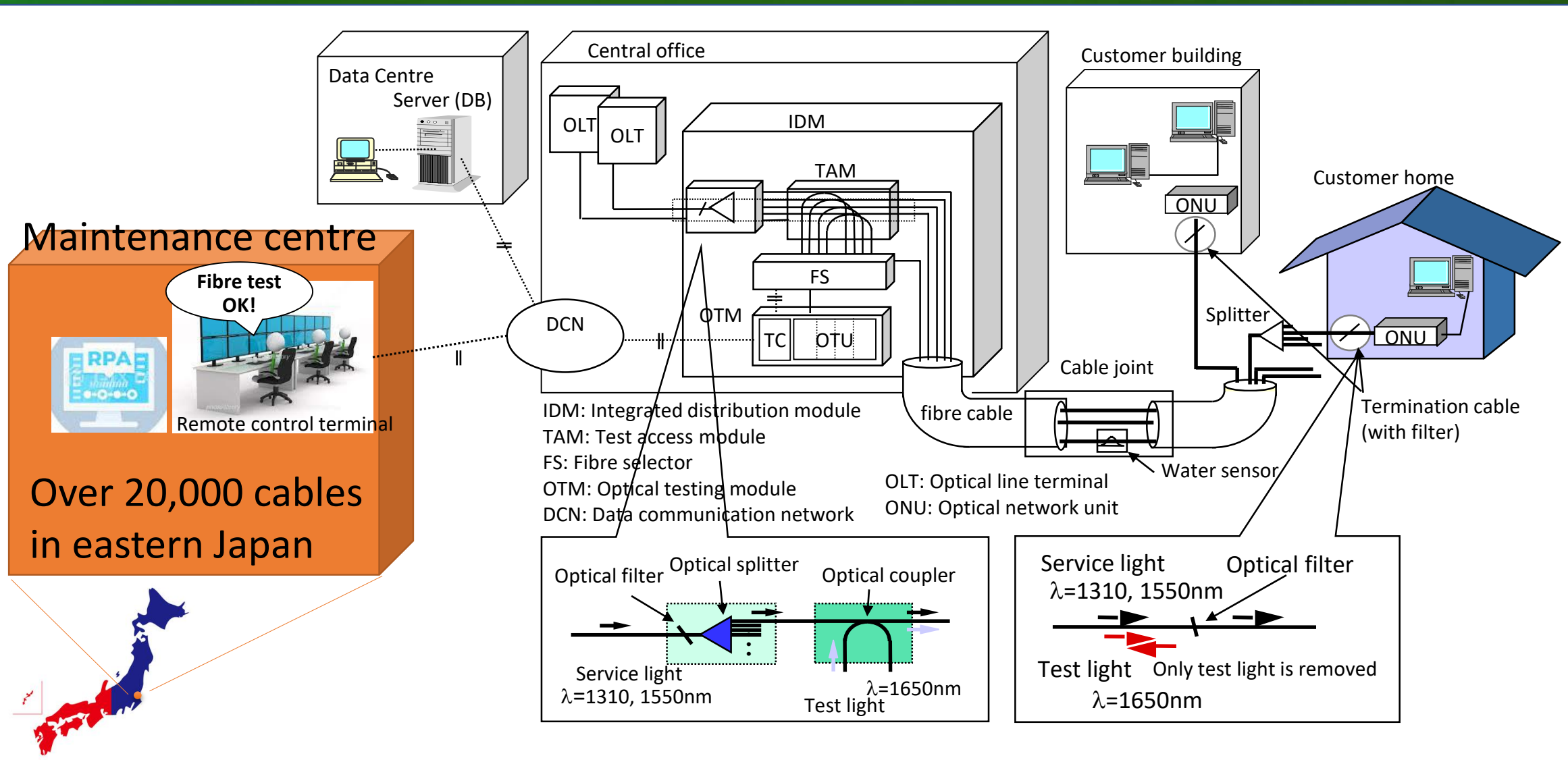
Sustainable smart maintenance

Consolidation of site and business: fibre testing



Sustainable smart maintenance

Optimize maintenance cycle

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- Preventive maintenance

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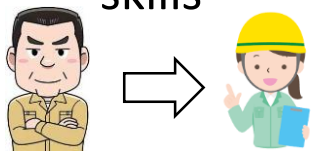
Organization

- Transmission of skills



- Sharing labor force

- Consolidation of site and business
- Cooperation with inhabitants

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Developing techniques

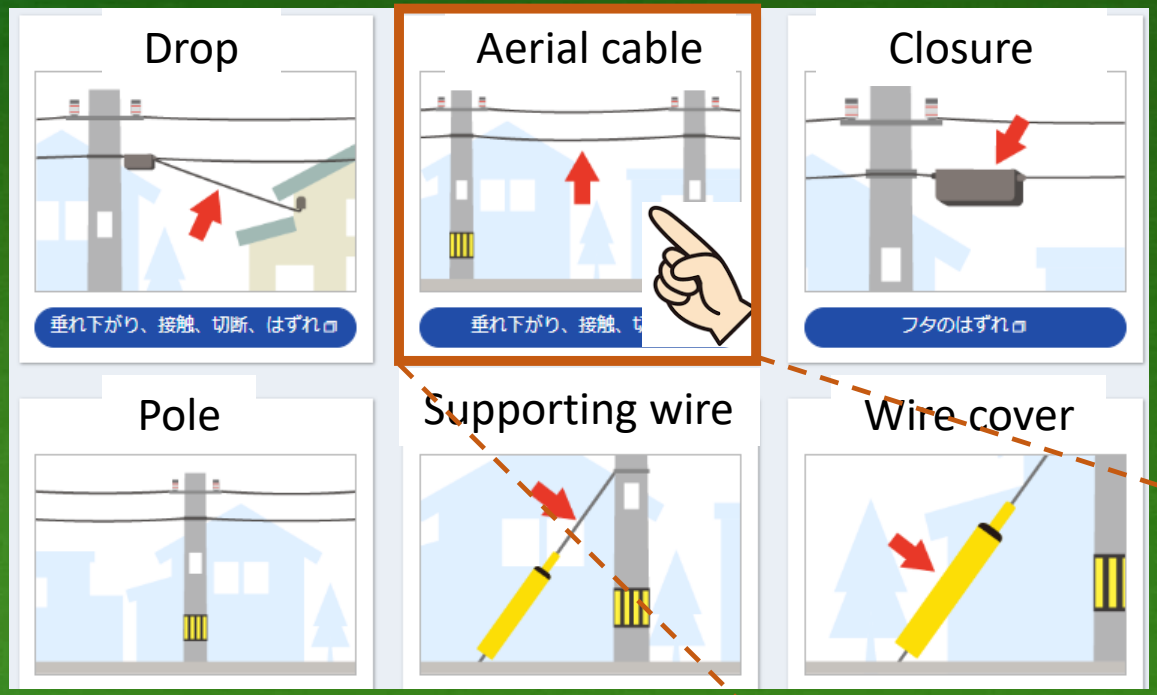
- Advanced technologies

- Utilizing digital data

→

Sustainable smart maintenance

Cooperation with inhabitants: Defect reporting apps



Sustainable smart maintenance

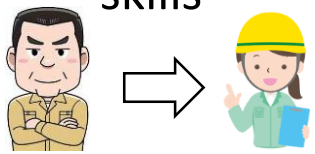
Optimize maintenance cycle

- Inspection
- Repair
- Renewal
- ＋
- Preventive maintenance

＋

Organization

Transmission of skills



Sharing labor force

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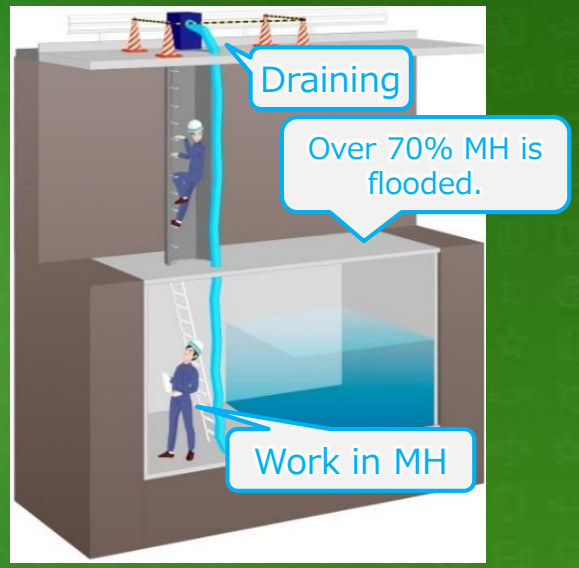
Sustainable smart maintenance

Advanced technologies: Robotics for MH inspection

Conventional

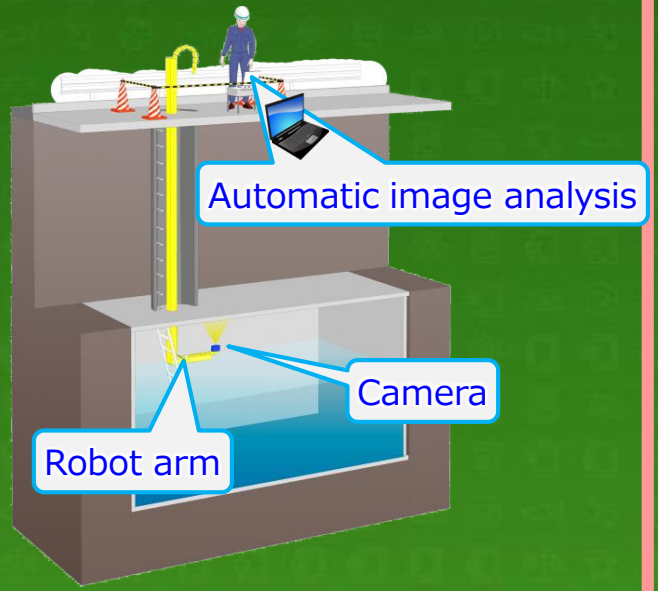
Visual inspection
Sketch



Draining (Ave. 30 min.)
Visual inspection
Record by handwritten sketch

Case1: Camera on robot arm

Digital image
Auto judgement
Work outside MH



Case2: Camera drone

Full-auto inspection (slill-less)
High-speed
Improve safety

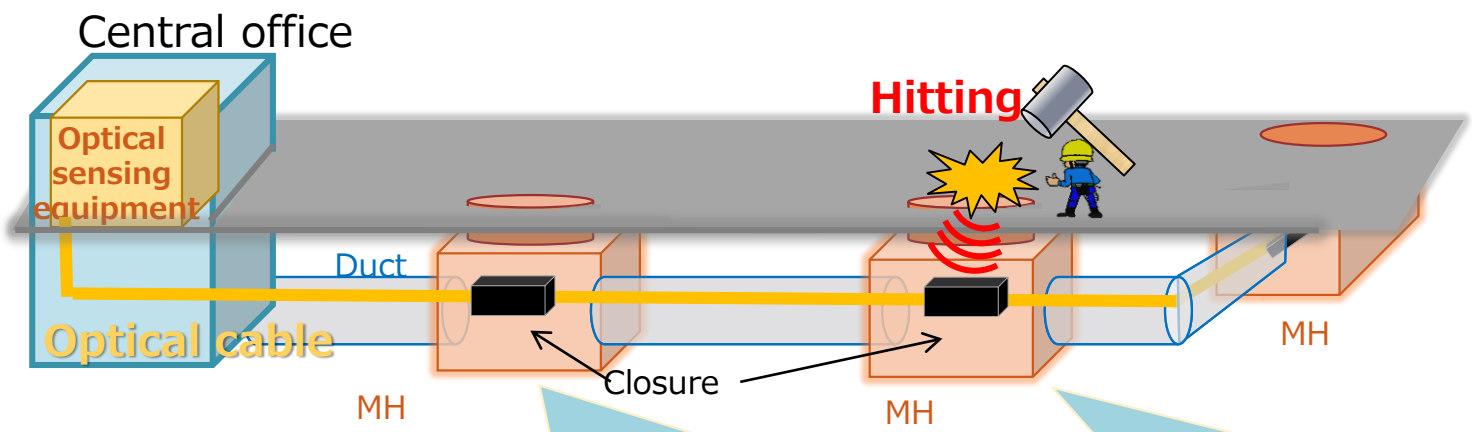
w/o draining (or less)
Automatic imaging & analysis
Record by high-definition image

Advanced technologies: Deterioration automatic detection

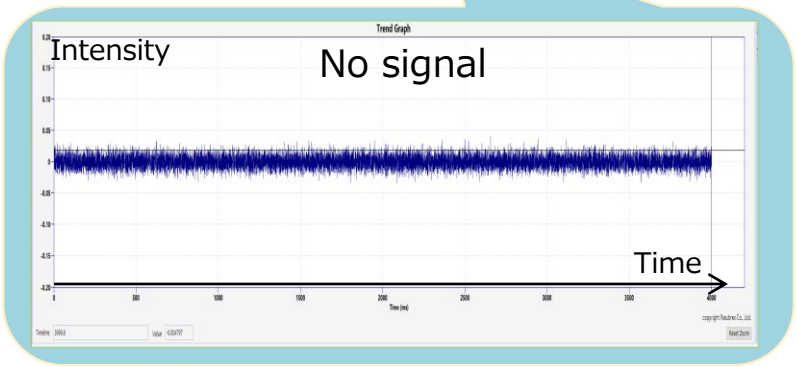
Inspection item	Exposed reinforcement	Corrosion
Performance	Detection rate: 98.7% False detection rate: 6.15%	Detection rate: 90.4% False detection rate: 8.2%
Example of original image		
Analysis result		

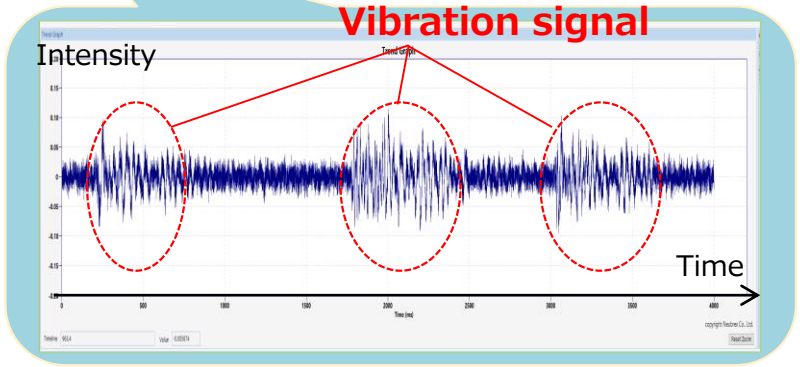
Advanced technologies: Cable route identification with fibre sensing

- **Hit the MH cover and measure the presence or absence of vibration to the optical fiber cable from a remote location by optical fiber sensing.**
- **It can measure the length of the optical cable passing through the vibrated MH.**
- **It can grasp the cable route precisely.**



Hit by hummer

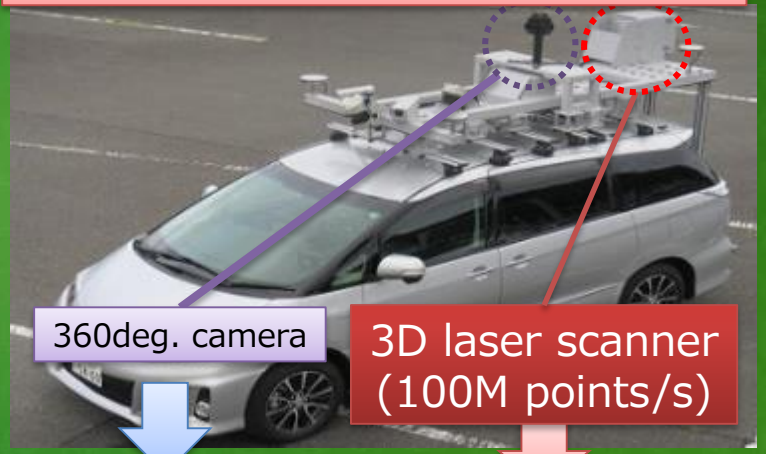




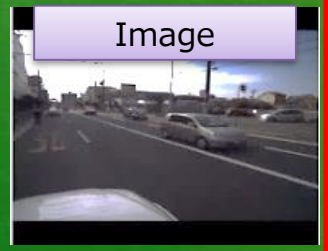
Advanced technologies: MMs and 3D digitalized facilities

- **3D point cloud data is acquired using mobile mapping system (MMS).**
- **Facilities can be modeled in 3D from point cloud data**
- **Only telecom facilities can be automatically detected**

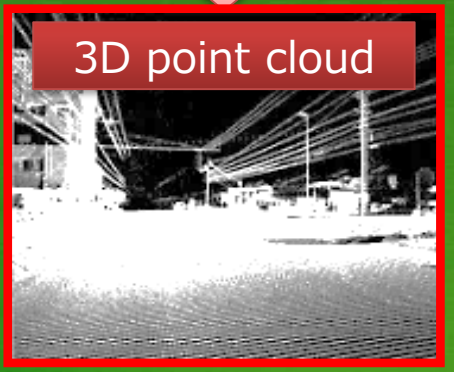
MMS



Image

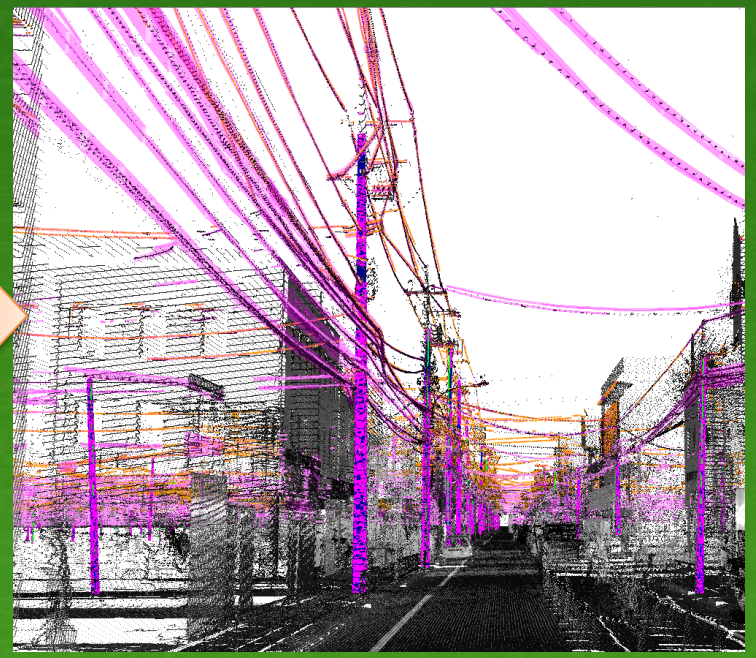


3D point cloud



Image

3D point cloud
(Detect facilities automatically)

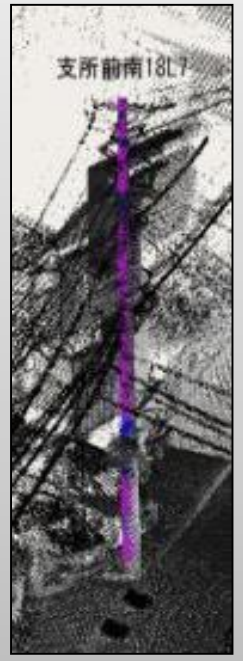


Advanced technologies: 3D digitalized facilities

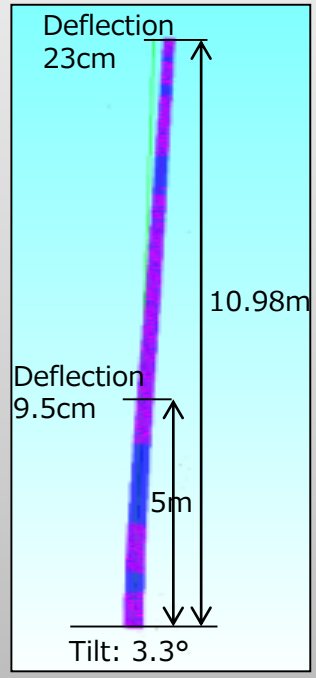
Detected telecom facilities can be measured structural states with high accuracy.

Actual image

3D modeling
Automatic detection
of telecom facilities



Automatic analysis

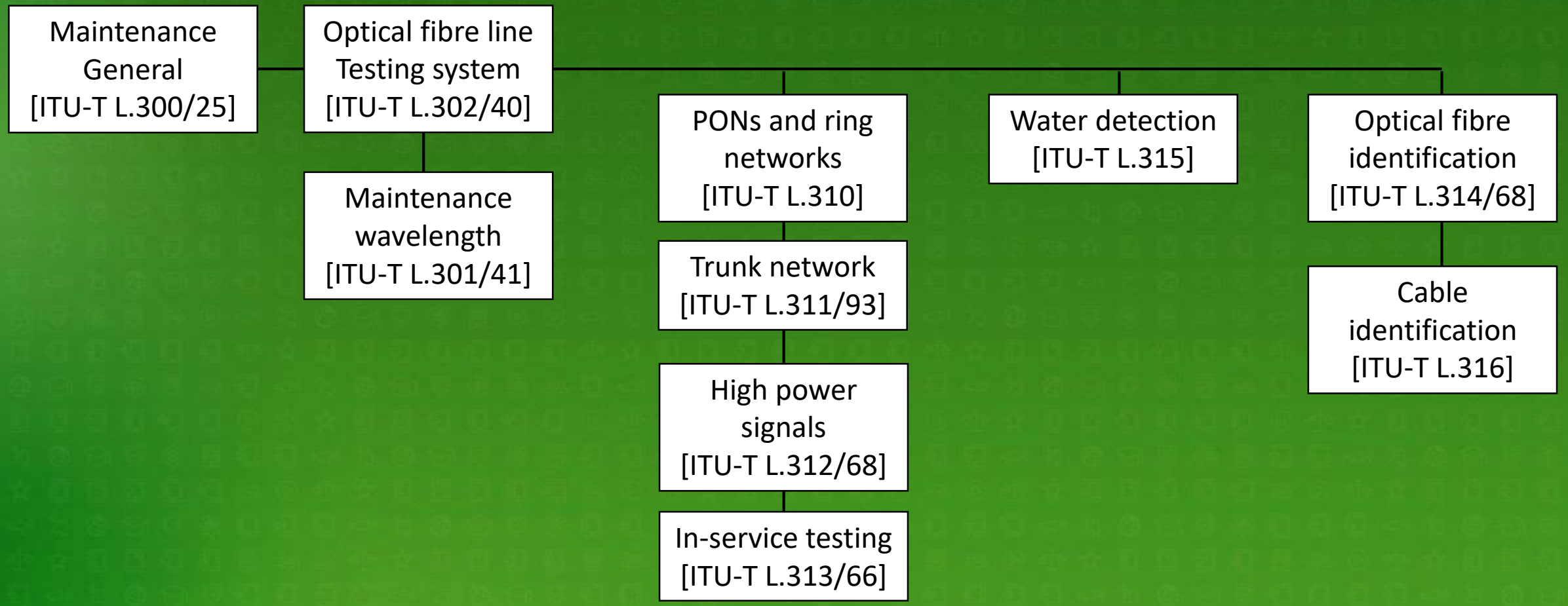


Structural state

pole tilt
deflection,
position,
cable height

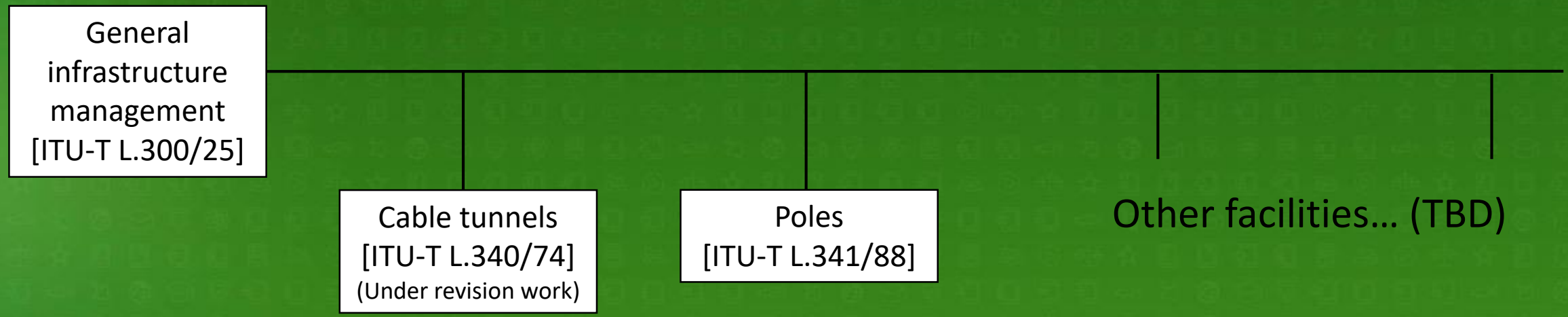
Maintenance related Rec. in ITU-T

Optical fibre cable maintenance
ITU-T L.300-329



Maintenance related Rec. in ITU-T

Infrastructure maintenance
ITU-T L.330-349



Conclusion

- It is important to establish maintenance cycle and business system for sustainable maintenance.
- Advanced technologies can improve efficiency and safety, thus supporting sustainable maintenance.
- Maintenance methods change with the progress of related technologies. Standardized documents revised in response to this change will be a useful resource for document users.