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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).

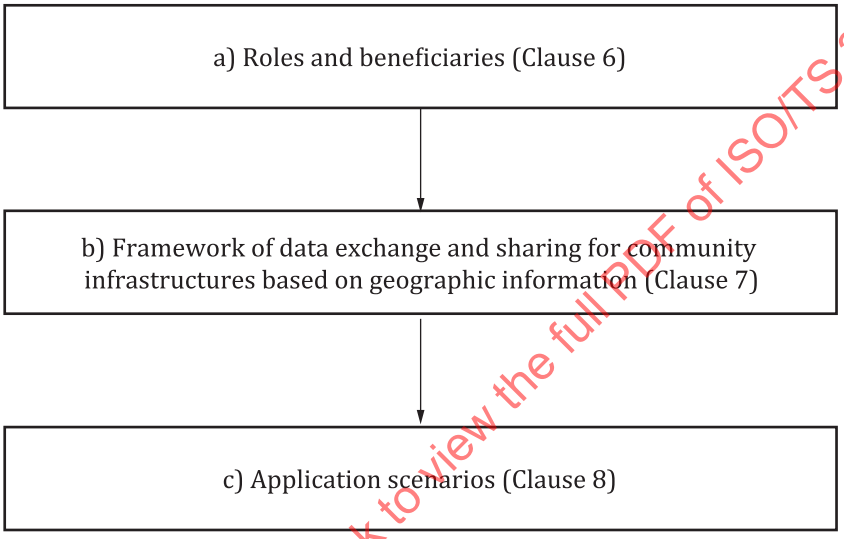

Figure 1 — Overview of this document

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.

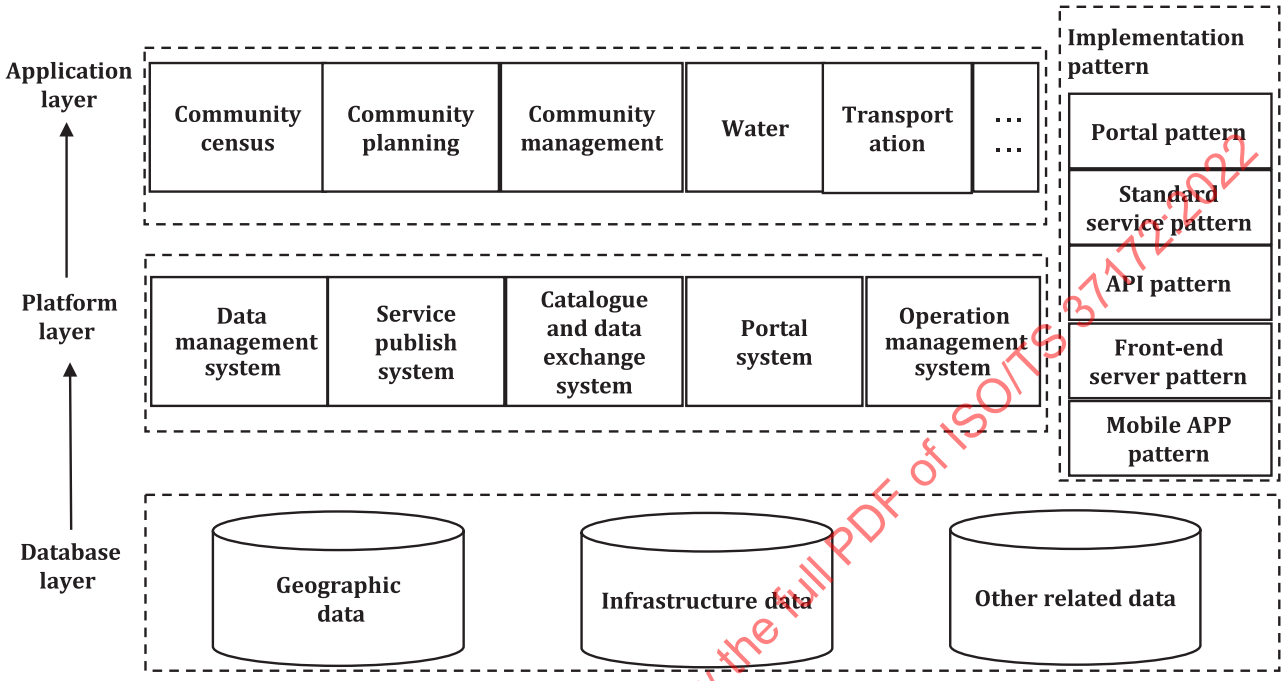

Figure 2 — Possible framework for data exchange and sharing for community infrastructures based on geographic information

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.					

7.4 Application layer

The application layer in the framework is to provide customized application function services for different users, industries and domains when data exchange and sharing is needed to support various smart city applications. For specific application scenarios, see Clause 8.

7.5 Implementation pattern

Implementation patterns mainly include:

a) Portal pattern: shares maps and application functionality through the portal system and meets the requirements of general users directly. This pattern is similar to “Tier 1 - Sharing maps over the Web” in Reference [10].

b) Standard service pattern: users directly reference the standard service provided by the platform to integrate data and applications. This pattern meets the needs of stakeholders with application development capabilities, e.g. standard OGC service includes OGC Web Map Service (ISO 19128), OGC Web Feature Service (ISO 19142), OGC API – Features (ISO 19168-1).

c) API pattern: for users who need to customize a simple business system. Users directly use the API (e.g. Map API, data API, functions API) to achieve the rapid development of business systems.

d) The front-end server pattern: intended for users who have high requirements for confidentiality and security and do not have access to the network. It means that the data exchange and sharing platform is deployed directly in a software and hardware environment provided by users.

e) Mobile APP pattern: aimed at users with high demand for portable applications. Mobile APP is customized to meet the needs of data access and sharing.

8 Application scenarios

8.1 General

Application scenarios in different use cases include community infrastructure census, community infrastructure planning, community infrastructure management, water management, transportation management, and public safety management, etc. 8.2 to 8.9 are examples but not an exhaustive list. These data for exchanging and sharing should take into account different spatial and temporal scales. The spatial scales of data include, e.g. neighbourhood, city, country. The temporal scales of data involve, e.g. day, week, year.

8.2 Community infrastructure census

Community infrastructure census projects consist of urban transportation, water supply, drainage, power supply, gas, heat supply, communication, environmental sanitation, and disaster prevention. They are basic information on the current situation of urban planning, construction and management.

Data exchange and sharing of various infrastructures based on geographic information obtains more geographic data and community infrastructure data from the database layer and gets more geographic information analysis functions from the platform layer, which greatly facilitates the census of urban infrastructures. It realizes the functions of warehousing, integration, query, statistics and spatial analysis of different levels and different departments, which lay a solid foundation for the subsequent management of various types of community infrastructures.

8.3 Community infrastructure planning

Community infrastructure planning plays an important role in effectively arranging community infrastructure resources, rationally arranging location and layout, pre-setting control of construction land, efficient use of community space resources, and coordinating settlement of construction

contradictions, which is conducive to driving community construction and community economic development.

Data exchange and sharing of community infrastructures based on geographic information using office automation technology, and workflow engine technology improves scientific approval and adoption rate of infrastructure planning projects, reduces the reporting period of construction units, and wins time and considerable economic benefits for construction units and design units. It is of great significance to improve the level of community planning management and promote the development of community planning management information in an in-depth direction.

To further strengthen and expand the use of geographic information data in community infrastructure planning, software such as CAD and GIS, as well as processes and tools to represent the design of the infrastructure, such as Building Information Modelling (BIM), should be applied in the exchange and sharing of community infrastructure data incorporating temporal and geographic data.

8.4 Community infrastructure management

Based on data exchange and sharing of geographic information and community management services, the community management department obtains more points of interest data of community components from geographic data in the database layer, and more geographic information analysis functions from the platform layer, which greatly facilitates the management of street lamps, public toilets, sanitation facilities, community appearance management, illegal investigation, and punishment, administrative law enforcement, etc.

Digital community management is based on data, such as geographic information, community components and grid division from the database layer. It integrates community management information such as community management components, community management vehicles and parking lots, and completely solves the problem of the source base map of community management platforms at all levels. Daily management of the community management bureau provides powerful data support and technical services, data was managed in the database layer, and technical services were managed in the platform layer. The dynamic control of illegal construction based on local coordinates serves the community, district, and street levels, and conducts real-time online supervision of illegal construction to realize the dynamic, fast, accurate and efficient operation of the community management business.

8.5 Water management

Water management can realize the sharing, exchange and communication of water affairs data through a unified geospatial framework and IoT technology. It achieves real-time monitoring, management, simulation and prediction of water quality, water pressure and other information, which forms a standardized and scientific pattern of water management.

Water supply management obtains water data from community infrastructure data in the database layer and provides water supply pipe network 2D and 3D visualization services through the platform layer, such as a water leakage point distribution map, maintenance personnel location information and vehicle location information. Water environment monitoring provides real-time monitoring and early warning of water quality of community reservoirs, rivers, and lakes, and on this basis, establishes automatic monitoring of pollution sources, sewage treatment processes, surface water quality and ecological remote sensing, etc. Coordinating relevant departments deal with the problems in a timely manner by managing all water quality monitoring data comprehensively.

8.6 Transportation management

Using geographic information technology to integrate transportation resources and realize the traffic data exchange and sharing can improve the capacity of the road network, balance the traffic load of the regional road network and realize a comprehensive model of transportation management in a large-scale, all-round, real-time, accurate and efficient way.

This is done in the following way:

— integrate, standardize and store road traffic data from different sources through the database layer;

— dynamically display them based on the platform layer through electronic maps, charts, and other means;

— analyse and judge traffic congestion, violations and accidents.

Meanwhile, mobile app patterns and front-end server patterns can be used to release traffic information through mobile phones, Internet and traffic broadcasts, etc. To view the geographical location and distribution of traffic facilities, the operation and maintenance of each traffic facility can be visually displayed on the electronic map, which can improve the operation and maintenance efficiency of traffic facilities.

8.7 Public safety management

Public safety data displays and information sharing is achieved by overlapping basic geographic elements and geo-based surveillance video, mobile devices, and electronic bayonet data on the same platform with GIS spatial analysis and visualization functions. It improves the ability of rapid response and collaborative processing among public safety departments.

Public safety infrastructure data can be integrated with geographic information through the database layer. Under the circumstances, emergency response command can be realized through strong functions of the platform layer to conduct smart operations such as data collection, crisis judgment, decision analysis, command deployment and real-time communication, which greatly improves emergency efficiency and assists decision-making. For example, major event planning and management can be carried out more scientifically and reasonably through the dynamic display of driving routes, vehicle types, vehicle speed simulation, time, distance and other information.

8.8 Environmental protection

Infrastructure data are collected from environmental protection departments at all levels, and fully utilized and analysed through geographic information technology. The environmental protection decision-makers can efficiently understand the environmental status and monitor environmental information changes in real-time. It is beneficial for making accurate and effective decisions.

On the basis of real-time monitoring and early warning of air monitoring points in the city, automatic monitoring of industrial exhaust gas and automobile exhaust gas is established, all air monitoring data are comprehensively managed in the data management system, and relevant departments are coordinated to monitor and deal with problems. Based on the electronic map, the simulation analysis function is used to realize an early environmental warning and online scheduling.

8.9 Renewable energy management

With geographic information technology, unified and standardized management of renewable energy data is achieved. Monitoring various indicators such as the quantity, quality, development, and utilization of renewable energy, as well as spatial evaluation models, enhances the availability and economic value of renewable energy. It can help investors and decision-makers enrich the applications of renewable energy.

Collecting the data of temperature, terrain, land types, and total solar radiation changing with time and place from the database layer provides a reference for the site selection of photovoltaic power stations. The wind direction and wind speed are monitored by sensors, and the wind development estimation model is established with a numerical simulation method, which provides the precondition for the full utilization of wind energy.

Annex A
(informative)

Use cases of data exchange and sharing for community infrastructures based on geographic information in different cities

A.1 Data exchange and sharing for community infrastructures based on "Map World - Nanjing"

This clause mainly gives more details of Nanjing use case of data exchange and sharing for community infrastructures based on geographic information.

Table A.1 gives the use case of data exchange and sharing for community infrastructures based on "Map World · Nanjing".

Table A.1 — Data exchange and sharing for community infrastructures based on "Map World - Nanjing"

Basics of the use case	Name	Data exchange and sharing for community infrastructures based on "Map World · Nanjing"
	Domain(s)	Infrastructure
	Version	V2.0
	Organization	Nanjing Planning and Natural Resources Bureau, Nanjing Urban Planning and Research Center, Nanjing City Underground Pipeline Digital Management Center, Nanjing Land and Resources Information Center, WudaGeoinformatics Co., Ltd, Jian Ye District People's Government, Gao Chun District People's Government, Qi Xia District People's Government, Yu Hua District People's Government, Nanjing Urban Management Bureau, Nanjing Ecological Environment Bureau .etc.
	Place	Nanjing, China
	Time	2012-2022
Objectives		With the in-depth construction of a smart community and the development of information technology, Nanjing government departments, enterprises and the public have an increasingly strong demand for urban infrastructure information sharing. "Map World·Nanjing" aims to condense rich and authoritative basic geographic information and provide a unified and authoritative basic geographic information "spatial basement" for infrastructure information exchange and sharing in the construction of smart community, in order to meet all kinds of application needs, avoid repeated construction and realize integrated sharing.

Table A.1 *(continued)*

Background	Current practices	Government departments are responsible for the construction and management of all kinds of infrastructure in cities. According to the construction requirements of smart community, all departments of the city have carried out informatization construction, constructed various information systems such as transportation, water supply, garden, education, and accumulated a large amount of infrastructure data. Current ways to share community infrastructure data include electronic documents, sheets, drawings and offline exchange; drafting guidelines and catalogues based on interface exchange, etc. These methods have realized the exchange and sharing of data to a certain extent. However, it has not yet fully met the needs of smart city construction.
	Gaps	(1) The relevant departments of urban infrastructure are carrying out informatization construction separately, the infrastructure data does not have a unified standard, and there are problems such as duplication of data construction, poor circulation, and difficulty in use when exchanging and sharing data. (2) The data format is inconsistent, the data calibre is different, and there is a lack of unified and effective data exchange and sharing tool. (3) The offline and online exchange methods are mixed, the cost of data exchange, sharing, communication and implementation is relatively high, and there is a lack of a unified exchange and sharing platform.
Practice How to realize infrastructure data exchange and sharing through geographic information?		(1) "Map World Nanjing" is the geographic information public service platform of Nanjing. Based on various types of geographic information data, the platform can realize the convergence, integration and management of urban infrastructure data: energy, water, transportation, waste and ICT. (2) Based on geographic information data, various departments publish the shared infrastructure data to the public service platform through network services for inquiries and use by authorized governments, enterprises, and citizens. This can improve data value and use efficiency, and change the complex and inefficient situation of data sharing between departments. (3) Nanjing Planning and Natural Resources Bureau provides geographic information base map and service interfaces to Nanjing Urban Management Bureau, Nanjing Ecological Environmental Bureau and other management departments, through signing a joint construction and sharing agreement. In this way, they can establish an efficient, stable and rapidly expandable urban infrastructure public service platform.
Significance What effect does the case have, and what significance and effect does it have?		Accompanying with Portal Pattern, Standard Service Pattern, API Pattern, Front-end server Pattern and Mobile APP Pattern provided by community infrastructure public service platform, this platform carries out community infrastructure sharing and exchange of data based on GIS. It has provided one-stop community infrastructure data services to a total of more than 50 government departments, including Nanjing Urban Management Bureau, Transportation Bureau, Ecological Environment Bureau, water companies, power companies, education departments, and other municipal authorities, and several district-level government departments including Jianye, Gaochun, and Qixia District. As a result, information isolation is mitigated to some degree, and community infrastructure resources service for society has been established.
Reference		1. Technical Requirements of Provincial and Municipal Level Nodes of Map World. 2. Guidelines on the construction of Smart City Public Information Platform. 3.http://jiangsu.tianditu.gov.cn/nanjing/index/page/index.html
Relevance to this document	Clause 7	Framework for data exchange and sharing for community infrastructures based on geographic information
	8.2	Community infrastructure census

A.2 Chongqing transportation comprehensive information platform

This subclause mainly provides more details on the Chongqing use case of data exchange and sharing for community infrastructures based on geographic information.

Table A.2 gives the use case of the Chongqing transportation comprehensive information platform.

Table A.2 — Chongqing transportation comprehensive information platform

Basics of the use case	Name	Chongqing transportation Comprehensive Information Platform
	Domain(s)	Transportation
	Version	V2.0
	Organization	Chongqing Planning and Natural Resources Bureau, Chongqing Transportation Bureau, Chongqing Public Security Bureau transportation Management Bureau, Chongqing Transportation Planning Research Institute
	Place	Chongqing, China
	Time	2010-2022
Objectives		In order to solve the problem of big data application with scattered data and different standards, the platform was initially built for the collection, sharing and application of traffic data in the city. After the initial goal was achieved, the goal was upgraded to building a comprehensive decision-making application support platform for transportation planning, construction and management in the city in order to promote the in-depth application of big data in the field of transportation and planning, accelerate the transformation of traditional intelligent transportation led by hardware construction to intelligent transportation led by data and services, and empower the traditional intelligent transportation industry.
Background	Current practices	The government's early informatization construction was scattered in the corresponding construction and management departments of various infrastructures, and the data was mainly used in infrastructure construction, management, and operation and maintenance. The data from different departments was connected through exchange and sharing, which met the shallow data application requirements at that time.
	Gaps	(1) Due to the scattered informatization construction, various problems such as inconsistent data standards, blocked sharing, duplication of construction, and low application level have been caused. (2) With the government's transformation from management to governance and the need for smart city construction, various government tasks have put forward higher requirements for the application of big data. Data is required to broaden the depth and breadth, conduct in-depth integration, support the solution of specific problems in practice, and play a greater role.

Table A.2 *(continued)*

Practice How to realize infrastructure data exchange and sharing through geographic information?	(1) Through 11 units including the Municipal Public Security Transportation Management Bureau, Transportation Bureau, Meteorological Bureau and other departments and Chongqing Mobile, Chongqing Unicom, Chongqing Telecom, Transportation Development Investment Group, Public Transport Group, Rail Group, and Urban Investment Gold Card Company unit. The platform accesses 16 types of dynamic traffic data from the 11 units and realizes the integration of traffic data based on people, vehicles, roads, and public transportation. (2) Build a big data spatio-temporal data lake in Chongqing transportation, and build a powerful hardware and software foundation support platform, the Spark + Hadoop architecture which is used to build a big data analysis and processing platform suitable for massive data storage and parallel processing, which supports the dynamic access, processing and access of massive heterogeneous big data and facilitates horizontal expansion. (3) Build a map of the city's transportation infrastructure integration. Based on geospatial location, collect, integrate and process various types of transportation infrastructure thematic maps, improve facility attribute information, and build a unified geographic infrastructure information carrier and coding standard. (4) Independently researched and developed big data analysis models and indicator systems. Independently researched and developed more than 40 core technology models including mobile phone signalling stop point recognition, job and residence judgment, GPS road network matching, multi-source vehicle speed integration, vehicle OD recognition, and track passenger flow classification. Built complete transportation big data analysis technology system and processed all kinds of raw data connected into monitoring indicators that reflect the operation of urban traffic. (5) Build a monitoring and evaluation system for people, vehicles, roads, and public transportation. Based on data and indicators, develop monitoring and evaluation function software to realize problem discovery and early warning, trend prediction, effect evaluation and other functions, and realize all-around monitoring and evaluation of Chongqing's people, vehicles, roads, public transportation, and infrastructure. (6) Transportation big data service and data sharing. On one hand, it is open for all municipal departments and units to share data through the Chongqing Transportation Comprehensive Information Platform. On the other hand, it provides data interface services, data query and application services, analysis and consulting services for social enterprises, scientific research institutes, and the public in need, and establishes a bridge for information sharing and exchange between the government and the public.

Table A.2 *(continued)*

Significance What effect does the case have, and what significance and effect does it have?		Through the deep integration of big data, the platform covers the entire process of city transportation perception, prediction, simulation, and decision-making assistance, and improves the scientific decision-making capabilities of government departments and the level of refined city management. The platform can directly provide decision-making support services for urban transportation planning, construction, and management. It can also provide services for transportation operations and services to social enterprises, transportation-related planning, design, and consulting agencies. The promotion and applications that the platform has completed include: 1. Relying on the platform, continue to carry out city traffic operation monitoring and evaluation analysis, and release reports on a regular basis. Regularly compile the "Annual Report on Transport Development in the Main Urban Area", "Transport Semi-annual Report", "Transport Monthly" and "Transport Weekly Report" of Chongqing Municipality, and publish them to social and public. 2. Relying on big data resources, carry out analysis and evaluation, form decision-making reference or special report, and assist city leaders in decision-making. Successively completed 43 special reports to the city leaders and related departments. More than a dozen special reports have been approved by city leaders, and relevant suggestions have been implemented. 3. Support the public security transportation police to carry out dynamic traffic management business. Relying on the platform, joint with Chongqing Public Security Transportation Management Bureau, established a "Transportation operation data analysis and application joint laboratory", to jointly carry out the main city traffic operation monitoring, early warning, prediction, research and judgment. 4. Support the planning and construction of bus lanes in the main city of Chongqing. So far, the construction of 105 km of bus lanes has been completed. Relying on platform big data, carry out bus lane planning, continuous follow-up evaluation and feedback planning for the operation effects of bus lanes opened one by one. 5. Serving smart land planning and spatial planning and improving planning science. Focus on the preparation of land and space planning, planning approval, project implementation plan preparation, land supply, plan review, monitoring and evaluation, etc., to carry out big data intelligent decision-making support, and provide full-process capability links. 6. Release information to provide authoritative information for citizens to participate in traffic management. Provide real-time transportation conditions and publish convenient services to the public through the Chongqing Government Network. Cooperate with Hualong.com to carry out the interpretation and information release of transportation operation status to guide citizens to understand traffic and support green travel. Cooperate with transportation radio stations to carry out half-hour and hourly transportation reports to guide drivers to avoid traffic jams.
Reference		1."Research and Demonstration of Chongqing Transportation Comprehensive Information Platform Framework" 2."Technical Report on the Construction of Chongqing Transportation Comprehensive Information Platform"
Relevance to this document	8.6	Transportation management

A.3 New OneMap

This subclause describes more details of the use case in Singapore.

Table A.3 gives the use case of the New OneMap.