NBS BIM Object Standard

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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.

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.

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.

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.

2.1.2. Data properties

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

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.

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.

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.

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.

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.

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.

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.

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.

2.2.4. Dependence

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

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.

2.3.2. Occurrence

The BIM object shall include only one occurrence of a 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.

Table 2: Order of priority

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

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.

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.

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.

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.

2.4.3. Units

Property names shall not include units.

2.5. IFC

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.

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.

2.5.3. IFC2x3

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

2.6. Facilities management properties

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.

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

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
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

2.6.2. COBie properties

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.

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.

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

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

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.

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.

3.1. General

1.3.1. Modelling scale

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

3.1.2. Insertion point

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

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.

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

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.

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.

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.

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.

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.

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.

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.

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.

4.1.2. Performance

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

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.

4.1.4. Ease of use

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

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.

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.

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.

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.

5.1.3. Consistent naming

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

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.

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.

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'.

5.5 Naming of image files for materials

5.5.1. 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.

5.5.2. Image file format

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

5.6. Image tiling

5.6.1. 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.

5.6.2. 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.

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.

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

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

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

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.

Construction resource (ISO 12006:2)

A product may be defined by shape representations and have a location in the coordinate space.

Container file

A construction object used in a construction process to achieve a construction result.

Convention (BS 8541-2)

Repository used to compile assemblies and components for specific purposes, including export and publication.

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.
	Common characteristics shared by multiple object occurrences.
Type	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.

Contact

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

Send your feedback to:
Email: info@theNBS.com
Telephone: 0345 456 9594, option 1
Telephone overseas: +44 191 232 9594
NBS telephone lines are open Monday to Friday from 9 am to 5 pm

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