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Smart community infrastructures — Guidelines on data exchange and sharing for smart community infrastructures

Infrastructures urbaines intelligentes — Cadre directeur pour l'échange et le partage de données pour les infrastructures urbaines intelligentes

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

Community is the crystallization of human technological progress, economic development and social civilization. It is also the basic unit of human economic activities and regional production. Community function and people's daily life are highly dependent on different types of community infrastructure. As the foundation of survival and development, community infrastructure includes energy, water, transportation, waste and information and communication technology (ICT). This community infrastructure provides convenience for urban residents. Therefore, the scientific and effective management of community infrastructure is crucial. It affects the living conditions of citizens, the efficiency of the social economy and the ecological safety of the community. Poor management of community infrastructure causes problems such as environmental pollution, traffic congestion, inadequate urban resources and a weak urban lifeline system. It is incompatible with sustainable development.

Data provide the fundamental basis of effective management. It is a common problem that different organizations or departments govern the data relating to community infrastructure. The existence of information silos across different community infrastructure negatively affects effective and efficient management. Therefore, strengthening the sharing of data is an important activity for smart communities. Standardized data exchange and/or sharing will benefit business collaboration across departments, organisations and communities; it will also improve service capabilities as regards community infrastructure. Furthermore, it will base the management of communities on data and improve outcomes, making communities safer, more hospitable and more liveable.

This document is a reference for governments and other enterprises, organizations and individuals who have a responsibility or need to share data from community infrastructure. This document helps to promote a foundation of information, eliminate isolated information silos and move toward the use of data to make communities smarter. An example of the benefits of implementing this document is the promotion of efficient cooperation by establishing mechanisms for information exchange among different departments within local governments.

This document provides a set of community infrastructure data governance methods and a unified framework of community infrastructure data exchange and sharing, underpinned by privacy and security principles. The purposes of this document are:

— to provide intensive, efficient, convenient, ecological and secure infrastructure for community infrastructure users, consumers or beneficiaries;

— to provide appropriate approaches to the exchange, monitoring, sharing and maintenance of community infrastructure services.

This document relates to smart community infrastructures, and should be used alongside ISO 37101, ISO 37120, ISO 37122, ISO 37123, ISO/TR 37150 and ISO/TS 37151. ISO 37101 contains the requirements for the different types of data which are supported. ISO 37120 provides macro-guidance to cities on how to achieve the United Nations sustainable development goals. Under the macro-guidance from ISO 37101, this document, ISO/TR 37150 and ISO/TS 37151 constitute implementation guidance for smart city infrastructure. This document focuses specifically on data exchange and/or sharing for smart community infrastructures.

In addition, this document should be used with ISO 8000-110, ISO 22745-1 and ISO/IEC 30182.

Smart community infrastructures — Guidelines on data exchange and sharing for smart community infrastructures

1 Scope

This document gives guidelines on principles and the framework to use for data exchange and sharing for entities with the authority to develop and operate community infrastructure.

The guidelines in this document are applicable to communities of any size that are engaged in data exchange and sharing. The specific practices of data exchange and sharing of community infrastructures will depend on the characteristics of each community.

NOTE 1 The concept of smartness is addressed in terms of data exchange and sharing, in accordance with sustainable development and resilience of communities as defined in ISO 37100.

NOTE 2 Annex A outlines useful case studies of data exchange and sharing for community infrastructure.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BSI PAS 183:2017, *Smart cities — Guide to establishing a decision-making framework for sharing data and information services*

3 Terms and definitions

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

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

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

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

3.1 Terms relating to smart community infrastructure

3.1.1
community
group of people with an arrangement of responsibilities, activities and relationships

Note 1 to entry: In many, but not all, contexts, a community has a defined geographical boundary.

Note 2 to entry: A city is a type of community.

[SOURCE: ISO 37100:2016, 3.2.2]

3.1.2
community infrastructure
systems of facilities, equipment and services that support the operations and activities of communities

Note 1 to entry: Such community infrastructures include, but are not limited to, energy, water, transportation, waste and information and communication technologies (ICT).

[SOURCE: ISO 37100:2016, 3.6.1]

3.1.3
organization
person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

Note 2 to entry: In this document, the concept of organization refers to an entity/institution inside the community that is tasked with implementing the management system, for example the local government. The community identifies an organization that it entrusts with the implementation of this document.

[SOURCE: ISO 37100:2016, 3.2.3]

3.1.4
smart community infrastructure
community infrastructure with enhanced technological performance that is designed, operated and maintained to contribute to sustainable development and resilience of the community

[SOURCE: ISO 37100:2016, 3.6.2, modified — Notes to entry removed.]

3.1.5
smart community infrastructure data
data created, captured, collected or curated from the various sources of smart community infrastructure

3.2 Terms relating to smart community infrastructure data

3.2.1
availability
property of being accessible and usable upon demand by an authorized entity

[SOURCE: ISO/IEC 27000:2018, 3.7]

3.2.2
authenticity
<entity> property of being genuine

3.2.3
data
reinterpretable representation of information in a formalized manner suitable for communication, interpretation or processing

Note 1 to entry: Data can be processed by humans or by automatic means.

[SOURCE: ISO/IEC 2382:2015, 2121272]

3.2.4
integrity
property of accuracy and completeness

[SOURCE: ISO/IEC 27000:2018, 3.36]

3.2.5
metadata
data defining and describing other data

[SOURCE: ISO/IEC 27050-1:2016, 3.19]

3.2.6
reference data
domain and community standardized data objects that define the set of permissible values to be used to populate other data objects

[SOURCE: ISO 5127:2017, 3.1.10.19]

3.2.7
reliability
property of consistent intended behaviour and results

[SOURCE: ISO/IEC 27000:2018, 3.55]

3.2.8
shared data
data that can be accessed within an existing software application as well as between different software applications, that may be executed asynchronously or concurrently

[SOURCE: ISO/IEC 2382:2015, 2122341, modified.]

3.2.9
thematic data
patterns of data within the data framework that are deemed important to support the provision of city services and the four levels of insight in the city

[SOURCE: BSI PAS 183:2017]

3.2.10
data spectrum
differentiation of data assets on the basis of whether they are considered closed, shareable or open

[SOURCE: BSI PAS 183:2017]

3.3 Terms relating to data exchange and sharing for smart community infrastructure

3.3.1
data access
right, opportunity, means of finding, using or retrieving data

[SOURCE: ISO 15489-1:2016, 3.1, modified — original term was 'access'.]

3.3.2
data creator
organization that creates, captures, collects or transforms data for a city or services, for example

[SOURCE: BSI PAS 183:2017]

3.3.3
data owner
designated curator for the community infrastructure data related to a city service

[SOURCE: BSI PAS 183:2017]

3.3.4
data publisher
organization that performs the publication role for community infrastructure data

[SOURCE: BSI PAS 183:2017]

3.3.5
data exchange
accessing, transferring and archiving of data

[SOURCE: ISO/TS 13399-5:2014, 3.7, modified.]

3.3.6
data sharing
providing shared, exchangeable and extensible data to enable community infrastructure

3.3.7
risk
effect of uncertainty

Note 1 to entry: An effect is a deviation from the expected – positive or negative.

Note 2 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of, an event, its consequence or likelihood.

Note 3 to entry: Risk is often characterized by reference to potential events (ISO Guide 73:2009, 3.5.1.3) and consequences (ISO Guide 73:2009, 3.6.1.3), or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood (ISO Guide 73:2009, 3.6.1.1) of occurrence.

[SOURCE: ISO 37100:2016, 3.4.12, modified.]

4 Principles for data exchange and sharing

4.1 General

This document shows the various possibilities for the use of data exchange and sharing for smart community infrastructures. The expectations of communities related to the outputs from and the use of data are often very high. However, it should be noted that there are many different constraints related on the range and validity of the outputs of data exchange and sharing. Examples are data reliability, availability, quality, complex relationships and temporal interpretation of data. Reasonable expectations should be set by smart communities related to the impact achieved as a result of the data exchange and sharing of community infrastructure data.

4.2 Principles

The following principles should be considered:

a) The community infrastructure data should be available to be exchanged and shared.

b) To be effective, the data should be of sufficient quality in order to be useful across smart community infrastructure services, or by more than one organization.

c) The data owner has the accountability and responsibility to ensure the exchange and sharing of the community infrastructure data is enabled.

d) The data creator should maintain the integrity of the community infrastructure data to be exchanged or shared.

e) The security and privacy of the community infrastructure data should be continuously preserved.

f) The data should use spatial methods to achieve the positioning and control of urban infrastructure objects.

g) The data should have temporal information to maintain changes to the community infrastructure for any reason, such as societal, environmental, cultural, strategic and policy changes. Temporal

data allows timely interventions when required and supports the tracking of community infrastructure changes to enable smart management and efficiency improvements.

h) A systematic approach to the exchange and sharing of data should be taken, with every data attribute identifiable by a set of mechanisms to facilitate the interoperability of community infrastructures.

i) The city, in its role as the curator of the exchange and sharing of infrastructure data, should ensure that this activity is carried out in an equitable and ethical manner in order to ensure that all parties are treated equally.

5 Type and model for data exchange and sharing

5.1 General

Smart community infrastructure includes energy, water, transport, ICT and waste services. The data addressed in this document are those related to the infrastructures and the built environment which support the community infrastructure.

The development and complexity of the smart community infrastructure and the planning, construction, operation, management and evaluation of the smart community infrastructure information services should be based on the construction, development and utilization of data resources. The data resources used should reflect the physical and operational conditions and interactions which are defined in ISO 37155-1.

Data exchange and sharing takes place between different application services and systems for smart community infrastructure. Different types of data exchange and sharing use different data types and functions.

The data framework for a smart city and community infrastructure is used to classify data as either metadata, reference data or thematic data. The data framework details how current city data assets are transitioned from the existing siloed service provision to the interoperable use of data across the entire data lifecycle.

The collective data assets relate to the data concepts specified in ISO/IEC 30182, and utilizes the classifications of open, shared and closed data within the data spectrum used by the community.

5.2 Types of data

5.2.1 Metadata

Metadata are data which define basic information about data used to verify the provenance and validity of the data to be exchanged and shared. An example of metadata in a smart community data framework is the data relating to the voluntary services organizations who deliver city services on behalf of the city to citizens.

5.2.2 Reference data

Reference data are any data which define the set of permissible values for the data which are to be exchanged or shared. For example, an atmospheric temperature reading at a certain location or video footage for a specific street which can be used for multiple purposes[41].

5.2.3 Thematic data

To deliver services to citizens, thematic data in a community should initially be the data sets and legacy data that are created, processed and managed by community. Examples of thematic data include bus traffic congestion along a specific street or electric power frequency fluctuations and pressure distribution along a specific underground water pipe line. The characteristics of smart community

infrastructure, as an integration of sub-systems, should be considered in the thematic data, for example, interaction between infrastructures services, if applicable according to ISO 37155-1.

Data exchange and sharing is primarily conducted between metadata, reference data and thematic data. The data types for data exchange and sharing of smart community infrastructure are described in 5.3.

5.3 Concept model for infrastructure data

Data should be made available and be collectable from community infrastructure services for exchanging and sharing. The collection of data are expected to be automated via technical interfaces, such as smart meters supported by APIs.

Tables 1 to 3 identify the elements of the smart city concept model (SCCM) defined in ISO/IEC 30182 which relate specifically to community infrastructure. Collectable community infrastructure data can be categorized into characteristics of something, consumption of something, movement of something, presence of something, production of something, status of something, supply of something and use of something. These are shown in Table 1. These descriptions are not exhaustive or mutually exclusive.

