Lands Department
The Government of the Hong Kong Special Administrative Region

Building Information Modelling (BIM) and Geographic Information System (GIS) Data Integration Guidelines

June 2023 Edition

REVISION HISTORY

Revision	Date	Amendment	Version Number
0	June 2023	(Initial Release)	1.0

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CHAPTER 1 INTRODUCTION

Background

1.1 The Smart City Blueprint for Hong Kong released in December 2017 sets out the overall framework and strategy for developing Hong Kong into a spatially enabled smart city including the adoption of Building Information Modelling (BIM) and the development of Common Spatial Data Infrastructure (CSDI) and 3D Digital Map.

1.2 The 3D Digital Map, which is one of the building blocks of CSDI, is to facilitate opening up and sharing of Government geospatial data. To meet the increasing needs of 3D Digital Map applications and to enhance better understanding of multi-level spaces of a modern city like Hong Kong, the Government aims to develop the high-quality 3D Digital Map by phases and strives to cover the whole territory by end 2023.

1.3 The Lands Department (LandsD) is now producing a set of 3D digital maps covering the whole territory, which includes the full-fledged 3D visualisation map, the 3D indoor map covering the accessible interior of buildings and structures for 1 250 buildings and the 3D pedestrian network data over the territory.

1.4 BIM data, which contains rich content of 3D boundary of floors, units, and common areas, can serve as an abundant supply of data required for future production and updating of 3D indoor map.

1.5 In this respect, LandsD has conducted a study on the BIM to GIS data conversion and integration processes with the project data contributed by the Urban Renewal Authority (URA) under the project of “Development of 3-Dimensional Intelligent Map (3D iMap)”. Based on the data conversion results and the technical issues encountered during the data conversion process shared by URA, the study aims to develop a set of high level requirements on BIM modelling and conversion serving as best practices to help practitioners of the Architectural, Engineering, and Construction (AEC) Sector to achieve seamless data integration between BIM and GIS.

Purpose and Scope

1.6 The purpose of the BIM and GIS Data Integration Guidelines (hereinafter referred as this Guidelines) is to provide a reference guide with a set of generic rules for the betterment of the conversion process of data from BIM to GIS platform.

1.7 This Guidelines aim to set out general guidelines and recommend good practices, focusing on high level requirements on BIM modelling and data conversion, to facilitate interoperable geospatial data management through seamless data integration between BIM and GIS.

Revision of this Guidelines

1.8 This Guidelines is a living document for general reference by the practitioners of the Architectural, Engineering and Construction (AEC) sector and its recommendations are not intended to be mandatory. This Guidelines will be updated regularly to take account of advances in technology and the changing needs of the AEC sector.

Definitions

1.9 The following is a list of definitions of the terms used in this Guidelines.

3D Floors: Floor Polygons in vector format. Each Floor Polygon represents the location and the outermost physical extent of the floor of the building.

3D Gates: Gate models the position and approximate physical extent of the entrance and exit of the independent space enclosed by the wall and the fence. Gate usually refers to the opening on the wall or the fence.

3D Units: Unit Polygons in vector format. Each Unit Polygon represents the location and physical extent of an enclosed space within Floor Polygon including all the structural details of the floor including but not limited to the building shape, elevators, escalators, entrances, doors, walls, stores, gates, hallways, balconies, entrance and exit of the floor.

3D Windows: Window models the position and approximate physical extent of the window of the independent space enclosed by the wall and the fence.

BIM Object: A combination of object geometry and product information that represents the product's physical characteristics in a digital environment.

Coordinate System: A set of mathematical rules for specifying how coordinates are to be assigned to each point.

Feature: Abstraction of real-world phenomena. A feature may occur as a type or an instance.

Feature Attribute: Characteristic of a feature. A feature attribute has a name, a data type, and a value domain associated to it.

Point: Topological 0-dimensional geometric primitive, representing a position.

Line: Topological 1-deminsional geometric primitive, representing a linear feature.

Polygon: Topological 2-deminsional geometric primitive, representing an area or a planar surface.

CHAPTER 2 HIGH LEVEL REQUIREMENTS ON BIM MODELLING

2.1 This chapter describes the high level requirements on BIM modelling to facilitate the conversion process of data from BIM to GIS platform.

Modelling Requirement #1: Mapping of Information Elements from BIM to GIS Environment

2.2 To ensure the interoperability for effective exchange of data across the BIM domain and GIS domain, it is of paramount significance to define the mapping of the information elements from BIM to GIS environment prior to the data preparation stage. By defining such mapping routines (***Figure 1*** refers), automation of the conversion process of BIM objects to the corresponding GIS features could be achieved.

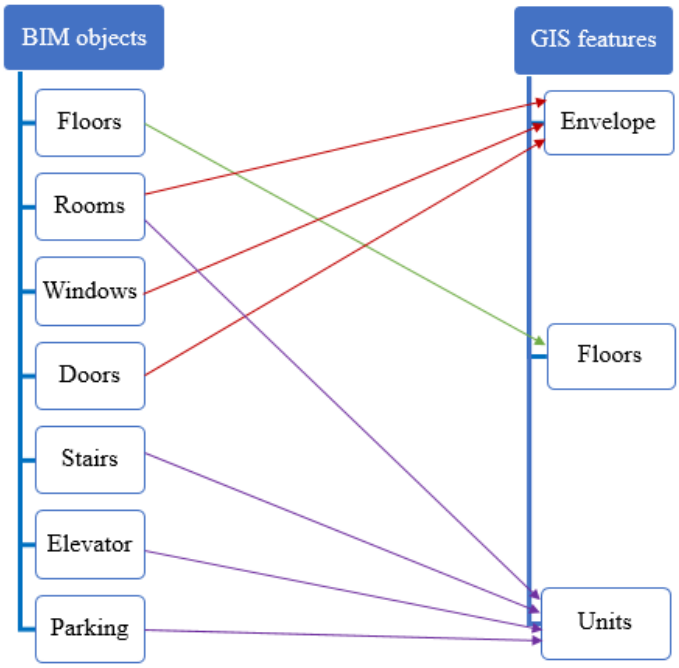

Figure 1 An illustration of mapping of information elements from BIM to GIS

2.3 The table below gives an example on the mapping of curtain wall and basic wall objects in BIM to the corresponding feature types in GIS.

BIM Domain		GIS Domain	
Model Categories		Feature Class	InteriorUsage
Wall	Curtain Wall	Bldg_Envelope	Window
	Basic Wall		Exterior Wall

Modelling Requirement #2: Assignment of Unique Identifier for BIM Objects

2.4 For ease of quality checking subsequent to the data conversion from BIM to GIS, it is a good practice to export the unique identifier of the elements in the BIM model (e.g. element ID in Revit) during the conversion of BIM elements to GIS. It is not uncommon to encounter error or unexpected results during the data conversion process since the data stored on BIM platform and GIS platform are of different data structures. The unique identifier, if exported from BIM elements to GIS features, could then be used for tracking the original element in the BIM model to facilitate further investigation and to ensure data completeness after the data conversion process. ***Figure 2*** below demonstrates the unique identifier of a BIM object being exported and stored as one of the attributes in the converted GIS data.

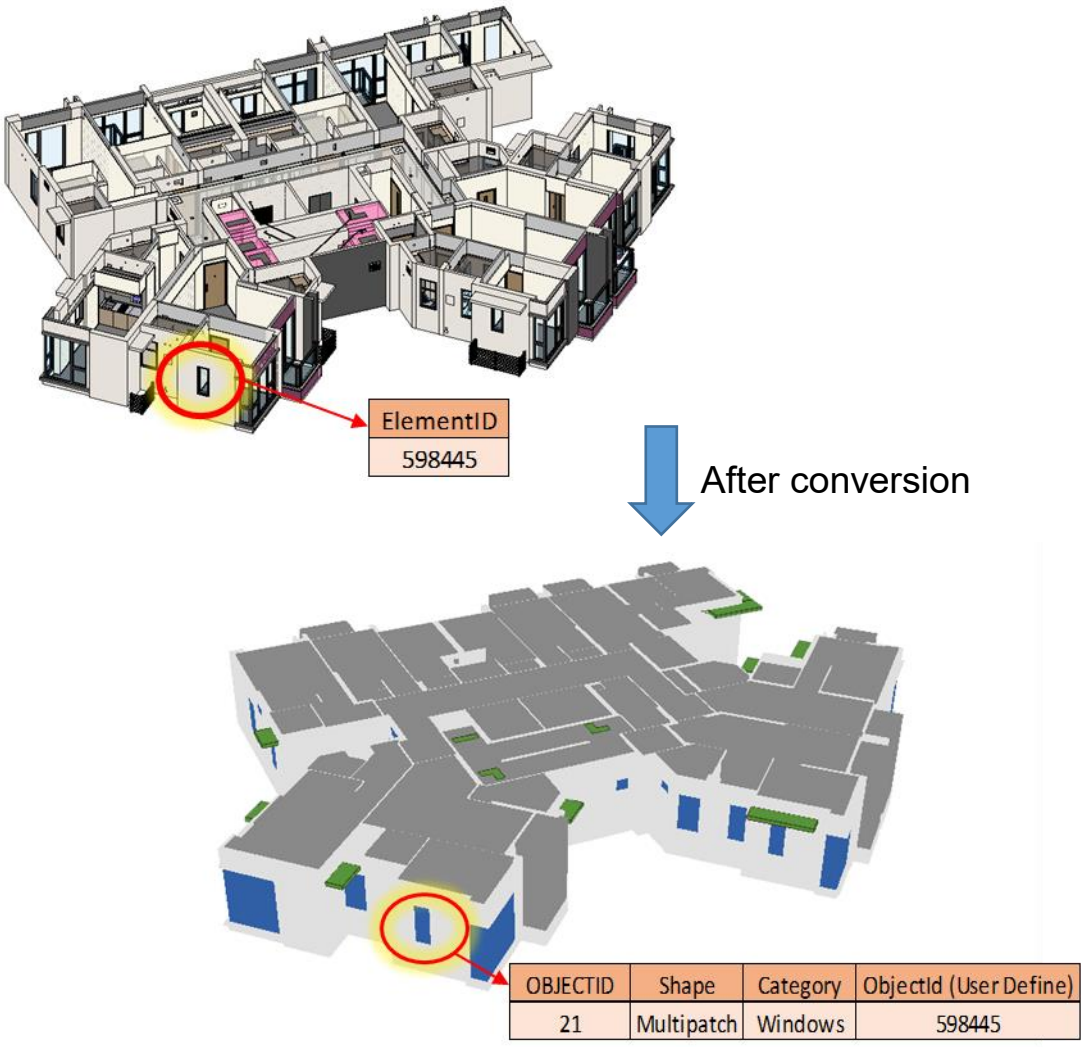

Figure 2 An illustration of assigning the unique identifier for BIM object

Modelling Requirement #3: Delineation of Units

2.5 According to the INSPIRE Data Specification on Buildings – Technical Guidelines D2.8.III.2_v3.0 (2013), a "Unit" is a subdivision of Building with its own lockable access from the outside or from a common area (i.e. not from another Building Unit), which is atomic, functionally independent, and may be separately sold, rented out, inherited, etc. To facilitate spatial analysis and indoor routing applications in the GIS environment after conversion, BIM modelers are recommended to delineate the extent of an enclosed space as "Room" or "Space" element (or equivalent) on BIM platform.

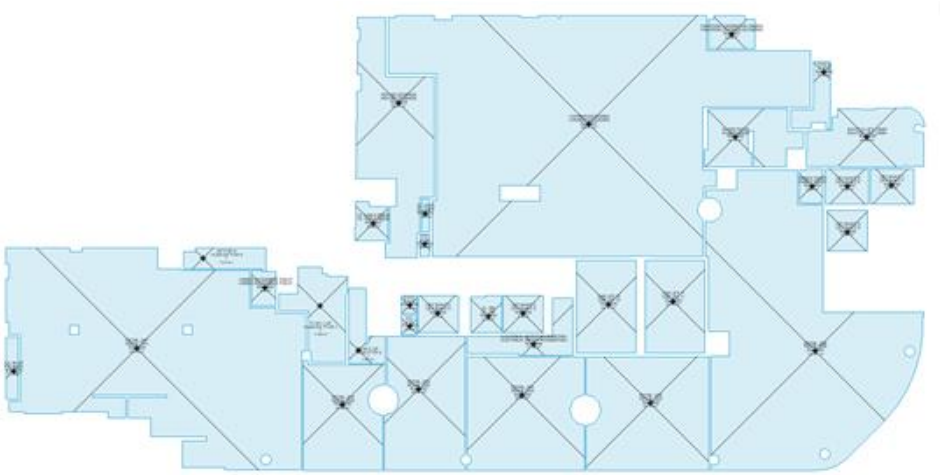

Figure 3 An illustration of delineating the extent of Unit elements on BIM platform

Modelling Requirement #4: Definition of Subtype for Classification the Use of a Space

2.6 To reduce duplication of effort in classifying and verifying the use of building units in GIS platform after data conversion from BIM, BIM modelers are recommended to indicate the use of a space in the name property of the "Room" element in a standardized manner in the BIM model.

2.7 The classification of the use of space could refer to the list of UnitSubtype as defined in the 3D Indoor Map Data Dictionary of LandsD as published on the Hong Kong GeoData Store. If BIM modelers follow another classification system to define the use of a space, a mapping table between the adopted classification system and the classification system in 3D Indoor Map Data Dictionary could be prepared for seamless conversion.

CHAPTER 3 HIGH LEVEL REQUIREMENTS ON CONVERSION OF DATA FROM BIM TO GIS

3.1 This section describes the high level conversion requirement for seamless conversion of data from BIM to GIS

Conversion Requirement #1: Level of Details in GIS Environment

3.2 BIM models store rich geometric and semantic information of a building throughout the building life cycle. Depending on the intended purpose of integration, partial objects in a BIM model could be selected and converted to the GIS platform to avoid excessive amount of details in the output GIS data. The unnecessary details increase demand for processing power and storage space, and might hinder data sharing. It is therefore important to define the required features on the GIS platform and the expected level of details. For instance, the inclined BIM objects such as escalators, balustrades and railings could be generalized in terms of base levels, feature height of floors and walls. ***Figure 4*** below gives an example showing the covered walkway represented in 3D objects on BIM platform was filtered out in the converted GIS data.

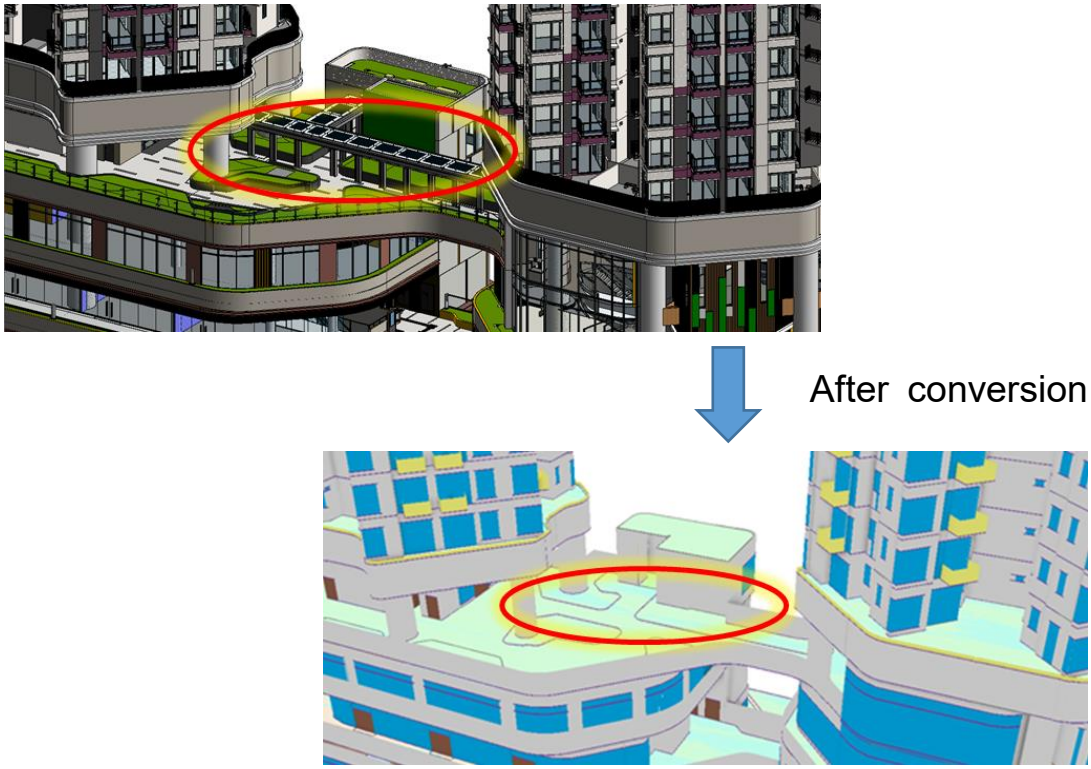

Figure 4 An illustration of filtering excessive amount of details from BIM model from the converted GIS output data

Conversion Requirement #2: Design of GIS Data Schema

3.3 For seamless integration with other spatial related information from the Government departments or private sector, when converting data from BIM to GIS, it is suggested to adopt the following data model and structure, which consists of 4 semantic components including building footprint, shell, floor and unit. Depending on the intended purpose of the applications, additional feature attributes could be integrated, such as Property Reference Number (PRN) and Assessment Number.

3.4 For mapping indoor features within a building, major feature classes of the exported GIS data are suggested as follows:-

Feature Class Name	Data Type	Details
3D Floor	Polygon	Represents the location and the outermost physical extent of the floor of the building
3D Units	Polygon	Represents the location and physical extent of an enclosed space within Floor Polygon
Place of Interest	Point / Polygon	Represents a location that a user is interested in on a map
3D Gate	Polyline	Represent the position and approximate physical extent of the entrance and exit of the independent space enclosed by the wall and the fence.
3D Window	Polyline	Represent the position and approximate physical extent of the window of the independent space enclosed by the wall and the fence

Conversion Requirement #3: Filling of Interstitial Spaces between Units

3.5 Spaces in BIM environment may be enclosed by “Wall” objects with thickness. When the extent of space is delineated by “Room” object based on the interior lines of the wall, interstitial spaces between Unit polygons are created after the “Room” objects are converted into GIS platform. It is a good practice to fill the interstitial spaces by expanding the extent of the Unit polygons using GIS software.

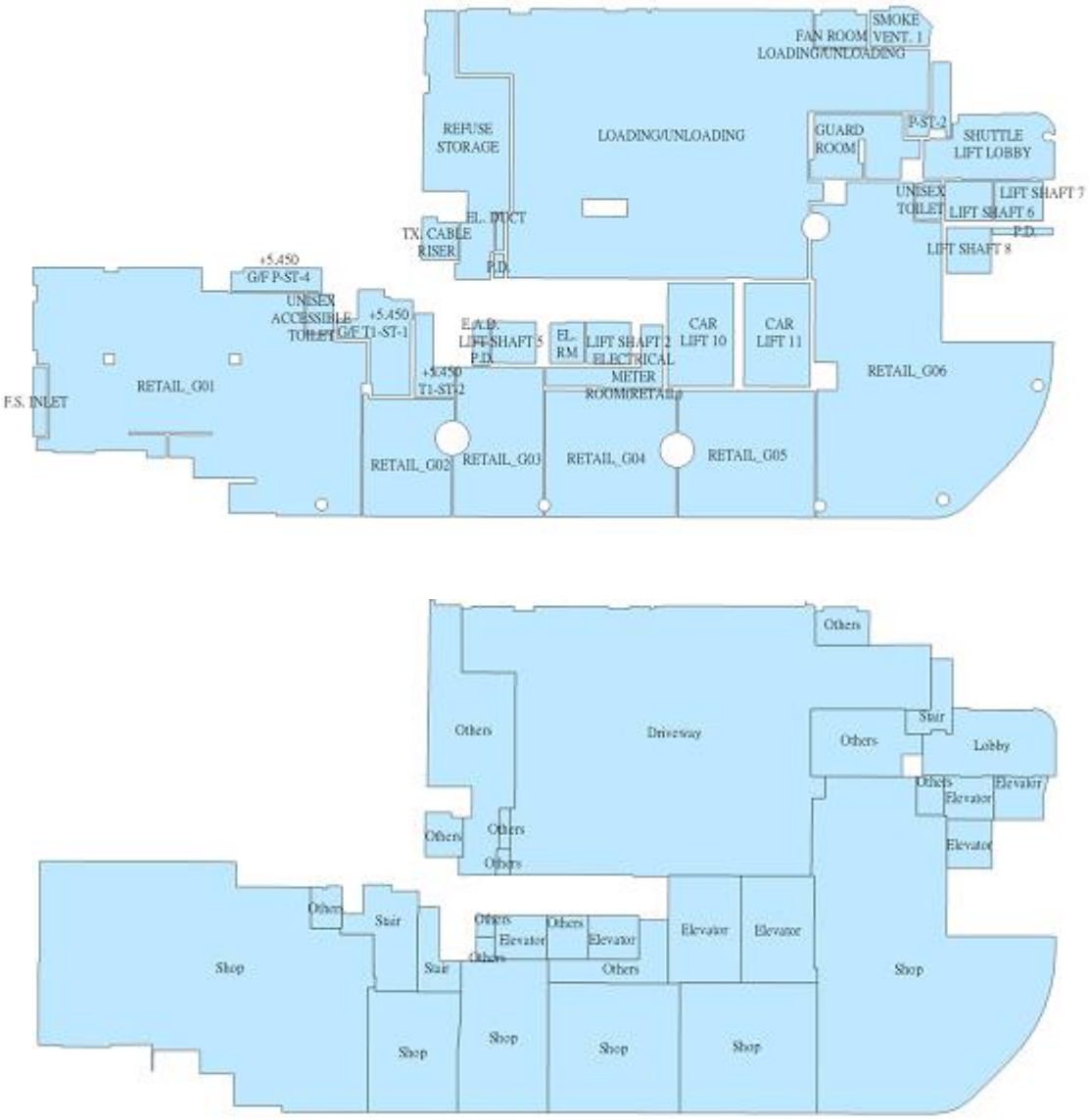

Figure 5 An illustration showing a group of building units converted from the BIM model before (above) and after (below) filling the interstitial spaces using GIS software

ENQUIRY AND FEEDBACK

AEC practitioners are always welcome and encouraged to provide comments or feedback on this Guidelines to LandsD (Attn.: Senior Land Surveyor/BIM, BIM Section, Survey and Mapping Office of LandsD at email: slsbim@landsd.gov.hk) so that continual improvements can be made to future editions.

ACKNOWLEDGEMENT

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