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Smart city use case collection and analysis – City information modelling – Part 1: High-level analysis

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SMART CITY USE CASE COLLECTION AND ANALYSIS – CITY INFORMATION MODELLING –

Part 1: High-level analysis

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The text of this Systems Reference Deliverable is based on the following documents:

Draft	Report on voting
SyCSmartCities/290/DTS	SyCSmartCities/299/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Systems Reference Deliverable is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC SRD 63273 series, published under the general title *Smart city use case collection and analysis – City information modelling*, can be found on the IEC website.

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INTRODUCTION

The IEC SRD 63273 series aims to scope out the requirements of city information modelling standards by collecting and analysing its use cases. Specifically, the IEC SRD 63273 series achieves the objectives of:

a) identifying the key application areas and stakeholders;

b) developing user stories and clarifying the relationship among these stakeholders;

c) collecting and analysing use cases of city information modelling; and

d) scoping out the requirements for city information modelling standards and providing recommendations to IEC regarding urban planning and management.

In this document, application areas refer to the deployment-oriented categories that focus on deploying city information modelling to fulfil a particular purpose.

The IEC SRD 63273 series provides useful information on understanding of city information modelling for standardization committees in IEC and other standards development organizations (SDOs) by:

1) promoting the collaboration and systems thinking regarding city information modelling standards;

2) contributing multiple domain-specific use cases for smart cities; and

3) supporting IEC in fostering the development of standards in the field of electrotechnology to help with the integration, interoperability, resiliency and effectiveness of city systems.

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The IEC SRD 63273 series adopts a multi-step approach to generate and collect the use case of city information modelling.

Step I – High-level analysis: The first step aims to generate the list of application areas of city information modelling for a high-level analysis. Needs statements, objectives, current practices, gaps, and scenarios (rationale for applying city information modelling in a specific application area) are investigated for the description of each application area. In addition, the ecosystem, which includes the list of stakeholders and the relationship among the stakeholders, is examined in each application area before developing user stories and use cases.

Step II – User story: The second step aims to develop a list of significant user stories based on the corresponding application area. In each corresponding area, one user story is generated for one specific stakeholder which has been identified in Step I. Each user story follows the same template, which includes one stakeholder (as a specific type of user), a specific situation (when), a goal (I want to), and a reason (so that).

Step III – Use case: The third step aims to develop use cases for a specific application area according to the list of user stories that have been generated in Step II. One user story in Step II can be expanded to be at least one use case. The organization of use cases follows the IEC short use case template (IEC TR 62559-1:2019, IEC 62559-2:2015 and IEC 62559-3:2017), which includes the name of the use case, scope/objective, narrative and list of actors.

Step IV – Use case database establishment and integrative analysis: This step is to establish the use case database of city information modelling and conduct integrative analysis of these use cases.

Step V – City information modelling standard gaps and requirements: This last step is to identify the standard gaps for city information modelling and requirements of the family of city information modelling standards.

The IEC SRD 63273 series contains two parts:

- IEC SRD 63273-1, Smart city use case collection and analysis – City information modelling – Part 1: High-level analysis
- IEC SRD 63273-2, Smart city use case collection and analysis – City information modelling – Part 2: Use case analysis

The scopes of the two parts are defined below.

Part 1 explains how the work of city information modelling use case collection and analysis address sustainable development goals, provides a brief overview of city information modelling, and identifies the key application areas and stakeholders of city information modelling.

Part 2 develops the list of user stories and the database of use cases, conducts integrative analysis of the use cases, scopes out the requirements of city information modelling standards and provides recommendations for IEC and other standards development organizations (SDOs) regarding urban planning and management.

In addition, according to the up-to-date understanding, urban digital twins are also used for describing such technology and solution for smart cities. Urban digital twins indicate the digital twins at the urban scale to enable transformation in how cities are planned, built and managed to deliver better services to make the urban environment more liveable, inclusive, safe, resilient and sustainable. Therefore, the application areas, stakeholders, user stories and use cases of city information modelling, which are identified and developed in the IEC SRD 63273 series, are also applied to urban digital twins to a great extent.

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SMART CITY USE CASE COLLECTION AND ANALYSIS – CITY INFORMATION MODELLING –

Part 1: High-level analysis

1 Scope

This part of IEC SRD 63273 explains how the work of city information modelling use case collection and analysis address sustainable development goals, provides a brief overview of city information modelling, identifies the key application areas of city information modelling, and determines the stakeholders and the relationships among them in these application areas.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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3.1.1
city information modelling
CIM
development of digital representations and simulations of a city made up of large quantities of geospatial data, often including real-time data, which enable better city planning and management

Note 1 to entry: The geospatial data are provided using an integration of building information modelling (BIM) and geographic information systems (GIS).

Note 2 to entry: The real-time data are obtained through extensive use of IoT sensors within the city.

Note 3 to entry: City information modelling involves handling large amounts of big data, which are generally brought together using cloud computing.

Note 4 to entry: Artificial intelligence is often used to generate and evaluate different scenarios using city information modelling data to help manage the city better.

3.1.2
stakeholder
individual, team, organization (IEV 831-01-14), or classes thereof, having an interest in a system (IEV 831-01-21)

Note 1 to entry: Usually a stakeholder can affect or is affected by the organization or the activity.

[SOURCE: IEC 60050-741:2020, 741-01-30, modified – The original Note 1 to entry has been replaced.]

3.1.3
use case
specification of a set of actions performed by a system, which yields an observable result that is, typically, of value for one or more actors or other stakeholders of the system

[SOURCE: ISO/IEC 19505-2:2012, 16.3.6]

3.1.4
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]

3.1.5
building information modelling
BIM
use of a shared digital representation of a built object (including buildings, bridges, roads, process plants, etc.) to facilitate design, construction and operation processes to form a reliable basis for decisions

Note 1 to entry: The acronym BIM also stands for the shared digital representation of the physical and functional characteristics of any construction works.

[SOURCE: ISO 29481-1:2016, 3.2]

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3.1.6
Internet of Things
IoT
infrastructure of interconnected entities, people, systems and information resources together with services which processes and reacts to information from the physical world and virtual world

[SOURCE: IEC 60050-741:2020, 741-02-01]

3.1.7
big data
extensive datasets – primarily in the data characteristics of volume, variety, velocity, and/or variability – that require a scalable technology for efficient storage, manipulation, management, and analysis

Note 1 to entry: Big data is commonly used in many different ways, for example as the name of the scalable technology used to handle big data extensive datasets.

[SOURCE: ISO/IEC 20546:2019, 3.1.2]

3.1.8
cloud computing
paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand

Note 1 to entry: Examples of resources include servers, operating systems, networks, software, applications, and storage equipment.

[SOURCE: IEC 60050-741:2020, 741-01-07, modified – Note 1 to entry has been added.]

3.1.9
artificial intelligence
AI
<discipline> research and development of mechanisms and applications of AI systems

Note 1 to entry: Research and development can take place across any number of fields such as computer science, data science, humanities, mathematics and natural sciences.

[SOURCE: ISO/IEC 22989:2022, 3.1.3]

3.1.10
city model
appropriate set of data which models those physical and social aspects of the city that are relevant for its objectives

[SOURCE: ISO ISO/IEC 30146:2019, 3.5]

3.1.11
spatiotemporal data
data representing a set of direct positions in space and time

3.1.12
application
set of technologies deployed to fulfil a particular purpose

[IEC 60050-741:2020, 741-01-02, modified – In the definition, "software designed" has been replaced by "set of technologies deployed".]

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3.2 Abbreviated terms

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2D	two dimensional
3D	three dimensional
AI	artificial intelligence
BIM	building information modelling
ANPR	automatic number-plate recognition
CIM	city information modelling
GIS	geographic information system
IoT	Internet of Things
ITS	intelligent transport system
SDGs	Sustainable Development Goals
SDOs	standards development organizations

4 Contributing to Sustainable Development Goals

4.1 General

The United Nations published 17 Sustainable Development Goals (SDGs) to enhance world peace and prosperity, eradicate hunger and poverty, and protect people and the planet by 2030. It calls for innovation and broad collaboration between public and private society. The IEC SRD 63273 series mainly addresses SDG 11 (Goal 11): sustainable cities and communities.

4.2 Mapping application areas of city information modelling and SDG 11

Goal 11 aims to make cities and human settlements inclusive, safe, resilient and sustainable. Specifically, Goal 11 includes ten targets:

11.1 safe and affordable housing;

11.2 affordable, accessible and sustainable transport systems;

11.3 inclusive and sustainable urbanization;

11.4 protect and safeguard the world's cultural and natural heritage;

11.5 reduce the adverse effects of natural disasters;

11.6 reduce the environmental impact of cities;

11.7 provide universal access to safe and inclusive green and public spaces;

11.a a strong national and regional development planning;

11.b implement policies for inclusion, resource efficiency and disaster risk reduction; and

11.c support least developed countries in sustainable and resilient building.

The CIM application areas studied in this document address the full list of targets in Goal 11 (Table 1). One application domain can address more than one target. For example, the application area of new town planning addresses 11.3 inclusive and sustainable urbanization, 11.7 provide access to safe and inclusive green and public spaces, and 11.a strong national and regional development planning.

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Table 1 – Mapping application areas of city information modelling and SDG 11

SDG 11 target	Contents	CIM application areas	Connections between SDG 11 and the application areas
11.1 Safe and affordable housing	By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.	• three dimensional visualization of property and land administration • Construction project approval management • Project management during construction • Real estate registration management • Underground pipeline management • Water management	All these CIM application areas are relevant to the whole life cycle of construction for housing, which also includes the civil services for the housing, such as underground pipeline and water management. By adopting CIM in housing constructions and management, the cities are able to manage the land use and provide more safe and affordable housing.
11.2 Affordable, accessible and sustainable transport systems	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	• Transport infrastructure planning • Traffic management	These two CIM application areas provide the description of how CIM can be applied in transportation infrastructure planning and traffic management. Both of them enable the city to develop an affordable and sustainable transport system.