

# Using Forge to Revolutionize Coordinated Project Information

Dr Stephen Hamil

Innovation Director at NBS

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Senior Director at Autodesk

**FORGE DEVCON**





## About the speaker

### Jim Quanci

Always positive and proactive embracer of new technologies - a builder of ecosystems that leverage the creativity and innovation of great people. Increasing the reach of the company by an order of magnitude to accelerate the design and creation of a more sustainable, humane and equitable world

Committed to making the company a great place to work and a success while also "making a difference" in the world we live in.

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# About the speaker

## Dr Stephen Hamil

Stephen first started working on NBS products in 1999 and has played a big part in all of the developments of the NBS product portfolio. He was the project lead for the development of the digital plan of work and classification streams of BIM Level 2 on behalf of the UK Government's BIM Task Group. Prior to joining NBS, Stephen studied at Durham University. His first degree was in Structural Engineering followed by a PhD in the digital modelling of building structures.

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# Using Forge to Revolutionize Coordinated Project Information

## 1. STATE OF THE INDUSTRY

On most projects the industry has moved from sharing information in paper form to sharing information in PDF form. We can do much better than this – and by adopting new digital work flows we will do.

## 2. STRUCTURING INFORMATION

Information is currently trapped in silos and inconsistently structured. By standardizing data structures and classifications we can provide structure. The emergence of modern web platforms, such as Forge, is now offering new levels of interoperability.

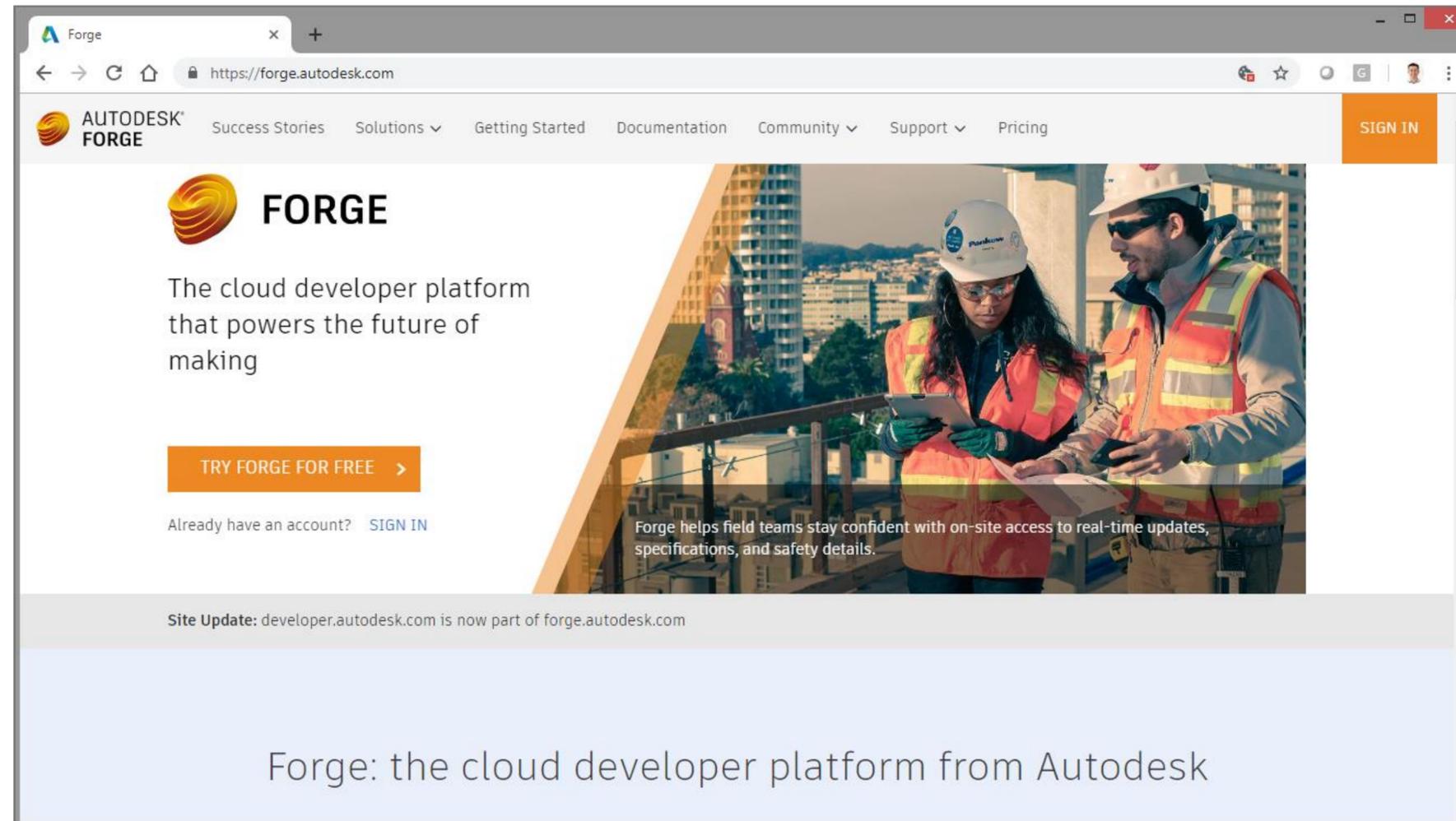
## 3. THE CLOUD AND CONNECTING INFORMATION

How Forge is integral to the latest NBS product innovations.

# Introduction

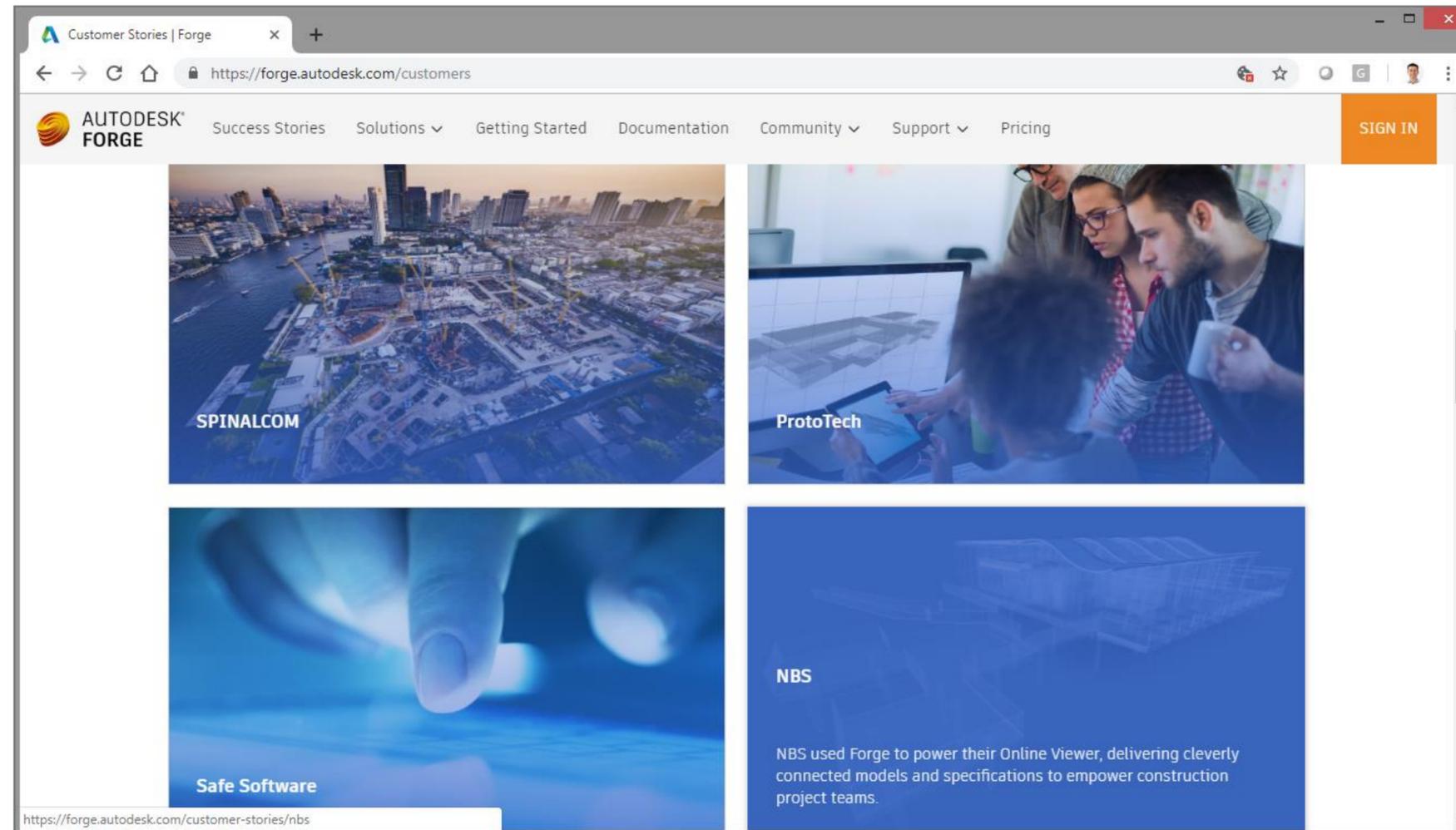


# Autodesk Forge



The cloud developer platform that powers the future of making

# Customer Stories



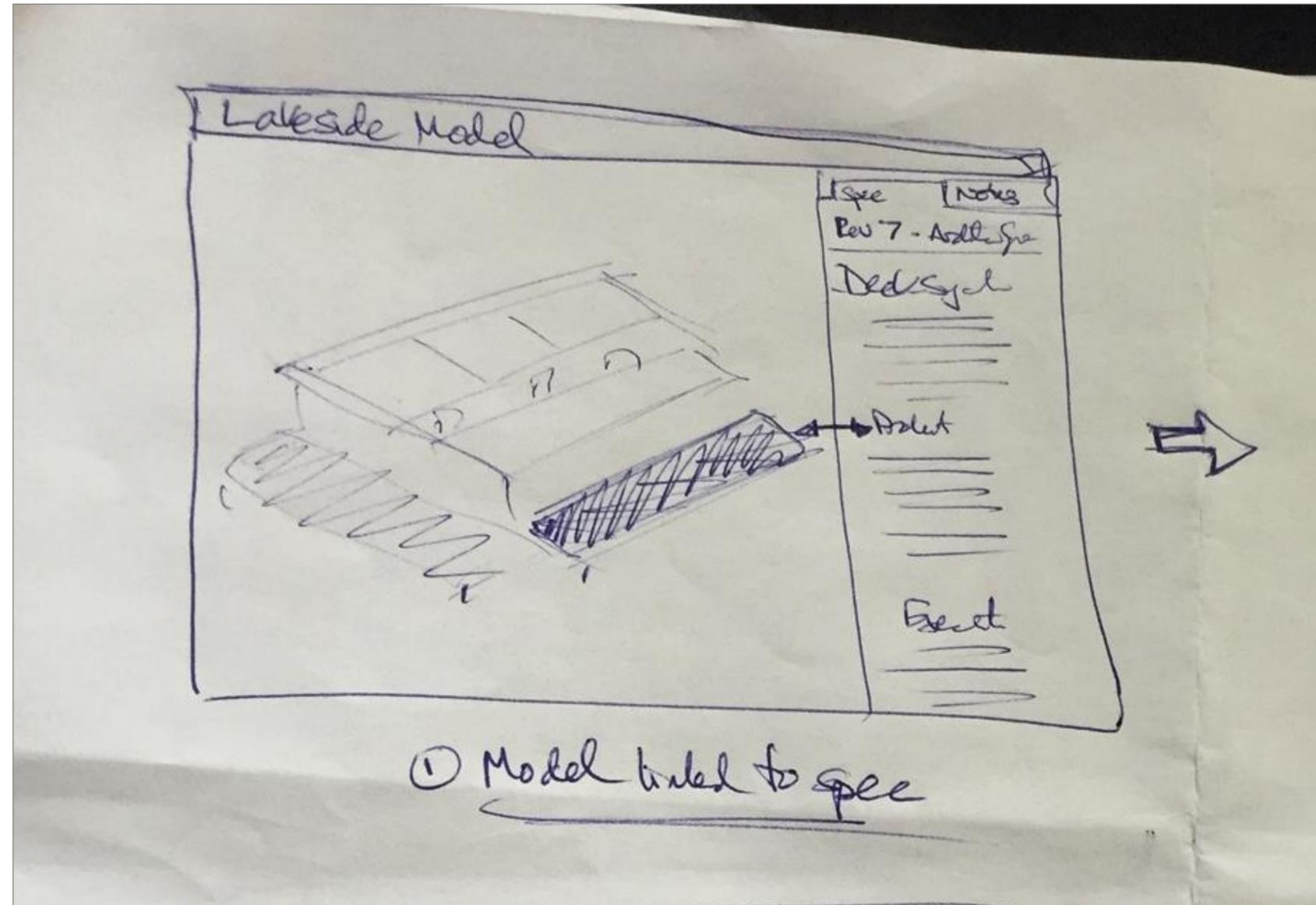
Forge empowers developers and innovators

# 2016 – The launch of Forge



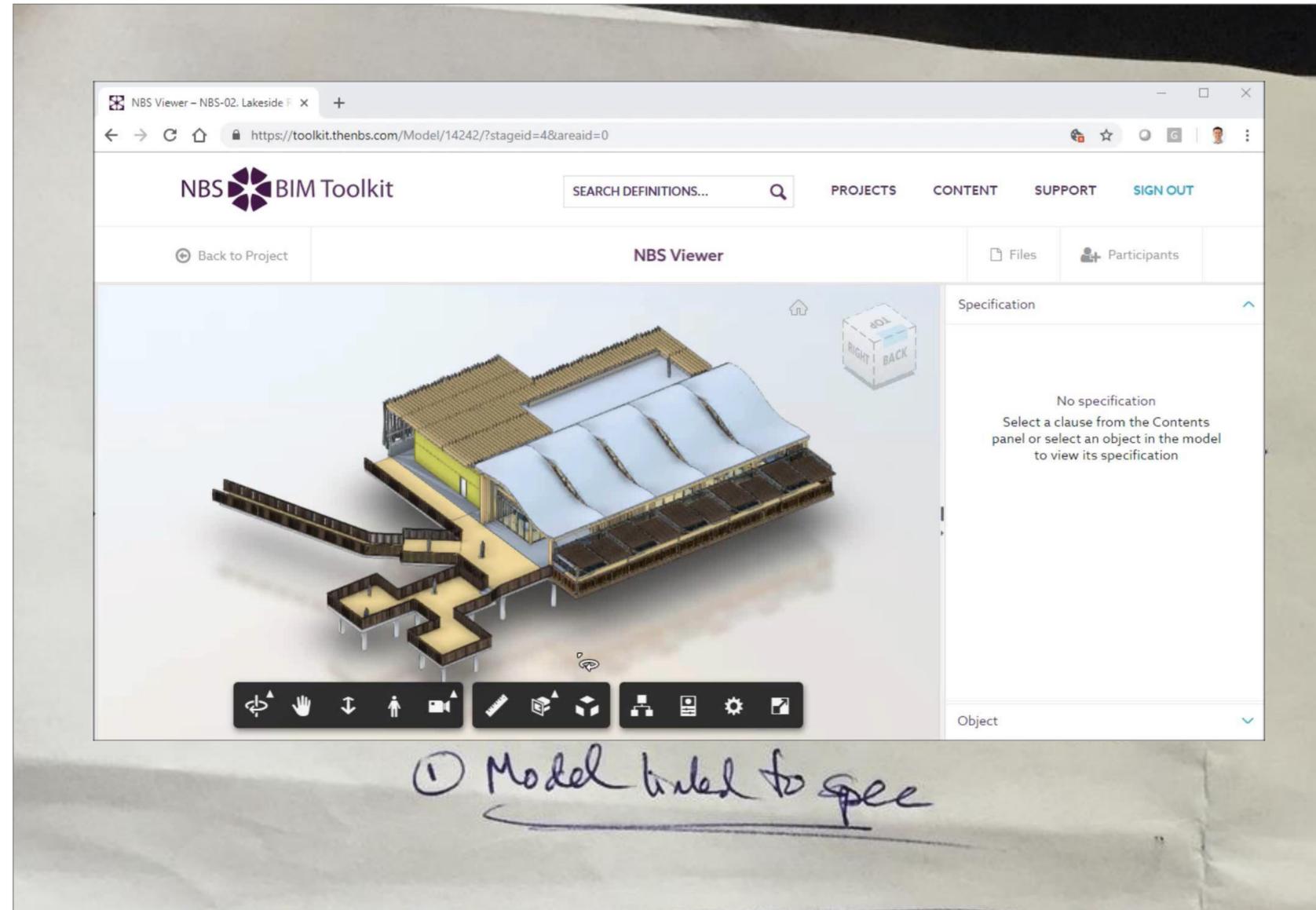
Autodesk Forge DevCon 2016

# 2016 – Sketches on paper



Sketch of the concept

# 2017 – Implemented



Launched at Forge DevCon 2017

# Introduction





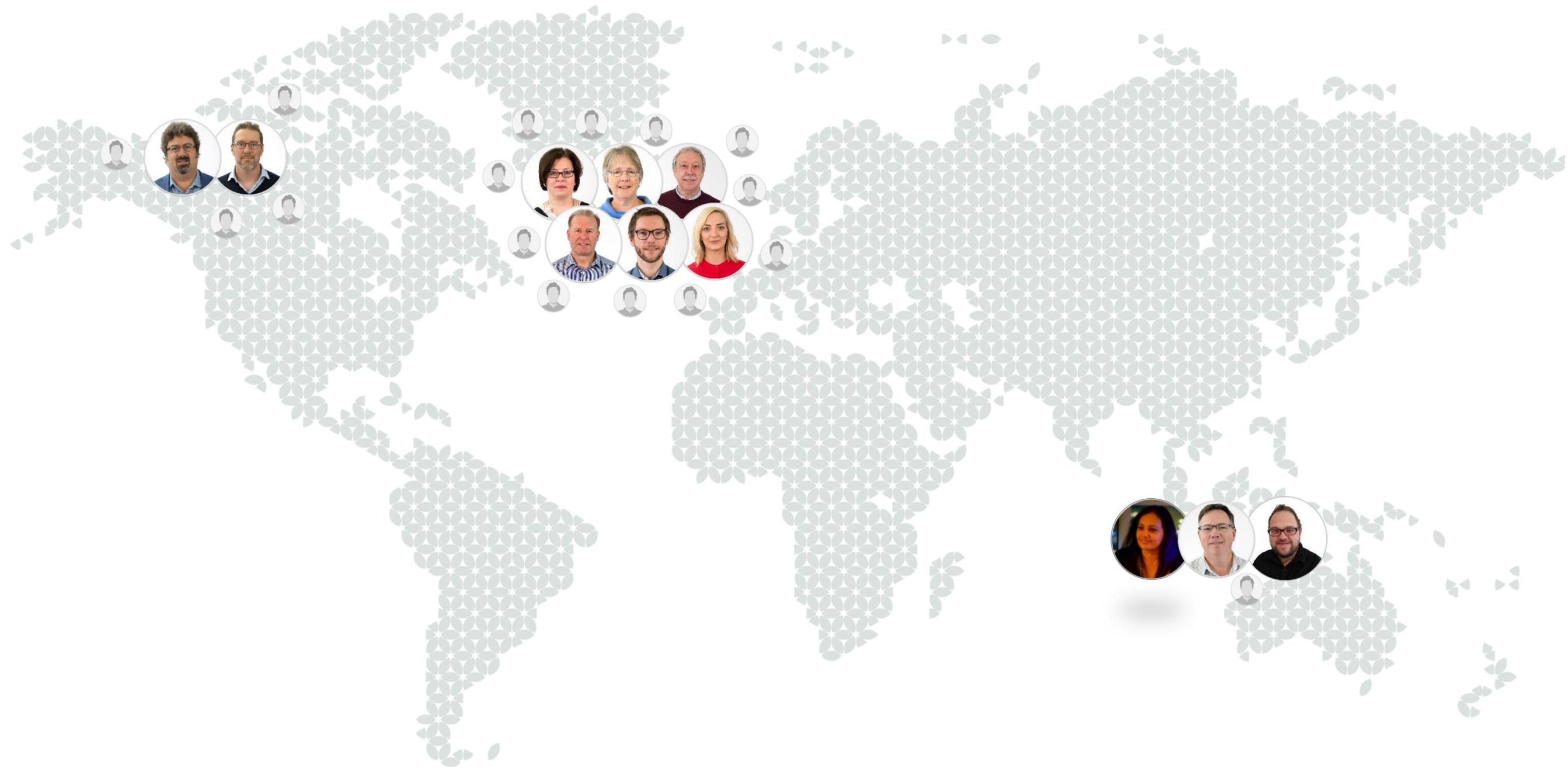


The Royal Institute of British Architects



The Royal Institute of British Architects and Lloyds

# Content authored around the world



# 1. State of the industry



# Collaboration and information sharing

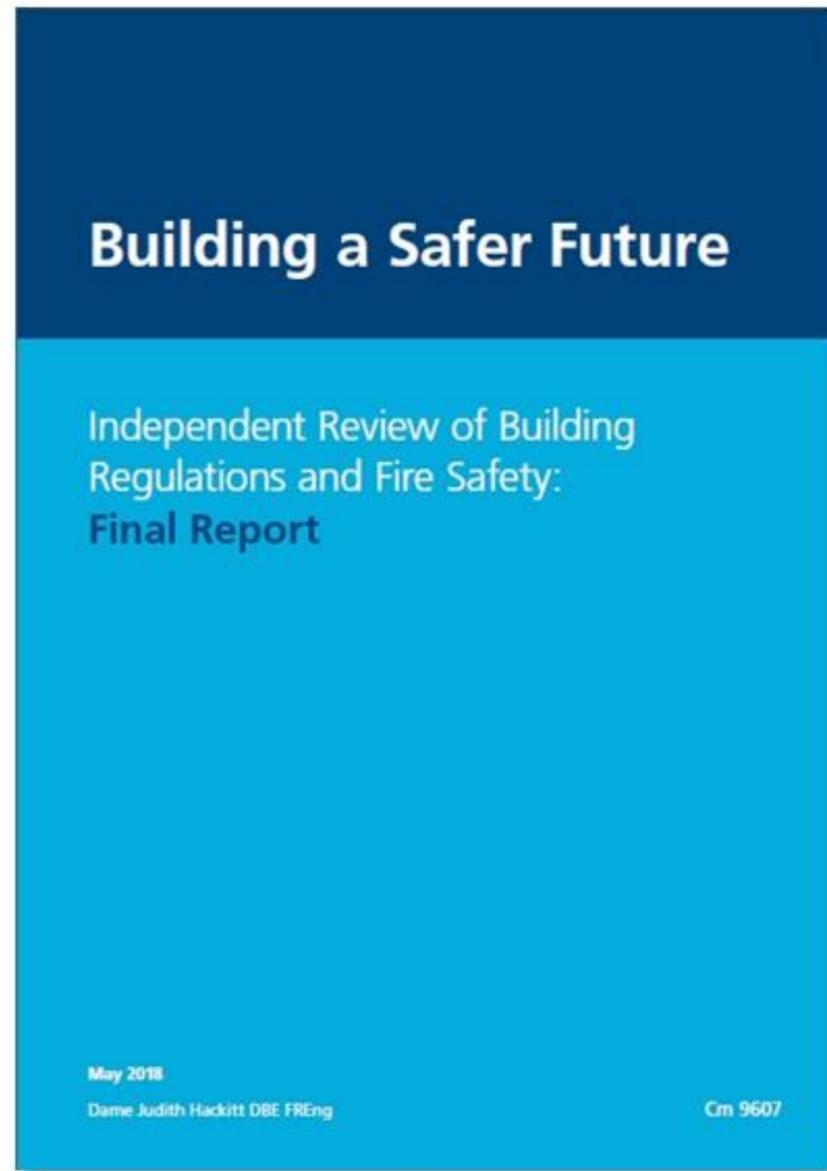


# Collaboration and information sharing



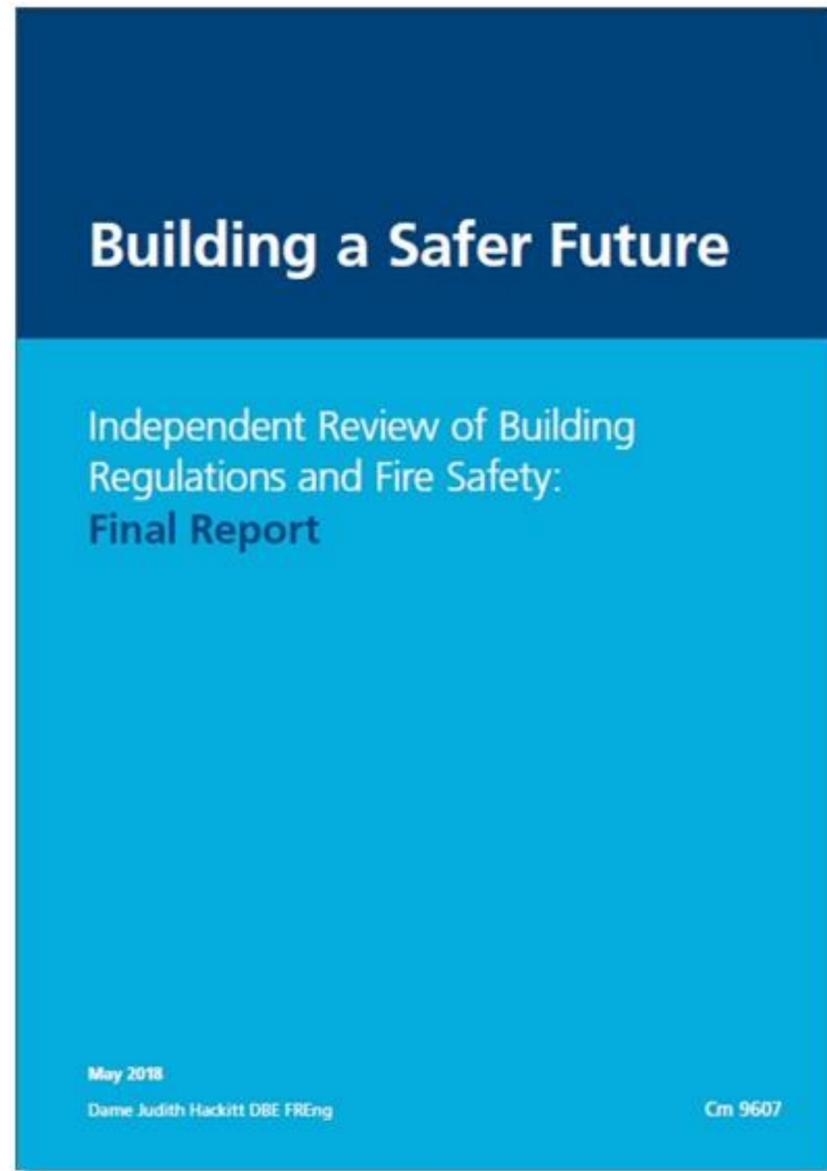
A paper based workflow. PDF at best.

# UK – Hackitt Report



- **Ignorance** – regulations and guidance are not always read by those who need to, and when they do the guidance is misunderstood and misinterpreted.
- **Indifference** – the primary motivation is to do things as quickly and cheaply as possible rather than to deliver quality homes which are safe for people to live in. When concerns are raised, by others involved in building work or by residents, they are often ignored. Some of those undertaking building work fail to prioritise safety, using the ambiguity of regulations and guidance to game the system.
- **Lack of clarity on roles and responsibilities** – there is ambiguity over where responsibility lies, exacerbated by a level of fragmentation within the industry, and precluding robust ownership of accountability.
- **Inadequate regulatory oversight and enforcement tools** – the size or complexity of a project does not seem to inform the way in which it is overseen by the regulator. Where enforcement is necessary, it is often not pursued. Where it is pursued, the penalties are so small as to be an ineffective deterrent.

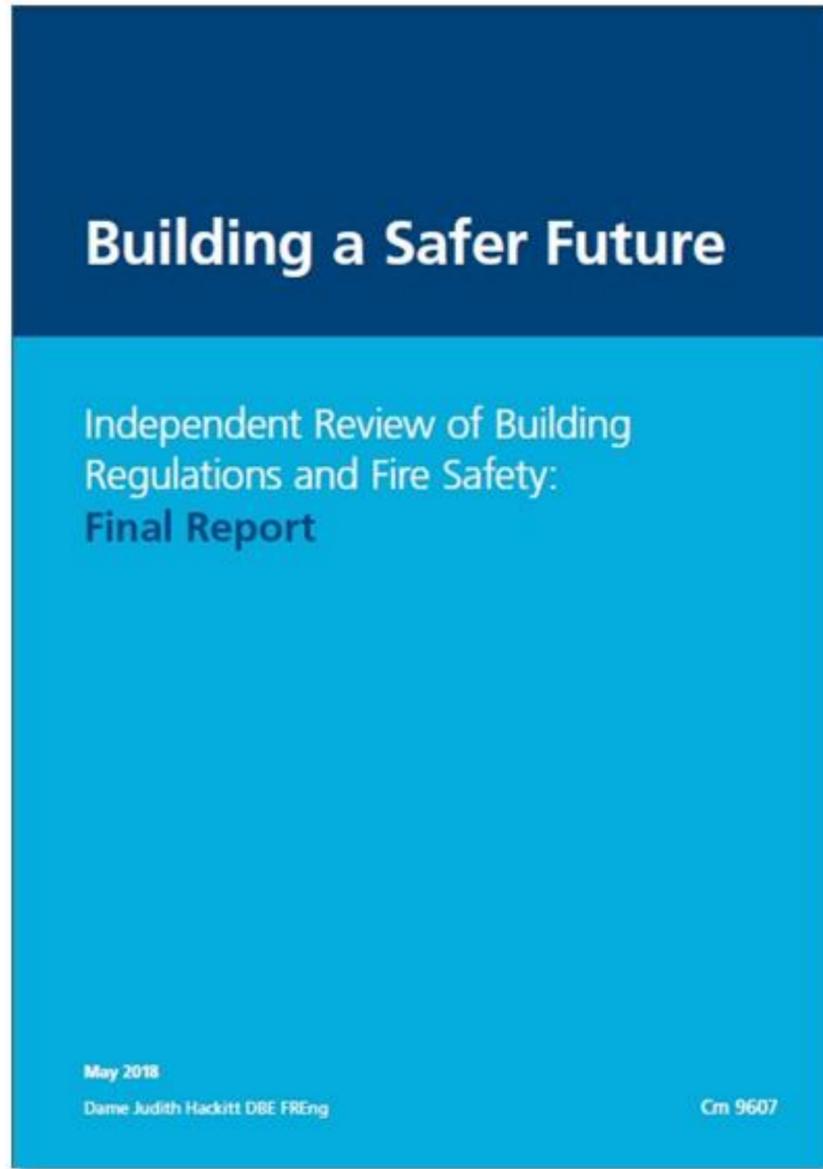
# UK – Hackitt Report



**Transparency of information and an audit trail** all the way through the life cycle of a building from the planning stage to occupation and maintenance is essential to provide reassurance and evidence that a building has been built safe and continues to be safe. For example, the current process for testing and 'certifying' products for use in construction is disjointed, confusing, unhelpful, and lacks any sort of transparency. Just as the process of constructing the building itself must be subject to greater scrutiny, the classification and testing of the products need to undergo a radical overhaul to be clearer and more proactive.

More rigour and oversight at the front end of the process **can lead to significant increases in productivity**, reduction in ongoing costs and to better outcomes for all in the latter and ongoing stages of the process. Improving the procurement process will play a large part in setting the tone for any construction project. This is where the drive for quality and good outcomes, rather than lowest cost, must start.

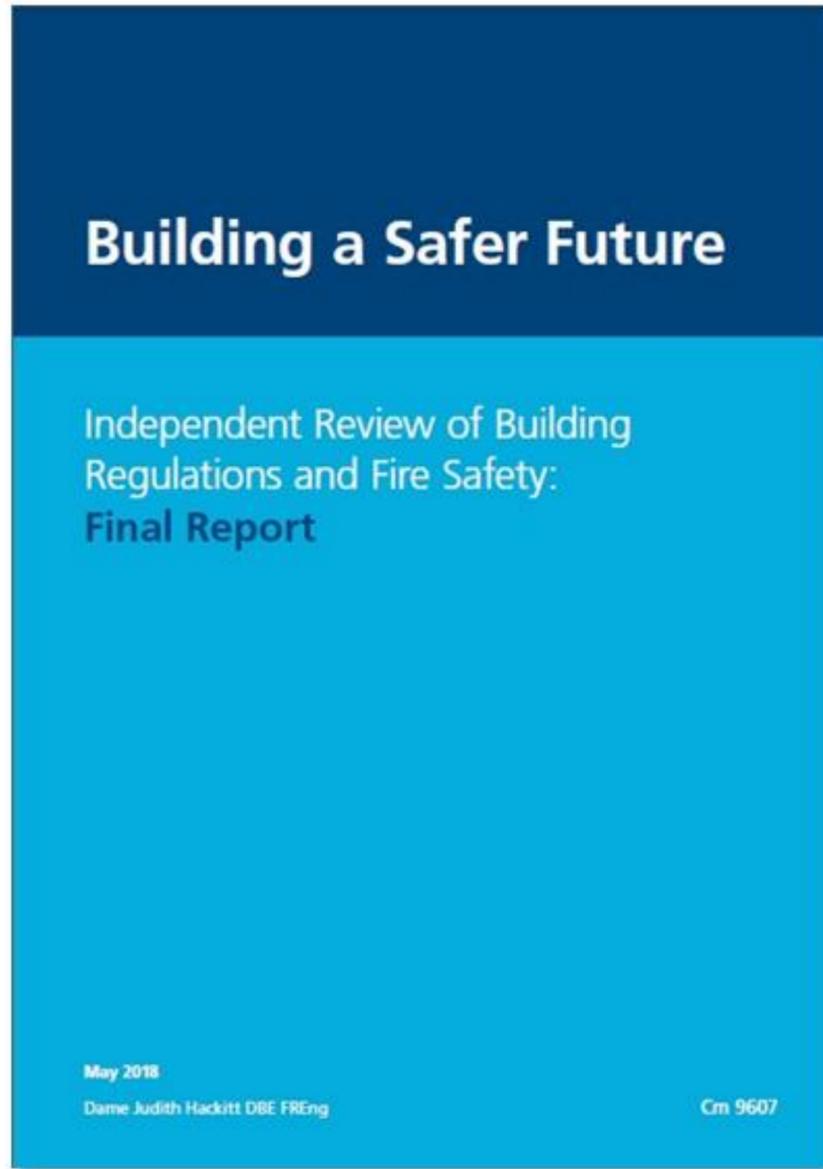
# UK – Hackitt Report



## Key information products

**2.19** The review has identified four key information products<sup>22</sup> that are integral to greater dutyholder oversight on building safety (and other Building Regulations requirements) throughout procurement, design and construction. A 'golden thread' of good quality information will also enable future building owners to better manage their buildings safely. As soon as detailed work commences the client needs to ensure that a **digital record** of the building work is established and a **Fire and Emergency File** is initiated. Both of these will need to be maintained throughout design and construction and be part of the regulatory oversight process. Formal handover will help enable occupation to commence. This should focus activity throughout, ensure a robust golden thread of key information is passed across to future building owners and thereby underpin more effective safety management throughout the building life cycle.

# UK – Hackitt Report



## Recommendation 2.3

Government should make the creation, maintenance and handover of relevant information an integral part of the legal responsibilities on Clients, Principal Designers and Principal Contractors undertaking building work on HRRBs. The four information products (the digital record, the Fire and Emergency File, Full Plans and Construction Control Plan) represent a minimum requirement.

## Recommendation 2.4

Government should consider applying the key roles and responsibilities and information product recommendations to other multi-occupancy residential buildings and to institutional residential buildings whilst bearing in mind necessary adjustments to keep the requirements proportionate.

# UK – Hackitt Report

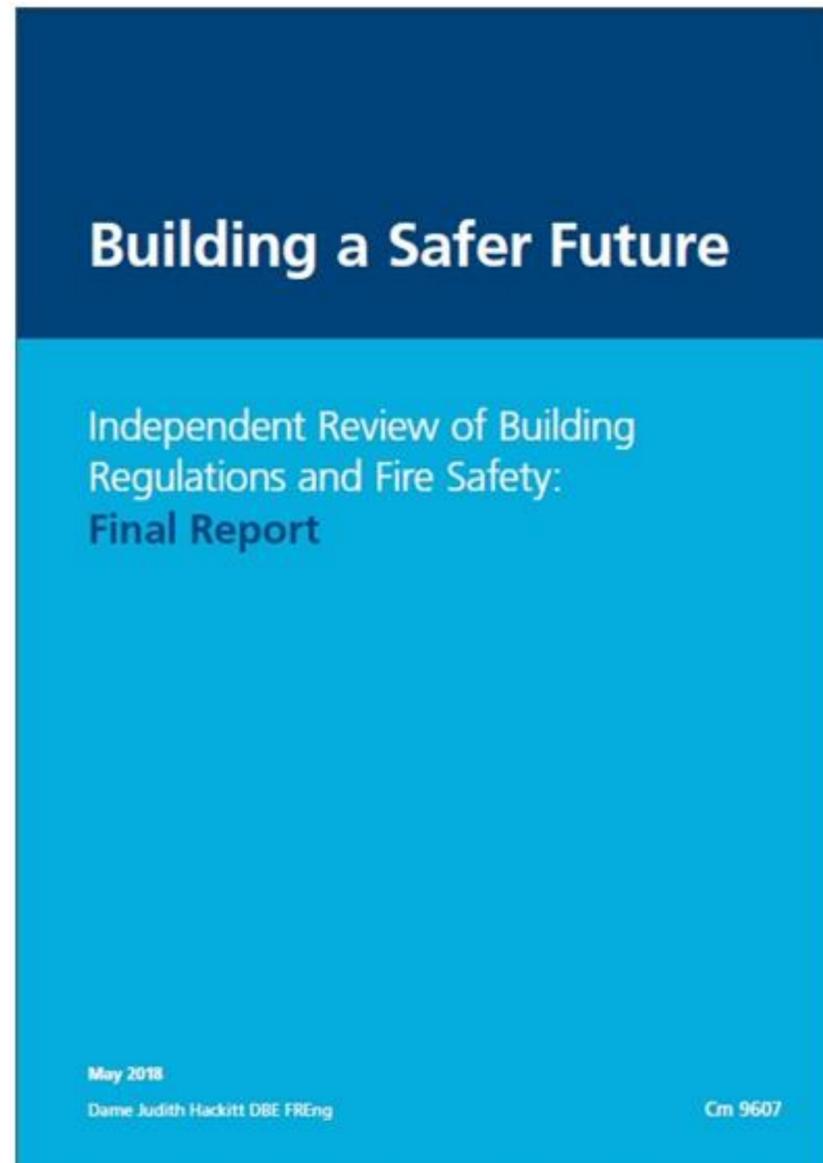
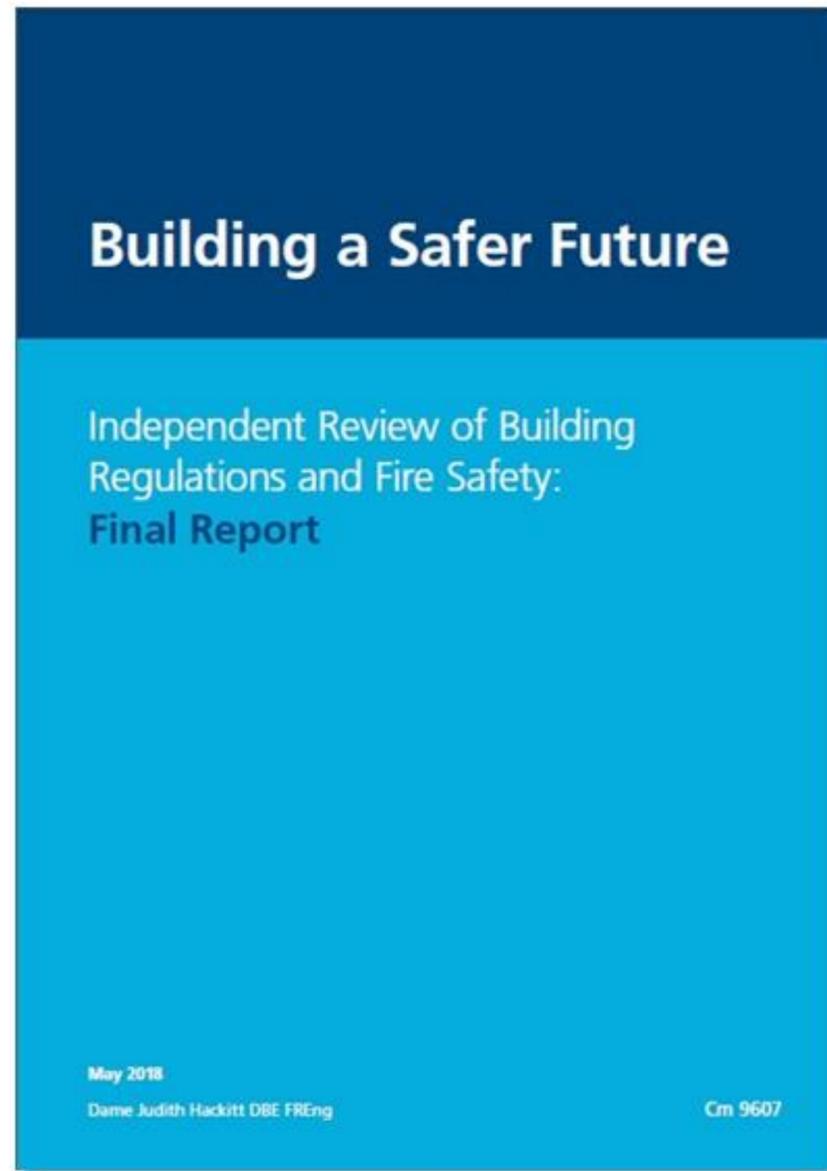


Table 3 – Key information products

Information Product	What is it?	Why?	Who?
<b>The digital record</b>	Digital record of the building as planned, then as built including, for example, products used. Intended to underpin an effective understanding of the constructed building across the life cycle. See Chapter 8 for more specific recommendations.	To underpin more effective delivery during design and construction phases, including more accurate records of the as-built building.	Initiated by the client, handed over and updated and finalised by the Principal Designer and Principal Contractor.
<b>The Fire and Emergency File</b>	Product setting out the key building safety information. The file will be initiated and then updated and ultimately passed across to the building owner (Appendix D sets out more detail <sup>9</sup> ).	To ensure that anyone carrying out design, construction or refurbishment work on a building can provide a clear and comprehensive record of the fire strategy for the building and its residents (including those who are vulnerable). This will help to ensure that the future building owner has a proper record of key building safety aspects so that they can understand why the fire and other safety precautions have been provided.	Initiated by the client, handed over, updated and finalised by the Principal Designer and Principal Contractor.
<b>Full Plans</b>	Detailed plans/specification of building works in respect of fire and structural safety as a minimum (alongside the necessary specification in all other aspects of the Building Regulations). See paragraph 2.29-2.32 below.	To demonstrate to the JCA that the building will be constructed so as to be safe, that the risks are understood and well managed and that broader Building Regulations requirements will be met. The JCA must deem this assessment sufficient for work to commence.	Principal Designer has primary responsibility.
<b>Construction Control Plan</b>	Describes how building safety and Building Regulations compliance will be maintained during the construction phase and how change will be controlled and recorded.	To communicate to all those involved in the construction phase of the project. It would help ensure a sufficiently robust focus on sustaining compliance during the construction phase.	Principal Contractor has primary responsibility.

# UK – Hackitt Report



## Recommendation 8.1

- a. Government should mandate a digital (by default) standard of record-keeping for the design, construction and during the occupation of new HRRBs. This is to include any subsequent refurbishments within those buildings.
- b. Digital records are to be in a format which is appropriately open and non-proprietary with proportionate security controls.

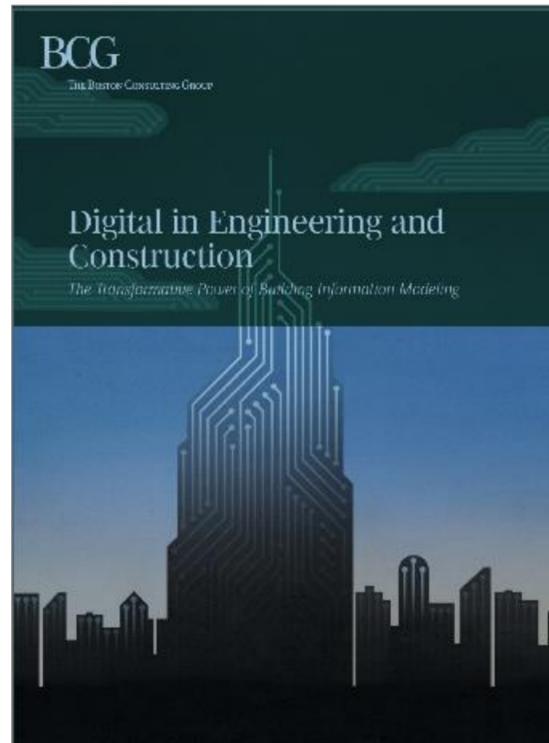
## Recommendation 8.2

Government should work with industry to agree what information must be held in the digital record for new HRRBs.

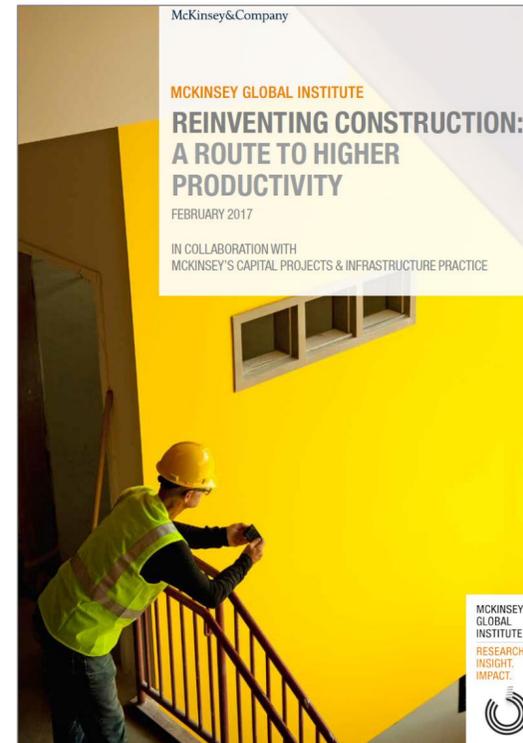
## Recommendation 8.3

- a. Government should work with industry to agree the type of information to be collected and maintained digitally (by default) to enable the safe building management of existing HRRBs.
- b. Dutyholders must identify and record where gaps in the above information exist and the strategy for updating that relevant information.

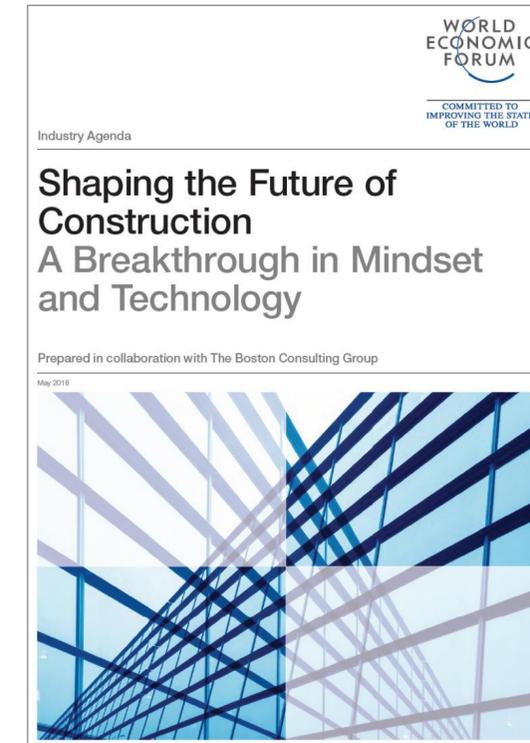
# Collaboration and information sharing



13-21% in savings



14-16% in productivity



3. Digital will have the most impact

# 2. Structuring information



# UK Government BIM

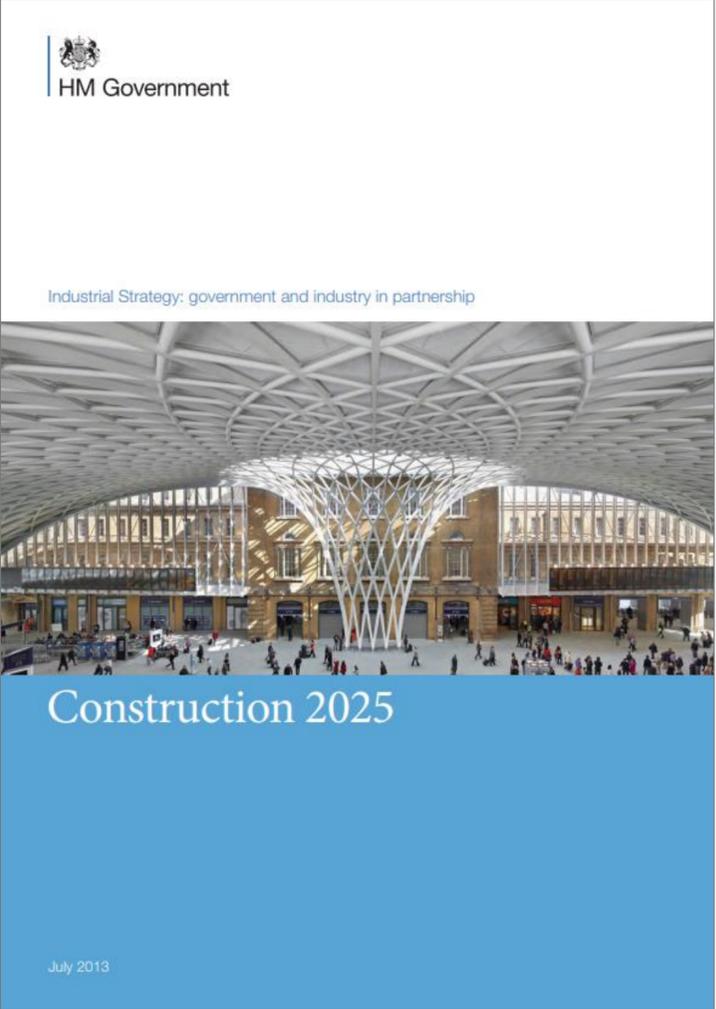
**"This Government's four year strategy for BIM implementation will change the dynamics and behaviours of the construction supply chain, unlocking new, more efficient and collaborative ways of working. This whole sector adoption of BIM will put us at the vanguard of a new digital construction era and position the UK to become the world leaders in BIM."**

**Francis Maude**  
Minister for the Cabinet Office



[BIMTaskGroup.org](http://BIMTaskGroup.org)

# UK Government BIM



## Lower costs

33%

reduction in the initial cost of construction and the whole life cost of built assets

## Faster delivery

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

## Lower emissions

50%

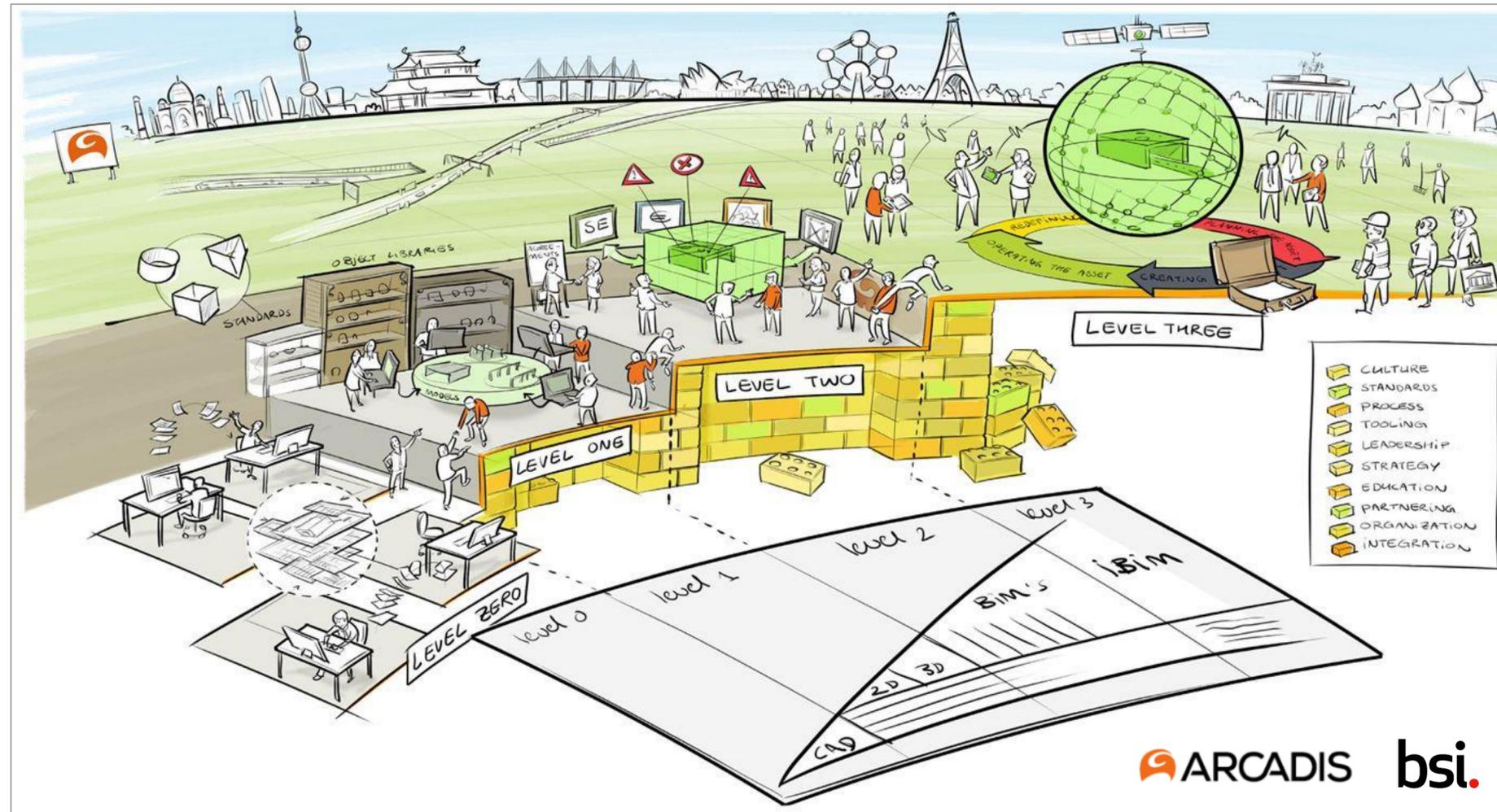
reduction in greenhouse gas emissions in the built environment

## Improvement in exports

50%

reduction in the trade gap between total exports and total imports for construction products and materials

# BIM adoption levels



“To level two and beyond...”

# BIM Level Two

A defined set of standards and tools

PAS 1192-2   PAS 1192-3   BS 1192-4   PAS 1192-5   BS 8536-1

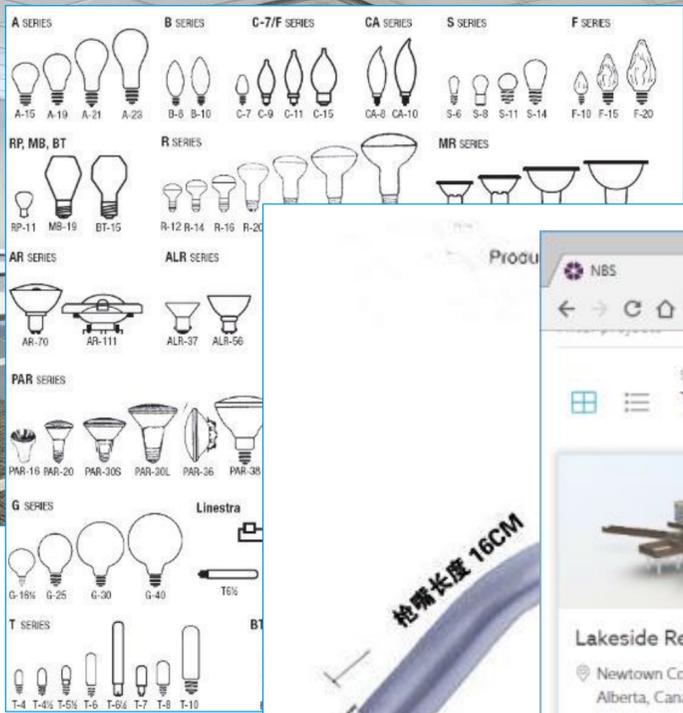
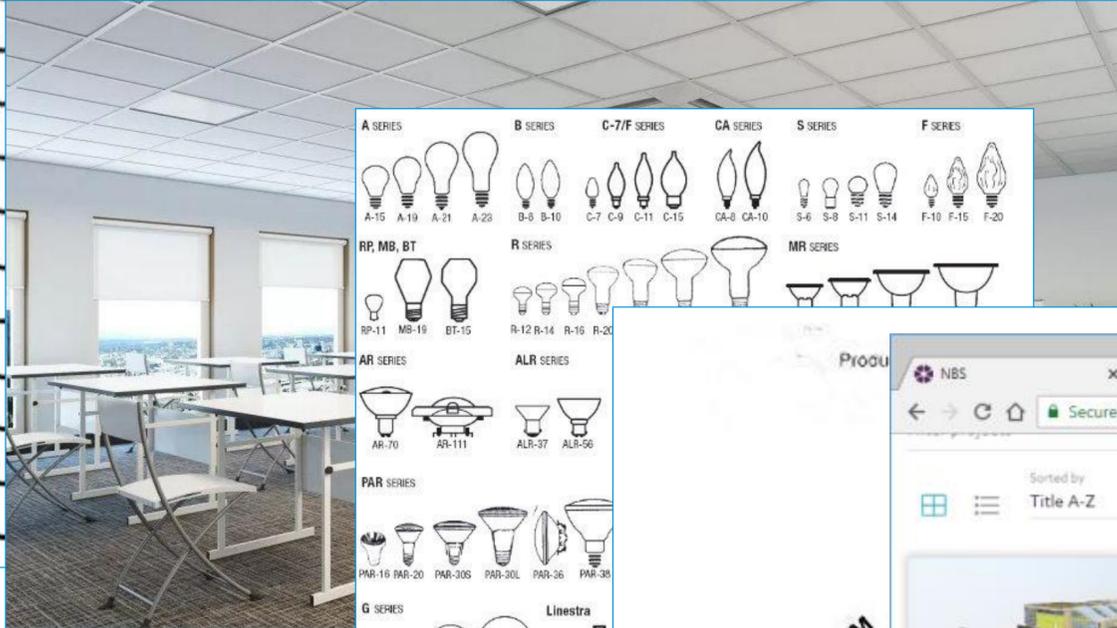
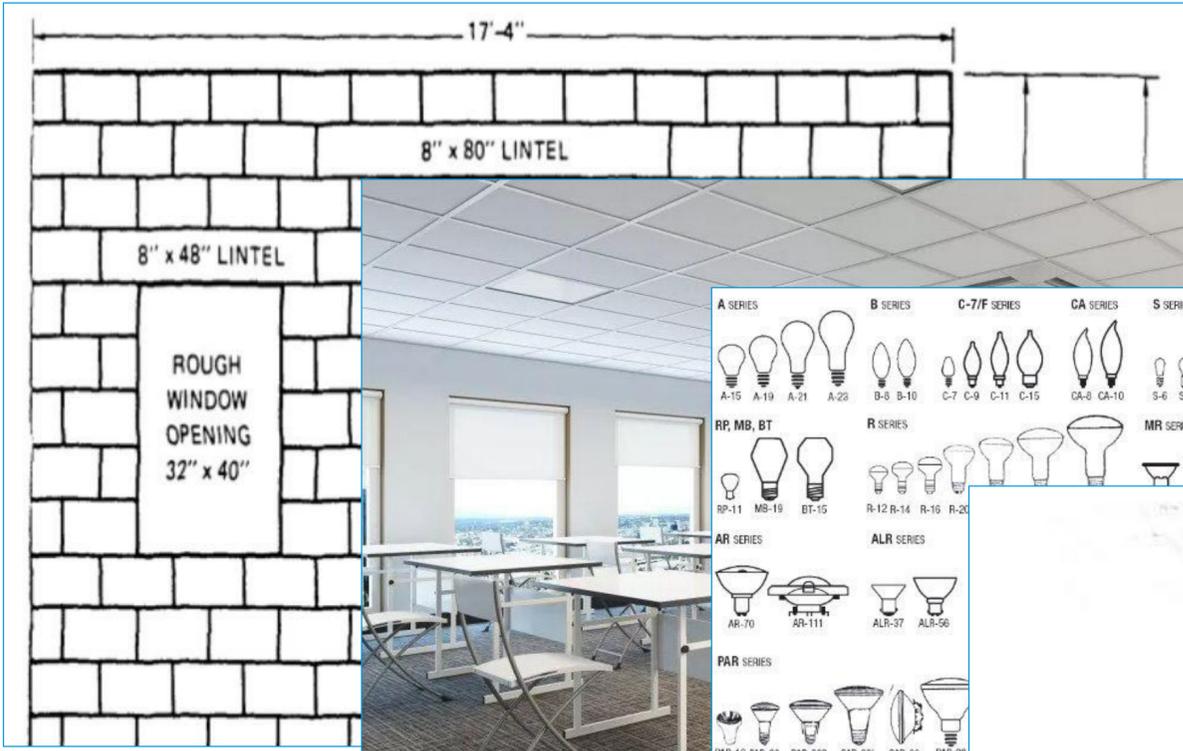
CIC BIM Protocol   Digital Plan of Work   Classification

12,000 classifications. Across 11 tables. For all sectors.

10	20	25	30	32	35	40	42	45
Preparation and repair	Administrative, commercial and domestic services	Cultural, educational, scientific and information	Industrial	Water and land management	Medical, health, welfare and leisure	Recreational	Sport and activity	Mechanical
50	55	60	65	70	75	80	85	90
Water, electrical	Food supply	Heating, cooling and refrigeration	Ventilation and air conditioning	Structural, general production and distribution	Communications, security, safety and protection	Transport	Services and maintenance	Construction and storage

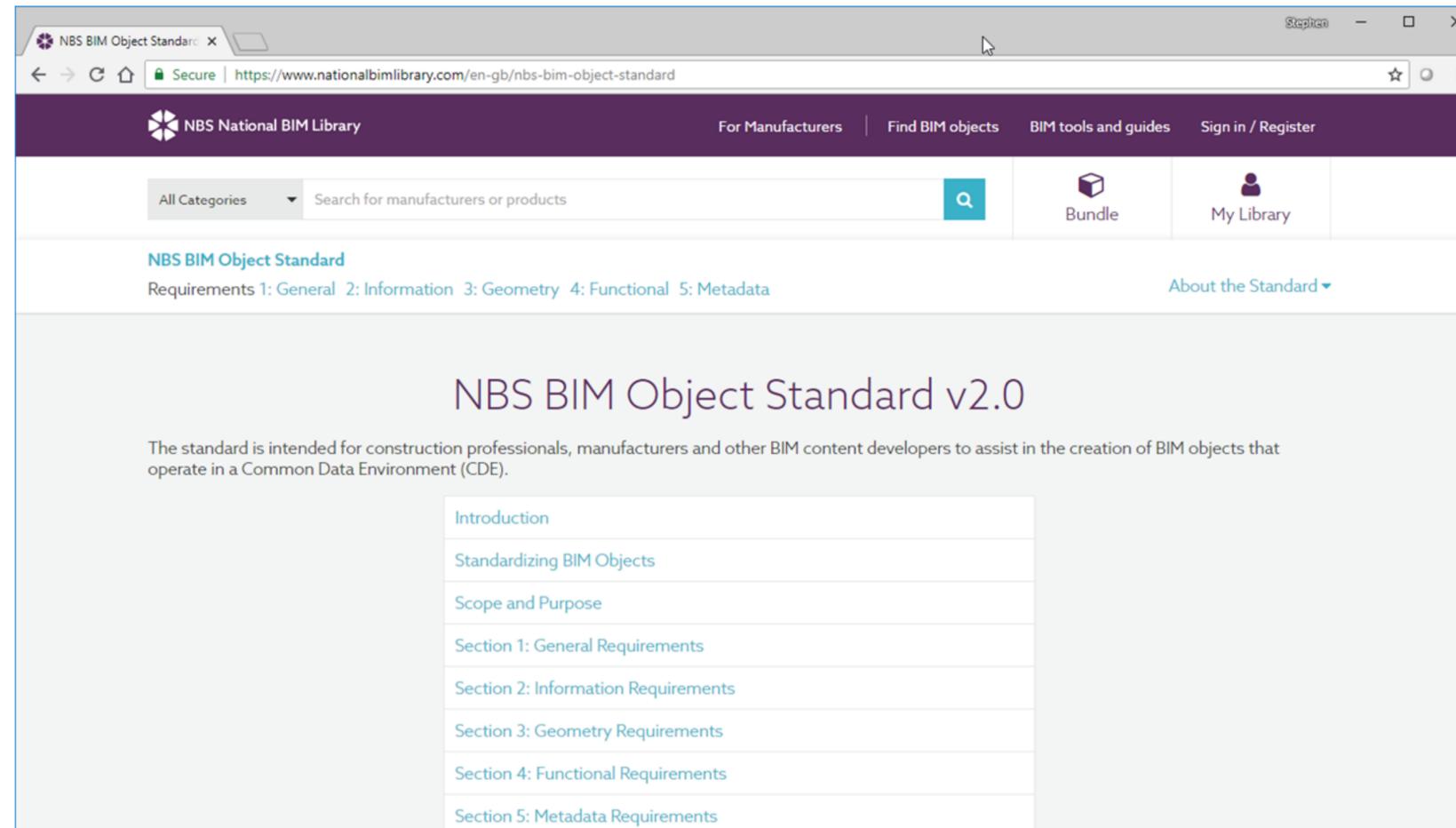
The need for standard data structures

# Standards



A screenshot of a web browser displaying a project page. The browser address bar shows the URL: <https://chorus.thenbs.com/org/ef335f70-956f-11e8-9420-5985807a4792/projects>. The page lists two projects: "Lakeside Restaurant" located at Newtown Country Park, Edmonton, Alberta, Canada, and "Old Post Office" located at Newcastle upon Tyne, NE1 1RH, UK. A developer console is open on the right side of the browser, showing HTML code and JavaScript snippets. A diagram of a cable is overlaid on the browser window, showing a length of 16CM and a diameter of 24MM.

# NBS BIM Object Standard



A guide on how to author good quality BIM objects

# A focus on the information

The information contained in the objects.

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 General

#### 2.2 Values

#### 2.3 Property groups and usage

#### 2.4 Property naming

#### 2.5 IFC

#### 2.6 Facility management properties

#### 2.7 BOS\_General

#### 2.8 BOS\_Certification

#### 2.9 BOS\_Environmental

#### 2.10 Supplementary properties

2.1.3 The BIM object shall have completed values where known, and shall not include unset or undefined values. Where the information is unknown, not applicable or not available, a default value 'n/a' shall be used. 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 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.

Properties

3D View

3D View: {3D} Edit Type

Graphics

View Scale	1 : 100
Scale Value	1: 100
Detail Level	Fine
Parts Visibility	Show Original
Visibility/Grap...	Edit...
Graphic Displ...	Edit...
Discipline	Architectural
Show Hidden ...	By Discipline
Default Analy...	None
Sun Path	<input type="checkbox"/>

[Properties help](#) Apply

Project Browser - ContentExamples.rvt

- Ceiling Plans
  - Level 0
  - Level 1
- 3D Views
  - {3D}**
- Legends
- Schedules/Quantities
  - 2.1 Inconsistent information
  - 2.2 Consistent information
- Sheets (all)
  - A100 - Unnamed
- Families
- Groups
- Revit Links

3D View: {3D} - ContentExamples.rvt

1 : 100

# Getting the geometry right

Describing the physical form, with the minimum level of geometry needed.

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

How detailed the geometry is depends on a number of factors 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.
- Surface/material data.
- Connection data.

### 3.1 General

#### 3.1 General

#### 3.2 Graphical detail

#### 3.3 Shape data

#### 3.4 Symbolic data

#### 3.5 Space data

#### 3.6 Surface and material data

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

3.1.3 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.

Properties

Floor Plan

Floor Plan: Level 0 Edit Type

Graphics

View Scale	1 : 200
Scale Value	1: 200
Display Model	Normal
Detail Level	Coarse
Parts Visibility	Show Original
Visibility/Grap...	Edit...
Graphic Displ...	Edit...
Orientation	Project North
Wall Join Disp...	Clean all wall j...
Discipline	Architectural

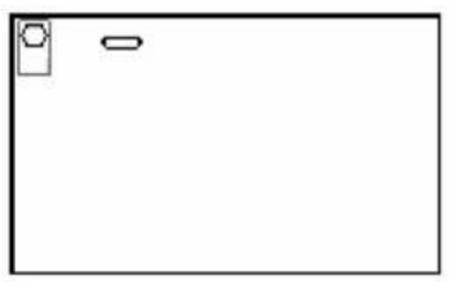
Properties help Apply

Project Browser - ContentExamples.rvt

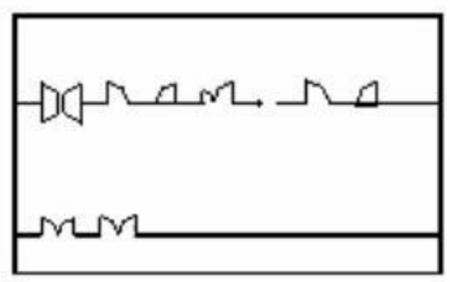
- Views (all)
  - Floor Plans
    - Level 0**
    - Level 1
    - Site
  - Ceiling Plans
    - Level 0
    - Level 1
  - 3D Views
    - {3D}
  - Legends
  - Schedules/Quantities
    - 2.1 Inconsistent information
    - 2.2 Consistent information



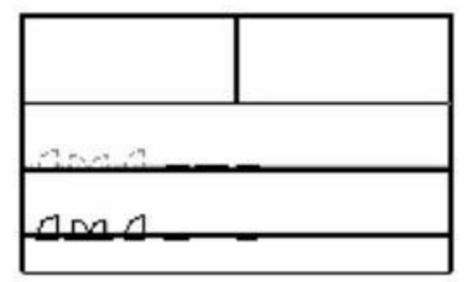
# NBS Content examples



1. Parametric behavior



2. Consistent information



3. Levels of detail

# Objects that function correctly

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



Representing characteristics, constraints and connectivity.

## 4.1 General

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

4.1.2 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.**

Properties

Floor Plan

Floor Plan: Level 0 Edit Type

System Color ... Edit...

Default Analy... None

Sun Path

Underlay

Range: Base L... None

Range: Top Le... Unbounded

Underlay Ori... Look down

Extents

Crop View

Crop Region ...

Annotation Cr...

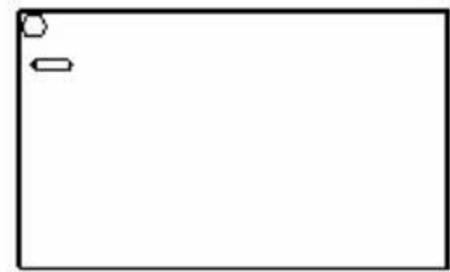
[Properties help](#) Apply

Project Browser - ContentExamples.rvt

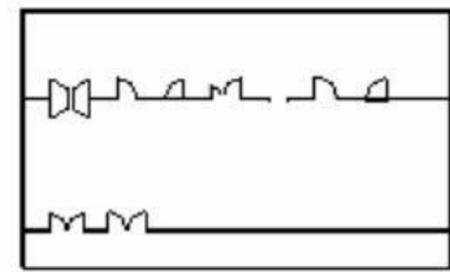
- Views (all)
  - Floor Plans
    - Level 0**
    - Level 1
    - Site
  - Ceiling Plans
    - Level 0
    - Level 1
  - 3D Views
    - {3D}
  - Legends
  - Schedules/Quantities
    - 2.1 Inconsistent information
    - 2.2 Consistent information



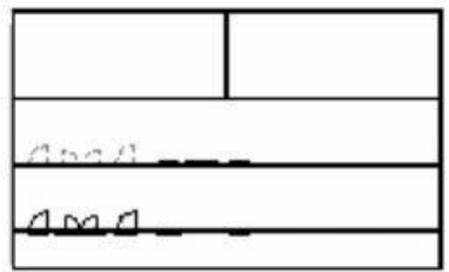
# NBS Content examples



1. Parametric behavior



2. Consistent information



3. Levels of detail

# Uniclass

## 13,400 classifications across 11 tables for all sectors

(Larger scale items – arranged broadly by industry sector and function)

10 Preparation and repair	20 Administrative, commercial and protective services	25 Cultural, educational, scientific and information	30 Industrial	32 Water and land management	35 Medical, health, welfare and sanitary	40 Recreational	42 Sport and activity	45 Residential
50 Waste disposal	55 Piped supply	60 Heating, cooling and refrigeration	65 Ventilation and air conditioning	70 Electrical power generation and distribution	75 Communications, security, safety and protection	80 Transport	85 Operation and maintenance	90 Circulation and storage

A unified classification system for the industry covering all construction sectors





# UK Government analysis of infrastructure

2017

## Data Driven Infrastructure

From digital tools to manufactured components

### Uniclass classification - at Asset level

Example showing asset - Elizabeth Line passenger tunnels in Tottenham Court Road station

### Uniclass classification - at Assembly level

Example showing passenger tunnel lining intersection for the Elizabeth Line stations

### Uniclass classification - at Sub-assembly level

Example showing passenger tunnel lining ladder frame for the Elizabeth Line stations

### Uniclass classification - at Component level

Example showing acoustic tunnel lining panel for the Elizabeth Line stations

**Ac - Activities**

- Ac\_80 Transport and loading activities
- Ac\_80\_10 Loading and unloading activities
- Ac\_80\_10\_60 Passenger activities
- Ac\_80\_10\_61 Passenger activities
- Ac\_80\_10\_62 Passenger activities
- Ac\_80\_10\_65 Passenger activities
- Ac\_80\_10\_64 Passenger activities
- Ac\_80\_10\_86 Ticketing
- Ac\_80\_50 Railway activities
- Ac\_80\_50\_71 Rail signal control
- Ac\_80\_50\_73 Railway transport
- Ac\_80\_50\_75 Railway transport
- Ac\_80\_50\_90 Train stopping
- Ac\_80\_60 Rail storage activities
- Ac\_80\_60\_11 Carriage cleaning
- Ac\_80\_60\_26 Engine fuel
- Ac\_80\_60\_27 Engine inspection
- Ac\_80\_60\_28 Engine servicing
- Ac\_80\_60\_29 Engine wash
- Ac\_80\_60\_70 Rail repair
- Ac\_90 Circulation
- Ac\_90\_10 Circulation
- Ac\_90\_10\_16 Covered walkways
- Ac\_90\_10\_24 Dropping and picking up
- Ac\_90\_10\_27 Entering and exiting
- Ac\_90\_10\_49 Lift stopping
- Ac\_90\_10\_50 Lift travelling
- Ac\_90\_10\_96 Wheelchair access
- Ac\_90\_20 Common activities
- Ac\_90\_20\_13 Changing
- Ac\_90\_20\_69 Queuing
- Ac\_90\_20\_96 Waiting

**EF - Elements / functions**

- EF\_20 Structural elements
- EF\_20\_10 Frames
- EF\_25 Wall and barrier elements
- EF\_25\_10 Walls
- EF\_70 Electrical power and lighting functions
- EF\_70\_30 Electricity distribution and transmission
- EF\_70\_80 Lighting
- EF\_75 Communications, security, and protection functions
- EF\_75\_10 Communication
- EF\_75\_30 Signalling
- EF\_75\_40 Security
- EF\_75\_50 Safety and protection

**Ss - Systems**

- Ss\_25 Wall and barrier systems
- Ss\_25\_10 Framed wall systems
- Ss\_25\_10\_32 Framed wall structure system
- Ss\_25\_10\_32\_45 Light steel wall framing system
- Ss\_25\_12 Panel wall structure systems
- Ss\_25\_12\_15 Concrete panel wall systems
- Ss\_25\_20\_33 Glass fibre reinforced concrete (GRC) cladding systems
- Ss\_25\_20\_33\_35 GRC cladding systems
- Ss\_25\_25 Wall lining systems
- Ss\_25\_25\_05 Acoustic panel systems

**Pr - Products**

- Pr\_20 Structure and general products
- Pr\_20\_29 Fastener products
- Pr\_20\_29\_60 Packings, washers and spacers
- Pr\_20\_29\_60\_96 Washers

**Ss - Systems**

- Ss\_25 Wall and barrier systems
- Ss\_25\_10 Framed wall system
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- Ss\_25\_12 Panel wall structure system
- Ss\_25\_12\_15 Concrete panel wall system
- Ss\_25\_20\_33 Glass fibre reinforced concrete (GRC) cladding system
- Ss\_25\_20\_33\_35 GRC cladding system
- Ss\_25\_25 Wall lining systems
- Ss\_25\_25\_05 Acoustic panel system
- Ss\_70\_30\_80\_45 Low-voltage system with prefabricated wiring
- Ss\_70\_80 Lighting systems
- Ss\_70\_80\_33 General space lighting system
- Ss\_70\_80\_33\_33 General lighting system with prefabricated wiring

**Pr - Products**

- Pr\_20 Structure and general products
- Pr\_20\_29 Fastener products
- Pr\_20\_29\_60 Packings, washers and spacers
- Pr\_20\_29\_60\_96 Washers

At this level the components can be linked to individual manufacturers data. This is described in more detail in 'Product Data Definition - A technical specification for defining and sharing structured digital construction product information' (S. Thompson, April 2016).

LEXiCON, hosted by the Construction Products Association (CPA), will implement the methodology set out in the Product Data Definition document and facilitate the capture of the following information relating to products:

- Essential Requirements for the Harmonised European Standards (hENs);
- Requirements from other Standard (e.g relevant ISO, EN or BS standards other than those captured above);
- Industry recognised documents;
- Mandated requirements for a specific sector or application e.g. NRM for Chartered Surveyors;
- Non-mandated but recognised within a specific sector e.g. CIBSE Guide M;
- Industry agreed and recognised e.g. identified by a professional institute, trade association or cross-industry group;
- User-defined additional terms proposed for approval and wider adoption.

54

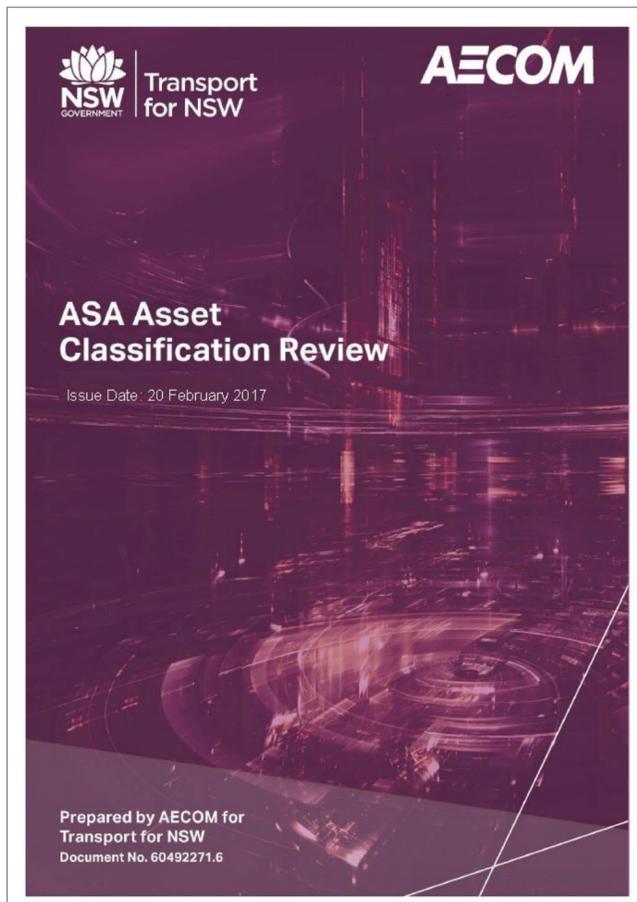
55

Below: Example of approved product data template from "Product Data Definition"

[http://bim-level2.org/globalassets/pdfs/product-data-definition\\_v2.pdf](http://bim-level2.org/globalassets/pdfs/product-data-definition_v2.pdf)

Property	Value	Units	Property	Value	Units	Property	Value	Units
Material	Concrete		Material	Concrete		Material	Concrete	
Colour	Grey		Colour	Grey		Colour	Grey	
Finish	Smooth		Finish	Smooth		Finish	Smooth	
Weight	2500	kg/m³	Weight	2500	kg/m³	Weight	2500	kg/m³
Strength	C25		Strength	C25		Strength	C25	
Modulus	30000	N/mm²	Modulus	30000	N/mm²	Modulus	30000	N/mm²
Permeability	10	kg/m²	Permeability	10	kg/m²	Permeability	10	kg/m²
Thermal conductivity	1.7	W/mK	Thermal conductivity	1.7	W/mK	Thermal conductivity	1.7	W/mK
Thermal expansion	10	µm/mK	Thermal expansion	10	µm/mK	Thermal expansion	10	µm/mK
Shrinkage	0.2	%	Shrinkage	0.2	%	Shrinkage	0.2	%
Creep	0.2	%/year	Creep	0.2	%/year	Creep	0.2	%/year
Compressive strength	25	N/mm²	Compressive strength	25	N/mm²	Compressive strength	25	N/mm²
Tensile strength	3	N/mm²	Tensile strength	3	N/mm²	Tensile strength	3	N/mm²
Modulus of elasticity	30000	N/mm²	Modulus of elasticity	30000	N/mm²	Modulus of elasticity	30000	N/mm²
Poisson's ratio	0.2		Poisson's ratio	0.2		Poisson's ratio	0.2	
Dynamic modulus	30000	N/mm²	Dynamic modulus	30000	N/mm²	Dynamic modulus	30000	N/mm²
Dynamic Poisson's ratio	0.2		Dynamic Poisson's ratio	0.2		Dynamic Poisson's ratio	0.2	
Dynamic compressive strength	25	N/mm²	Dynamic compressive strength	25	N/mm²	Dynamic compressive strength	25	N/mm²
Dynamic tensile strength	3	N/mm²	Dynamic tensile strength	3	N/mm²	Dynamic tensile strength	3	N/mm²
Dynamic modulus of elasticity	30000	N/mm²	Dynamic modulus of elasticity	30000	N/mm²	Dynamic modulus of elasticity	30000	N/mm²
Dynamic Poisson's ratio	0.2		Dynamic Poisson's ratio	0.2		Dynamic Poisson's ratio	0.2	
Dynamic compressive strength	25	N/mm²	Dynamic compressive strength	25	N/mm²	Dynamic compressive strength	25	N/mm²
Dynamic tensile strength	3	N/mm²	Dynamic tensile strength	3	N/mm²	Dynamic tensile strength	3	N/mm²
Dynamic modulus of elasticity	30000	N/mm²	Dynamic modulus of elasticity	30000	N/mm²	Dynamic modulus of elasticity	30000	N/mm²
Dynamic Poisson's ratio	0.2		Dynamic Poisson's ratio	0.2		Dynamic Poisson's ratio	0.2	

# Transport for New South Wales



**4 Classification Reviews (Stage 1 & 2)**

**4.1 Summary of Findings**

The findings from this review are as follows:

- ASA ACS:** As a classification system, the TfNSW Asset Standards Authority (ASA) Asset Classification System (ACS) is not complete and does not comply with ISO 12006-2:2015 requirements. It is a single table that partially represents objects of several ISO classes. The ACS classification system is structured around both base-of-classification and part-of (modelling) principles.
- COBie:** COBie (as utilised by the Sydney Metro Stage 1) stipulates the format for the exchange of asset information for each object and therefore the use of a classification system is recommended.
- NRT:** Northwest Rapid Transit (NRT) adapted the ORIS Structure (VBS) for both Asset Location (LVBS) and Asset Description (ADBS) COBie that can be used as a template to create a classification system and doesn't comply with ISO 12006-2:2015 requirements. The template was not complete as it did not explicitly define all lifecycle activities and was probably not intended for use as a template for LVBS. The total objects for LVBS in the template are 237 and expanding ACS to incorporate the naming conventions is recommended.
- WZB:** The classification used by the Woolgoolga to Ballina partially represents objects of several ISO classes (classification) and part-of (modelling) principles. Conventions for drainage, roads and bridges may be used.
- RMS:** The RMS classification deals with objects of several ISO classes (classification) and part-of (modelling) principles. It does not provide a coding system to be used.
- Uniformat II:** Uniformat II was used by NSW Health Infrastructure. It was adopted as one of the tables (Table 21) in the COBie template. Uniformat II does not support separate tables as needed (Entities, Work result, building assets) as it does not include bridge and tunnel objects.
- NATSPEC:** NATSPEC provide a classification system which is used for the construction and maintenance of roads. NATSPEC is generally geared to the construction and maintenance and operations, for some Systems limited to Systems.
- Austrroads:** The Austrroads Data Standard for Road Management data requirements throughout the system has not been aligned with ISO 12006 requirements (Inventory Location and Reference Code lists). It is recommended to incorporate its information management principles into the ACS.

**5 Mapping TfNSW ASA ACS to Uniclass 2015 (Stage 3)**

**5.1 Preferred Classification Decision Point 1**

Stage 1 & 2 indicated that all the current classification systems used by TfNSW are either not or only partially aligned with the ISO 12006 classification framework. Additionally, it identified that there is currently no unified approach for asset classification across all construction sectors in Australia. NATSPEC's classification table is the only classification system that refers to ISO 12006-2 and the organization recommends that any amendment or adoption of a new classification system for the Australian construction industry should be based on ISO 12006-2:2015 requirements.

Therefore, the need for a comprehensive and widely adopted into construction industry has become imperative with the emergence of risk based decision making throughout the asset lifecycle.

Both Uniclass and OmniClass classifications follow the international standard ISO 15926-2:2015. Uniclass has a design goal of operating as a dynamic online classification system. The requirement for NSW when looking to accommodate additional TfNSW projects is to align with the ISO 12006-2:2015 requirements. Based on the findings from Stage 1 and 2, AECOM recommended Uniclass 2015 as the preferred classification system for Stage 3 against ASA ACS.

Based on the findings, AECOM recommended Uniclass 2015 as the preferred classification system for Stage 3 against ASA ACS in order to assess any gaps, if identified, improved or enhanced or replaced and to inform the recommendations.

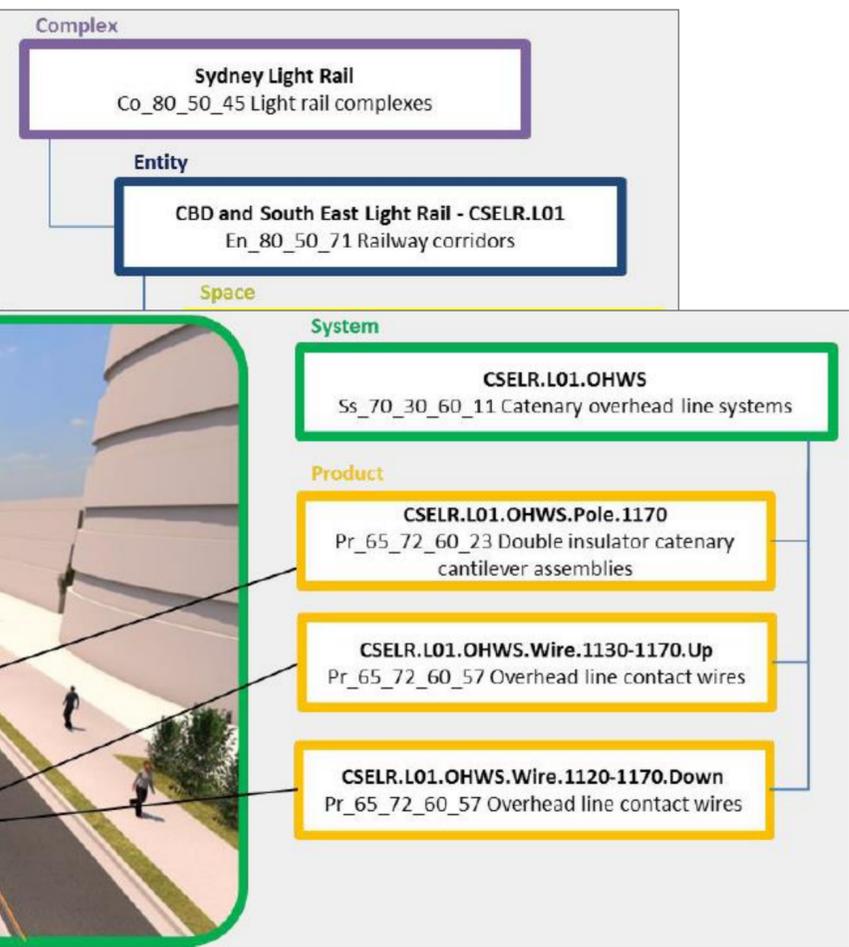
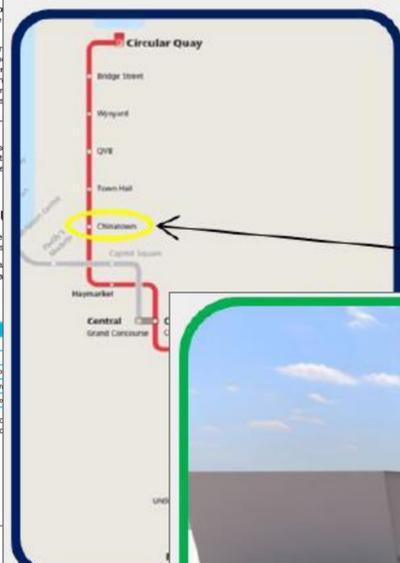
**5.2 Mapping TfNSW ASA ACS to Uniclass 2015**

AECOM assessed and documented gaps and differences between TfNSW ASA ACS and Uniclass 2015. The result of this assessment informed the recommendations.

In total, 1,059 objects from the ASA ACS register as well as the 1,059 objects from the Uniclass 2015 register were mapped into the Uniclass 2015 object table. Table 30 below outlines the mapping results.

Type	Description
1:0	An object exists in ACS but doesn't exist in Uniclass
1:1	Same object exists in both classification systems
1:Many	There are many objects in ACS that can be mapped to one object in Uniclass
Many:1	There are many objects in Uniclass that are mapped to one object in ACS
Many:Many	There are many similar objects named different in both classification systems

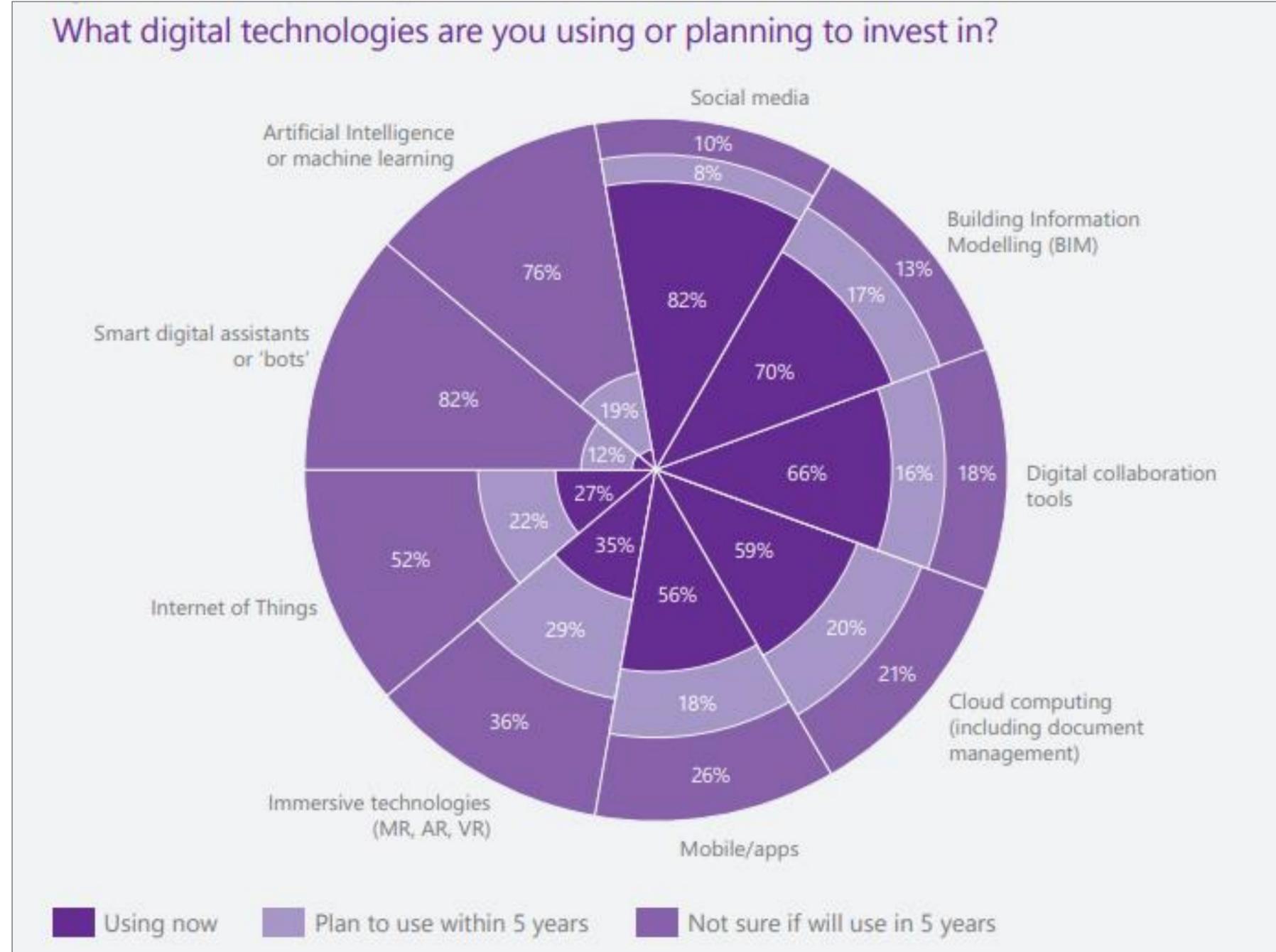
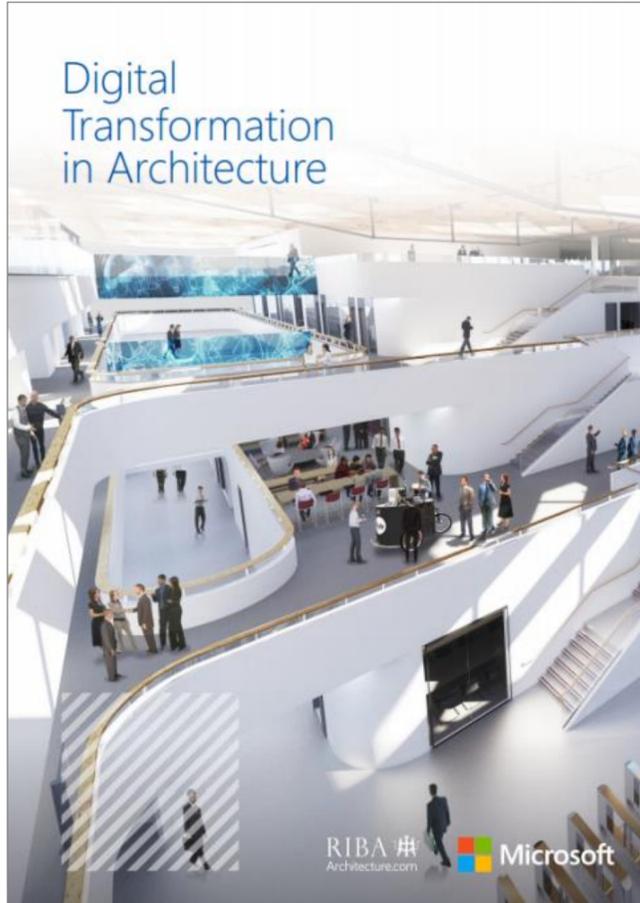
Figure 32 provides a summary of the mapping results, which indicates that 50% (530) objects were mapped into Uniclass directly (1:1 type) whereas, 50% (529) objects were mapped into Uniclass via a Many:1 type.



# 3. The cloud and connecting information



# NBS report for Microsoft and RIBA



🏠 > NBS

## My projects (9)

Open an existing project or get started on a new one.

Create Project

Filter projects



Sorted by

Code A-Z ▾



Demonstration Project

📍 Newtown, Newland



Office Masters



Sample specifications

📍 Newcastle upon Tyne, NE1 1RH UK



Old Post Office

📍 Newcastle upon Tyne, NE1 1RH UK

  
Dashboard

  
Projects

  
Libraries

📘

  
Settings

🏠 > NBS

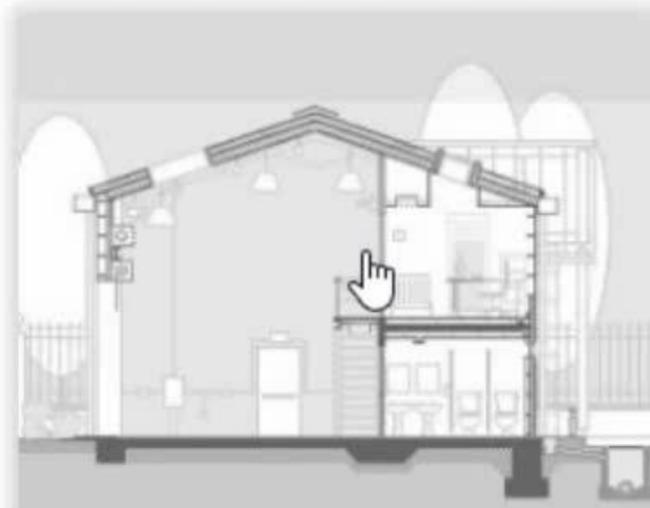
## My projects (9)

Open an existing project or get started on a new one.

Create Project

Filter projects 🔍

Sorted by  
Code A-Z ▾



Demonstration Project

📍 Newtown, Newland

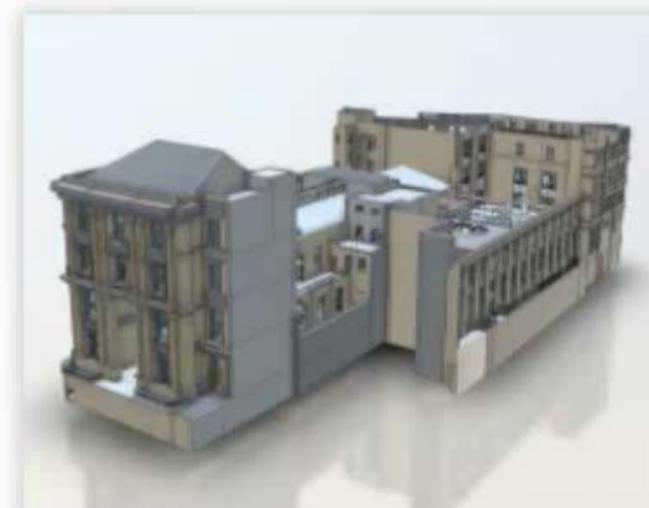


Office Masters



Sample specifications

📍 Newcastle upon Tyne, NE1  
1RH UK



Old Post Office

📍 Newcastle upon Tyne, NE1  
1RH UK

🏠 > NBS

## My projects (9)

Open an existing project or get started on a new one.

Create Project

Filter projects



Sorted by

Code A-Z ▾



Demonstration Project

📍 Newtown, Newland

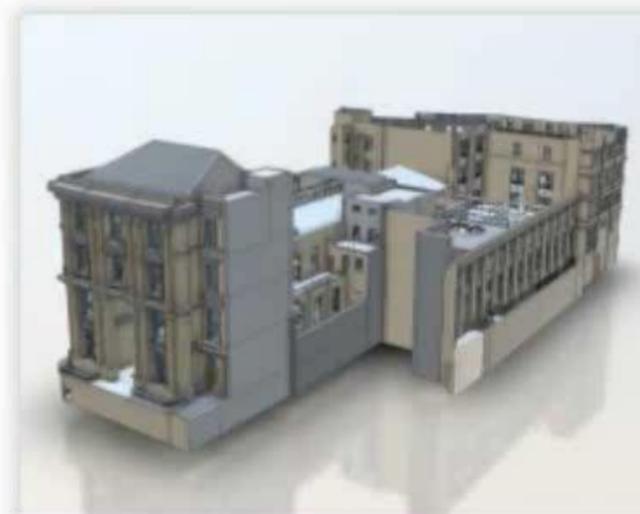


Office Masters



Sample specifications

📍 Newcastle upon Tyne, NE1 1RH UK



Old Post Office

📍 Newcastle upon Tyne, NE1 1RH UK

**Properties**

3D View

3D View: {3D} Edit Type

**Graphics**

View Scale	1 : 100
Scale Value 1:	100
Detail Level	Fine
Parts Visibility	Show Original
Visibility/Graphics...	Edit...
Graphic Display O...	Edit...
Discipline	Architectural
Show Hidden Lines	By Discipline
Default Analysis D...	None
Sun Path	<input type="checkbox"/>

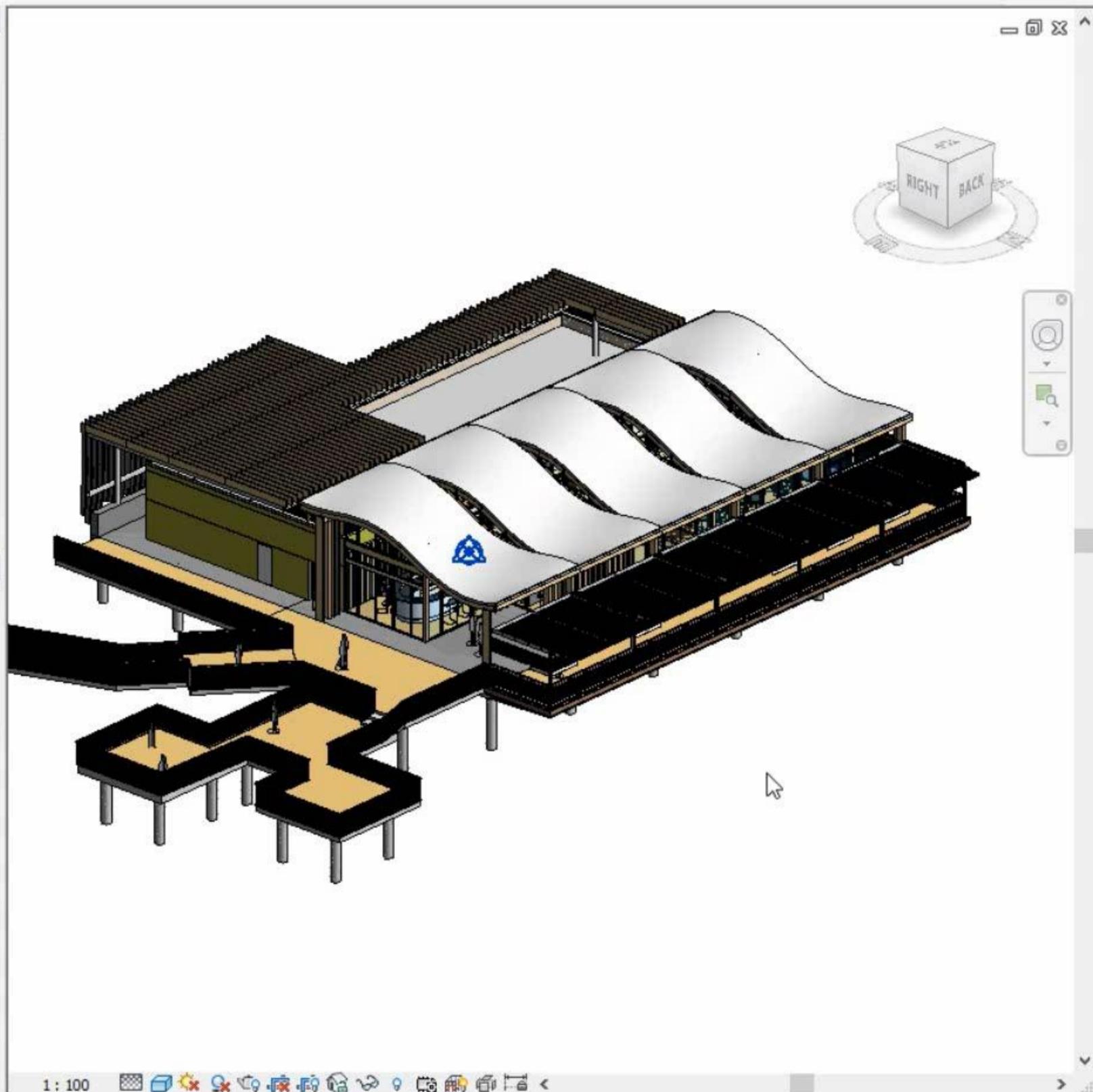
**Extents**

Crop View

Apply

**Project Browser - 001 NBS Lakeside Restaura...**

- Enlarged disabled toilet
- Enlarged toilets
- Ground floor plan
- Ground floor plan - finishes
- Ground floor plan - fire strate
- Ground floor plan - furniture
- Ground floor plan - presentat
- [-] Ceiling Plans
- [-] 3D Views
- [-] Elevations (Building Elevation)
- [-] Elevations (Interior Elevation)
- [-] Sections (Building Section)
- [-] Sections (Wall Section)
  - Typical wall section - external
  - Typical wall section - male toi
  - Typical wall section - male toi
  - Typical wall section - male toi
  - Typical wall section - public h
  - Typical wall section - skyligh



**NBS Chorus Panel**

NBS Chorus - Test

Dashboard Projects Libraries

NBS

### My projects (4)

Open an existing project or get started on a new one.

[Create Project](#)

Filter projects

Sorted by Title A-Z

**Content Examples**

Last edited: 20 days ago

**Humber River Hospital**

British Columbia (Colombie-Britannique), Canada

Last edited: 12 months ago

**Properties**

3D View

3D View: 3D - Main Edit Type

**Construction**

Issued

**Graphics**

View Scale 1 : 100

Scale Value 1: 100

Detail Level Medium

Parts Visibility Show Original

Detail Number 1

Rotation on S... None

Visibility/Grap... Edit...

Graphic Displ... Edit...

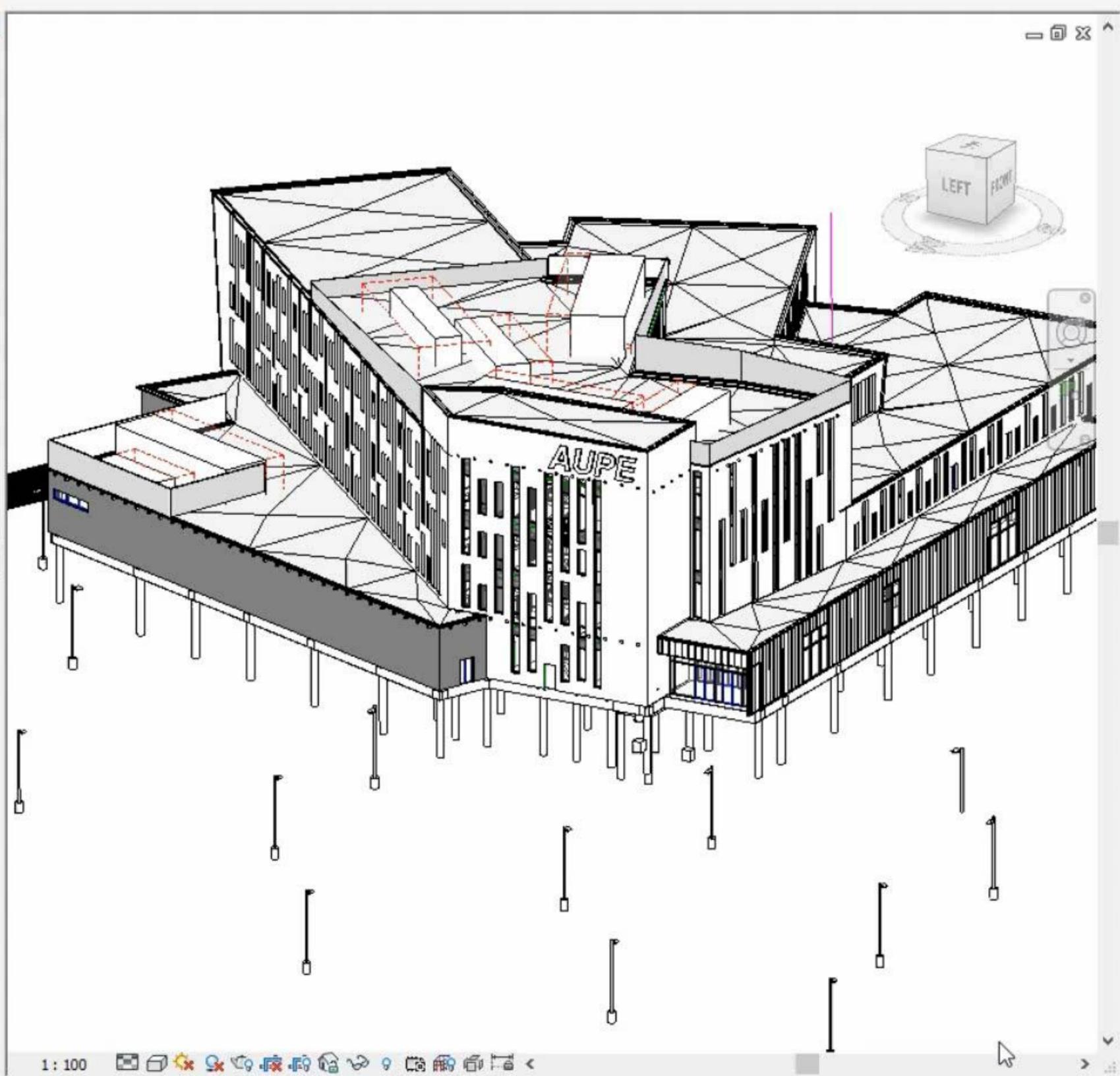
Discipline Coordination

Show Hidden ... By Discipline

Properties help Apply

**Project Browser - For Export.rvt**

- Views (all)
  - Floor Plans
  - 3D Views
    - 3D - Main**
    - 3D - Section
    - (3D)
- Legends
- Schedules/Quantities
- Sheets (all)
- Families
- Groups
- Revit Links



NBS

**My projects (4)**

Open an existing project or get started on a new one.

Create Project

Filter projects

Sorted by Title A-Z

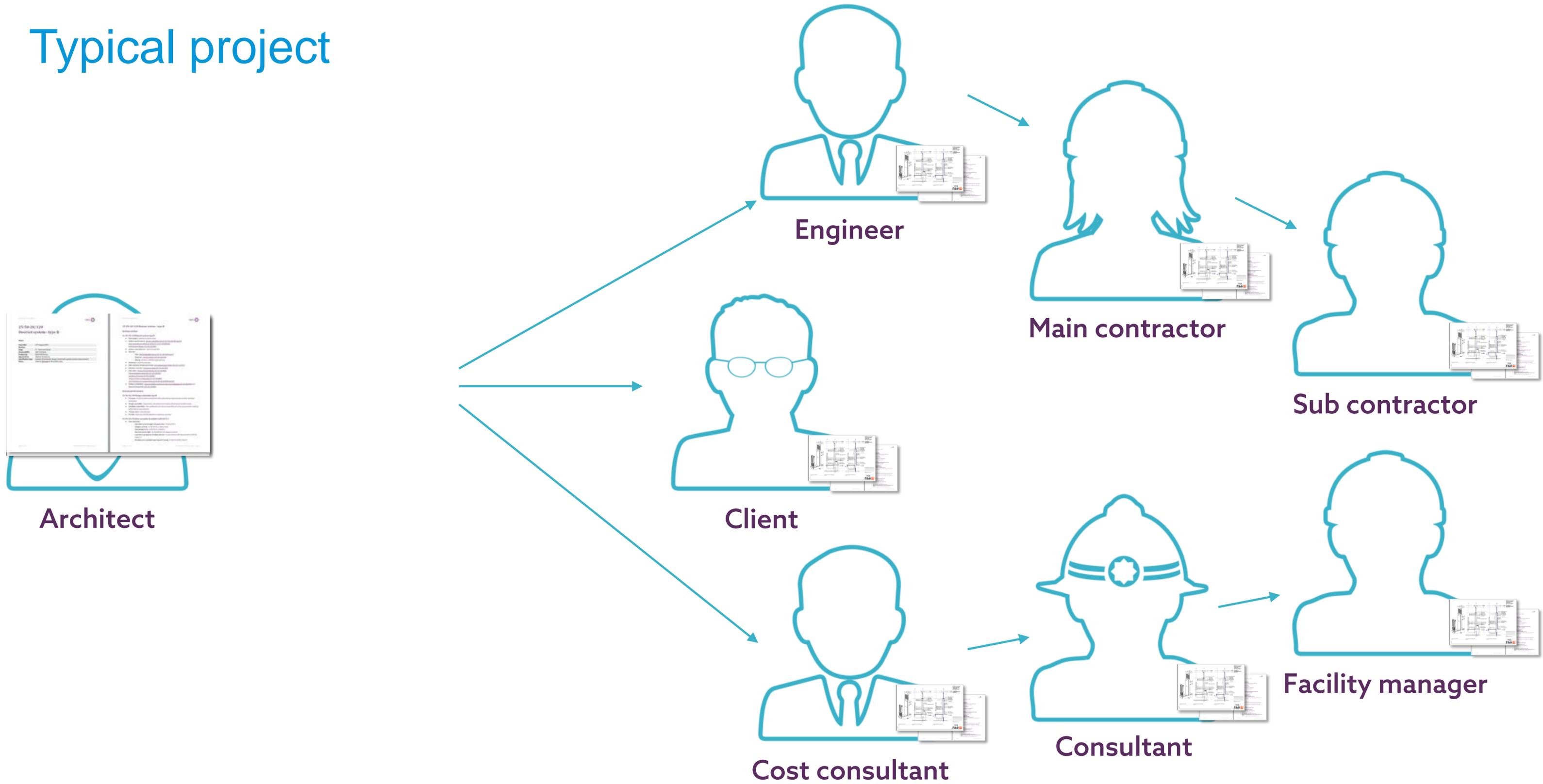
**AUPE**

Last edited: 4 days ago

**Content Examples**

Last edited: 19 days ago

# Typical project



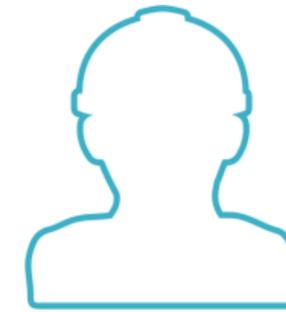
# Cloud future



Engineer



Consultant



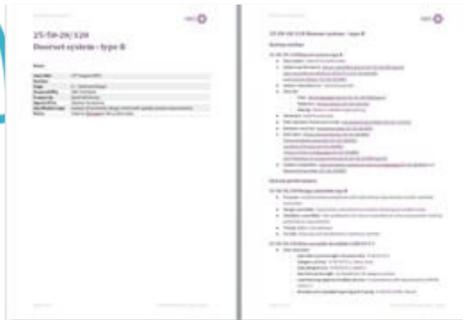
Sub contractor

The screenshot shows the NBS BIM Toolkit web interface. At the top, there's a navigation bar with 'SEARCH DEFINITIONS...', 'PROJECTS', 'CONTENT', 'SUPPORT', and 'SIGN OUT'. Below this, the main area is titled 'NBS Viewer' and features a 3D model of a building. To the left of the model is a 'Contents' panel with a search bar and a table of building components. To the right is a 'Specification' panel with instructions to select a clause or object. At the bottom, there's a toolbar with various icons and a footer that says 'The NBS Viewer is currently in BETA. VIEW BETA UPDATES'.

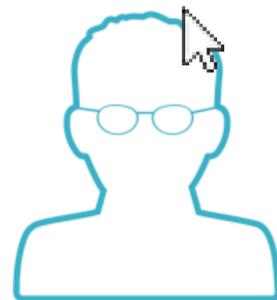
Title	Suffix	NBS Code	Uniclass 2015
Deconstruction syste...		10-45-20/110	Ac_10_10_20
Board suspended coi...	type A	20-10-10/110	Ss_30_25_10_10
Board suspended coi...	type B	20-10-10/110	Ss_30_25_10_10
Soffit lining and beam...	type A	20-10-10/170	Ss_30_25_10_80
Soffit lining and beam...	type B	20-10-10/170	Ss_30_25_10_80
Unit (modular) suspe...		20-10-20/190	Ss_30_25_32_90
Dock system		20-15-25/125	Ss_30_20_30_25
Rooflight system		20-25-75/170	Ss_30_30_72_72
Reinforced bitumen ...	type A	20-50-30/185	Ss_30_40_30_72
Reinforced bitumen ...	type B	20-50-30/185	Ss_30_40_30_72
Joint-supported woo...		20-55-05/150	Ss_30_20_10_50
Internal floor tiling sy...	type A	20-55-35/140	Ss_30_42_32_40
Internal floor tiling sy...	type B	20-55-35/140	Ss_30_42_32_40
Internal floor tiling sy...	type C	20-55-35/140	Ss_30_42_32_40
Raised access floor s...		20-55-70/170	Ss_30_20_70_70
Carpet tile system		20-55-75/110	Ss_30_42_72_10



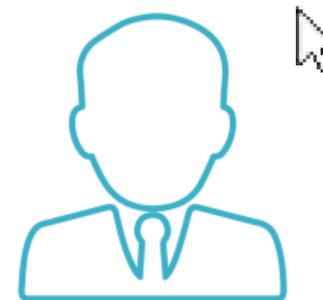
Architect



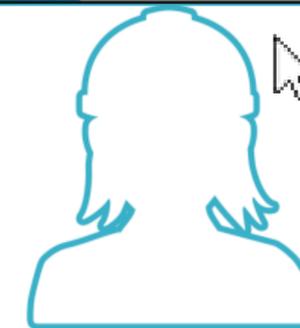
Facility manager



Client



Cost consultant



Main contractor



Google

- CONTENTS
- GUIDANCE
- PRODUCTS
- MODEL

Systems

Ss\_40\_15\_75\_94 Wash basin systems

1 Description: Semi-countertop wash basins to male and female washrooms

System performance:

2 System manufacturer: [Armitage Shanks](#) - see individual product details below

- 3 Components:
- [Counter top wash basins](#)
  - [Washbasin thermostatic water...](#)

System accessories:

4 Execution: [Installing sanitary assemblies ...](#)

- 5 System completion:
- [Water supply fittings](#)
  - [Documentation Type A](#)

Products

Pr\_40\_20\_96\_18 Counter top wash basins

1 Manufacturer: [Armitage Shanks](#)



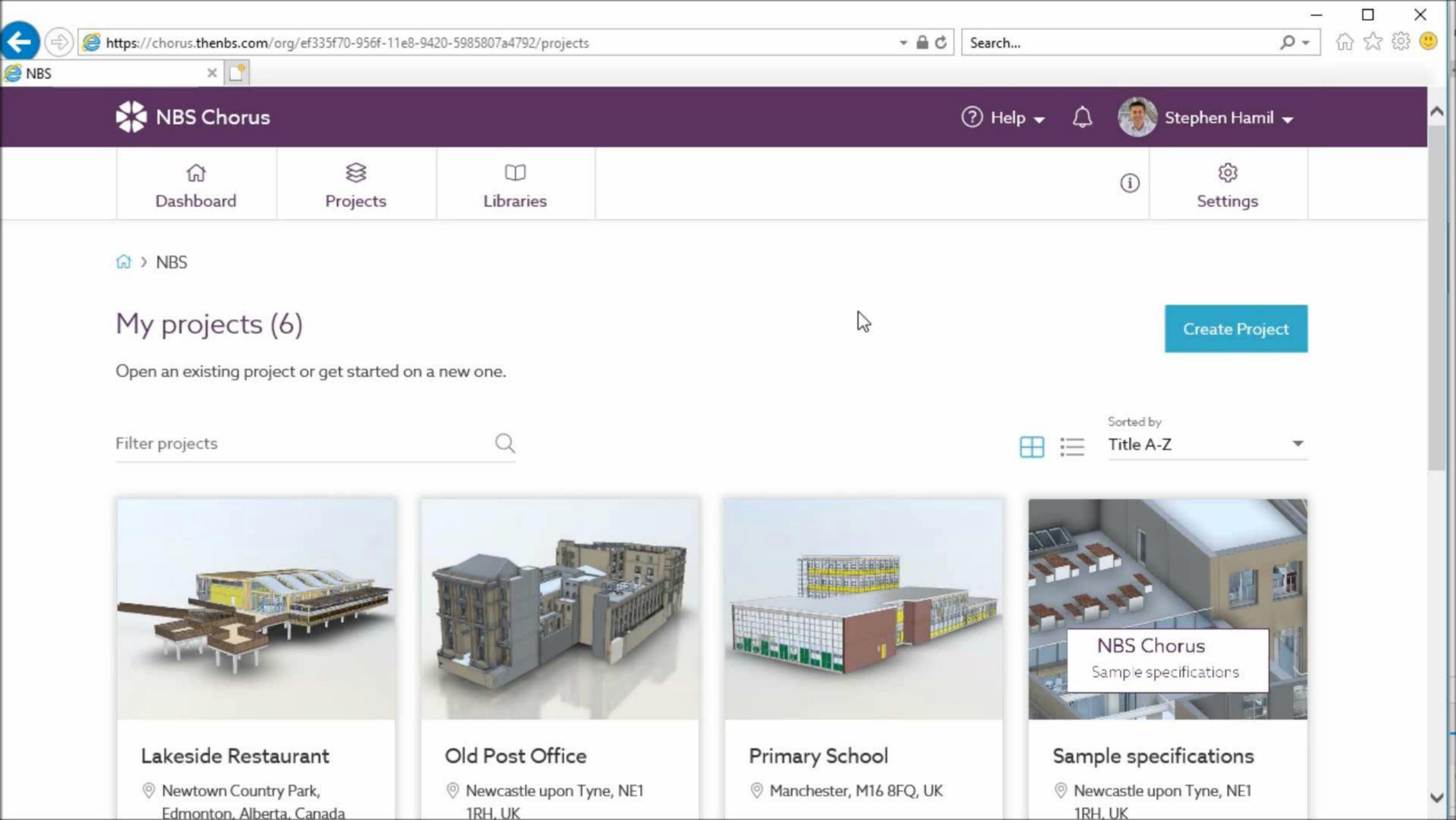
00 21 13 Instructions to bidders

Part 1 General

1.1 Bid call

- Offers signed under seal, executed, and dated will be received by the .....:
  - Located at .....
  - Before 14:00:00 local time on the ..... day of ....., 20.....
  - The time piece at the location for receiving bids shall be the only measure for the exact time.
- Offers submitted after the above time ..... be returned to the bidder unopened.
- Submit Document 00 43 00 - Supplementary Bid Information Form within ..... hours after closing time for receiving Bid Form.
- Offers will be opened ..... immediately after the time for receipt of bids.
- Offers will be opened at 14:00 on the ..... day of ....., 20....., at the office of the .....
- Amendments to the submitted offer will be permitted if received in writing with date-time prior to bid closing and if endorsed by the same party or parties who signed and sealed the initial offer.





Dashboard

Projects

Libraries



Settings

NBS

# My projects (6)

Create Project

Open an existing project or get started on a new one.

Filter projects



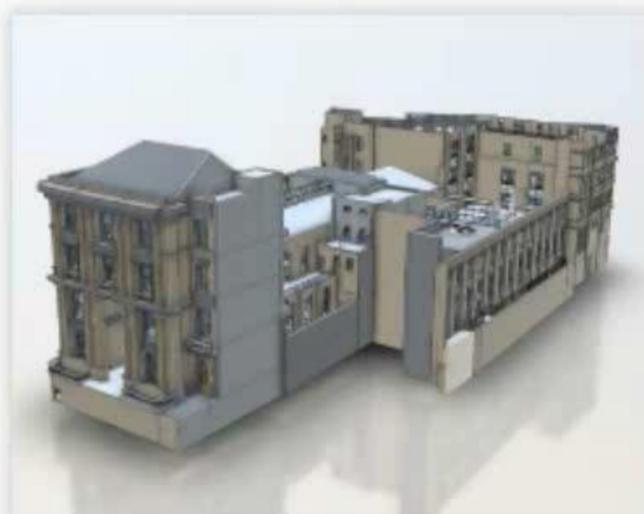
Sorted by

Title A-Z



Lakeside Restaurant

Newtown Country Park, Edmonton, Alberta, Canada



Old Post Office

Newcastle upon Tyne, NE1 1RH, UK



Primary School

Manchester, M16 8FQ, UK



NBS Chorus  
Sample specifications

Sample specifications

Newcastle upon Tyne, NE1 1RH, UK

# Summary



# SUMMARY

## 1. STATE OF THE INDUSTRY

We can and we will do better. Digitizing our workflows is the key enabler.

## 2. STRUCTURING INFORMATION

We need standard data structures to underpin the new tech.

## 3. THE CLOUD AND CONNECTING INFORMATION

The cloud and associated emerging tech will revolutionize the way we work.

# Final thought

“The most meaningful way to differentiate your company from your competition ... is to do an outstanding job with information. How you gather, manage, and use information will determine whether you win or lose.”

**Bill Gates**



# Final thought

“The most meaningful way to differentiate your company from your competition ... is to do an outstanding job with information. **How you gather, manage, and use information will determine whether you win or lose.**”

**Bill Gates**





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