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GIS (geospatial) / BIM interoperability

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Foreword

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This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)*.

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

The complexity of information needed to support decisions relating to built assets by the public and private sectors as well as by citizens, require digitally enabled practices based upon interoperable systems. Indeed, the decisions that are needed over a built asset's life cycle and across its different stages rely on these complex sets of information. Moreover, these decisions are made by a multitude of actors that perform information-processing activities such as data creation, capture, transformation, and analysis, and are embodied in project and asset management practices as defined in existing and emerging standards.

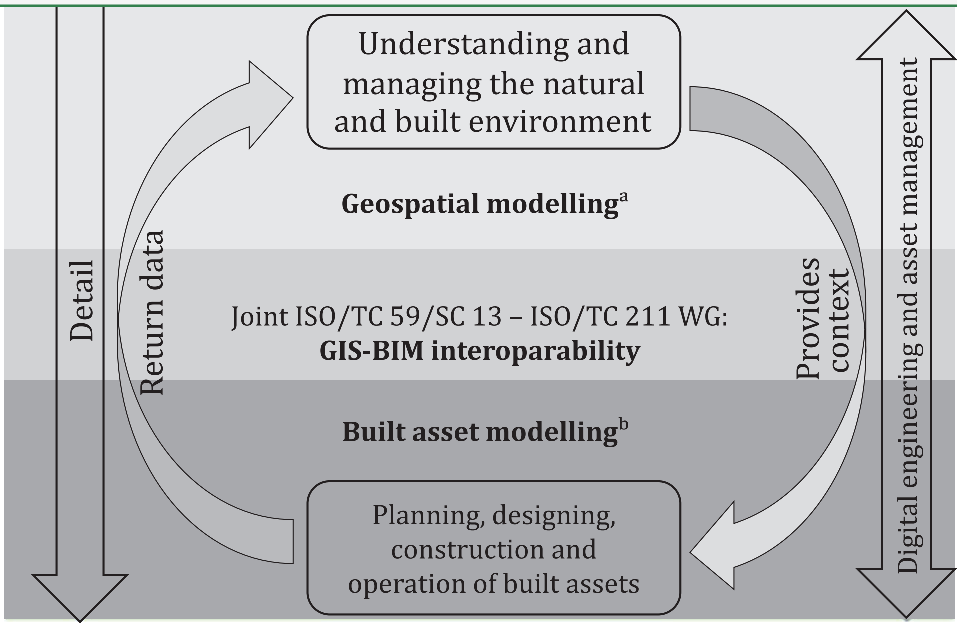
Consequently, several initiatives aimed at the digitalization of built assets at regional, national and international levels have spurred considerable investments around the globe. A key component of these initiatives concerns the need for collaboration and interoperability between information processing systems. These systems rely on digital practices that support digital engineering and asset life cycle management, which rely heavily on different domains of information modelling. These domains include both the observed natural environment and built structures. They also span many scales, from the fabricated asset to its territorial and contextual setting. In this case, the domain of geographic information, “maps”, and geomatics, is encompassed with the concept of geographic information systems (GIS), whereas the built asset and its parts is encompassed by the concept of building information modelling (BIM). Traditionally these two information systems have been viewed as separate domains. From a digital engineering and asset management perspective however, there is an increasing overlap and need for interoperability between the two, as illustrated in Figure 1.

The two domains can also be viewed as two different sets of tools, used by several disciplines/domains.

The geospatial domain with its many professions (e.g. land management, engineering surveying, geodata management, remote sensing and cartography) uses GIS tools to acquire, manage, analyse, distribute and present geospatial information.

The geospatial domain handles (most of the time) descriptive models that are designed for many purposes and long-term use and were formerly presented on maps in scale 1:100 to 1:100 000 000. But as the need for geospatial applications varies greatly between actors, the main standardization committee for geomatics, ISO/TC 211, focuses on enabling the development of application schema. The main focus has been on a set of common rules for the development of application schemas (ISO 19109). However, there are applications schemas provided in other organisations, like OGC's CityGML standard for urban environments (including buildings). Buildings (and their urban environment) and the data specification for buildings in the European INSPIRE directive, both based upon ISO/TC 211 standards, including ISO 19109.

The AECO (architecture, engineering, construction and operations) domain with its many professions (e.g. project development, architecture, civil engineering, contractor, facility management) related to planning, designing, building and operating built assets (buildings, infrastructure, etc.) uses the evolving BIM method for collaborative and digital processes in construction projects and for asset management. The models are (most of the time) prescriptive models, designed for a specific purpose and project phase and were formerly presented on drawings in scale 10:1 to 1:1 000, including landscape drawings, rail and road geometrics. These AECO disciplines have at least one thing in common: the building.



a ISO/TC 211: ISO 19101 (all parts), ISO 19103, ISO 19104, ISO 19105, ISO 19106, ISO 19107, ISO 19108, ISO 19109, ISO 19110, ISO 19111, ISO 19136 (all parts), ISO 19150 (all parts).

b ISO/TC 59/SC 13: ISO 16739-1, ISO 29481 (all parts), ISO 19650 (all parts), ISO 12006 (all parts).

Figure 1 — Standards that relate to the cycle of information flow between geospatial and BIM domains (adapted from a diagram developed by the Joint OGC / bSI IDBE Working Group)

To date, the interaction between the BIM and the GIS domains has not been intuitive or seamless. In its simplified form the GIS, or geospatial modelling, domain has traditionally focused on modelling at the territorial scale and has adopted a large perspective of the observed environment which includes a multitude of distributed assets. The BIM domain has focused more on modelling the components of a single built asset. With the move towards integrated information environments, the differences in focus and scale between the two domains are diminishing. Arguably, use cases and perspectives in both domains are converging and overlapping. Indeed, and as mentioned, decisions pertaining to built assets typically require data and information that span both domains. Therefore, information models from both domains are becoming increasingly bound to each other: every built asset has a location and is situated within a context relative to the existing environment. Conversely, the existing environment incorporates all built assets.

With this move towards integrated information environments, use cases will increasingly require seamless transitions between both domains and their information models, from the bird's eye perspective to the manufactured component found within a built asset, to support the various asset life cycle practices and requirements within a specified context as illustrated in Figure 1. A key challenge in achieving this seamless transition or movement between both domains is ensuring the interoperability in systems used for geospatial information modelling and built asset information modelling. Currently, state-of-the-art modelling of geospatial information is based upon international standards developed and maintained by ISO/TC 211 and Open Geospatial Consortium, Inc. (OGC), whereas state-of-the-art modelling of built assets is based upon standards developed and maintained by ISO/TC 59/SC 13 and buildingSMART International (bSI).

This document aims to identify measures to enable interoperability between the two domains. These measures are expected be developed in either ISO/TC 211, ISO/TC 59/SC 13 or as a joint work between the two committees. To achieve this the enterprise interoperability framework (EIF) defined in ISO 11354 (all parts) has been used, focusing on the need for interoperability in data, services and processes to ensure seamless exchanges and transitions between both domains. First this document focuses on identifying standards within the two aforementioned interoperability levels. Barriers, or incompatibilities, between the two domains are then exposed and discussed. Lastly, specific work packages aimed at eliminating these barriers are identified and suggestions for future work aimed at streamlining interoperability between the two domains are made.