TECHNICAL SPECIFICATION

ISO/TS 37172

First edition

Smart community infrastructures — Data exchange and sharing for community infrastructures based on geographic information

Infrastructures territoriales intelligentes — Échange et partage de données pour les infrastructures territoriales basés sur l'information géographique

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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

Data from community infrastructures, e.g. water, energy, transportation, waste, information and communication technologies (ICT), provides high-quality support for decision-making and social services. It is particularly important in the process of smart community construction. ISO 37156 focuses on data exchange and sharing for smart community infrastructures. It provides guidelines on principles and the framework to use for data exchange and sharing for entities with authority to develop and operate community infrastructure. The pilot project to investigate the utility of ISO/TC 268/SC 1 deliverables, including ISO 37156 and ISO/TR 37171, determined that more practically operational standards are needed to provide technical guidance on implementation and application scenarios of smart community infrastructure data exchange and sharing.

As intelligent transportation, urban management, environmental improvement, earthquake prevention and disaster mitigation create new needs for the use of geographic information regarding community infrastructures, geographic information has become an important basic information of a smart community. Data exchange and sharing for community infrastructure based on geographic information involves different stakeholders, various data types, and different periods of the data life cycle (e.g. production, storage, distribution). It is necessary to strengthen cooperation to clarify the relationship, boundaries, roles, objectives, and responsibilities between different stakeholders in order to support government decision-making and urban operation and management.

As an implementation case of ISO 37156 on geographic information, this document helps improve the operability of ISO 37156, and provides practical guidance for the ongoing ISO 37156 pilot city. This document is intended to guide data exchange and sharing in smart community infrastructure-related industries, including but not limited to, standard-setting, data production, equipment procurement and construction, platform construction and policy formulation.

Smart community infrastructures — Data exchange and sharing for community infrastructures based on geographic information

1 Scope

This document provides a framework for data exchange and sharing based on geographic information for smart community infrastructures, along with specific application scenarios.

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

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

3.2
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]

3.3
smart community infrastructure
community infrastructure (3.2) with enhanced technological performance that is designed, operated and maintained to contribute to sustainable development and resilience of the community

Note 1 to entry: It is the infrastructure that is considered to be “smart” in this document, and not the community.

Note 2 to entry: Sustainable development tends to require community infrastructures that meet multiple, often contradictory, needs at the same time.

Note 3 to entry: Information and communication technologies (ICT) is an enabler but not a precondition for achieving smart community infrastructures.

[SOURCE: ISO 37100:2016, 3.6.2]

4 Abbreviated terms

OGC	The Open Geospatial Consortium
CSW	Catalogue Services for the Web
API	Application Programming Interface
APP	Application
IoT	Internet of Things

5 Overview of this document

This document describes a framework for data exchange and sharing for community infrastructures based on geographic information and analyses application scenarios (see Figure 1).

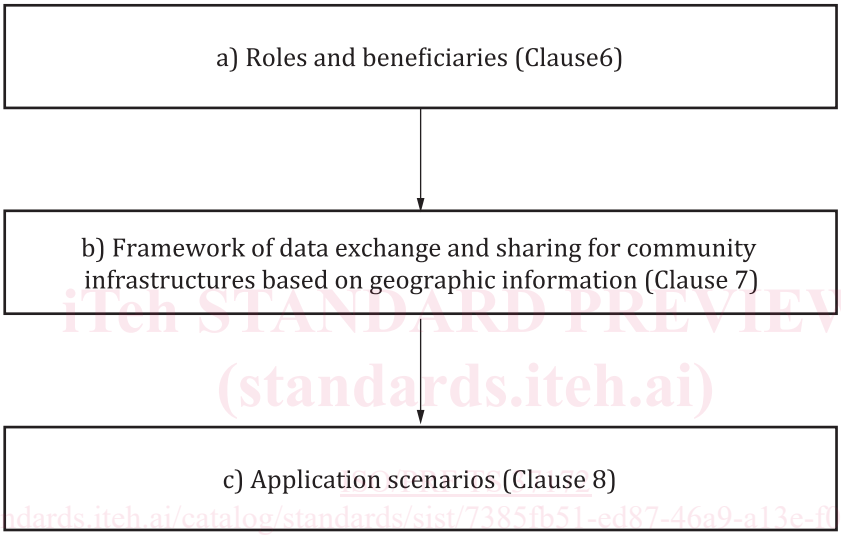

Figure 1 — Overview of this document

a) The roles and benefits for data exchange and sharing regarding community infrastructures are described in detail in Clause 6.

b) The framework for data exchange and sharing for community infrastructures based on geographic information describes a specific method for data exchange and sharing, including database layer, platform layer, application layer and implementation pattern (See Clause 7).

c) This document offers several application scenarios of data exchange and sharing for community infrastructures based on geographic information in different use cases, e.g. community infrastructure census, planning and management, water management, transportation management, public safety management, and environmental protection (See Clause 8).

6 Roles and benefits

Possible roles of stakeholders regarding data exchange and sharing for community infrastructures based on geographic information are as follows. The list of roles is not exhaustive but defines key stakeholders during data exchange and sharing.

— Community managers, including the mayor and government sectors.

— Data providers, including people or organizations providing data.

— Data producers, including providers of data acquisition, processing, integration, etc.

— Software platform developers, including system developers and service publishers.

— System operators and maintainers, including system operation and maintenance managers.

— Equipment providers, including providers of infrastructure, hardware equipment, etc.

— Citizens, the inhabitants of a city.

— Consumers, individuals or organizations that use infrastructure.

The exchange and sharing of community infrastructure data based on geographic information should form a set of infrastructure data for stakeholders to use. These data should be continuously updated, optimized, and broadened to integrate various data, such as demographic data, economic data, and buildings data. Stakeholders in each role should share their own data in the public service platform of urban infrastructure, for other roles to query and use, so that data can be shared quickly and effectively, promoting the openness and intelligence of city development.

The benefits of data exchange and sharing for community infrastructures based on geographic information are as follows (these benefits include but are not limited to the following items):

— For community managers, the data exchange and sharing process will assist scientific decision-making and improve management efficiency.

— For data providers, data exchange and sharing will contribute to richer data; it is beneficial to providing better data products.

— For data producers, the data exchange and sharing process will provide more cooperation opportunities for data production.

— For software platform developers, the demand for software platforms will be clearer after data exchange and sharing. It is beneficial to improving system functions and creating more market opportunities for developers.

— For system operators and maintainers, data exchange and sharing provide more data format for the system, optimizing system analysis and early warning capabilities. It is beneficial to improving operation and maintenance service for them.

— For equipment providers, data exchange and sharing will contribute to the continuously expanding market demand for equipment and thus bring about more cooperation opportunities for them.

— For citizens, with high-quality infrastructure services, the quality and attractiveness of the city will be improved, and citizens can achieve a sense of contentment and happiness.

— For consumers, data exchange and sharing for community infrastructure based on geographic information can provide more comprehensive and high-quality infrastructure services for consumers.

7 Framework for data exchange and sharing for community infrastructures based on geographic information

7.1 Framework

Some problems occur such as inconsistency, poor sharing and circulation of infrastructure data due to information construction by different community infrastructure departments separately, which also results in the waste of repeated data construction. In order to resolve such problems, it is necessary to provide authoritative, unified and convenient services for community planning, construction and management by developing the framework for data exchange and sharing for community infrastructures, which is used to avoid repeated construction and realize resource integration and sharing.

The framework involves three parts: database layer, platform layer, and application layer (see Figure 2). The database layer describes database and data characteristics. The platform layer represents the information systems. The application layer provides customized application functions. Five implementation patterns are provided to support the exchange and sharing of community infrastructure data. Mechanisms are to ensure the effective operation of data exchange and sharing for community infrastructures based on geographic information.

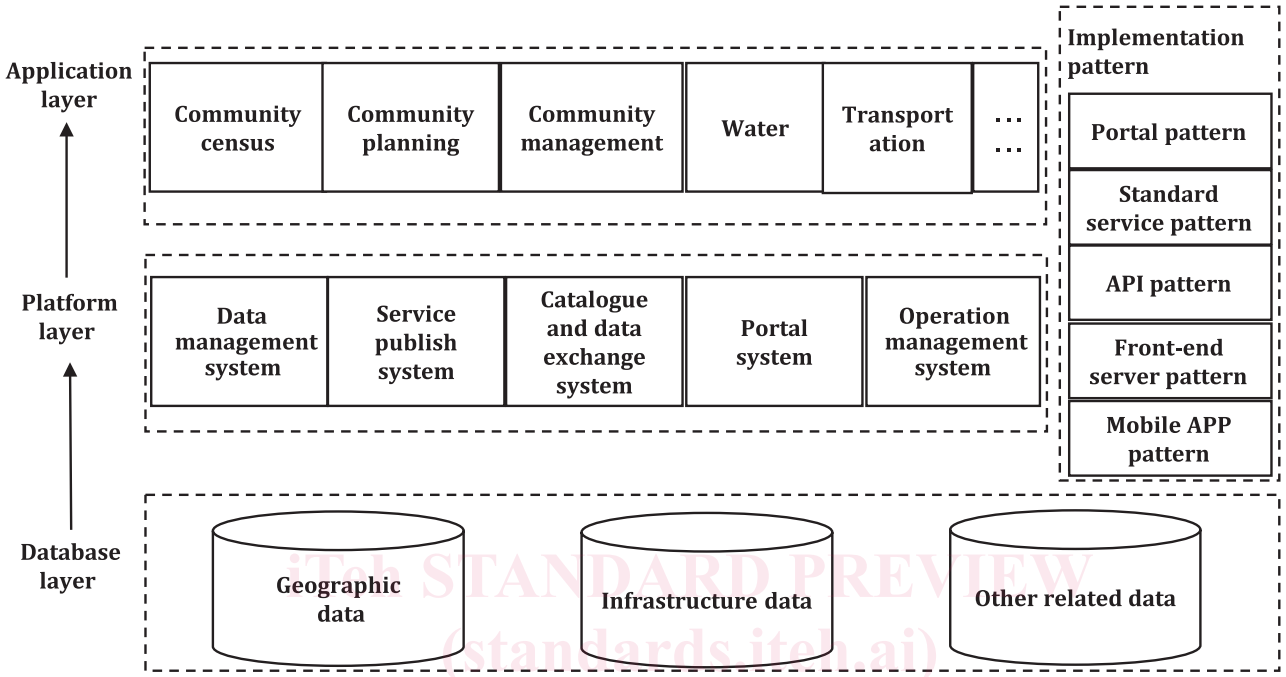

Figure 2 — Possible framework for data exchange and sharing for community infrastructures based on geographic information

7.2 Database layer

The database layer shows the database and includes geographic data, infrastructure data and other related data. Geographic data mainly includes Digital Orthophoto Map (DOM), Digital Elevation Model (DEM), Digital Raster Graphic (DRG), Digital Line Graphic (DLG), etc. Infrastructure data mainly includes water, energy, transportation, waste, and ICT data. Other related data refer to population, economy, legal person, building, cell phone signalling, social networking, etc. Data should be organized according to thematic data, reference data, and metadata. Data should be classified according to the data spectrum described in ISO 37156, including close data, shared data and open data. Data characteristics contain traceability, reliability, integrity, privacy and security, integration, described in the list below. Further information is contained in ISO 19115-1 and ISO 19157.

a) Data traceability: tracing the source of the data and tracking its circulation.

b) Data reliability: includes correctness of data range, the correctness of sequence, mathematical examination, and the correctness of spatial location.

c) Data integrity: includes the completeness of the database layer, attributes items, and especially key data.

d) Data privacy and security: involves data encryption, security levels and verification information. The privacy and security principles of data management should also align with ISO 37156.

e) Data integration: involves the standardization of data name and expression and the unique identification of data.

7.3 Platform layer

The platform layer mainly includes five parts:

a) The data management system: implements integrated management and effective organization of multi-source, multi-type, and multi-format data. Integrated management includes several operations of data, e.g. extracting, transferring, loading. The data management system helps construct a community infrastructure data system of energy, water, transport, waste, ICT, with features refined. For example, energy involves heat, gas, electricity, lighting and other elements; Transportation involves aviation, shipping, railways, highways, rail transportation, urban roads, parking, etc.

b) The service publish system: realizes the conversion of data and functions to services, provides standard OGC services. It also supports unified service publication and management.

c) The catalogue and data exchange system: adopts a CSW service specification, and provides service registration, discovery and binding to achieve interoperability between national, provincial and municipal community infrastructure services. It also implements the integration of community infrastructure data in order to conduct the analyses and data mining. More details about the most common way to use a CSW are mentioned in ISO 19115-1.

d) The portal system: provides visualization of data resources in the platform and software applications and meets the requirements of browsing, querying, data processing, online mapping, and printing.

e) The operation management system: conducts management of user authorization, service and real-time monitoring for the status of the application server. Meanwhile, it achieves collaborative service between distributed city-level platforms and district-level platforms.

Each system provides functional applications for different stakeholders (see Table 1). For example, data producers and data providers can benefit from the data management system, and system operators and equipment providers can benefit from operation management systems. In addition, the portal system and catalogue and data exchange system can provide resource browsing, catalogue querying and other functions for all stakeholders.

Table 1 — Relationship between system and stakeholders

Stakeholders	Framework for data exchange and sharing for community infrastructures				
	Data management system	Service publish system	Catalogue and data exchange system	Portal system	Operation management system
Community managers			√	√	
Data providers	√	√	√	√	√
Data producers	√		√	√	
Software platform developers	√	√	√	√	√
System operators and maintainers			√	√	√
Equipment providers			√	√	√
Consumers			√	√	
Citizens			√	√	
Key √: the system provides corresponding functional applications for different stakeholders.					