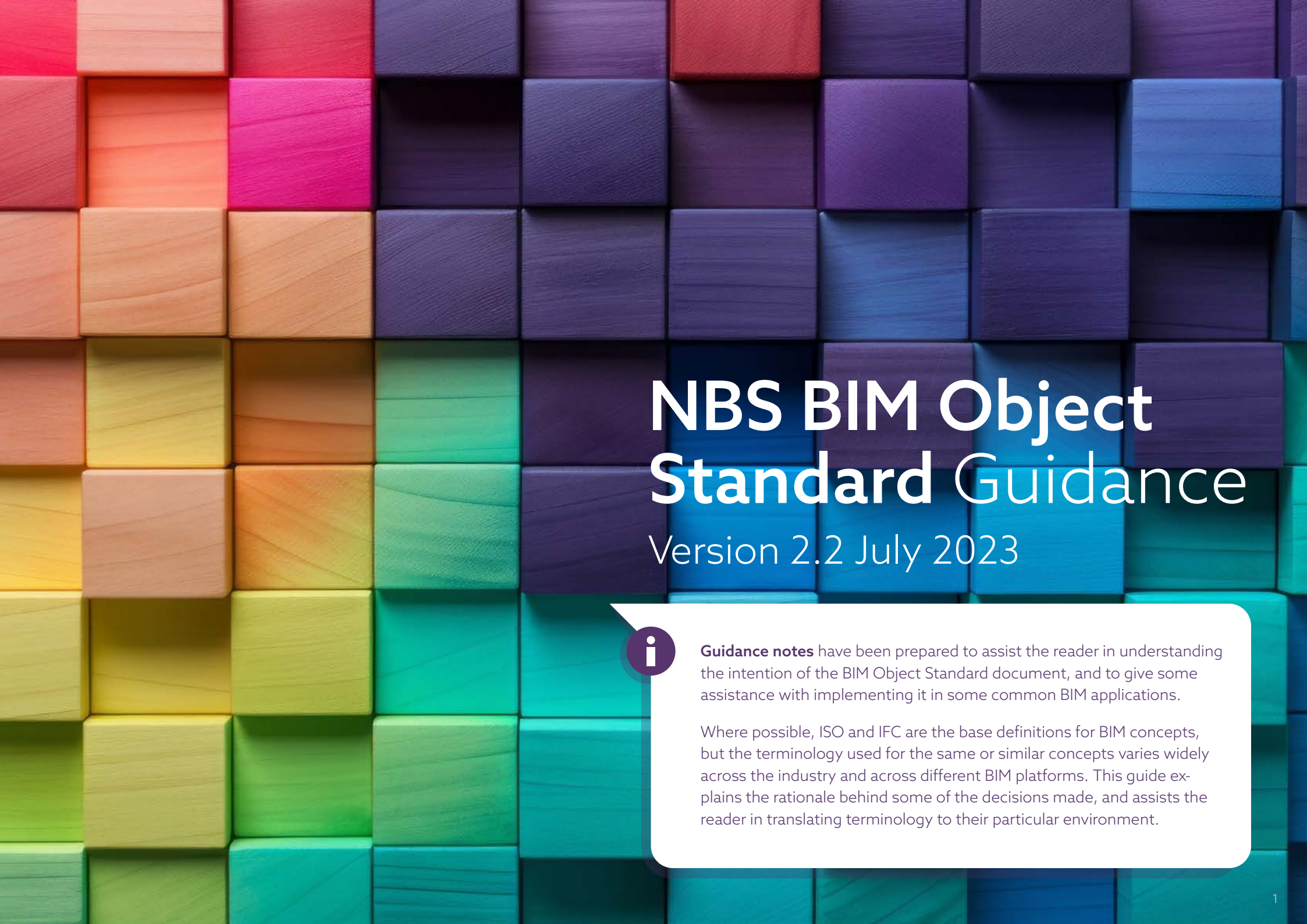

NBS BIM Object Standard Guidance

Version 2.2 July 2023

Guidance notes have been prepared to assist the reader in understanding the intention of the BIM Object Standard document, and to give some assistance with implementing it in some common BIM applications.

Where possible, ISO and IFC are the base definitions for BIM concepts, but the terminology used for the same or similar concepts varies widely across the industry and across different BIM platforms. This guide explains the rationale behind some of the decisions made, and assists the reader in translating terminology to their particular environment.

Contents

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Introduction

After almost a decade of the NBS BIM Object Standard, the industry adoption of BIM and how we work within digital construction has developed greatly.

Although technology has improved the core fundamentals are the same, for designers to succeed we need to make sure the building blocks of modelling are correct. The NBS BIM Object Standard continues to do this by defining the requirements for a BIM objects in terms of information, geometry, behaviour, and presentation. By standardizing on content structure, this enables greater collaboration across the construction industry.

In 2014 due to the lack of industry wide understanding regarding BIM it was important to provide clarity on the information structure of objects as this was becoming a blocker to adoption. Fundamentally the requirements were to ensure that appropriate information could be created in a suitable format at the right time so that better decisions could be made throughout design, construction, and facilities management.

It was important to share what helped the industry and what did not. The Standard was designed to do exactly that. At NBS we wanted to promote best practice and a consistent way of working going forward, and where it existed, give examples of how to use the various information standards that already existed. Since the NBS BIM Object Standard was launched it has been revised at points where external standards such as the ISO 19650 series have been updated.

In terms of geometry when BIM objects are created to the NBS BIM Object Standard it helps create a BIM object that has digital geometry that reflects how the physical object acts and performs as it would be expected within the real world.

The Standard takes consideration to minimum requirements for the physical form of the construction product, how the object is intended to be used and the level of detail required while adhering to parametric requirements.

Arguably the most important part of a BIM objects is the information that it contains. The NBS BIM Object Standard defines a set of rules to follow that covers general, IFC and Facilities management requirements. The general information is to provide the BIM object with an identity, classification, propriety information and a standardized naming structure. IFC and Facilities management properties supplement the general information and further aid data management and interoperability throughout a project's lifecycle. Capturing information within a BIM object enables the exchange of lifecycle information and assists with the management of assets in the future. At NBS when we author BIM objects internally, we go one step further in terms of the management of information and include key specification data encouraging symmetry between the specification and the digital model. This additional specification information is an optional requirement set out in the standard.

Standardization between objects and the necessity of consistency allows data-rich models to be produced on projects. Consistent data is powerful because it is the foundation of any data driven decision making process. This can provide information to the varied disciplines through a project's life cycle - at the right time and stored in the correct place. This is a key benefit to the NBS BIM object standard and what the NBS Source platform as a whole offers. Objects that have been built to follow the NBS BIM Object Standard as their foundation will be easier to source, use, compare and exchange between clients, designers, and manufacturers.

The NBS BIM Object Standard and associated guidance is the resource we use every day internally at NBS and with our content partners to create objects. As a free-to-use tool, we hope that find it a useful tool also within your organization.

Jane Hibbert,
Head of Supplier Technical Content at NBS

About NBS

NBS is a technology platform for the construction industry used by organisations of all sizes, from small architecture and engineering firms to the very largest global construction companies.

We enable our customers to work safer and reduce their risk by providing up-to-date content at their fingertips, and to work smarter through an intelligent set of connected tools which help them develop and manage their project information faster and more accurately.

For building product manufacturers, we offer a complete digital route to market through a set of tools and services that target our highly engaged audience of architects and specifiers.

NBS is a 50-year-old tech scale-up. With our finger on the pulse of the construction industry, our future lies in cloud-based technologies and connected data, as we fast become an information marketplace for the construction industry.

NBS & BIM

NBS has been at the very forefront of BIM development, and its experts hold key positions in groups and organizations that have helped shape the BIM landscape. Over the years, NBS has been represented in key industry groups such as the BSI B/555 BIM standards committee, CEN 442, CPIc, ICIS and BuildingSMART.

A single source of product information, NBS Source is designed to make it easy to create, store and manage manufacturers' specification data, BIM objects, literature and third-party certifications in one place.

BIM objects on NBS Source have been authored to the trusted NBS format and have direct connectivity to leading BIM 3D design tools such as Autodesk Revit and can be directly integrated into NBS Chorus software.

A wealth of free BIM information can be found on **theNBS.com/bim**

The NBS BIM Object Standard

At NBS, we recognized that the lack of an industry-wide standard for BIM objects was a barrier to the successful adoption of BIM. The construction industry needed access to BIM objects that could be relied upon, and product data was also required at the right levels of information with the appropriate geometry.

NBS took the lead with devising a solution by defining what constitutes a high-quality BIM object and providing consistency in the content and structure of these objects. The introduction of the NBS BIM Object Standard in 2014 played a major role in assisting organizations to standardize their BIM approach, and its subsequent updates are an indication of how NBS is demonstrating its knowledge and expertise throughout the entire digital plan of work.

The standard meant that manufacturers or designers creating their own objects for practice and project-specific purposes could do so to a common standard, enabling greater collaboration, efficiency and more meaningful information exchange.

The NBS BIM Object Standard is now a globally recognized standard, and gives architects and specifiers the confidence in the quality of the BIM objects used within their project models as the industry could now build objects using a common approach - resulting in better value across the whole life of the built asset.

For more information and latest news about BIM, visit **thenbs.com/BIM**

Standardizing BIM Objects

There are many definitions of building information modelling (BIM). Put simply, it is a means the process by which everyone can understand a building through the use of a digital model.

Modelling an asset in digital form enables those who interact with the building to optimize their actions, resulting in a greater whole-life value for the asset. In order to enable users from different companies, disciplines or geographical areas to effectively use model information, the digital building blocks that are used to create virtual assets need to be standardized.

These building blocks are commonly known as BIM objects. Since all physical assets require products, the availability of manufacturers' BIM objects is an important factor in achieving success with BIM.

These objects need to be of the right quality, and they need to be compatible with generic objects that are chosen before a product is selected. Associated data such as technical specifications need to connect with the BIM objects to support work processes.

NBS has been achieving standardization between generic and proprietary information for 50 years, and our entire product range is geared towards supporting the work processes of every construction professional involved in a project.

This standard recommends compatibility with the Construction Operations Building information exchange (COBie) standard, which identifies the information necessary for management of the facility after it is constructed. One of the advantages of COBie is that information collected at various milestone dates can be compared in various ways. With COBie, construction data can be compared across project stages; has the cost changed, and has the delivery time improved or reduced? These are typical stage-to-stage questions.

On a broader scale, being able to compare construction data across numerous built assets will help to assess greater whole-life value. By comparing projects, data optimization becomes possible: lessons can be learned from what has worked well, and this knowledge can influence future projects, refurbishment works and maintenance activities.

A BIM object is a combination of many things:

- Information content that defines the product.
- Model geometry representing the product's physical characteristics.
- Behavioural data such as detection, maintenance and clearance zones that enable the BIM object to be positioned in (or function in the same manner as) the product itself.

For each of these BIM object essentials, it is important that a standardized approach is taken, as creating digital assets using a consistent kit of parts will yield all of the benefits that standardization brings.

BIM data should be efficient to use, easily comparable and interoperable.

NBS Source sets an industry standard for quality, efficient generic and manufacturers' objects. We expanded the standard that we used for our own library to form this BIM Object Standard (BOS). The BIM Object Standard establishes every object with a core property set that:

- adopts a consistent approach to classification;
- applies a standard naming convention for ease of use; and
- standardizes approaches to the level of information and object presentation.

This supports efficient workflows and enables the creation of high-quality digital building assets.

Note: For a consistent approach to classification, the new International Standard ISO 19650 requires a classification system that aligns to the ISO 12006-2 framework.

Uniclass is the leading worldwide example of a classification system based on this framework. By standardizing the information recorded within objects, we can compare them and make an appropriate selection for the project.

Common approaches to the modelling of the physical characteristics of products make the BIM objects simple to use, affording the designer a reliable, consistent and intuitive experience. The hard work is in the detail. BIM objects in Industry Foundation Class (IFC) format, for example: these IFC files are manipulated so that they have their information properties consistently grouped and organized. This makes their use in various BIM platforms straightforward and consistent. Another example is the use of standardized properties. The benefits of this become obvious when using objects from more than one manufacturer in the same project. When creating schedules that span products from many manufacturers, the use of a standardized property set enables information relating to each of these products to be displayed in a single column.

With each BIM platform vendor having their own approach to information handling, the importance of setting minimum requirements for information transfer is vital to achieving collaboration and interoperability.

Scope and Purpose

Scope

This standard defines the information, geometry, behaviour and presentation of BIM objects to maximize consistency, efficiency and interoperability across the construction industry. Words in bold (and others) are explained in the Terms and Definitions section of this document.

Purpose

This standard is intended to assist construction professionals, manufacturers and other BIM content developers in creating BIM objects that operate in a Common Data Environment (CDE). It is a quality standard for BIM objects, and a benchmark by which objects can be consistently assessed. The standard is not intended to specify how to create BIM objects in specific software platforms (it is assumed that readers of the standard will have the requisite knowledge to operate their software of choice). Through the use of a common standard, the integration of building information and its effective use becomes possible.

Section 1: General Requirements

This section describes the general requirements for BIM objects.

The scope of this section includes general requirements such as object categorization, IFC element type and predefined type requirements.

1.1 General

1.1.1. Terms

The word 'shall' is used to express requirements of this standard.

The word 'should' is used to express recommendations.

The word 'may' is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause.

The word 'can' is used to express possibility, e.g. a consequence of an action or an event. Terms in bold are defined in the Terms and Definitions section.

1.1.2. Object designation

The BIM object shall be created as:

a) A generic or manufacturer object.

b) A component or layered object.

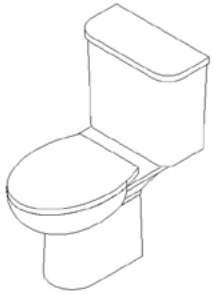
a) The term object is also synonymous with 'entity', 'construction entity' and 'construction element'.

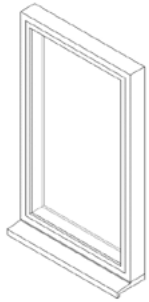
A generic object is intended for use in the initial stages of design.

A manufacturer object is intended to represent an obtainable product provided by a manufacturer or supplier. The term 'manufacturer object' is also synonymous with 'proprietary object' or 'product object'.

b) BIM objects are provided as either layered objects or component objects; both types can be found in generic, manufacturer and project object form.

Component objects: Comprise doors, windows, sanitaryware, furniture, etc. These objects can be further defined as static objects or parametric objects: the difference being that a static object will be available in one size, whereas a parametric object will be available in a range of predetermined sizes (or else the size can be determined by the designer). These objects can be held outside the model and imported into it.

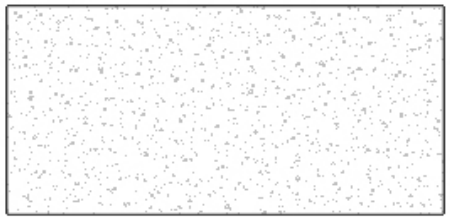




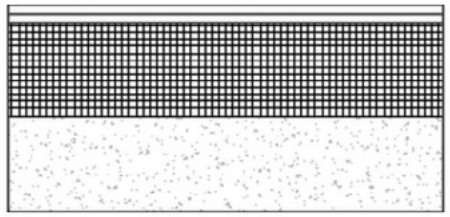
Layered objects: Comprise walls, floors, ceilings, roofs, etc. These objects are typically constructed from a number of layers and do not have a fixed geometry; this is defined by the designer, e.g. a concrete floor layer thickness may be determined by the designer's structural calculations. The thickness of the object layers may also be determined by manufacturers, e.g. an insulation board may be available in a set number of thicknesses. Typically these objects are system objects that come with the BIM platform. The object itself cannot be added into the model, but the definitions of the layers can be imported to create a specific object.

Layered objects may comprise single or multiple products, for example:

A single product layered object could be a composite insulation board with facings and core or a concrete slab.



A multiple product layered object could be a warm roof consisting of waterproof covering, underlay, insulation, vapour control layer and concrete slab.



The BIM platforms used by designers handle multiple layered objects differently. Some authoring systems will have the capability to model multiple product layered objects; others will not have this capability and the layers will have to be modelled individually.

Typically, layered objects will be delivered in a container file. This can host the layered object and variations of the layered object, and the designer can select as required. For example, the manufacturer of the composite insulation board described above will deliver all product variances in one container file.

1.1.3. Assembly

The BIM object may, where relevant, be part of a larger collection of objects that forms an assembly, including an assembly which represents the context in which an object is used.

Component and layered objects can be aggregated together to form an assembly, e.g. a room.

Assembly objects refer to separate objects which have been combined and managed as a group in the model or object library. The assembled group of objects may contain metadata solely for the group, may have additional metadata relating to the group, or just contain the metadata of the constituent objects.

As an example, an accessible toilet is an assembled group containing a toilet, handrails, cubical walls and a door. Each of these objects will have its own metadata, but the assembly itself could also have metadata giving the overall size or the standard that it complies with.

In some instances, when aggregated together to form an assembly, some component information may become irrelevant. For example, a door handle that comes as part of an overall door assembly.

Care must be taken when an assembly is made up of multiple objects where each material has performance criteria that may be unrelated to the assembly as a whole.

An object may be gathered into an assembly to aid understanding of the context in which a product can be used.

For example, a manufacturer's wall insulation BIM object may be shown within a generic wall build-up, even if the insulation manufacturer does not supply any other objects within the wall. The accompanying objects forming the wall assembly should have a minimum geometrical detail equivalent to a generic object.

Construction Operation Building information exchange (COBie), Industry Foundation Classes (IFC) and all BIM authoring tools offer the capability to group components into functional systems. The various methods used may be found in 'Building Information Modelling. The Digital Plan of Work & Assemblies' (March 2013 V7-1).

1.2. Object Type

1.2.1. Identification

The BIM object type shall be identifiable within the associated BIM authoring system, and assigned using the appropriate IfcElementType and PredefinedType from the BuildingSMART International IFC4 (Add2) schema (ISO 16739).

If an appropriate type does not exist, the following shall be used:

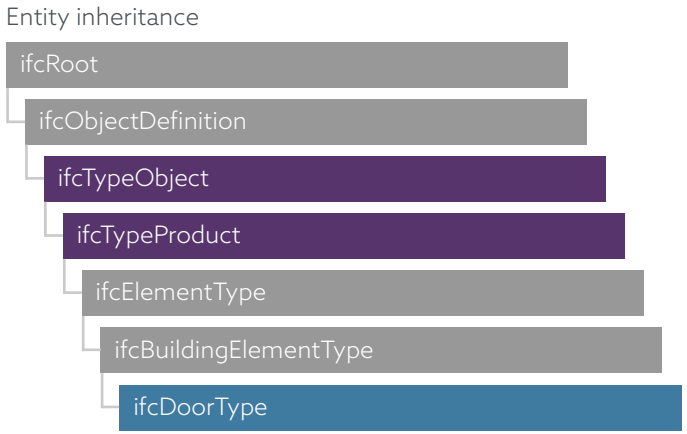
a) IfcBuildingElementProxyType for the IfcElementType.

b) 'USERDEFINED', in upper case, for the PredefinedType.

The term 'object type' is known in other publications as 'object class', 'template', 'style', 'functional type', 'library part' or 'subtype'. To exchange information about a building using common and understood rules, the IFC specification (developed and maintained by buildingSMART International as its 'data standard' and registered with ISO as ISO 16739) should be used.

The IfcElementType defines the specific information about a type that is common and shared by multiple object occurrences; this information is represented by a set of property set definitions. The type is further described through its PredefinedType, which can be identified through the associated enumerated Pset.

Example: IfcDoorType defines a particular style of doors which may be included in the model through single or multiple instances of IfcDoor. A door type defines the overall parameters of the door, and refers to the particular parameter of the lining and one (or several) panels through IfcDoorLiningProperties and IfcDoorPanelProperties.



Where the authoring system of a BIM Platform necessitates using an atypical authoring method (example: creating some stair elements without using the dedicated stair authoring tool), the IfcElementType should be selected by the elements' intended use, rather than by their authoring category.

Compliance check

Is the object appropriately assigned to an object class and mapped to the appropriate IfcElementType and PredefinedType?

✓	✗
Functional Type = door mapped to IfcDoorType. DOOR	Functional Type = door mapped to IfcWindowType
Functional Type = roof window mapped to IfcWindowType. SKYLIGHT	Functional Type = window mapped to IfcDoorType

If no element type exists for the object in question, IfcExportType should be completed with the value 'IfcBuildingElementProxyType', and IfcExportAs should be completed with 'USERDEFINED'.

Compliance check

If an element type does not exist, has the object been appropriately assigned to a proxy type?

✓	✗
IfcExportAs= IfcBuildingElementProxyType	IfcExportAs= IfcBuildingElementProxyType
IfcExportType = USERDEFINED	IfcExportType = DOOR

For further guidance on type selection, see IFC type selection document.

1.2.2. IFC Exchange

The BIM object should include all necessary IFC properties to allow complete export to IFC from the BIM platform.

Section 2: Information Requirements

This section defines the requirements for the information contained within a BIM object. The scope of this section includes general requirements such as property sets, properties and values, as well as COBie and IFC properties

2.1. General

2.1.1. Property assignment

The BIM object shall contain properties that are appropriately assigned as type or component. Common properties shall be assigned to type and not to component.

A type property is applicable to many occurrences of its use, while the value assigned to a component property only applies to a single occurrence. The term 'component' is sometimes replaced with 'instance'.

Compliance Check: unless the property is unique to the object instance, properties should be assigned as type when possible.

Example:

Configuration (doorset arrangement indicating number of door leaves and operation) = Type – single leaf, single action.

DoorNumber (project door number) = Component (instance) – (value completed in the project environment)

2.1.2. Data properties

The BIM object shall use information properties to represent aspects of construction products that are not modelled geometrically.

Information within the BIM object may not just be geometrical. For example, performance information such as G-Values, R-Values and U-Values would be represented as non-geometrical information. Other information such as workmanship may be in connected documents such as the specification.

2.1.3. Completed values

The BIM object shall have completed values where they are known, and shall not include unset or undefined values. This is to avoid any doubt of error if a value is unable to be completed within the set parameter. Where the information is unknown, not applicable or not available, a default value 'n/a' shall be used and NOT left blank. If the data type restricts the use of an alphanumeric value, the appropriate value to that property shall be used, e.g. '0' for numeric fields and '1900-12-31T23:59:59' for date fields.

Values associated with certain properties will be dependent upon the stage of the project. For example, the property 'InstallationDate' would not have a final value associated with it until the product had actually been installed. In the case of generic objects, properties such as 'Manufacturer' would be unknown and therefore a default value of 'n/a' is required ('not applicable' or 'not available'). This acts as an aide-memoire for information that may be completed later on in the project, often by a different person or organization.

Compliance check: a generic door component may leave the property value for 'Manufacturer' completed with a placeholder value of 'n/a', but properties with known values such as 'Width' should be completed with a value corresponding to the correct datatype.

2.1.4. Units of measurement

The BIM object shall use units of measurements that are appropriate to its type, intended use and specific domain. The BIM object:

a) Shall use the Système international d'unités (SI) protocols for dimensions and units generally.

b) Should use base unit symbols to BS ISO 80000-1.

NOTE: The only exceptions are where the construction industry has (without dispute) retained an alternative unit of measurement, e.g. bar as a unit of pressure, or where a specific unit has been required by an information schema such as COBie or IFC.

The BIM Object may make use of units relating to the object type. Example: a tank may measure storage capacity in L rather than m^3.

Metric units are taken from the International System of Units (SI), which is based on the international System of Quantities adopted by the General Conference on Weights and Measures (CGPM). Names and symbols, a series of prefixes and rules for use are included.

ISO 80000-1 provides general information and definitions concerning quantities, systems of quantities, units, quantity and unit symbols, and coherent unit systems, especially the International System of Quantities (ISQ) and the International System of Units (SI).

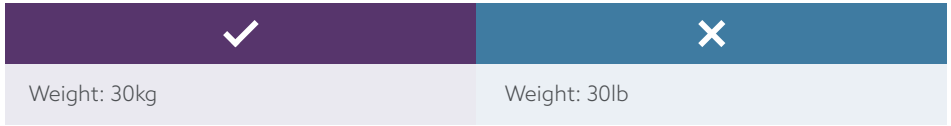
Compliance check

Are base unit symbols to ISO 80000-1?

✓		✗	
Name	Symbol	Name	Symbol
Metre	m	Metre	M
Kilogram	kg	Kilogram	KG
Kilowatt	kW	Kilowatt	KW

Compliance check

Is the unit metric?



2.1.5. Implied units

Information shall be provided for characteristic functional measures and quantities of service life planning to ISO 15686-4. If no measure is given then a unit should be implied by the property value type. In the case of materials and layered constructions, a unit volume or area should be assumed, e.g. m^3.

2.1.6. Hard-coded properties

The BIM object shall retain hard-coded properties within the specific BIM platform, which allow for tasks such as performance analysis and calculations of specific functionality. Each property should be completed with a value if known.

Hard coded properties are fixed data or properties in a BIM platform that cannot be altered. Where these allow for tasks such as performance analysis and calculations of a specific functionality, they should be completed with a value, if known and available.

Hard coded properties may already be assigned to the properties of a predefined category of object, and it may not be possible for them to be deleted.

2.1.7. Dimensional properties

The BIM object shall contain properties providing dimensional information limited to that necessary to define unambiguously the nominal model geometry of the construction product.

The intention of generic and manufacturer BIM objects is to identify a product rather than providing the level of detail required to fully manufacture or fabricate it. Dimensional information should be limited to define the nominal model geometry and imply the product, while at the same time providing sufficient information relating the operation and installation spatial requirements for that object.

2.2. Values

2.2.1. General

The BIM object property value shall be controlled so that completion of the value facilitates information accuracy. The BIM object shall include, where appropriate, pre-determined sizes, multiple sizes and configurations that are accurately represented and easily available for selection within the BIM platform.

BIM objects may have a number of variations and options from which the designer will be required to make a selection. How this is best achieved will be dependent upon the individual BIM platform.

Not all attributes require final values when the object is placed in a project model; the extent of completion should be defined by the project's requirements and its stage. Not all property values will require an absolute numerical value but, if they do not, they should ask for a 'maximum', 'minimum' or 'in the range of' value.

Ensuring that any dimensional properties are linked (parametric properties) to the geometrical representations that they relate to will reduce errors of having a different value in the property than that indicated by the geometric model. See clause 3.1.3 for further information.

A BIM object with multiple options may be developed as individual objects that are then embedded into the overall BIM object; for example, a window could be made up of frame, mullions and glass.

Where the BIM platform allows, a catalogue that will load multiple versions of a BIM object can be very efficient in presenting many possible product variations, or predefined types. This is typically done through a text-based file.

2.2.2. Product variants

The BIM object can represent product variants, using a property with a value comprising an alphanumeric or numerical single value, list value, range value, enumerated value and reference value or bounded value.

a) The BIM object property can be assigned a single value where a value has a single selection. The value shall be predetermined and completed where the value is available and known.

b) The BIM object property can be assigned a list value where several unique values of the same type are given in an ordered list, the order of which is significant, e.g. 200, 400, 600, 800.

a) BuildingSMART defines an IfcPropertySingleValue as 'a property object which has a single (numeric or descriptive) value assigned'.

Compliance check

Have the properties been completed with a single value?

✓		✗	
Property Name	Example Value	Property Name	Example Value
Description	Manufacturer 'A' door	Description	Manufacturer 'A', 'B' and 'C' door
PanelThickness	0.12	PanelThickness	0.12, 0.15, 0.18

c) The BIM object property can be assigned a range value where a value has an upper and lower limit (bound). The lowest bound shall be presented first, followed by the highest bound. Where the range uses positive and negative signs, the numbers are separated using 'to'; for all other situations, use a hyphen. If the value is not given, it indicates an open bound, e.g. OverallWidth 0.9–1.25 m.

Name	UpperBoundValue	LowerBoundValue	Unit
OverallHeight	1930	2300	-
OverallWidth	0.9	1.25	m
MaxHeight	20.0	<nil>	-
MaxWidth	<nil>	20	kg

d) The BIM object property can be assigned an enumerated value where a value has a choice of fixed values, selected from a defined list of enumerators. Individual items shall be separated from each other using a comma and a single space, e.g. a, b, c, d.

b) BuildingSMART defines a list value as 'a property that has several (numeric or descriptive) value assigned, these values are given by an ordered list'. Each value in the list is unique and all list members should be of the same type.

Compliance check

Have the properties been completed with suggested values forming a list?
Are the listed items separated from each other using a comma and space?

✓		✗	
Property Name	Example Value	Property Name	Example Value
HeatOutput	1.6kW, 1.75kW	HeatOutput	1.6 to 1.75kW
Style	Basalt, Bracken, Brindle, Buff	Style	Basalt; Bracken; Brindle; Buff

c) BuildingSMART defines a bounded value (range) as 'a property object which has a maximum of two (numeric or descriptive) values assigned, the first value specifying the upper bound and the second value specifying the lower bound'.

✓		✗	
Property Name	Example Value	Property Name	Example Value
HeatOutput	1.6 - 1.75 kW	Style	-50 - 25°C
TemperatureRange	-50 to +25°C		

d) BuildingSMART defines an enumerated value as 'a property object which has a value assigned which is chosen from an enumeration'.

Compliance check

Has the property been completed with a selected value from the list of enumerators? Are the items in the values separated from each other using a comma and space?

✓		✗	
Property Name	Example Value	Property Name	Example Value
DamperBlade ActionEnum	Parrallel, Opposed, Other, Unset	DamperBladeAction	Parrallel or Opposed or Other or Unset
DamperBladeAction	Parallel		

2.2.3. Property values

Unless otherwise restricted by property type, the BIM object property value shall:

a) Be assigned an alphanumeric data type to allow both numbers and characters to be entered.

b) Be separated from units by a space where the unit is expressed within the value, with the exception of degree Celsius, percentage and angular degree.

c) Include values that are consistently capitalized using sentence case without text formatting. Conjunctions, acronyms, model numbers and units of measurement shall adopt common practice.

d) Not end in a full stop.

a) When a property requires a mixture of both numbers and characters, such as when a number value has units indicated, an alphanumeric datatype must be used.

Compliance check

	✓		✗	
Property name	Datatype	Example Value	Datatype	Example Value
ModelNumber	Text	Powerglide 320	Number	Powerglide 320

Compliance check

✓		✗	
Property Name	Example Value	Property Name	Example Value
Output	10 kW	Length	100mm
Voltage	230 V	Output	10kW
Operating Temperature	70°C	Voltage	230V
RecycledContent	50%	Operating Temperature	70 °C
		RecycledContent	50 %

c) To maintain consistency in the presentation of information, property values should adopt the principles set out here.

Compliance check

Do the values have a consistent approach to capitalization and adopt title case? Has text formatting (for example, bold or italics) been omitted?

✓	✗
Brackets: 4 brackets and fixings	Brackets: 4 brackets And Fixings
Material: PVC-U	Material: UPVC
MinimumClearance: 220 mm clearance either side	MinimumClearance: 220 MM Clearance either side

d) To maintain consistency in the presentation of information, property values should not end in a full stop.

Compliance check

Is the property value free of full stops?

✓	✗
Grade: Highly vandal resistant	Grade: Highly vandal resistant.

2.2.4. Dependence

The BIM object property value can be expressed as a formula where the value is dependent upon other properties.

Formulae can be used to derive other pieces of information and populate other property values.

Compliance check

If a value is dependent upon other properties, has the property value been expressed as a formula?

Example: an object height should always be equal to the object width plus length.

✓		✗	
Property Name	Value	Property Name	Example Value
Height	= Width + Length	Height	1200
Width	500	Width	500
Length	700	Length	700

2.3. Property groups and usage

2.3.1. Property set presentation

The BIM object shall include properties that are organized so that they are easily viewed and retrieved, and consistently located within the BIM platform where possible.

Properties shall be grouped as follows:

Table 1: Property Groups and Usage

Property Group	Autodesk® Revit®	IFC, ArchiCAD, Vectorworks & AECOsim
IFC	IFC Parameters	Pset_
COBie	Other	COBie
BOS_General	General	BOS_General
<SpecificationSource>_Data	Data	<SpecificationSource>_Data

Note 1: When included, replace <SpecificationSource> with the name of the source of additional data properties. There can be multiple specification sources.

BIM platforms use different terms for similar concepts concerning groups, properties and property sets. The BIM Object Standard looks to follow the IFC usage of these terms; the IFC model differentiates between attributes that are directly attached to the object as attributes of the entity, and properties, grouped in a property set and assigned to the object by a relationship. The latter is the more flexible way to extend applicable properties.

IFC, Graphisoft® ArchiCAD®, Nemetschek® Vectorworks®, Bentley® AECOsim® and others support the display of properties in their property sets.

Autodesk® Revit® assigns properties to a display group, which determines how they are displayed in the user interface. These display group names are not user-editable, and thus are not a direct equivalent of property sets. Due to this restriction, property set naming and grouping will vary between Revit and other BIM platforms.

Properties which have been hard coded to a data group, and cannot be edited within the BIM platform, are exempt from property sorting requirements.

Property sets defined as minimum requirements by the BIM Object Standard (IFC, COBie and BOS_General) shall be grouped as laid out in Table 1.

User-defined property sets may be included to group additional properties as detailed in Section 2.8. These may be included under the <SpecificationSource>_Data groups. When included, <SpecificationSource> should be replaced in the property set name with the name of the data source. As a common example, if NBS specification properties are included in an object, these may be grouped under NBS_Data and sorted to the Data display group in Revit.

2.3.2. Occurrence

The BIM object shall include only one occurrence of a property.

An object should not have duplicate properties (for example, the same property name used more than once), and where possible it should not have properties that have different names for the same values.

Adding IFC4 FM Handover, COBie or some user-defined property sets to an object may duplicate some properties that are already included by the BIM platform. These could be hard coded properties, or properties required by some other process or function (such as analysis tools). If the BIM platform or add-on tools allow the properties to be mapped, either in the user interface or during the export process, then any duplicated properties that are required should be mapped to a single occurrence of that property.

2.3.3. Order of priority

The BIM object shall include a single property occurrence based upon the following order of selection where a property exists in multiple sources.

The BIM object should include a single property based upon the selection order outlined in Table 2. Duplicated properties can lead to inconsistencies in structured data. If properties appear in more than one set, say IFC and COBie, this clause establishes which property set should be used to include the property.

Hard coded properties are fixed data or properties in a BIM platform that cannot be altered. Hard coded properties may already be assigned to the properties of a predefined category of object and it may not be possible to delete them. As other software (such as performance analysis software) may rely on these hard coded properties upon export, these properties may remain in their original location.

Table 2: Order of priority

Selection Order	Property Set
1	Hard-coded
2	IFC
3	COBie
4	BOS_General
5	<SpecificationSource>_Data
6	USERDEFINED

Compliance check

Does the BIM object include a property that exists in multiple information sources? Has the property been selected from the highest ranking property set from the order of selection table?

Example: Property NominalLength appears in the COBie property set, and in the relevant IFC Pset.

✓	✗
NominalLength sorted to IFC property set.	NominalLength sorted to COBie property set.

2.3.4. Identical property information

Where properties have different names but the same definition and value requirement, their use shall be based upon the order of selection in clause 2.3.3. Only one property shall be included to avoid duplication of values.

Where there is identical property value information between a hard coded property and a required parameter, the hard coded property which does not conform to naming conventions should be mapped to a parameter with a correctly formatted name.

Compliance check

Does the BIM object only include one occurrence of a property and value?

	✓		✗	
Property name	Definition	Value	Definition	Value
ProductInformation	A valid URL hyperlink to further product information.	www.manu-facturer.com/datasheet	A valid URL hyperlink to further product information	NR 25
DataSheet			URL for the product datasheet	www.manu-facturer.com/datasheet

2.3.5. Precedence

The BIM object type property shall take precedence where a property exists with the same name at type and component level.

Where possible, it is best to avoid duplicating properties at different levels (i.e. type and instance) within the object structure.

2.4. Property naming

2.4.1. General

Property names shall be entered as PascalCase, and where a parent-child relationship occurs, the child shall be prefixed with the corresponding parent property so that they are sorted logically.

By prefixing the corresponding parent property, the information can be logically sorted.

Compliance check

Does the BIM object include property names entered as PascalCase (the first letter of each word being capitalized and with no spaces between each word) and prefixed with the corresponding parent property where a parent-child relationship occurs?

- SubFrame
- Material
- Fixings

✓	✗
SubFrameMaterial	MaterialSubFrame
SubFrameFixings	FixingsSubFrame

2.4.2. Boolean properties

Properties with values having Boolean (Yes/ No) data types shall be given a name which clearly implies that they require a Yes/ No value, e.g. HasHandle.

A Boolean datatype is one that can only provide two possible values, for example TRUE or FALSE. Some BIM platforms use a similar concept of YES or NO. Where the property requires a Boolean value, the property shall be named so that a TRUE or FALSE, or YES or NO value is required. For example, 'IsExternal' is an indication of whether the element is designed for use in the exterior (TRUE) or not (FALSE). If the value is TRUE then this implies that it is an external element and faces the outside of the building.

2.4.3. Units

Property names shall not include units.

2.5.1. IFC4 Common property sets

The BIM object may include IFC4 common property sets (Pset_xxxxCommon) that are relevant to the construction product and associated IfcElementType, where available.

An IfcElementType defines the specific information about a type and can be further represented by a set of property set definitions. For example, IfcBoilerType can be further defined by Pset_BoilerTypeCommon, which includes common attributes (properties) for boilers.

Example of expected IFC4 Common properties: Pset_BoilerTypeCommon

Property name	Property Type	Example Value
Reference	SingleValue (Identifier)	A1
Status	(Enumerated Value) NEW,EXISTING,DEMOLISH, TEMPORARY, OTHER,NOT KNOWN,UNSET	UNSET
PressureRating	SingleValue (Pressure Measure)	0
OperatingMode	(Enumerated Value) FIXED,TWOSTEP,MODULATING,OTHER, NOTKNOWN,UNSET	UNSET
HeatTransfer SurfaceArea	SingleValue (Area Unit)	0
NominalPartLoadRatio	BoundedValue (Range)	0.0, 0.0
WaterInletTemperature Range	BoundedValue(Real)	0.0, 0.0
WaterInletTemperature Range	BoundedValue(Temperature)	0
IsWaterStorageHeater	SingleValue (Boolean) TRUE / FALSE	FALSE
PartialLoadEfficiency Curves	ListValue (User Defined) 1 2 3	0
OutletTemperatureRange	BoundedValue (Range)	0.0, 0.0
NominalPartLoadRatio	BoundedValue (Range)	0
EnergySource	(Enumerated Value) COAL,COAL_PUL-VERIZED,ELECTRICITY, GAS,OIL,PRO-PANE,WOOD,WOOD_CHIP, WOOD_PELLET, WOOD_PULVERIZED,OTHER, NOTKNOWN,UNSET	UNSET

Compliance check

Does the object include relevant IFC common property sets for the occurrences of the associated IfcElementType where available?

✓	✗
Type: IfcDoorType	Type: IfcDoorType
Predefined Type: DOOR	Predefined Type: DOOR
Pset_DoorCommon	Pset_SlabCommon
Property Name	**Property Name**
Reference	Reference
Status	Status
FireRating	AcousticRating
AcousticRating	FireRating
SecurityRating	Combustible
DurabilityRating	SurfaceSpreadOfFlame
HygrothermalRating	ThermalTransmittance
WaterTightnessRating	IsExternal
MechanicalLoadRating	LoadBearing
WindLoadRating	Compartmentation
IsExternal	PitchAngle
Infiltration	
ThermalTransmittance	
GlazingAreaFraction	
HandicapAccessible	
FireExit	
HasDrive	
SelfClosing	
SmokeStop	

2.5.2. Proxy

The BIM object may include Pset_BuildingElementProxyCommon if no IFC common property set (Pset_xxxxCommon) exists for that object in IFC4.

When a particular property set is not available within the schema, a proxy can be used. The Pset_BuildingElementProxyCommon may be used in these cases, consisting of the following properties which are applicable to a wide range of object types.

Compliance check

For objects with no suitable IFC Pset, has Pset_BuildingElementProxyCommon been included?

Pset_BuildingElementProxyCommon	Example Value
Reference	n/a
Status	UNSET
FireRating	n/a
ThermalTransmittance	0
IsExternal	FALSE
LoadBearing	FALSE

2.5.3. IFC2x3

The BIM object can include additional information from Ifc2x3 (ISO/PAS 16739) in addition to IFC4 Add2.

Additional information from IFC2x3 may be included.

Exercise caution for the following reasons:

- Predefined Pset lists have been expanded. In IFC2x3, the only available predefined Pset for IFCBoilerType is Pset_BoilerTypeSteam; in IFC4, Pset_BoilerTypeWater has been added.
- Properties included in sets may have changed. In IFC2x3, NominalEfficiency and HeatOutput are in Pset_BoilerTypeCommon; in IFC4, these have been removed and added to Pset_BoilerTypeWater.
- In property data types may have changed. In IFC2x3 Pset_BoilerTypeCommon, NominalEfficiency and HeatOutput are IFCListValues; in IFC4 Pset_BoilerTypeWater, these are now IFCPropertyTableValues.

2.6. Facilities management properties

The aim of COBie is to capture data relating to manageable assets for the owner/ operators, with equipment and product assets being described and captured in the Type and Component. As such, the published mapping from the FM Handover MVD to the COBie spreadsheet systematically excludes component occurrences that represent the building structure and component occurrences that are not associated with a type.

COBie is limited in its use to facilities: the schema was not developed to address all construction projects and hence not all products. It is not particularly well suited to projects of a linear or horizontal nature, such as transport, water, power, maritime, etc.

It is recommended that COBie properties be included on objects, even if COBie is not a project/ client requirement. As it is not known what information may be required by facilities managers in the future, adopting this approach would mean that objects created now would not need to be modified later for use on a future project where COBie may be requirement.

2.6.1. Facilities management properties

The BIM object shall have properties to support the exchange of life cycle information about the rooms and equipment in a building, and to assist with the management of the asset.

These facilities management properties shall be provided by the COBie Model View Definition (MVD) properties derived from Chapter 4.2 of the United States National Building Information Model Standard (NBIMS-US) V3, or by the IFC4 Facilities Management-related property sets derived from BuildingSMART International IFC4 (Add2).

Properties shall be consistently selected from the chosen source.

The BIM object shall include facilities management properties. The required property sets may be either the IFC4 facilities management property sets detailed in Section 2.6.3 or COBie in Section 2.6.2 (Tables 3 and 4).

There are a number of ways in which information for a COBie or IFC4 FM deliverable can be produced. These include, but are not limited to, the direct creation of a COBie spreadsheet from the BIM platform. Objects may contain the relevant COBie properties. Alternatively, COBie information can be produced from an IFC file, using IFC to COBie translation tools and settings, based upon properties as defined by buildingSMART IFC2x3 Basic FM Handover View. Whichever method is chosen, the properties should be consistent and not contain a hybrid of the two.

A COBie deliverable can be extracted from IFC if the data is structured and exists within the file. Likewise, COBie information could also be pushed into an IFC file if the information is structured and exists within the file. The total COBie deliverable is provided by a range of companies and comes from many sources, and not all information can be populated from the BIM platform.

2.6.2. COBie properties

The BIM object may have the COBie Type and Component properties detailed in Tables 3 and 4 available for use, provided with the object either as an accompanying set of available properties or embedded in the object. The property shall be completed with the detailed property requirement.

NOTE 1: Where the recording of COBie data is a requirement, it is only necessary to include COBie data for managed assets.

Property name	Property requirements	Data type	Example
AccessibilityPerformance	An alphanumeric value representing the accessibility issue(s) which the product satisfies.	Alphanumeric	Automatic
AssetType	An alphanumeric default value of: 'Fixed' to indicate fixed equipment and products attached and integral to the function, e.g. heating, plumbing, elevators. 'Movable' to indicate standalone equipment and products, e.g. a chair, table, lamp.	Alphanumeric	Fixed
Category	A classification code, e.g. Uniclass2015. Complete the value with a single text string with the classification number, a colon and the classification name.	Alphanumeric	Pr_40_70_62_37: Hand driers
CodePerformance	An alphanumeric value representing the code compliance requirement(s) which the product satisfies.	Alphanumeric	Fully earthed
Color	An alphanumeric value representing the primary colour of the product.	Alphanumeric	White
Constituents	An alphanumeric value with details of the various parts of the product.	Alphanumeric	Electric motor

As per the requirements of clause 2.3.4, it is best practice to map relevant hard coded properties to the corresponding COBie properties, such as NominalLength and NominalHeight, etc.

The COBie component properties will generally be completed with their respective 'n/a' or '1900-12-31T:23:59:59' default values, as the values for these properties are not generally known until the handover stage of the project.

Property name	Property requirements	Data type	Example
Description	An alphanumeric value giving a concise description of the product represented by the BIM object. Manufacturer objects shall include factual information only and may include the manufacturer's trade and catalogue name.	Alphanumeric	Lightweight hand dryer
DurationUnit	The units used to record durations; typically, this is 'year'.	Alphanumeric	year
ExpectedLife	A numerical value representing the expected serviceable life of the product. The units are recorded by DurationUnit.	Numeric	10
Features	An alphanumeric value representing the primary features or other important characteristics relevant to the product specification.	Alphanumeric	Quiet operation, tamper-resistant locking screws
Finish	An alphanumeric value representing the characteristic primary finish of the product.	Alphanumeric	Matt
Grade	An alphanumeric value representing the standard grading(s) to which the product corresponds.	Alphanumeric	Class 1 appliance
Manufacturer	A valid email address for the organization responsible for supplying or manufacturing the product.	Alphanumeric	company@email.com
Material	An alphanumeric value representing the characteristic or primary material of the product.	Alphanumeric	Die-cast aluminium

Property name	Property requirements	Data type	Example
ModelNumber	An alphanumeric value representing the product, item or unit number assigned by the manufacturer of the product. This could be a part number, SKU, catalogue number or equivalent.	Alphanumeric	553
ModelReference	An alphanumeric value for the name of the manufactured item as used by the manufacturer.	Alphanumeric	Excel hand dryer
Name	A unique human-readable alphanumeric name that begins with the product type.	Alphanumeric	Hand dryer
NominalHeight	A numerical value of the nominal height (typically the vertical characteristic dimension of the product) in millimetres.	Numeric	240
NominalLength	A numerical value of the nominal length (typically the primary or larger of the two perpendicular horizontal dimensions of the product) in millimetres.	Numeric	310
NominalWidth	A numerical value of the nominal width (typically the secondary or smaller of the two perpendicular horizontal dimensions of the product) in millimetres.	Numeric	180
ReplacementCost	A numerical value representing the cost to replace the product in the project currency. If the project currency is not known, provide in local currency.	Numeric	300

Property name	Property requirements	Data type	Example
ReplacementCost	A numerical value representing the cost to replace the product in the project currency. If the project currency is not known, provide in local currency.	Numeric	300
Shape	An alphanumeric value representing the characteristic shape of the product.	Alphanumeric	Rectangular
Size	An alphanumeric value representing the characteristic size of the product, e.g. 50 litres.	Alphanumeric	310 x 240 x 180 mm
SustainabilityPerformance	An alphanumeric value describing the sustainability issue(s) which the product satisfies.	Alphanumeric	Low-energy
WarrantyDescription	An alphanumeric value providing a concise description of the warranty content and any exclusions.	Alphanumeric	On-site warranty and advanced replacement warranty
WarrantyDuration Labor	A numerical value representing the duration of the labour warranty. The units are recorded by WarrantyDuratio-nUnit.	Numeric	5
WarrantyDuration-Parts	A numerical value representing the duration of the parts' warranty. The units are recorded by WarrantyDuratio-nUnit.	Numeric	5
WarrantyDurationUnit	The units used to record warranty durations. Typically this is 'year'.	Alphanumeric	year
WarrantyGuarantor-Labor	A valid email address for the organization responsible for the labour warranty.	Alphanumeric	company@email.com
WarrantyGuarantor-Parts	A valid email address for the organization responsible for the parts' warranty.	Alphanumeric	company@email.com

Table 4: COBie Component Properties (for use in the project only – not by the manufacturer)

Property name	Property requirements	Data type	Example
AssetIdentifier	An alphanumeric default value, 'n/a'.	Alphanumeric	n/a
Barcode	An alphanumeric default value, 'n/a'.	Alphanumeric	n/a
InstallationDate	The default value '1900-12-31T23:59:59'.	Alphanumeric	1900-12-31T23:59:59
SerialNumber	An alphanumeric default value, 'n/a'.	Alphanumeric	n/a
TagNumber	An alphanumeric default value, 'n/a'.	Alphanumeric	n/a
WarrantyStartDate	The default value '1900-12-31T23:59:59'.	Alphanumeric	1900-12-31T23:59:59

2.6.3. IFC4 Facility management properties

The BIM object may have the IFC4 facility management properties available for use, provided either with the object as an accompanying set of available properties or embedded in the object. The property shall be completed with the detailed property requirement.

The properties shall be selected from the following IFC4 property sets:

a) Pset_ManufacturerTypeInformation.

b) Pset_ManufacturerOccurrence.

c) Pset_Warranty.

If the IFC4 FM properties have been selected as the chosen schema, Pset_ManufacturerTypeInformation and Pset_Warranty should be added as type properties, and Pset_ManufacturerOccurance should be added as instance property.

WarrantyStartDate: note that for IFC4, this property is at type level, differing from the COBie instance property above.

2.7. BOS_General

The BIM object shall include properties from the BOS_General property group to ensure a minimum level of information sufficient to identify a construction product and its use.

There may be multiple classification and specification properties where required.

BIM objects require sufficient information so that they can be identified. This will mean both human-readable information (such as descriptions, product numbers and classification information) and computer-readable information (such as Globally Unique Identifiers, GUIDs).

Table 5: General Properties

Property name	Property requirements	Data type	Example
Author	The name of the person, organization or library provider that authored the object.	Alphanumeric	Company
ManufacturerName	The name of the manufacturer of the product. Property may be omitted for generic objects.	Alphanumeric	Company
ManufacturerURL	A valid URL hyperlink to the manufacturer's website. Property may be omitted for generic objects.	Alphanumeric	www.company.
<Specification>Description	The appropriate specification system clause title may be included. When included, replace <Specification> with name of specification system, for example NBSDescription. Reference to multiple specification systems can be included.	Alphanumeric	Hand Dryer
<Specification>Reference	The appropriate specification system clause reference may be included. When included, replace <Specification> with name of specification system, for example NBSReference. Reference to multiple specification systems can be included.	Alphanumeric	54896

The General property set (Table 5) includes properties required for the identification of the type, such as name, classification and specification information.

The following properties: ProductInformation, ManufacturerURL, ManufacturerName are optional for generic objects.

Different jurisdictions and different projects may require the use of different classification systems. This standard recommends the inclusion of Uniclass2015 so that all objects from all countries/ territories have at least one common classification assigned to them.

More information on the Uniclass2015 tables and classification codes can be found here: https://uniclass.thenbs.com

Multiple classification or specification systems may be referenced by the BIM object. Each system should have a set of parameters named for the system chosen, rather than including the systems references as a list.

Example: to classify products to systems A and B, properties should be provided as follows: SystemACode, SystemBCode, SystemATitle, SystemBTitle, etc.

UK Classification Reference Guidance

BS 8541-1 states that one classification to a UK convention should be provided, and that preference may be given to classification conventions based on product and function, as it may be harder to assign classification conventions based on work sections.

BOS Specification properties

National BIM Library objects include classification information for the NBS Chorus specification system. To read more on NBS Chorus, visit https://www.thenbs.com/nbs-chorus.

UniclassCode: to be completed with an alphanumeric value of the appropriate NBS clause reference from https://uniclass.thenbs.com/. The clause reference shall be in the format AA_xx_yy_zz_nn, where AA is the table code, xx_yy_zz is the NBS section code and nn is the two digit NBS clause number.

BIM objects require sufficient information so that they can be identified. This will mean both human-readable information (such as descriptions, product numbers and classification information) and computer-readable information (such as Globally Unique Identifiers, GUIDs).

Property name	Property requirements	Data type	Example
ProductInformation	A valid URL hyperlink to further product information, such as technical documentation, installation guides, certificates, product catalogues or literature, and an alphanumeric value of a description of the location where the document can be found. Property may be omitted for generic objects.	Alphanumeric	www.company.com/HandDryer
Revision	For completion within the project environment.	Alphanumeric	n/a
<Classification>Code	The appropriate classification code. Replace <Classification> with name of classification system, for example Uniclass2015Code. Reference to multiple classifications systems can be included.	Alphanumeric	Pr_40_70_62_37
<Classification>Title	The appropriate classification title. Replace <Classification> with name of classification system, for example Uniclass2015Title. Reference to multiple classifications systems can be included.	Alphanumeric	Hand driers
<Classification> Version	The appropriate classification version. Replace <Classification> with name of classification system, for example Uniclass2015Version. Reference to multiple classifications systems can be included.	Alphanumeric	Products v1.1
Version	An indication of the sequence of the object publication.	Alphanumeric	1

UniclassTitle: to be completed with an alphanumeric value of the appropriate NBS clause title from https://uniclass.thenbs.com/. If the value is not known or not available, the property shall be completed with 'n/a'.

NBS Plugin Compliance check

Does the object include the 'UniclassCode' property?

Has the 'UniclassCode' property been completed with a reference in the format AA_xx-yy-zz_nn

Has the NBS clause reference been derived from https://uniclass.thenbs.com/?

✓	✗
UniclassCode: Ss_25_30_22_77	UniclassCode: 45-25-28/1234 Ss_25_30_22_7777

NBS Plugin Compliance check

Does the object include the 'UniclassTitle' property?

Has the 'UniclassTitle' property been completed with an NBS clause title?

Does the NBS clause title match https://uniclass.thenbs.com/.

✓	✗
UniclassTitle: Sliding doorset system	UniclassTitle: a sophisticated door system with unrivalled quality

2.8 BOS_Certification

The BIM object may include properties from the BOS_Certification property group. Multiple certification properties may be included.

Table 6: Certification Properties

Property name	Property requirements	Data type	Example
<Certification-Scheme>Code	The appropriate certification scheme may be included. When included, replace <CertificationScheme> with name of the Certification Scheme, for example BBA.	Alphanumeric	01/0234
<Certification-Scheme>Title	The appropriate certification scheme may be included. When included, replace <CertificationScheme> with name of the Certification Scheme, for example BBA.	Alphanumeric	Roofing

2.9 BOS_Environmental

The BIM object may include properties from the BOS_Environmental property group. Multiple environmental properties may be included.

Table 7: Environmental Properties

Property name	Property requirements	Data type	Example
<EnvironmentalScheme>Code	The appropriate environmental scheme may be included. When included, replace <EnvironmentalScheme> with name of the Environmental Scheme, for example BRE Green Guide.	Alphanumeric	01/0234
<EnvironmetalScheme>Title	The appropriate certification scheme may be included. When included, replace <EnvironmentalScheme> with name of the Environmental Scheme, for example BRE Green Guide.	Alphanumeric	Roofing

2.10. Supplementary properties

2.10.1 Additional property sources

The BIM object may include supplementary properties from other sources, including:

Characteristic selection and performance properties to BS ISO 15686-4.

IFC property sets relevant to the PredefinedType, where applicable.

Properties derived from the relevant specification system clause and completed with the appropriate property name and value.

Properties derived from the construction product manufacturer.

User-defined properties. Properties that do not fall under the groupings outlined in clause 2.3 shall be clearly named to aid understanding (see section 5, Metadata requirements).

Properties to assess economic and environmental impacts of a product.

a) ISO 15686-4 provides information and guidance on the use of standards for information exchange for service life planning of buildings, constructed assets and their components, as well as the required supporting data.

b) Section 2.5 outlines the inclusion of the relevant IFC4 common property sets (Pset_xxxxCommon). However, there may be additional relevant Psets related to the PredefinedType which may be included.

Example: for a layered object defining a floor covering, Pset_CoveringFlooring may also be added in addition to the common property set of Pset_CoveringCommon.

For component sanitary fixtures, the common Pset of Pset_SanitaryTerminalTypeCommon should be applied. However, depending on the sanitary terminal PredefinedType, a number of additional Psets may apply.

Example: in addition to Pset_SanitaryTerminalTypeCommon, bath objects may also include Pset_SanitaryTerminalTypeBath, bidets may include Pset_SanitaryTerminalTypeBidet, and so on.

c) Performance information and other information such as workmanship, for example, may be in connected documents such as the specification.

UK Guidance

NBS clauses are created by in-house technical authors, who are continually researching and updating content to provide the best clause options and technical guidance to specifiers. NBS clause details can be found at https://www.thenbs.com/our-tools/uniclass/API.

For example, Pr_40_70_62_37, Hand dryers:

Property	Definition	Value
Form	Form of the hand dryer	High velocity air through HEPA filter
Operation	Method of operation	Automatic
ElectricalSupply PowerRating	Power rating, measured in [kW].	2.0 kW
BodyEnclosure	Body enclosure material	Plastics
IngressProtection Minimum	Enclosure ingress rating to BS EN 60529	IPX5
NoiseLevel At1mMaximum	Maximum noise level at 1m, measured in [dB (A)]	60 dB (A)

d) Manufacturers may have product properties which have not already been covered within the General, IFC or COBie property sets recorded within the object.

Compliance check

Does the object include additional properties derived from the manufacturer?

Have the manufacturer's properties been suitably completed?

Note that the incorrect example should not include properties where the values are not known.

	✓		✗	
Property name	Definition	Value	Definition	Value
ApertureAirSpeed	Speed (mph)	430 mph	Speed (kph)	430 kph
AutomaticShutOffTime	Time(s) to shutoff	30s	Time(s) to shutoff	1 min
BacteriaReductionRate	Rate (%)	99.9%	Rate (%)	User to populate
HandDryingTime	Approximate hand drying time(s)	10s	Approximate hand drying time(s)	1 min
MinimumClearance	Clearance dimension (mm)	220 mm clearance either side and 30 mm above machine	Clearance dimension (mm)	Not known
MotorRotation Frequency	Revolutions per minute (rpm)	90000 rpm	Revolutions per minute (rpm)	Not known

e) User-defined properties may be added to user-defined property sets, any additional properties shall be named using PascalCase and use the conventions set out in Clause 2.4.1. Any user-defined properties are subject to the property set grouping and duplication constraints set out by Section 2.3.

f) Additional properties may be added to the BIM object relating to economic and environmental impact of the product. Example: a property detailing the VOC emission of a covering type product may be included.

Section 3: Geometry Requirements

This section defines the minimum geometry requirements of the BIM object to describe the physical form of the construction product.

A number of factors affect how detailed the geometry is, such as the type of object and how it is intended to be used, together with the practicalities of working with contemporary BIM platforms.

The scope of this section includes general requirements, such as level of geometric detail. In addition, this section defines dimensional and measurement requirements.

Geometric information is divided into:

- General geometry data.
- Shape data.
- Symbolic data.
- Space data.
- Surface/ material data.
- Connection data.

The object should be modelled with geometrical detail that will not compromise the BIM model when used in practice. To avoid over-modelling, follow the principle of not modelling elements of a product that will not be seen.

The intention of a BIM object is to imply a product rather than to manufacture or fabricate the object, or to produce an exact photorealistic representation of it.

Where a manufacturer states restrictions on certain criteria of a product, these should, if appropriate, be built into the object. An example of this would be if a door manufacturer has a limitation on the size of the door that it can produce; this limitation should be built into the object where the BIM platform will allow.

3.1. General

1.3.1. Modelling scale

The BIM object shall have geometry produced at the scale 1:1.

Objects should be created at a scale of 1:1 using real world coordinates. Many problems that arise during construction can be traced to errors and ambiguities of scaling dimensions, particularly when information is entered incorrectly. Dimensions added as text that is unrelated to an underlying coordinate system can also cause errors.

3.1.2. Insertion point

The BIM object shall include an insertion point that is suitable for its intended use.

An insertion point is the point at which the object is placed into the project environment (usually indicated by the cursor position). Depending on the object type and required behaviour, the insertion point may vary. For example: for doors and windows, the insertion point will be central so the content parametrically expands outwards. Ensure that the default insertion point used when creating the object is appropriate for the object and is consistent for similar types of objects.

If the BIM platform allows for a different object origin to the insertion point, it is recommended to model objects with an origin of 0,0,0.

3.1.3. Parametric function

The BIM object may, where supported by the BIM platform and where appropriate:

a) Have parametric geometry that is locked and aligned to appropriate reference elements such as planes, lines, levels and points.

b) Include dimensions and labels that are constrained to reference planes.

a) Geometry should be linked to reference plane or points, where possible, to allow for basic parametric function.

It is best practice to build objects that utilize only native BIM elements in their creation. Leaving DWG, DWF, non-BIM 3D content (e.g. Autodesk® 3DS® or Trimble® SketchUp® objects) or other non-BIM content within the object will result in larger file sizes and/ or poorer performing objects.

b) Dimensions should be derived automatically using associative dimensioning functions within the BIM platform. By entering dimension values as 'text', there will be no direct relationship with the geometry as the dimensions are purely geometrical characters, and may cause coordination errors if text values are changed without the corresponding geometry changing as well.

3.1.4. Modelling units

The BIM object shall use metric geometry with units of millimetres, unless the local construction industry has (without dispute) retained an alternative unit of measurement.

3.1.5. Actual thickness

Layered BIM objects shall represent the actual thickness of a layer unless unsupported by the BIM platform, in which case the minimum thickness supported by the BIM platform shall be used.

3.2. Geometric detail

The term 'geometrical detail' refers to the extent of geometric/ shape/ visual detail included in a BIM object. The term is synonymous with geometrical 'level of detail'.

The geometrical content contained within a BIM object allows architecture and engineering deliverables to be visualized or documented. The object should have appropriate geometrical detail and not include more detail than is required or is useful, or that will compromise the BIM when used in practice.

In some instances, 3D geometry may not be required or appropriate. For example, when modelling a metal window: the outer profile of the frame will be modelled but not the intricate internal framing members; these may be represented using 2D line work incorporated into the object. This logic also applies to geometry that will not be visible, or elements such as screws or nails, which are not to an appropriate scale to be useful as modelled geometry.

The geometrical detail contained within an object may depend upon the construction discipline creating and using the object. Objects such as pipes and ducts may only need to be characterized by extent (such as a bounding box) and key connectivity. The amount of information included (or perceived to be included) in a particular type of model or drawing will determine how it might be used by others, and care should be taken that this is not beyond its intended use. For example, an early stage model that shows all pipe and duct sizes may imply that the engineering calculations have been progressed to a stage to support those conclusions, when in fact the modeller has simply selected detailed objects from a library as an indication of the eventual design. The Level of Information assigned to the object in the project environment will determine at which level that information will be relied upon.

3.2.1. Geometric extent

The geometrical detail of an object shall be appropriate for its intended use and informational purpose. The geometrical detail of an object shall represent the extent of the object and its connectivity. Objects can be represented by a 3D bounding box to show location, size and spatial relationship in the model, but preferably be geometrically sufficient to recognize the object and allocated space without containing excessive geometrical detail.

As it is not known at which stage of a project's life cycle a library object will be used, a more generalized approach to required level of detail has been taken in this standard.

- Generic objects should be geometrically broadly similar to the AIA level of development 200–350.
- Manufacturer objects should be geometrically broadly similar to the AIA level of development 350.
- Project objects should be geometrically broadly similar to the AIA level of development 200–400.

3.2.2. Dimensions

Generic objects shall include nominal or expected dimensions where actual dimensions are unknown. Manufacturer objects shall include accurate overall dimensions and any further dimensions necessary for the object to fulfil its intended purpose.

A generic object should have nominal values (synonyms for nominal are 'typical', 'average' or 'expected'). A manufacturer object or project object, on the other hand, should contain actual dimensions that are representative of physical and functional characteristics of obtainable products.

While dimensions are generally a drafting issue, their inclusion in metadata provides key information, for example on specification and costing. When they are added, you should ensure that they are accurate and necessary. Where possible, dimensions should be parametrically linked to the object geometry.

3.3 Shape data

3.3.1. Essential geometry

The BIM object shall include:

a) Geometric representation of the space defined by the construction product's external boundary.

b) Geometry with a defined purpose.

c) Essential openings and geometric details, from which meaningful information can be gained.

Geometric representation is also referred to as product shape. Avoid including excessive detail whenever possible. It is best practice to follow the principle of not modelling elements of a product that will not be seen.

If modelling a door, for example, essential openings could be considered to be the main structural feature. Modelling details such as architraves and mouldings will add to the visual effect, but their structural value may be limited.

3.3.2. Fixed geometry

The BIM object shall have fixed geometry where the construction product is not intended to be modifiable, has a fixed form or is available in one size and shape only.

An object that is only available in one size (a WC, for example) should be presented as a fixed form to reflect the real world selection and availability of the product.

3.4 Symbolic data

3.4.1. Displaying objects

To allow coherent viewing of BIM objects, the following shall be included:

a) A means of displaying a geometrical convention (a representation, a simplified representation or a symbol) at scales 1:20, 1:50 and 1:100. Use an appropriate geometrical convention for the product and scale.

b) Default lines, line types, hatching and fill patterns, as appropriate to the BIM authoring system and conforming to local industry practice, to distinguish between geometric features such as depth and product parts.

a) A convention is an accepted way of drawing an item which may have the nature of a representation, a simplified representation or a symbol.

A representation is a scale view of an object, often also referred to as visibility or display. The terms 'Low/symbolic/simple/Course, Medium, High/detailed/fine/ realistic' are often used as a substitute for 1:100, 1:50 and 1:20.

Ensure that objects support 2D detail at 1:100 as a minimum. If objects only support larger 2D scales (e.g. 1:20) then any 1:100 views will be swamped with detail.

A simplified representation can reduce modelling authoring time, and is most appropriate when a limited indication of the features of an object is required.

b) Lines, hatching, and fills are used to improve the user's understanding and visualization of the object in 2D and 3D. They also allow the object developer to differentiate different components that may make up the object.

It is preferable to use 'out-of-the-box' fill or hatching patterns provided by the BIM platform being used. This avoids having multiple similar/ identical patterns with different names within the model.

The term line type is also synonymous with line pattern.

3.4.2. Supplementary symbolic data

The BIM object may include the following:

a) Information devices or supplementary geometry to show abstract items and convey geometric information that would not otherwise be modelled, such as directional arrows and opening directions.

b) 2D lines, where required, to convey relevant geometric details that are not otherwise modelled in 3D.

A symbol can be used where the size is not significant and a non-realistic indication of the object is appropriate. The symbol size and shape do not necessarily relate to the size and shape of the object, or to the scale representation. Regard should be given to the symbol's geometrical detail, its intended representative scale and plotted output.

a) Geometric shapes for information devices are limited, and therefore could have more than one meaning. A geometric shape for an information device should not be used if its meaning is not determined by context and experience; for example, a window opening direction or a flow direction arrow.

3.5. Space data

3.5.1. Operation and maintenance zones

The BIM object may include 2D and 3D space data such as:

a) Minimum operation space.

b) Access space.

c) Placement and transportation space.

d) Installation space.

e) Detection zone space.

A description of a product's shape alone is not sufficient to check whether it is correctly installed. Products and equipment may require surrounding operation space or additional space requirements for transportation, installation and assembly.

a) Minimum operation space (clearance zones): clear area required for the product to correctly function, including circulation and opening of doors, hatches, etc.

b) Access space: that required for maintenance and operation of the product. Maintenance includes, but is not limited to, cleaning, servicing, repairing and replacing parts of the asset.

c) Placement and transportation space: manoeuvring space for the largest single subassembly into which the product can be broken down, to allow ingress to and egress from its place of installation in the built asset.

d) Installation space: that required for on-site assembly, installation or de-installation of the product.

e) Detection zone space: that required for motion detection, functional coverage and sensor/ detector range.

Zones should be modelled as distinct from the object geometry. Using a different material for the clearance space or using different geometry definitions ensures that these spaces can be identified digitally as separate to the core object.

3.6. Surface and material data

3.6.1. Material appearance

The BIM object may include colours, hatching, fill patterns or texture image file to an appropriate scale to reflect the construction product material and appearance in the relevant geometrical view, e.g. elevation, section, isometric and animation views.

3.6.2. Generic object colour

Generic objects may use representative colours for the construction product, or white if it exists in a variety of colours.

3.6.3. Control and selection

The BIM object shall provide individual control and selection of textures and colours for a material's constituent parts where functionally possible within the BIM platform.

3.6.4. Default materials

The BIM object may include default materials provided by the BIM platform.

Section 4: Functional Requirements

This section describes the functional requirements that can be embedded within the BIM object to represent behavioural characteristics, constraints and connectivity.

4.1 General

4.1.1. Object behaviour

The BIM object shall behave in an appropriate manner that reflects its relationship with associated objects within the BIM platform.

An object shall reflect its real world relationship with associated objects, i.e. a door or a window will generally be related to a wall.

4.1.2. Performance

The BIM object functional behaviour shall not compromise the performance of the project model in which it is placed.

While object functionality can greatly aid the designer, this should not be to the detriment of the performance of the model when used within the project environment.

When creating BIM objects, the level of parametric behaviour required should be carefully considered. The objects should include parametric behaviour which allows for the required variations to the object; however, when the level of parametric behaviour exceeds the level of functionality required, it may become difficult to use or have a detrimental effect on project performance.

4.1.3. Reliance

The BIM object shall be configured so that its use is not reliant upon a host object, unless placement on a host is a specific requirement of the construction product.

Unless a specific host is required for object functionality, the object should be built to allow for flexibility in placement. Careful consideration must be given to the use of a host, as this could potentially limit the object's use in the project environment.

For example, a wall-based light fixture may need to also be placed on a column; the method of object modelling should reflect the intended use.

4.1.4. Ease of use

The BIM object shall be modelled so that its behaviour is easily controlled.

Object variations or options should be modelled and categorized within the BIM platform to enable their visibility to be controlled easily.

Where clearance zones indicating space requirements for accessibility or specific activities such as maintenance access have been included, they should be modelled as a volume and categorized appropriately, with relevant controls to enable them to be hidden or revealed as required. These parameters should be named consistently to allow functionality to be developed to show all/ hide all in a particular geometrical view.

4.1.5. Constraints

The BIM object may include constraints that limit selection criteria to those variations or accessories that are available in the construction product. Constraints shall not have a detrimental effect or confuse or limit the object's use.

Constraints are useful in that they can limit selection criteria to those variations that are possible and available in the product. Where a manufacturer states restrictions to certain criteria of the proprietary product then these should, if appropriate, be built into the object. An example of this would be if a door manufacturer has a limitation on the size of the door that they can produce; this should be built into the object where the BIM platform allows.

A constraint can be a 'geometric constraint', whereby geometric properties are limited and controlled, e.g. a dimension can be constrained by fixed length or range, or two lines can be constrained to be parallel. A constraint can also be an 'information constraint', whereby non-geometrical properties are limited, e.g. a product value can only be 'red'.

4.1.6. Associated objects

The BIM object shall be modelled so that it can be associated and connected with other objects where the association is appropriate to the project model and its analysis.

Some objects require connections or associations for proper function or analysis within the project model. A WC object with connections to services greatly aids the designer when it comes to analysis.

Section 5: Metadata requirements

This section defines metadata requirements for BIM objects. The scope of this section includes naming conventions for files, objects, properties, materials, values and images.

5.1. Naming conventions

5.1.1. Spelling

The BIM object shall use spellings that respect the approach taken by the parent resource, e.g. NBS uses the Oxford English Dictionary (OED) as the default spelling guide, whereas COBie and IFC use North American English.

A consistent approach to spelling is important when it comes to scheduling of information in a consistent manner.

Compliance check

Does the property retain the default spelling?

✓	✗
Color	Colour
WarrantyDurationLabor	WarrantyDurationLabour

5.1.2. Composition

Names **shall** be composed of alphanumeric characters without text formatting (e.g. a-z, A-Z, 0-9) and limited to a maximum of 75 characters. The naming fields shall use the underscore character (_) as a delimiter and the dash character (-) within phrases. Information within each field is to be PascalCase (capitalized first letters for words and no spaces).

No spaces or other punctuation shall be used.

Naming conventions should be intuitive so that information can be found and retrieved. Spaces and punctuation are not helpful in the digital era, and the use of special characters may mean different things and commands in in different software packages. A big difference from traditional CAD is that naming is visible from within the object and the project model. This offers the ability to provide search functionally and interactions with other databases.

Compliance check

Does the BIM object property name comprise A–Z, a–z, 0–9 characters?

✓	✗
ExternalWindow_ SkylightType1_600x900mm	External.Window_ Skylight(Type1)_600x900mm

5.1.3. Consistent naming

The BIM object shall include properties and values that are consistently and uniquely named.

It is important that the BIM object and filename are unique, not only to avoid duplication of information but also to aid the export of information and its interpretation.

5.1.4. Abbreviations

Where the BIM platform has filename character limitations, the values within the fields can be abbreviated. An abbreviation can be created using no more than seven characters, and uppercase lettering without full stops and spaces. The same abbreviation shall be used for its singular or plural contexts.

Values should avoid unnecessary abbreviations as they can be interpreted in a number of ways, potentially giving rise to errors. However, due to character limitations within certain BIM platforms, abbreviations may be required. To aid readability, characters should have capital letters at the start of each abbreviation.

Abbreviations should be common to relevant local industry standards. BIP 2207 Building information management. A standard framework and guide to BS 1192, Appendix G gives examples of commonly used abbreviations.

Compliance check

Are abbreviations seven characters long or less? Are they capitalized?

✓		✗	
Abbreviation	**Definition**	**Abbreviation**	**Definition**
Brk	Brick	Bed	Definition
Curtn	Curtain	Br	Bed
Shtng	Sheeting	Extpolne	Bar
SIPs	StructurallyInsulated Panels		
Thrmstc	Thermostatic		

5.1.5. Naming fields

BIM objects, materials and associated images shall be composed of the naming fields defined in Table 6. See clauses 5.2.1, 5.4.1 and 5.5.1 for the composition of each name type.

Table 8: Naming Fields

Type	Description	Example
Originator	Used to convey the object provider by a 3–6 character code. Where an object is provided through an object library but developed by another party, include a code to convey the library provider.	NSWPH
Source	Used to identify the library object manufacturer. The manufacturer name shall not be abbreviated. For a generic object, this field may be omitted.	BettaWindows
Type	Used to identify the object type.	Window
Material	Used to identify the material type.	Plastic
Subtype/ Product Code	Used to convey additional information to further define the construction product, such as the product range. The manufacturer product range shall not be abbreviated. This field can also be used to identify the predefined (Sub) type.	Skylight
Differentiator	Used to convey additional information required to adequately identify the object, or not otherwise captured in the attribute data.	600x900mm
Image type	Used to convey the image type, e.g. bump, cut-out, render.	Bump

5.2 File and BIM object naming

5.2.1. Files and object name composition

The file and BIM object names shall be composed of the fields defined in Table 6, in the following arrangement:

<Originator>_<Source>_<Type>_<Subtype/Product code>_<Differentiator1>

NOTE 1: The differentiator field is optional and may be included as needed.

It is important that the object name is unique in the project, not only to avoid duplication of information but also to aid the export of information and its interpretation.

The field <differentiator> is optional for all objects. The <Source> field may be omitted for generic objects.

Compliance check

Has the naming structure of <Originator>_<Source>_<Type>_<Subtype/Product code>_<Differentiator> been respected?

✓	✗
ABC_WindowsLtd_Window_ Casement_600x900mm	CasementWindow_600x900m

5.3. Naming of individual layers within a multi-layered object

5.3.1. Layer naming

A multi-layered BIM object shall include individual layers that are named to the requirements of clause 5.2.

5.4 Naming of materials within the BIM platform

5.4.1. Name competition

The material name shall be composed of the fields defined in Table 6, in the following arrangement:

<Originator>_<Source>_<Material>_<Subtype1>_<Differentiator1>

NOTE 1: The subtype and differentiator fields are optional and may be included as needed.

5.4.2. Suffix

Objects in Autodesk® Revit® format shall include properties for material objects that are named with the suffix '_mtrl'.

It is important that the material name is unique in the project, not only to avoid duplication of information but also to aid the export of information and its interpretation. The field <differentiator> is optional for all materials. The <Source> field may be omitted for generic materials.

Compliance check

Has the naming structure of <Originator>_<Source>_<Material>_<Subtype/Product code>_<Differentiator> been respected?

✓	✗
ABC_CompanyA_Plastic_White_Matte	White Plastic

5.5 Naming of image files for materials

5.1. Name competition

The following naming convention shall be composed of the fields defined in Table 6, in the following arrangement:

<Originator>_<Source>_<Material>_<SubType>_<Differentiator1>_<ImageType>

NOTE 1: The subtype and differentiator fields are optional and may be included as needed.

Aligning the material image and the material name will aid use. The file extension (i.e. .jpg, .bmp, etc.) will indicate that the file is an image.

Compliance check

Has the naming structure of <Originator>_<Source>_<Material>_<Subtype/Product code>_<Differentiator>_<ImageType> been respected?

✓	✗
ABC_CompanyA_Plastic_White_Matte_Bump.jpg	White Plastic Bump Map

5.2. Image file format

The material image files shall be in bitmap (bmp) or jpeg (jpg) format.

6. Image tiling

6.1. Image shape

Where the material image file is to be repeated, it shall either be square or rectangular in shape to allow the image to be repeated and tiled with no overlaps or gaps.

6.2. Image quality

The material image file shall meet the minimum requirements:

a) 512 x 512 pixels for square images.

b) 512 pixels on its longest side for rectangular images.

c) 150 dpi.

IFC document

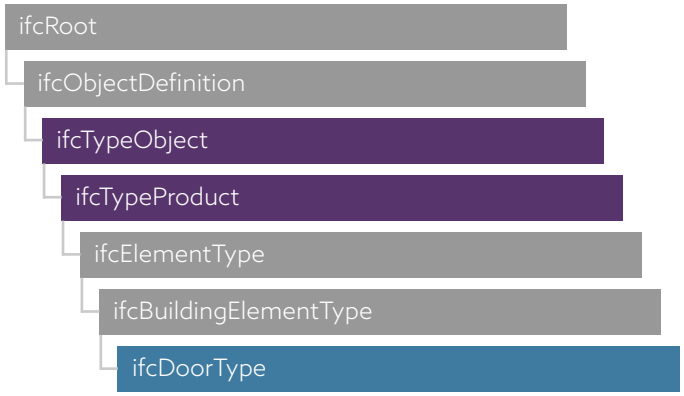
Selecting the IfcElementType and PredefinedType:
To select the IfcElementType, browse the list of entities on the IFC4 Add2 buildingSMART website, found here: http://www.buildingsmart-tech.org/ifc/IFC4/Add2/html/.

As an example, IfcCoveringType may be selected for a wall cladding. See definitions here: http://www.buildingsmart-tech.org/ifc/IFC4/Add2/html/schema/ifcsharedbldgelements/lexical/ifccoveringtype.htm.

Check the inheritance diagram to ensure that the entity is being defined at the required level of IfcElementType.

Inherited definitions from supertypes

Entity inheritance



Many object types have specific enumerations, which list the options available for the PredefinedType. If the enumerated list is available, these will be defined under 'Attribute definitions'. Click the IfcXXXXTypeEnum link to open the list.

Attribute definitions

#	Attribute	Type	Description	G
10	PredefinedType	ifcCoveringTypeEnum	Predefined types to define the particular type of the covering. There may be property set definitions available for each predefined type	X

Select the appropriate PredefinedType from the associated enumerated list: http://www.buildingsmart-tech.org/ifc/IFC4/Add2/html/schema/ifcsharedbldgelements/lexical/ifccoveringtypeenum.htm.

Enumeration definition

Constant	Description
CEILING	The covering is used to represent a ceiling.
FLOORING	The covering is used to represent a flooring.
CLADDING	The covering is used to represent a cladding.
ROOFING	The covering is used to represent a roof covering.
MOLDING	The covering is used to represent a molding being a strip of material to cover the transition of surfaces (often between wall cladding and ceiling)
SKIRTINGBOARD	The covering is used to represent a skirting board being a strip of material to cover the transition between the wall cladding and the flooring
INSULATION	The covering is used to insulate an element for thermal or acoustic purposes
MEMBRANE	An impervious layer that could be used for e.g. roof covering (below tiling - that may be known as sarking etc.) or as a damp proof course membrane
SLEEVING	The covering is used to isolate a distribution element from a space in which it is contained
WRAPPING	The covering is used for wrapping particularly of distribution elements using tape.
USERDEFINED	User defined type of covering.
NOTDEFINED	Undefined type of covering.

References

The following documents have influenced the development of this standard.

BS EN ISO 19650-1:2018:	Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Concepts and principles.
BS EN ISO 19650-1:2018:	Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Delivery phase of the assets.
PAS 1192-3:2014:	Specification for information management for the operational phase of assets using building information modelling.
BS 8541-1:2012:	Library objects for architecture, engineering and construction. Identification and classification. Code of practice.
BS 8541-2:2011:	Library objects for architecture, engineering and construction. Recommended 2D symbols of building elements for use in building information modelling.
BS 8541-3:2012:	Library objects for architecture, engineering and construction. Shape and measurement. Code of practice.
BS 8541-4:2012:	Library objects for architecture, engineering and construction. Attributes for specification and assessment. Code of practice.
BS EN ISO 80000-1:2013:	Quantities and units. General.
BS ISO 15686-6:	Buildings and constructed assets. Service life planning. Procedures for considering environmental impacts.
BS ISO 16739:2013:	Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries.
ISO/PAS 16739:2005:	Industry Foundation Classes, Release 2x, Platform Specification (IFC2x Platform).
BS ISO 15686-4:2014:	Building Construction. Service life planning. Service life planning using Building Information Modelling.
Building Information Management	A Standard Framework and Guide to BS 1192. Mervyn Richards, 2010.

Terms & definitions

Terms and definitions used throughout the NBS BIM Object Standard are generally as defined in BS EN ISO19650-2 and PAS 1192-3. In addition, the following apply:

Assembly A collection of objects that forms a system.

BIM platform Application that is usually used in design for generating data for multiple uses. Examples include Autodesk® Revit®, Bentley AECOsim, Graphisoft ArchiCAD, Nemetscheck Vectorworks and Tekla Structures.

COBie (Construction Operation Building information exchange) A subset of BS ISO 16739, IFC-documented as a BuildingSMART model view definition (MVD), which includes operational information. The definition of COBie is maintained by BuildingSMART Alliance and BuildingSMART UKI. .See also FM Basic Handover Model View Definition (MVD)

Component object An individual object that has unique geometry and does not rely on any other objects to be understood. It carries information about its identity, appearance, performance and usage. Can also carry behavioural information. The object has unique geometry ranging from simple to highly complex.

A component may contain a number of variants in its parameters; however, any variation to the geometry of a component constitutes a new object. For example, a door, chair or light fitting. Note: A component object:

- Can be aggregated together with construction material objects to form an assembly, e.g. a room.
- Is an individual building element that can be reused. For example, doors, stair cores, furniture and internal room layouts, facade panels.

Component objects are typically inserted and moved/ rotated into the required position.

The term 'component' is sometimes replaced with 'instance', 'occurrence' or 'element'.

Components Specific instances of each type that may require management such as inspection, maintenance, service or replacement during 'in-use' phase.

Constraint Can be:

- A 'geometric constraint' whereby geometric properties are limited and controlled, e.g. a dimension can be constrained by fixed length or by range, or two lines can be constrained to be parallel.
- An 'information constraint' whereby non-geometrical properties are limited, e.g. product value can only be 'blue'.

IFC: Restriction for a specified reason.

Construction entity (ISO 12006:2)	Consists of elements defined by technical function, form and/or position such as walls and roofs, ventilation and electrical power supply. Construction entities are the basic units of the built environment and together form, e.g. buildings, landscape, roads and dams. See also Object.
Construction information (ISO 12006-2)	Information resource of interest in a construction process. Includes general reference information as well as project information, e.g. BIM, scale models, drawings, diagrams, calculations, specifications.
Construction object (ISO 12006-2)	Object of interest in the context of a construction process. See also Object.
Construction product	ISO 12006-2: A product intended to be used as a construction resource. IFC defines a product as a physical object (manufactured, supplied or created) for incorporating into a project. It may be physically existing or tangible. A product may be defined by shape representations and have a location in the coordinate space.
Construction resource (ISO 12006:2)	A construction object used in a construction process to achieve a construction result.
Container file	Repository used to compile assemblies and components for specific purposes, including export and publication.
Convention (BS 8541-2)	Accepted way of drawing an item which may have the nature of a representation, a simplified representation or a symbol.
Datatypes (defined, enumeration and select) BS ISO 29481-1	Named types of data that may be used, including labels, text descriptions, identifiers, enumerated ranges of possible values from which a selection should be made for alternative routing through a schema.
Documentation View	'Documentation View' includes, tabular, schedules, cost estimations, thermal calculations, performance reports'. See also view type.
Digital Plan of Works	Digital Plan of Works (dPoW) Schedule of phases, roles, responsibilities, assets and attributes, made available in a computable form. See also RIBA Plan of Works 2013.
Enumeration (IFC)	Construction that allows an attribute value to be one of multiple predefined values identified by name.

External reference (IFC)	Link to information outside the data set, with direct relevance to the specific information the link originates from inside the data set.
Field (BS 1192)	Part of a container name reserved for metadata.
FM Basic Handover Model View Definition (MVD)	An IFC View Definition, or FM Handover Model View Definition, MVD, defines a subset of the IFC schema, that is needed to satisfy one or many Exchange Requirements of the AEC industry. The basic FM hand overview definition developed by BuildingSMART exchanges facility management information among building models. The COBie spreadsheet is a mapping of the FM Handover Model View Definition (MVD) of the current IFC 2x3 scheme as documented in the COBie responsibility matrix. http://projects.BuildingSMARTalliance.org/files/?artifact_id=4093
Generic object	BS 8541-1: Type object intended for use in stages of design when the object is not resolved in a product. Or Object type intended for use in stages of design when the finalised solution has not yet been completely resolved. Example: Generic – Hand-Drier 285x200x250 (electric device).
Geometric representation	Geometric representation of the space defined by a products external boundaries. Also referred to as product shape or shape representation in other documentation.
Geometrical view	Includes elevation, plan, section, front, side, isometric and animation views. See also View type.
Hard coded	Fixed data or property in a BIM platform that cannot be altered.
Identification (ISO 16739)	Capability to find, retrieve, report, change, or delete specific instances without ambiguity.
IfcBuildingElementProxy Type	This defines a list of commonly shared property set definitions of a building element proxy and an optional set of product representations. It is used to define an element specification (i.e. the specific product information that is common to all occurrences of that product type).
IfcPredefinedType	Defines the particular type.
IfcTypeObject	The object type defines the specific information about a type, that is common and shared by multiple object occurrences. The object type is represented by a set of property set definitions. Similar to class, template and type.

Industry Foundation Class (IFC)	Open vendor-independent neutral file format that defines an extendable set of consistent data representing building information for exchange and interoperability between AEC software applications. The IFC specification is developed and maintained by BuildingSMART International as its "Data standard". It is registered with ISO as ISO16739.
Information device (BS 8541-2)	Convention indicating an abstract item.
Instance	BS 1192: An occurrence of an entity at a particular location and orientation within a model. Synonym for occurrence. Similar to the term instance of a class in object oriented programming. See also component.
Layered object	A composite layered object with simple to medium geometry and a range of parameters. A layered object may consist of one layer, e.g. waterproof membrane, insulation, metal decking or consist of a number of layers combined to for a multi layered object. A multi layered object is often used where it is more practical to model multiple layers together rather than model each separate layer individually.
Level of detail (BS 8541-3)	Completeness and accuracy of a virtual shape representation compared to the physical and functional characteristics of the actual object.
Level of measurement (BS 8541-3)	Completeness and accuracy of a virtual measurement compared to the physical and function characteristics of the actual object.
Line (ISO 128)	Geometrical object, the length of which is more than half of the line width and which connects an origin with an end in any way, e.g. straight or curved, and without interruptions. The term line width is also synonymous with line weight or pen weight.
Line types	A collection of lines. Synonym for line pattern.
Manufacturer object	Type object intended to represent an obtainable product, either as a requirement or exemplar or as-built, as defined by BS 8541-1. Note: The term manufacturer object is also synonymous with proprietary object or product object.

Material (object)	May carry information regarding identity, performance and appearance. Material may be assigned a specific colour, surface pattern or designated render appearance and specific line work for 2D representation to control the outward appearance of the construction product or geometrical representation in geometrical views. Materials can be used on their own as finishes and coatings, as building products within an object, or to represent an option within an object. The term material is often synonymous with building material, construction material and surface.
Metadata	Data used for the description and management of documents and other containers. Note: Each item of meta-data resides in a field. Codes are the values allowed for fields.
Object	ISO 12006-2: Any perceivable or conceivable word. Or PAS 1192: Item having state, behaviour and unique identity – for example, a wall object. The term object is also synonymous with entity, construction entity and construction element as defined by ISO 12006-2.
Occurrence object (BS 8541)	Representation of an actual occurrence (instance) of an object in a building. See also component.
Parameter	See property.
Parametric geometry	Geometry is that is defined and controlled by its parameters.
Placeholder	A simplified or generic representation of a 3D object
Presentation (BS EN ISO 13567-2)	Information which may relate to particular elements or to the model or drawing, and which may need to be switched on or off. Note: Presentation in formation is related primarily to the geometrical appearance on screen and paper, as opposed to element information which is related to the physical structure.
Product object (BS 8541)	See Manufacturer object.
Property	The generalisation of all characteristics (either types or partial type, i.e. property sets that may be assigned to objects. Shared among object instances, it reflects the specific information of an object type, but it may also represent the occurrence information of the actual object in the project context, if it is assigned only to a single object instance. Properties are used to represent technical data and functions for designing, calculating and simulating the product.

	They can be: ISO 16739: Unit of information that is dynamically defined as a particular entity instance. ISO 12006-2: Construction objects have construction properties. Properties are represented as attributes in construction information. Note: The term parameter is often used by BIM platforms to describe the property information type that has been used to define a BIM object.I
Property set	Collection of characteristics associated with an object and grouped together that can comprise of parameters and attributes.
Representation (BS 8541-2:2011)	Scale view of an object. Note: a) Representation is often also referred to as visibility or display. b) The terms 'Low/ symbolic/ simple/ Course, Medium, High/ detailed/ fine/ realistic' are often used to as a substitute for 1:20, 1:50 and 1:100.
RIBA Plan of Work 2013	The RIBA Plan of Work 2013 comprises eight work stages, each with clear boundaries and details the tasks and outputs required at each stage. Further information can be viewed at http://www.ribaplanofwork.com
Schema	Data model in a formal machine-readable notation. The IFC specification consists of such a schema and associated informal human-readable semantic definitions. The schema describes a set of data types and their possible relationships.
Section (ISO 10209-1:1992)	A representation showing only the outlines of an object lying in one or more cutting planes. Synonym for cut.
Selection property (BS ISO 16757:1)	Used to select a single product from a catalogue which often contains more than a million products of a similar kind.
Simplified representation (BS 8541-2)	Scale view incorporating only the essential shape, size or features of an object.
Specification	Description of the quality of, and requirements of, the construction product.
Supplementary geometry (BS ISO 16792)	Geometric elements included in product definition data to commutate design requirements but not intended to represent a portion of the manufactured product.

Symbol (BS 8541-2)

Geometrical device without scale used:

a) on a drawing to indicate the occurrence and/or location of an item

b) in an annotation to indicate one or more of the attributes of that item.

System

Systems consist of products defined by technical function, form and/or material such as masonry, insolation and blockwork.

IFC: organised combinations of related parts, composed for a common purpose or function or to provide a service. System is essentially a functionally related aggregation of products.

Système international d'unités (SI) (International System of Units) (BS EN ISO 800000-1)

System of units, based on the International System of Quantities and adopted by the General Conference on Weights and Measures (CGPM). Comprises names and symbols, including a series of prefixes, with rules for their use.

Type

Common characteristics shared by multiple object occurrences.

The named specification for equipment, products and materials.

Similar to object class, template, style, category, subcategory, functional type, library part, or subtype in other publications.

Value(s)

Information given against a property.

Example: Text, Boolean, Length, Look up table, Real, Units, Volume.

Variations/ Variants

A form or version that differs in some respect from other forms of the same things or from a standard.

View types

Collective term used for and including geometrical view and document view.

Visibility

See representation.

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NBS welcomes feedback and encourages all parties from the construction industry to comment on the NBS BIM Object Standard, and help shape future editions.

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Support

NBS provides free tools, templates and guides to help create objects to this standard. For more information, please visit: https://www.nationalbimlibrary.com/en/bim-tools-and-guides/

The NBS National BIM Library hosts over 700 generic template objects and thousands of manufacturer-specific objects all authored to this standard. Users may download these objects for free and use these on their construction projects. For more information, please visit: https://www.nationalbimlibrary.com