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

Maintenance and operation – Infrastructure maintenance

Telecommunication infrastructure facility management

Recommendation ITU-T L.330

ITU-T L-SERIES RECOMMENDATIONS

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

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Recommendation ITU-T L.330

Telecommunication infrastructure facility management

Summary

Recommendation ITU-T L.330 identifies facilities, items, typical frequency and criteria to be inspected by operators, along with fundamentals of telecommunication infrastructure facility management. Its intended users are not only operators who need to improve life-cycle management, but also developers who consider applying rapidly progressing technologies.

Extensive outside telecommunication infrastructure facilities that support information technology continue to deteriorate due to aging. To provide telecommunication services continuously and to upkeep infrastructure safety, it is important to maintain service functions based on appropriate facility management as a series of maintenance tasks that includes inspection, diagnosis and repair. Demand is dramatically increasing for cost-effective technologies that can improve maintenance productivity for various types of infrastructure.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T L.330	2020-10-29	15	11.1002/1000/14515

Keywords

Facility management, infrastructure, inspection, restoration and repair, outside plant.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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Recommendation ITU-T L.330

Telecommunication infrastructure facility management

1 Scope

This Recommendation covers:

– fundamentals of telecommunication infrastructure facility management including the physical cabling and outdoor supporting infrastructures,

– maintenance cycle/frequency as a series of inspection, diagnosis and repair for the purpose of maintaining telecommunication services and infrastructure safety,

– considerations on infrastructure structural risks and their rating,

– requirements for facilities management and items to be inspected, typical inspection frequency and criteria.

Inspection test methods and repair methods for each facility, which are described in other Recommendations, lie outside the scope of this Recommendation.

2 References

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 guy-line [b-ITU-T L.261]: A wire installed to prevent poles collapsing as a result of tension imbalances that occur during or after cable installation. One end of the guy-line is fixed to the pole and the other end is fixed to the ground by a guy anchor.

3.1.2 risk [b-ISO 31000]: Effect of uncertainty on objectives.

NOTE 1 – An effect is a deviation from the expected. It can be positive, negative or both, and can address, create or result in opportunities and threats.

NOTE 2 – Objectives can have different aspects and categories, and can be applied at different levels

NOTE 3 – Risk is usually expressed in terms of risk sources, potential events, their consequences and their likelihood.

3.1.3 suspension wire [b-ITU-T L.261]: Wire that is installed in advance between telecommunication poles from which aerial optical cables are suspended. It supports a tension applying to non-self-supporting aerial optical cables.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 aerial cable: An optical fibre cable for aerial applications.

NOTE – See [b-ITU-T L.102].

3.2.2 bridge-supported conduit: A steel or poly(vinyl chloride) (PVC) conduit used when a cable is installed across rivers, and supported by brackets and bolts in the middle of bridges.

3.2.3 cabinet; pillar: Terminals designed to accommodate telecommunication cables and to protect spliced connections on the telecommunication network. Moulded in sheet moulding

compound (SMC) composite or metal, these terminals protect the subscriber connection material against external aggressions (resistance to shocks, resistance to fire and weather conditions, protection against deterioration, etc.) They have to guarantee specific ingress protection (IP).

3.2.4 drop cable: An optical fibre cable used for drop applications.

NOTE – See [b-ITU-T L.105].

3.2.5 ground height: The clearance from ground level.

NOTE – See [b-ITU-T L.261].

3.2.6 handhole: An underground structure smaller than a manhole for installing smaller count cable and smaller enclosures. It is composed of a cover and a main frame. The cover can be made in steel, cast iron or glass reinforced plastics (GRPs). The main frame is made of reinforced concrete or polymer concrete, and this is assumed in this Recommendation.

3.2.7 manhole: An underground structure less than 10 m long for cable and enclosure installation and maintenance that consists of a cover and a main frame. The cover can be made in steel, cast iron or glass reinforced plastics (GRPs). The main frame is made of reinforced concrete or polymer concrete and this is assumed in this Recommendation.

3.2.8 offset distance: The clearance from cables of other owners.

NOTE – See [b-ITU-T L.261].

3.2.9 open-cut tunnel: An underground tunnel for telecommunication of diameter 2 m to 5 m used for installation or maintenance and with a reinforced concrete main frame. It has a rectangular cross-section.

NOTE – See [b-ITU-T L.340].

3.2.10 pole: Support commonly used to carry aerial fibre optic cables or for joint use with electrical power cables.

NOTE – Poles made of concrete, wood, steel or glass-reinforced plastics (GRPs) are widely used, as mentioned in [b-ITU-T L.261]. Most concrete poles are made of pre-stressed concrete [b-ISO 22965-1], and this is assumed in this Recommendation.

3.2.11 shelter: An enclosed space, constructed from brick, steel or concrete, which is a permanent or prefabricated structure, designed for protection against climatic effects.

3.2.12 shield tunnel: An underground tunnel for telecommunications of diameter 2 m to 5 m that is used for installation or maintenance and that consists of a steel shield with a concrete lining. It has a circular cross-section.

NOTE – See [b-ITU-T L.340].

3.2.13 tower: A self-supporting or cantilevered structure, while a mast is held up by stays or guys. A mast is a ground-based or rooftop structure that supports antennas at a height where they can satisfactorily send or receive radio waves.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

GRP Glass-Reinforced Plastic

IP Ingress Protection

PDCA Plan-Do-Check-Action

PVC Poly(Vinyl Chloride)

SMC Sheet Moulding Compound

5 Conventions

None.

6 Fundamentals of outside plant facility management

6.1 Plan-do-check-action cycle

The plan-do-check-action (PDCA) cycle in the field of telecommunication facility management consists of the following four tasks as depicted in Figure 1.

a) Facility management

This task includes data management for recording and referencing the history of past inspection and repair works in different types of fault prone locations or areas. It also includes planning for inspection and repair based on appropriate prioritization, considering the history, installation environment and importance of the facility in terms of compliance with regional regulations, safety and service continuity. Facilities should be categorized based on the criticality of network (core, aggregate and access) availability.

b) Inspection

This task includes the implementation of inspection and diagnosis by means of visual observations, or appropriate measurement or sensing methods. It is recommended that quantitative rather than subjective methods be used by field engineers, except when there is no alternative. The inspection category is described in clause 6.2.

c) Evaluation

This task includes a risk rating assessment based on inspection results. The risk rating is described in clause 6.3.

d) Restoration and repair

This task includes the implementation of a restoration and repair with a method appropriate for each facility. It includes replacement with a new facility.

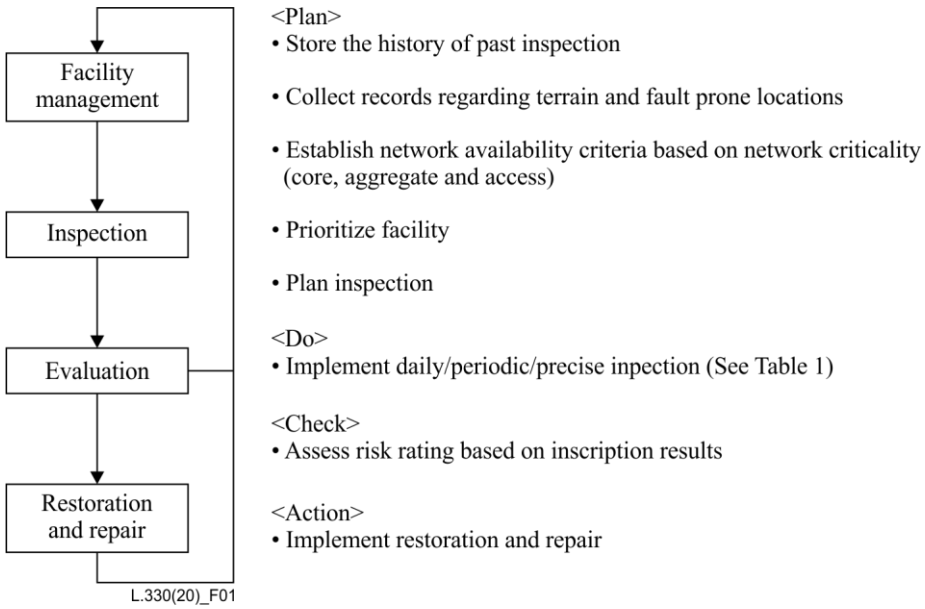


Figure 1 – Plan-do-check-action cycle for telecommunication facility management

6.2 Inspection category

Inspection categories for telecommunication infrastructure facilities are listed in Table 1.

Table 1 – Inspection categories

Inspection category	
Daily inspection	Inspection performed visually or with simple tools when working on-site
Periodic inspection	Inspection performed at planned intervals. Some inspection items may include quantitative records
Precise inspection	Inspections performed to determine risk rating when more detailed assessments are required after result of the daily/periodic inspection

6.3 Risk rating

Risk ratings determined from the results of inspections are classified into four levels as listed in Table 2.

Table 2 – Risk rating

Risk rating	
I (normal)	No action is required
II (low)	Follow-up inspection is required. Defects have no immediate effect, but are expected to move to a higher rating in the long term
III (high)	Planned repair is required. Defects will progress quickly and can be expected to move to the higher rating
IV (emergency)	Immediate repair is required. Defect induced accidents may occur

6.4 Problem identification, restoration and repair

Restoration and repair time determined from the results of inspections are described using the four area grid in Table 3.

Table 3 – Restoration and repair

Finding problems	Fixing problems	
	Easy	Hard
Easy	Problem easily identified Standard repairs methods, mean time to repair is less than 4 h	Problem easily identified Lengthy time to repair, longer than 4 h, could require several repair personnel
Hard	Problem takes a long time to identify and troubleshooting may require several personnel Standard repairs methods, mean time to repair is less than 4 h	Problem takes a long time to identify and troubleshooting may require several personnel Lengthy time to repair, longer than 4 h, could require several repair personnel

7 Considerations on infrastructure risk

The infrastructure risks and their typical factors for each facility that should be considered are listed in Table 4.

Table 4 – Infrastructure risks and typical factors

Facility		Risk	Typical factors
Pole	Concrete pole	Breakage, collapse	Neutralization, rebar corrosion, unbalanced load
	Steel pole		Corrosion, unbalanced load
	Wooden pole		Decay, crack, unbalanced load
	GRP pole		Crack, unbalanced load
Wire	Guy-line	Breakage	Corrosion, wind/ice loading
	Suspension wire		
Cable	Aerial cable	Breakage, cracking	Unclasping, wind/ice loading, biotic damage, forest fire, crop burning
	Drop cable		
Tunnel	Open-cut tunnel	Collapse	Neutralization, rebar corrosion
	Shield tunnel		Corrosion of steel shield
Manhole Handhole	Cover	Breakage, road accident, road noise	Abrasion, over-loading
	Concrete frame	Collapse	Neutralization, rebar corrosion
	Polymer concrete frame		Hydrolysis, biotic damage
Conduit	Bridge-supported conduit	Breakage, falling objects	Corrosion, vibration
Cabinet or pillar		Collapse, water ingress	Corrosion, deformation, brittleness
Tower		Breakage, collapse	Corrosion, unbalance load, vibration, wind
Shelter		Collapse, water ingress	Corrosion

8 Requirements for inspection of outside plant facilities

8.1 Inspection frequency

The typical recommended frequencies for periodic inspection are listed in Table 5.

Table 5 – Typical inspection frequencies

Facility		Typical inspection frequency (Note)
Pole	Concrete pole	≤5–10 years
	Steel pole/GRP pole	
	Wooden pole	≤5 years
Wire	Guy-line	≤5–10 years
	Suspension wire	
Cable	Aerial cable	Daily inspection
	Drop cable	

Table 5 – Typical inspection frequencies

Facility		Typical inspection frequency (Note)
Tunnel	Open-cut tunnel	≤5 years
	Shield tunnel	
Manhole Handhole	Cover	≤5–10 years
	Concrete frame	≤10 years
	Polymer concrete frame	
Conduit	Bridge-supported conduit	≤5–10 years
Cabinet or pillar		<2–3 years
Tower		<2–3 years
Shelter	Prefabricated structure	<2–3 years
NOTE – Inspection frequency may be different in accordance with the types of terrain in which the facility is installed.		

8.2 Items to be inspected

Most check points for the inspection of outside plant facilities can be examined preliminarily in terms of the presence or absence of the phenomenon, which are designated "Y/N". Some check points require a quantitative measurement to evaluate the risk rating or degree of deterioration, which is designated using the minimum required unit for the measurement. See Figure 2.

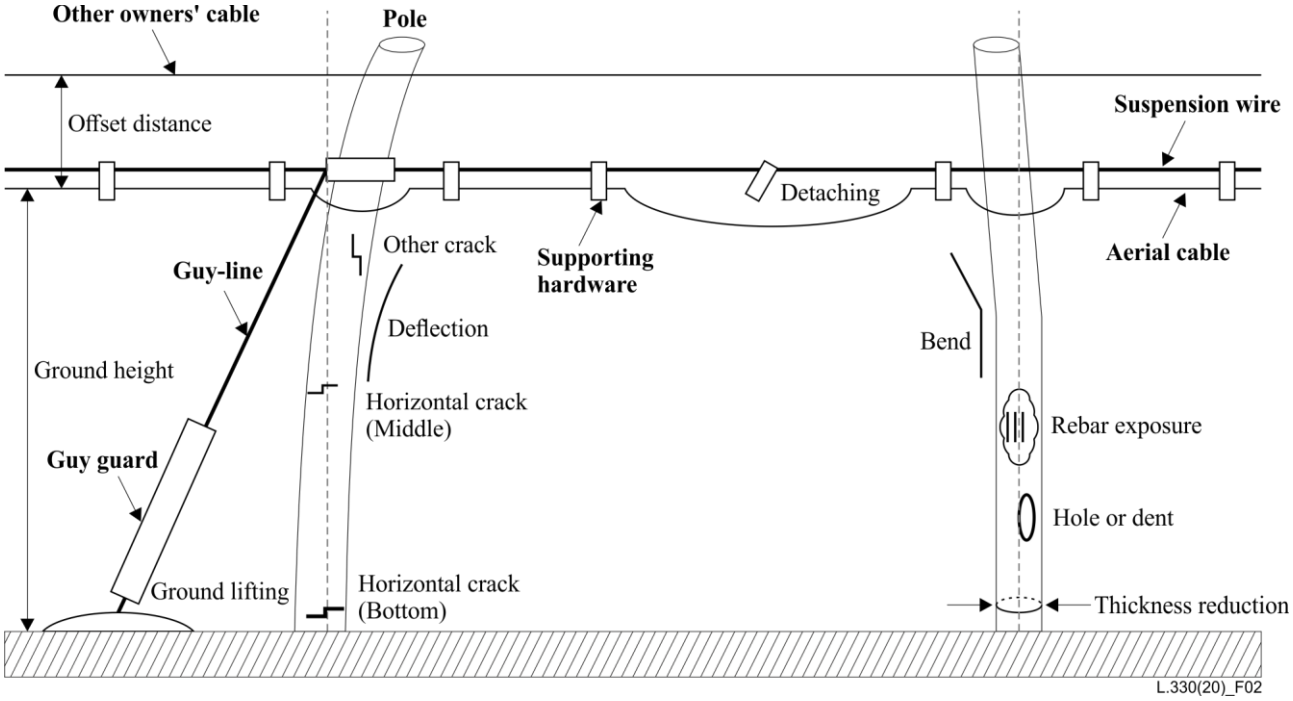


Figure 2 – Poles, wires and cables and their inspection items

8.2.1 Pole

See Table 6.

Table 6 – Inspection of pole

Facility	Item	Daily	Periodic	Precise
Concrete pole	Deflection	Y/N	Y/N	1 cm (Note 1)
	Bending	Y/N	Y/N	
	Crack	Y/N	0.1 mm (Note 2)	
	Surface damage	Y/N	Y/N	
	Sinkage, tilt	Y/N	Y/N	
Steel pole	Deflection	Y/N	Y/N	1 cm (Note 1)
	Rusting	Y/N	Y/N	
	Thickness	Y/N	0.1 mm (Note 2)	
	Surface damage	Y/N	Y/N	
	Sinkage, tilt	Y/N	Y/N	
Wooden pole	Deflection	Y/N	Y/N	1 cm (Note 1)
	Crack	Y/N	Y/N	
	Surface damage	Y/N	Y/N	
	Sinkage, tilt	Y/N	Y/N	
GRP pole	Deflection	Y/N	Y/N	1 cm (Note 1)
	Crack	Y/N	Y/N	
	Surface damage	Y/N	Y/N	
	Sinkage, tilt	Y/N	Y/N	
NOTE 1 – Deflection at a given height (e.g., 5 m) above ground level is measured when precise inspection is required. NOTE 2 – Measured at the bottom (close to the ground) and the middle of each pole. Regarding concrete poles, the details should follow [b-ISO 16311 (all parts)].				

8.2.2 Wire

See Table 7.

Table 7 – Inspection of wire

Facility	Item	Daily	Periodic	Precise
Guy-line	Diameter		0.1 mm	
	Rusting	Y/N	% (Note 1)	
	Guy guard	Y/N	Y/N	
	Excess sagging	Y/N	Y/N	
	Anchor-side ground lifting	Y/N	Y/N	
Suspension wire	Lack of ground height	Y/N	0.1 m (Note 2)	
	Lack of offset distance	Y/N	0.1 m (Note 2)	
	Rusting	Y/N	% (Note 1)	
	Contact with other objects	Y/N	Y/N	
NOTE 1 – Measured percentage rusted area [b-ISO-4628-3]. NOTE 2 – Measured when a lack of height or distance is observed. The height or distance should be compliant with regional regulations or special instructions from other owners (e.g. road or power).				

8.2.3 Cable

See Table 8.

Table 8 – Inspection of cable

Facility	Item	Daily	Periodic	Precise
Aerial cable	Lack of ground height Lack of offset distance Contact with other objects Detaching	Y/N Y/N Y/N Y/N		0.1 m (Note 1) 0.1 m (Note 1)
Drop cable	Lack of ground height Lack of offset distance Contact with other objects Detaching	Y/N Y/N Y/N Y/N		0.1 m (Note 1) 0.1 m (Note 1)
NOTE 1 – Measured when a lack of clearance is observed. The clearance should be compliant with regional regulations or special instructions from other owners (e.g., road or power).				

8.2.4 Tunnel

See Table 9.

Table 9 – Inspection of tunnel

Facility	Item	Daily	Periodic	Precise
Open-cut tunnel	Crack Water leak Joint gap, offset Exposed rebar, length Surface damage Deformation Covering depth of rebar Concrete neutralized depth Strength of concrete Concrete chloride content	Y/N Y/N Y/N Y/N Y/N Y/N	0.1 mm (Note 1) Y/N 1 mm 1 cm 1 cm^2 Y/N	 1 mm (Note 2) 1 mm 1 mm 1 N/mm^2 0.1 kg/m^2
Shield tunnel	Crack Water leak Joint gap, offset Exposed rebar, length Surface damage Deformation Defects/voids inside lining	Y/N Y/N Y/N Y/N Y/N Y/N	0.1 mm (Note 1) Y/N 1 mm 1 cm 1 cm^2 Y/N	 1 mm (Note 2) Y/N
NOTE 1 – The details should follow [b-ISO 16311 (all parts)]. The crack pattern should be recorded for large crack widths (e.g., no less than 0.3 mm). NOTE 2 – Inner space displacement in tunnels.				

8.2.5 Manhole and handhole

See Table 10 and Figure 3.

Table 10 – Inspection of manhole and handhole

Facility	Check point	Daily	Periodic	Precise
Cover	Abrasion	Y/N	0.1 mm	
	Crack	Y/N	Y/N	
	Rattle	Y/N	Y/N	
	Level difference	Y/N	0.1 mm	
Concrete frame	Crack	Y/N	0.1 mm (Note 1)	
	Water leak	Y/N	Y/N	
	Exposed rebar, length	Y/N	1 cm	
	Defects in concrete surface	Y/N	1 cm^2	
	Covering depth of rebar			1 mm
	Concrete neutralized depth			1 mm
	Strength of concrete			1 N/mm^2
	Concrete chloride content			0.1 kg/m^2
Polymer concrete frame	Crack	Y/N	0.1 mm (Note 2)	
	Water leak	Y/N	Y/N	

NOTE 1 – The details should follow [b-ISO 16311 (all parts)]. The crack pattern should be recorded for large crack widths (e.g., no less than 0.3 mm).

NOTE 2 – The areas where cracks occur (top/side/bottom surface) should be carefully recorded for polymer concrete frames.

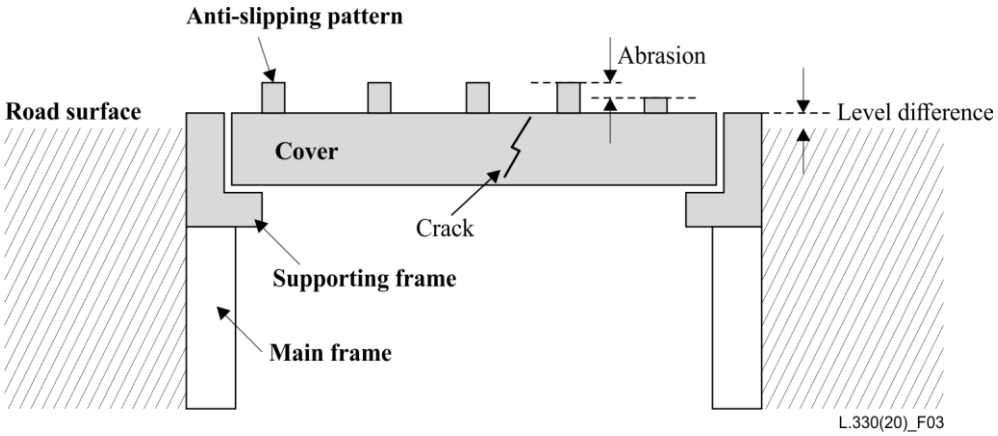


Figure 3 – Manhole cover and its inspection items

8.2.6 Conduit

See Table 11 and Figure 4.

Table 11 – Inspection of conduit

Facility	Item	Daily	Periodic	Precise
Bridge-supported conduit	Rusting	Y/N	% (Note 1)	
	Deflection	Y/N	Y/N	1 cm (Note 2)
	Joint defects	Y/N	Y/N	
	Supporting hardware – beams, bolts, brackets	Y/N	Y/N	

NOTE 1 – Measured percentage rusted area [b-ISO-4628-3].

NOTE 2 – Measured when the large deflection is found. It is given by the maximum deflection between supporting points.

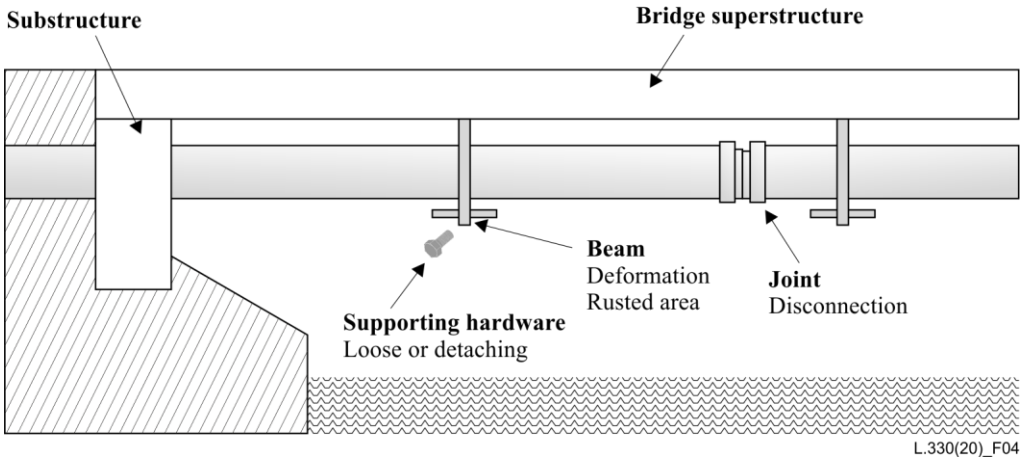


Figure 4 – Bridge-supported conduit and its inspection items

8.2.7 Tower

See Table 12.

Table 12 – Inspection of tower

Facility	Item	Daily	Periodic	Precise
Tower	Rusting Deflection Joint defects Supporting hardware – beams, bolts, brackets	Y/N Y/N Y/N Y/N	% (Note 1) Y/N Y/N Y/N	1 cm (Note 2)
NOTE 1 – Measured percentage rusted area [b-ISO-4628-3]. NOTE 2 – Measured when the large deflection is found. It is given by the maximum deflection between supporting points.				

8.2.8 Shelter

See Table 13 and Figure 5.

Table 13 – Inspection of shelter

Facility	Item	Daily	Periodic	Precise
Shelter	Rusting Corrosion	Y/N Y/N	% (Note 1) Y/N	
NOTE 1 – Measured percentage rusted area [b-ISO-4628-3].				

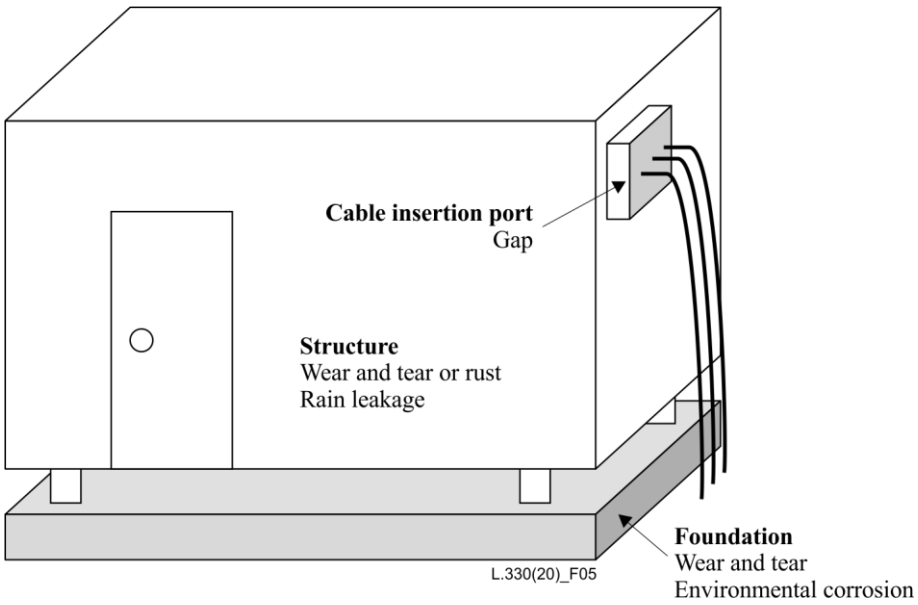


Figure 5 – Shelter and its inspection items

8.2.9 Cabinet or pillar

See Table 14.

Table 14 – Inspection of cabinet or pillar

Facility	Item	Daily	Periodic	Precise
Cabinet or pillar	Rusting	Y/N	% (Note 1)	
	Corrosion	Y/N		
	Water ingress		Y/N	
	Deformation	Y/N		
	Brittleness	Y/N	Y/N	
NOTE 1 – Measured percentage rusted area [b-ISO-4628-3].				

Annex A

Example of pole risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from pole inspection results are listed in Table A.1. The recommended maintenance action for each risk rating is listed in Table 2.

Table A.1 – Example of pole risk ratings

Facility	Example result	Rating
Concrete pole (Note)	– bend	IV
	– large horizontal crack at the bottom	III
	– significant rebar exposure, damage, and surface rust	III
	– small horizontal crack in the middle	II
	– other cracks	II
	– large deflection	II
	– other defects	II
Steel pole	– hole or dent in the body	IV
	– large thickness reduction at the bottom	IV
	– significant amount of loose rust at the bottom	IV
	– significant amount of rust	III
	– small thickness reduction	III
	– large deflection	II
	– other defects	II
Wooden pole	– significant horizontal crack in the body	IV
	– significant rot at the bottom	IV
	– shrinkage or tilt	IV
GRP pole	– significant cracks in the body	IV
	– bend	IV
	– large deflection	II
NOTE – The details should follow [b-ISO 16311 (all parts)].		

Annex B

Example of wire risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from wire inspection results are listed in Table B.1. Figure B.1 shows an example of wire risk rating with apparent features. The recommended maintenance action for each risk rating is listed in Table 2.

Table B.1 – Example of wire risk ratings

Facility	Example result	Rating
Guy-line (Note)	– small diameter reduction – large rusted area (100%) – anchor-side ground lifting – moderately sized rusted area (more than 50 %) – small rusted area (0 to 50 %) – large deflection	IV IV IV III II II
Suspension wire (Note)	– lack of ground height/offset distance – large rusted area (100%) – moderately sized rusted area (more than 50 %) – small rusted area (0 to 50 %)	IV IV III II
NOTE – The details should follow [b-ISO 4628-3].		

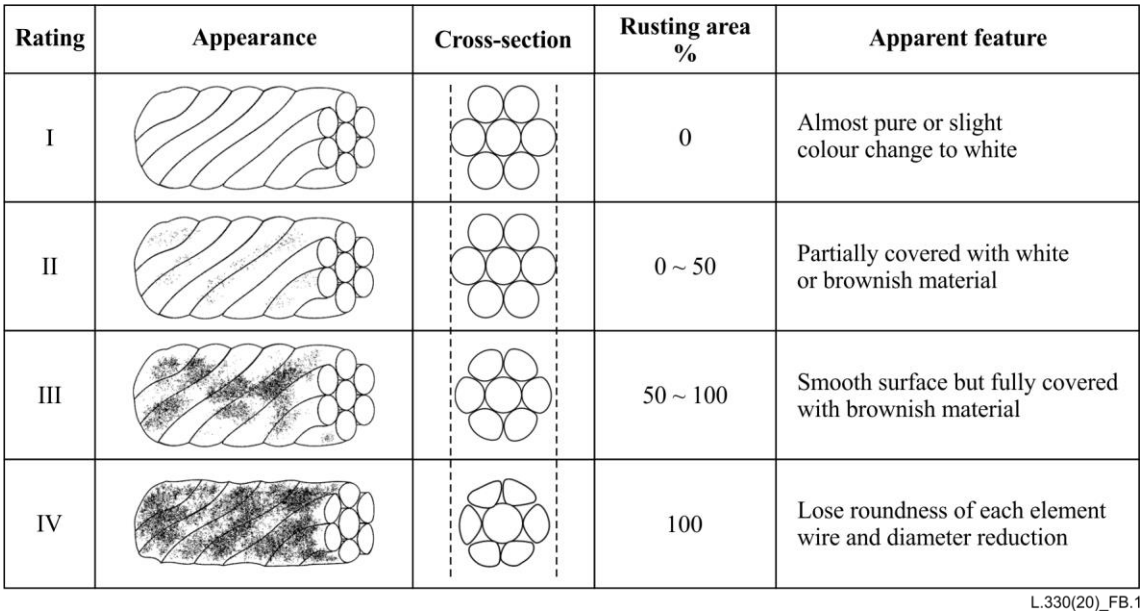


Figure B.1 – Example of risk rating for wire rusting

Annex C

Example of cable risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from cable inspection results are listed in Table C.1. The recommended maintenance action for each risk rating is listed in Table 2.

Table C.1 – Example of cable risk ratings

Facility	Result example	Rating
Aerial cable	– lack of ground height	IV
	– lack of offset distance	IV
	– detachment	IV
	– contact with other objects (trees, signs, etc.)	III
Drop cable	– lack of ground height	IV
	– lack of offset distance	IV
	– detachment	IV
	– contact with other objects (trees, signs, etc.)	III

Annex D

Example of tunnel risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from tunnel inspection results of are listed in Table D.1. Figure D.1 shows an example of risk rating for water leak with schematic image. The recommended maintenance action for each risk rating is listed in Table 2.

Table D.1 – Example of tunnel risk ratings

Facility	Example result	Rating
Open-cut tunnel	– exposed and corroded rebar, water leak with sediment	IV
	– water leak with sediment from joint gap	IV
	– exposed rebar, continuous water leak	III
	– water leak (dripping) from joint gap	III
	– large cracks	Note
	– traces of water leak from joint gap	II
	– stray water leak from cracks	II
	– crack without water leak	I
	– joint gap without water leak	I
Shield tunnel (Note)	– detachment of concrete lining with water leak	IV
	– continuous or rust water leak from cracks	IV
	– large deformation, sediment from joint gaps	IV
	– thinning rebar due to corrosion	IV
	– water leak (dripping) from cracks or joint gaps	III
	– traces of water leak from joint gaps	II
	– crack or joint gap without water leak	I
NOTE – The details should follow [b-ISO 16311 (all parts)].		

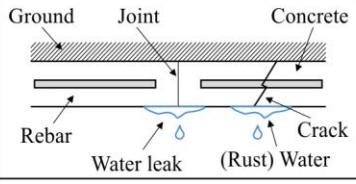
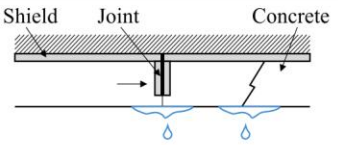
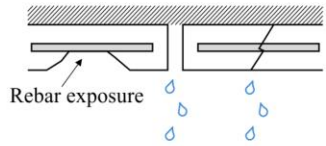
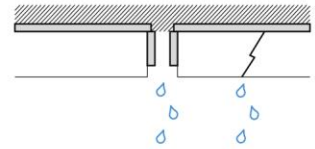
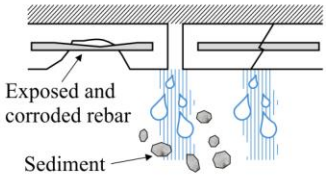
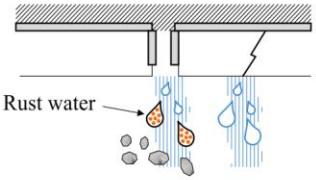
Rating	State	Schematic image	
		Open-cut tunnel	Shield tunnel
II	Traces of water leak and stray water leak		
III	Dripping water leak		
IV	Continuous water leak with sediment		

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Figure D.1 – Example of risk rating for water leak in tunnel

Annex E

Example of manhole or handhole risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from manhole or handhole inspection results are listed in Table E.1. The recommended maintenance action for each risk rating is listed in Table 2.

Table E.1 – Example of manhole or handhole risk ratings

Facility	Example result	Rating
Cover	– large level difference – significant abrasion – crack in cover	IV IV IV
Concrete frame	– exposed and corroded rebar – continuous water leak from crack or joint gap – large cracks – crack without water leak	IV IV Note I
Polymer concrete frame	– crack in the top or bottom surface – water leak from crack or joint gap – crack in side surface	IV IV III
NOTE – The details should follow [b-ISO 16311 (all parts)].		

Annex F

Example of bridge-supported conduit risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from bridge-supported conduit inspection results are listed in Table F.1. The recommended maintenance action for each risk rating is listed in Table 2.

Table F.1 – Example of bridge-supported conduit risk ratings

Facility	Example result	Rating
Bridge-supported conduit	– large rusted area (Note)	IV
	– large deformation of steel beams	IV
	– loose or detached supporting hardware	IV
	– disconnected conduit joints	IV
	– moderately rusted area (Note)	III
NOTE – Measured percentage of the superficial area can be used to define "large" or "moderate".		

Annex G

Example of cabinet or pillar risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from cabinet or pillar inspection results are listed in Table G.1. The recommended maintenance action for each risk rating is listed in Table 2.

Table G.1 – Example of cabinet or pillar risk ratings

Facility	Example result	Rating
Cabinet or pillar	– hole, dent, wear or tear in the body	IV
	– large thickness reduction at the bottom	IV
	– significant amount of loose rust at the bottom	IV
	– significant amount of rust or corrosion in the body	IV
	– small thickness reduction	III
	– other defects	III

Annex H

Example of tower risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from tower inspection results are listed in Table H.1. The recommended maintenance action for each risk rating is listed in Table 2.

Table H.1 – Example of tower risk ratings

Facility	Example result	Rating
Tower	– moderate to large wear and tear in the foundation	IV
	– significant amount of loose rust in the elements	IV
	– significant amount of rust or corrosion	IV
	– large deflection	IV
	– loose or detached supporting hardware	IV
	– other defects	III

Annex I[1]

Annex intentionally left blank.

[1] To avoid any confusion with an informative appendix, there is no Annex I in this Recommendation.

Annex J

Example of shelter risk ratings

(This annex forms an integral part of this Recommendation.)

The infrastructure risk ratings from shelter inspection results are listed in Table J.1. Figure J.1 shows example of risk for shelter. The recommended maintenance action for each risk rating is listed in Table 2.

Table J.1 – Example of shelter risk ratings

Facility	Example result	Rating
Shelter	– moderate to large wear and tear in the foundation	IV
	– significant amount of decay or loose rust in the main frame	IV
	– moderate to large wear and tear in the main frame	IV
	– environmental decay of the cement concrete or prefabricated structure	III
	– rain leakage	III
	– large gap at cable insertion port on the wall	III

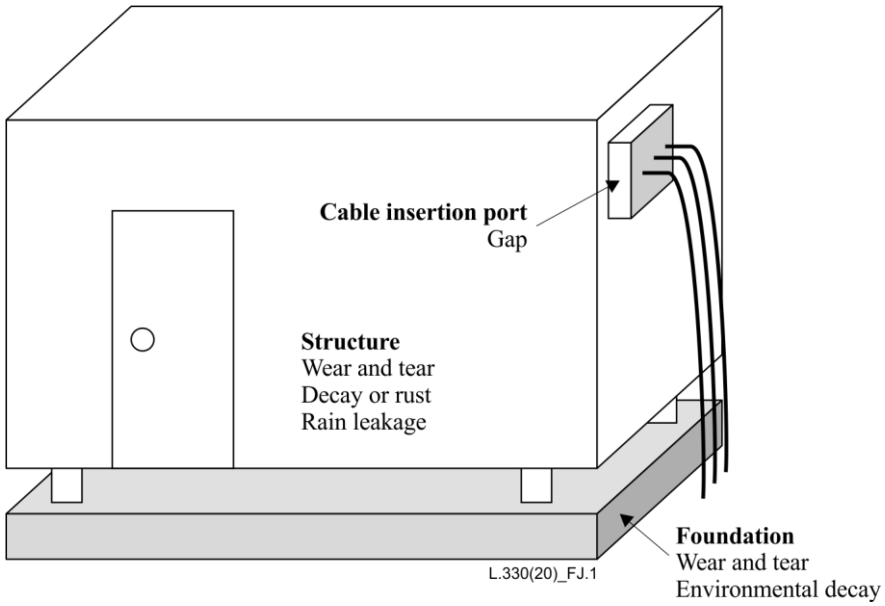

Figure J.1 – Example of shelter risks

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