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Smart community infrastructures — Operation and maintenance of utility tunnels

Infrastructures urbaines intelligentes — Exploitation et maintenance des tunnels techniques

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A utility tunnel is typically constructed underground to carry pipelines. A utility tunnel is also used to carry communications cables such as telecommunication cables, radio cables and television cables.

In a smart community, a utility tunnel is an important part of the infrastructure that accesses energy distribution, city information / data acquisition as well as transmission systems, while also being crucial for the redistribution of social resources. It is a valuable aspect of public infrastructure and a lifeline to ease the congestion of community traffic by fully utilizing the community underground space.

If the utility tunnel is well-planned, constructed and managed, it can have the following advantages:

— effectively conserves underground space;

— reduces the need for repetitive road / pavement excavations in contrast to traditional buried pipelines;

— eliminates the risk of overhead facility accidents caused by inclement weather, thereby enhancing the landscape and public safety of the community;

— reduces the operation and maintenance costs of pipelines and improves infrastructure management;

— increases community energy carrying capacity and promotes community efficiency and sustainable development.

This document provides a general overview and framework for the operation and maintenance of utility tunnels. It aims to provide requirements and recommendations for stakeholders of utility tunnels to improve safety, maintainability, cost-effectiveness, technology application, sustainability and management efficiency.

This document benefits the stakeholders of utility tunnels, including but not limited to, authorities, investors, developers, operation providers, maintenance providers, pipeline operators and citizens. It provides requirements and recommendations for cooperation between the public and private sectors and their regulators. Effective cooperation ensures the safe, orderly and intensive development and rational utilization of community underground space. The document also assists operation and maintenance providers in delivering safe and reliable energy supply services, improving the quality of community living for citizens.

This document contributes to the digitalization and smartness of the operation and maintenance of utility tunnels. Several global innovations have been made for the digitalization and smartness of the operation and maintenance of the utility tunnel, such as:

— National Underground Asset Register (NUAR)[1] in the UK provides a digital map for stakeholders to access information about underground pipelines and cables, enabling stakeholders to obtain the data required for safe operation and maintenance based on their roles;

— The community underground pipeline network management platform in China are integrated platforms, for example, Beijing Government Services[2];

— Before You Dig Australia (BYDA)[3] in Australia is a national infrastructure information system platform that ensures the safety of construction workers and communities during excavation projects, promoting the vision of zero damage and zero harm.

This document encourages a platform-based approach for managing the operation and maintenance of the utility tunnels. It aims to strengthen information exchange and sharing, and ensure the safe and effective operation and maintenance of the utility tunnels.

1) https://www.gov.uk/guidance/national-underground-asset-register-nuar

2) https://banshi.beijing.gov.cn/

3) https://www.byda.com.au/

Smart community infrastructures — Operation and maintenance of utility tunnels

1 Scope

This document specifies requirements and recommendations for the operation and maintenance of utility tunnels in terms of application, safety, energy conservation, advanced technology and economic rationality. This document aims to ensure the sustainable development as well as safe and stable operation and maintenance of utility tunnels.

This document is applicable to communities of any size that have utility tunnels.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
utility tunnel
enclosed structure and ancillary facility built under the city to access two or more pipelines, e.g. electricity cables and water supply pipes

Note 1 to entry: A utility tunnel is also used to carry communications cables such as telecommunication cables, radio cables and television cables.

Note 2 to entry: For the purposes of this document, "utility tunnel" is used, but other terms that can be used such as utility corridor, common services tunnel, common ditch or utilidor.

3.2
utility tunnel body
enclosed structure that can independently withstand the effects of external water and soil within the design service life, including the main body structure of the utility tunnel and the various entrances and exits, maintenance roadways, ventilation ducts and other structures

3.3
ancillary facility
supporting facility of the utility tunnel for the purpose of safe operation and maintenance

EXAMPLE Firefighting system, ventilation system, power supply system, illumination system, monitoring and alarm system, water supply system, drainage system and identification system.

3.4
pipeline
pipe or cable utility line that is installed inside the utility tunnel for carrying water, rainwater, sewage, reclaimed water, gas, heating water, cooling water, steam, electricity and communication data

3.5
operation and maintenance management platform
OMMP
integrated platform that meets the monitoring, management, processing, and decision-making needs of stakeholders of a utility tunnel based on the latest smart community infrastructure technologies, e.g. smart monitoring, Internet of Things (IoT), big data, building information modelling (BIM), geographic information system (GIS) and related smart equipment

Note 1 to entry: An OMMP should be reliable, safe, advanced, usable, maintainable, extensible and open.

Note 2 to entry: An OMMP should be able to be accessed to the development map of the utility operator and provider.

3.5.1
building information modelling
BIM
use of a shared digital representation of an asset to facilitate design, construction and operation processes to form a reliable basis for decisions

[SOURCE: ISO 23386:2020, 3.6]

3.5.2
geographic information system
GIS
information system dealing with information concerning phenomena associated with location relative to the Earth

[SOURCE: ISO 19101-1:2014, 4.1.20]

3.6
stakeholder
organization or individual who obtains investment returns, supply quality, safety guarantees and city management benefits through the operation and maintenance of utility tunnels EXAMPLE Authority, investor, developer, operation provider, maintenance provider, pipeline operator, citizen.

3.6.1
authority
organization that develops, maintains, administers and / or enforces regulations to ensure safety, quality and performance as well as other important aspects of a utility tunnel

Note 1 to entry: The role of authority sometimes can be performed by the government or land owner.

EXAMPLE Community governmental agency.

3.6.2
investor
organization that invests in the development of a utility tunnel

Note 1 to entry: The financing institution can also be an investor when they provide funding for the development of a utility tunnel.

EXAMPLE Development bank, commercial bank.

3.6.3
developer
organization that is responsible for the plan, design and construction of a utility tunnel and operation of a utility tunnel by organizing it in whole, or in part

Note 1 to entry: The developer can delegate utility tunnel operation and maintenance providers to operate and maintain the utility tunnel.

EXAMPLE Private developer, municipality.

3.6.4
operation provider
organization that is responsible for operating a utility tunnel

3.6.5
maintenance provider
organization that is responsible for maintaining a utility tunnel

3.6.6
pipeline operator
organization that is responsible for operating and maintaining a portion or the entirety of the pipelines

EXAMPLE ICT vendor, water supplier, electricity supplier, gas supplier.

3.6.7
citizen
member of a smart community who benefits from the development and operation of a utility tunnel

4 Benefits to stakeholders

4.1 General

The main relationship among stakeholders is shown in Figure 1:

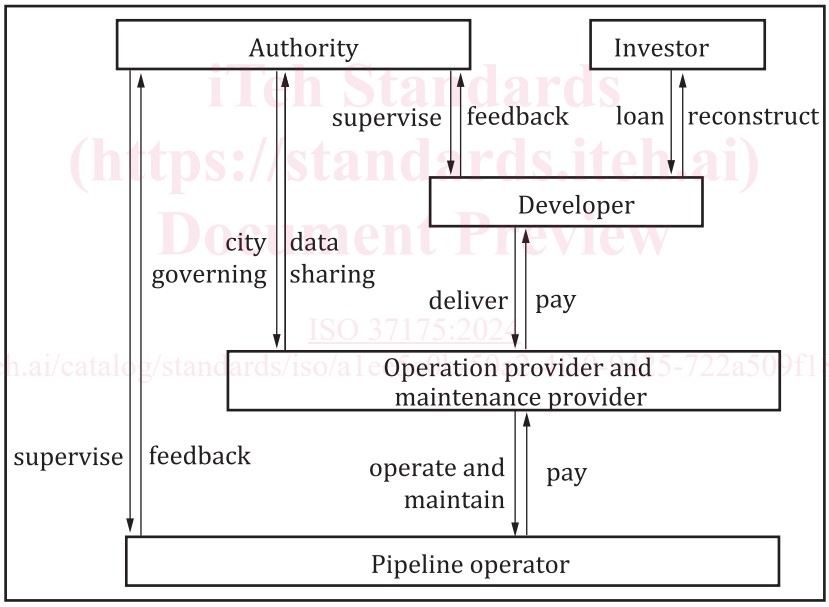

Figure 1 — Relationship among stakeholders

The operation and maintenance of a utility tunnel covers the stakeholders' benefits involved in the plan, design, construction, operation and maintenance of the utility tunnel throughout its life cycle. The main benefits that the stakeholder contributes to the process are as follows:

— improve the level of community governance and operation, to plan and use underground space efficiently, and to promote the sustainable development for the city authority;

— generate investment income for the investor;

— balance the sustainable development of community construction for the developer;

— realize the safe and efficient operation of the utility tunnel, as well as certain economic benefits for the operation provider;

— realize the normal operation of the utility tunnel and specific economic benefits for the maintenance provider;

— ensure the safety of pipelines and meet the energy supply needs for the sustainable development of smart cities for the pipeline operator;

— save costs for operation and maintenance of utility tunnels;

— ensure smart management in the operation and maintenance life cycle of the utility tunnel.

4.2 Authorities

The authority is responsible for the overall management of the operation and maintenance of the utility tunnel. Application of this document helps authorities to:

— coordinate the issues and activities in the entire life cycle of the utility tunnel including plan, design, construction, handover of the operation and maintenance services, smart operation and maintenance, to promote the formulation of requirements related to smart infrastructure, reduce operation and maintenance costs, and achieve cost efficiency;

— operate as a "system of systems" to improve efficiency of the smart utility tunnel as an integrated infrastructure;

— ensure the safe operation of the utility tunnel through efficient distribution and optimized management;

— achieve a better balance of benefits among all stakeholders.

4.3 Investors

The investor focuses on investment returns. Application of this document helps investors to:

— identify relevant risk during the operation and maintenance period by understanding the technical requirements during the operation period before investing;

— provide a basis for investors to formulate possible operational risk management strategies;

— understand the relevant technical requirements of operation and maintenance, and monitor investment or loan control more accurately;

— contribute to decision-making on collaborative investment or fund-raising.

4.4 Developers

Application of this document helps developers to:

— identify the relevant requirements during the plan, design and construction stages which can improve the efficiency and cost control during the operation stage, and increase the developer's income;

— contribute to the systematic development of a smart integrated utility tunnel operation and maintenance system;

— specify the requirements for the plan, design and construction, and operation and maintenance of the utility tunnel to the entrusted party.

4.5 Operation providers

Application of this document helps operation providers to:

— develop organizational policies, overall management plans and control requirements for the operations and maintenance of utility tunnels that suit operation providers' specific characteristics;

— identify safety management and emergency requirements to help operational safety and risk management;