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BLOCKCHAIN BIM

BIM Objects Evolution for Heritage Future Asset Management

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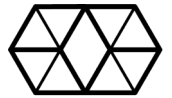
Agenda



BIM Objects in AEC Industry

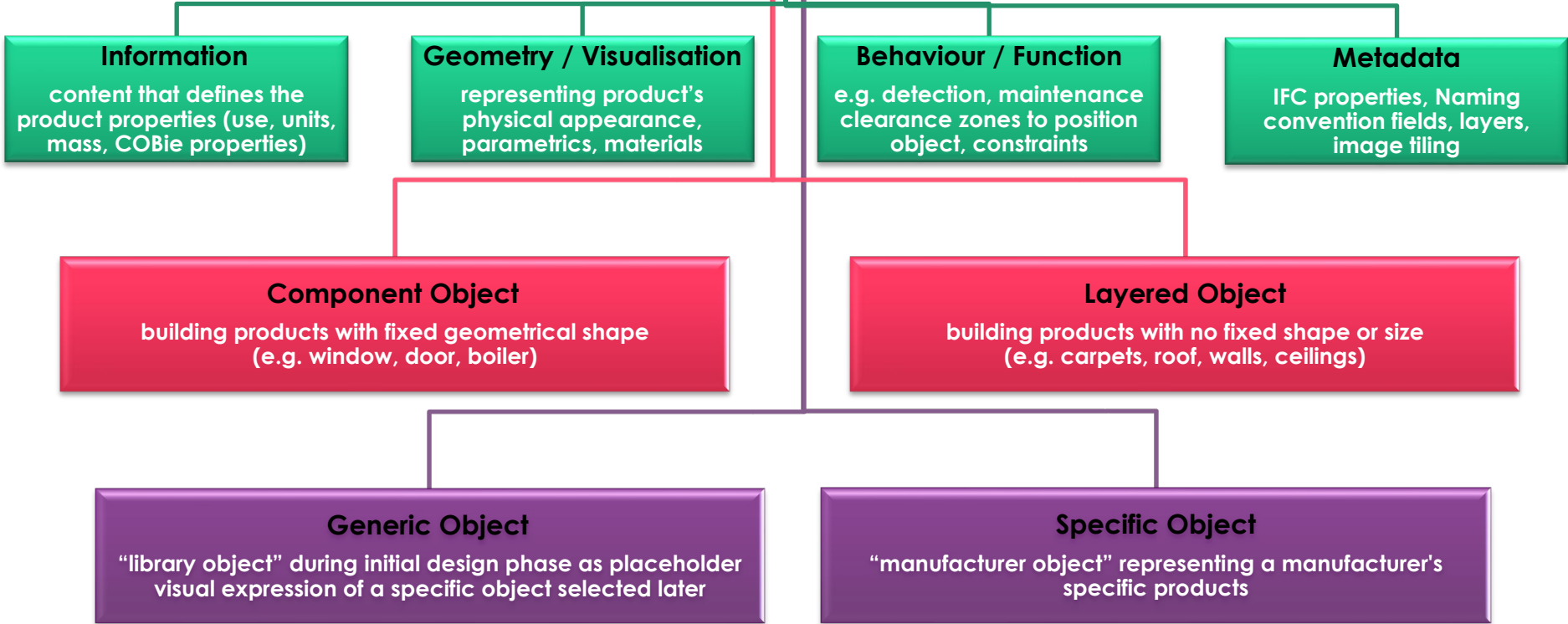
What is a BIM Object

National Building Specification - NBS



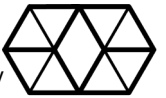
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BIM Object Product or Component Data File



What is a BIM Object

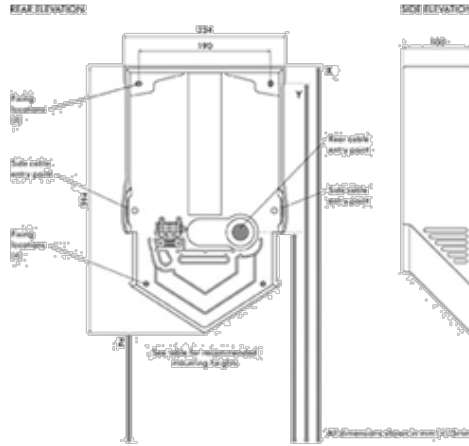
NBS National BIM library
<https://www.nationalbimlibrary.com/en/about-bim-objects/>



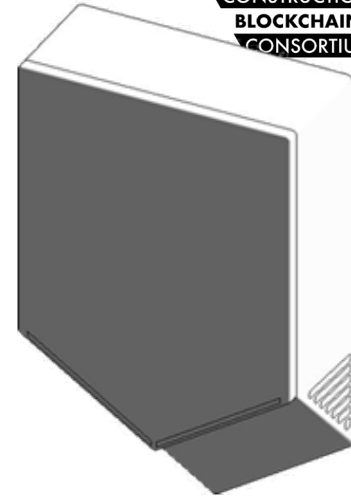
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Product data sheets/
technical information



Dimensions and
product geometry



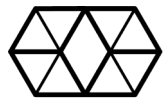
BIM object

Information & Behavioural Data

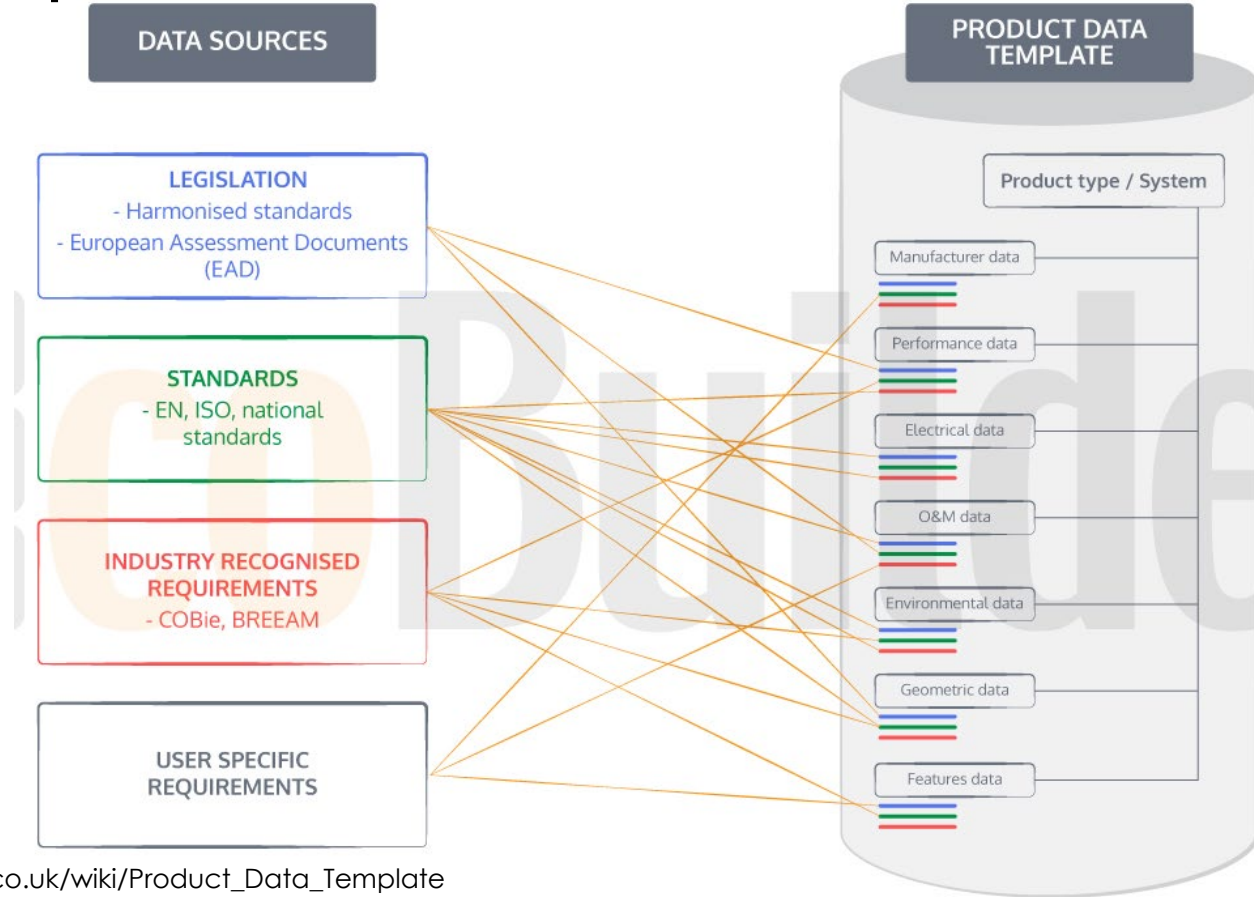
File formats:

- IFC
- Autodesk Revit
- Bentley AECOsim
- Nemetscheck Vectorworks
- Graphisoft ArchiCAD

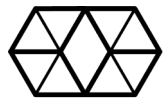
Product Data Template



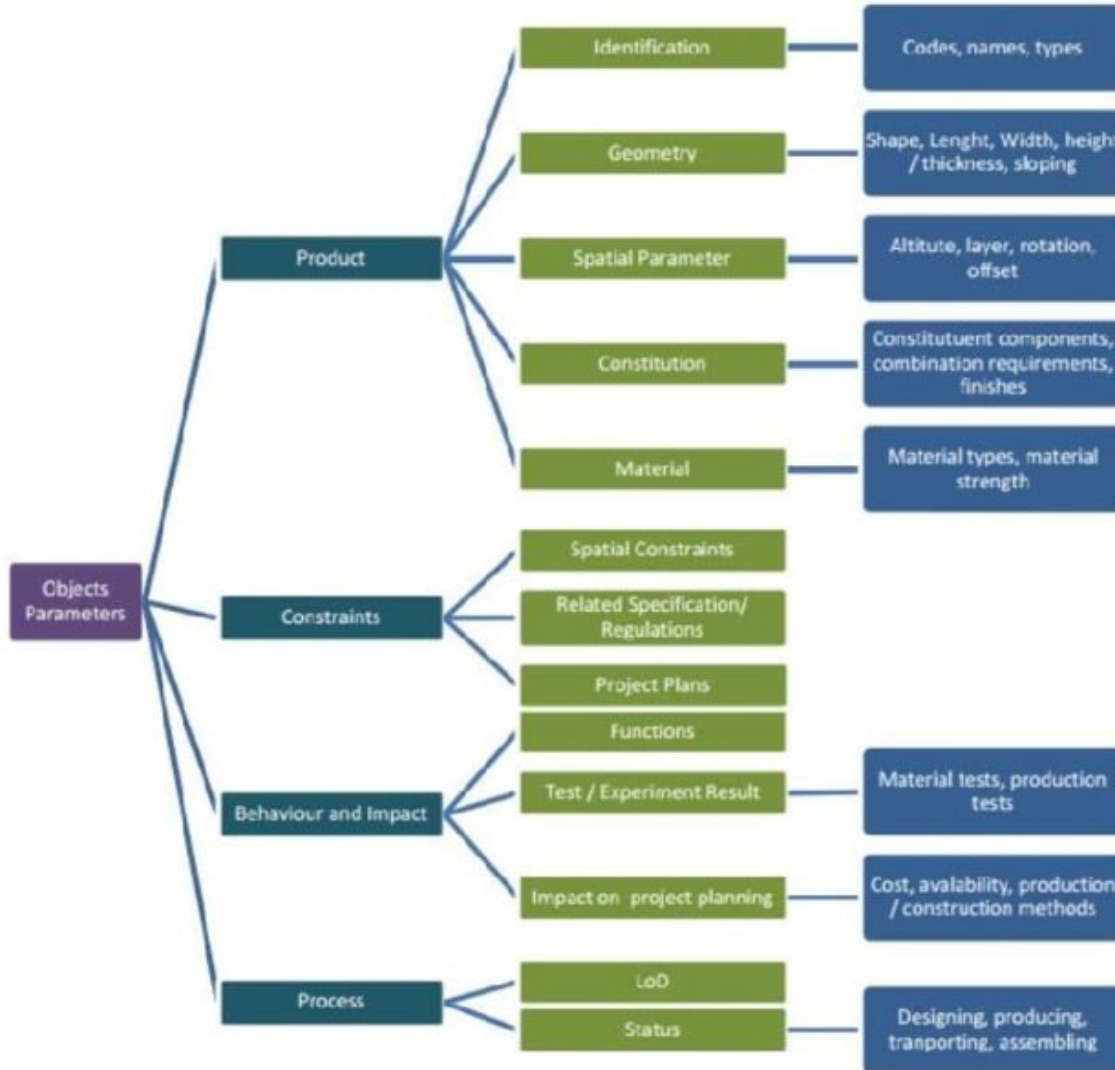
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https://www.designingbuildings.co.uk/wiki/Product_Data_Template



Information in a BIM Object



Lu, W., Chen, K., Wang, J. and Xue, F., 2017, July. Developing an open access BIM objects library: A Hong Kong study. In *Proceedings of the Joint Conference on Computing in Construction* (pp. 407-414).

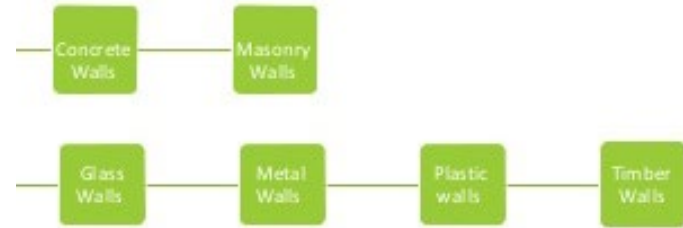
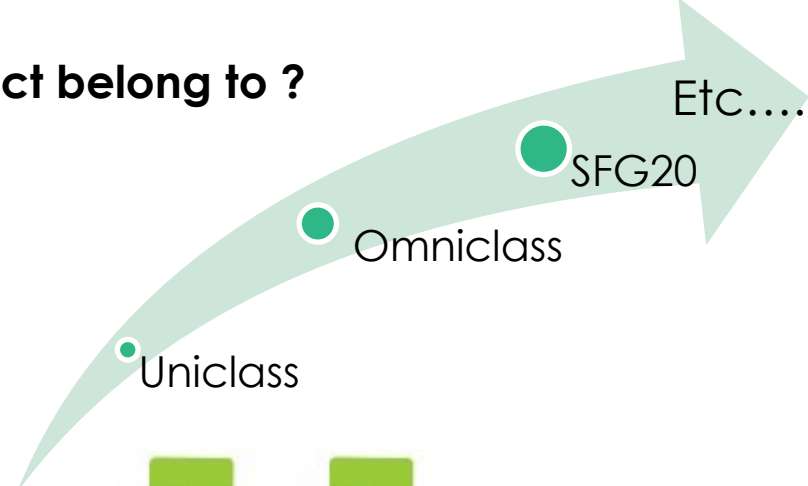
Evolution of BIM Objects Standardisation

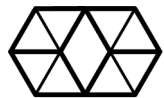


- ❖ **NBS BIM Object Standard** – introduced 2011
 - NBS BIM Object Standard v2.1 – 2019 (create all types of data information, geometry, function, metadata)
- ❖ **BS 8541 (1-6)** - Library objects for architecture, engineering and construction:
 - Part 2:2011 - Recommended 2D symbols of building elements for use in building information modelling
 - Part 1:2012 - Identification and classification. Code of practice
 - Part 3:2012 - Shape and measurement. Code of practice
 - Part 4:2012 - Attributes for specification and assessment. Code of practice
 - Part 5:2015 - Assemblies. Code of practice
 - Part 6:2015 - Product and facility declarations. Code of practice
- ❖ **buildingSMART Data Dictionary (bSDD)** - a 'vocabulary' that details what objects should be called
 - online service of **classifications** and their properties, allowed values, units and translations
- ❖ **buildingSMART Industry Foundation Classes Schema (IFC)** - BIM objects should be structured to IFC class name and property sets, irrespective of software platform creating object. IFC schema is a standardized data model that codifies
 - **identity and semantics** (name, machine-readable unique identifier, object type or function)...
 - **characteristics or attributes** (such as material, color, and thermal properties)
 - **relationships** (including locations, connections, and ownership)
 - **abstract concepts** (performance, costing)
 - **processes** (installation, operations)
 - **people** (owners, designers, contractors, suppliers, etc.)
- ❖ **Construction Operations Building Information Exchange (COBie)**

BIM Objects & Classification in Heritage

What system does the object belong to ?





Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa	Air Valve-Wastewater r-2-4 inch-THD.rfa
Gate Valve-FlxFL-Resilient Wedge-Cast Iron-Hand Wheel.rfa	Gate Valve-MxMJ-Resilient Wedge-Cast Iron.rfa	Plug Valve-Eccentric-0.5-2.5 inch-DI.rfa	Plug Valve-Eccentric-0.5-2.5 inch-DI.rfa	Plug Valve-MJ-Ball-Centric-Cl-Buried Service.rfa	Plug Valve-MJ-Ball-Centric-Cl-Buried Service.rfa	Pump Control Valve.rfa	Pump Control Valve.rfa	Pump-Cavity-High Pressure.rfa	Pump-De-Clogging-Self Priming.rfa	Pump-Dewatering-Submersible.rfa	Pump-Dewatering-Submersible.rfa	Pump-Dewatering-Submersible.rfa
Pump-Dosing-12 bar-Low Flow.rfa	Pump-Dosing-Digital-4 gph.rfa	Pump-Dosing-Digital-8 gph.rfa	Pump-Dosing-Mechanical-166 gph.rfa	Pump-Dosing-Mechanical-278 gph.rfa	Pump-Drainage-Submersible-Cast Iron.rfa	Pump-Drainage-Submersible-Stainless Steel.rfa	Pump-Drainage-Submersible-Stainless Steel.rfa	Pump-Effluent-Submersible-Stainless Steel.rfa	Pump-End Suction-Decant-Close-Coupled.rfa	Pump-End Suction-Decant-Close-Coupled.rfa	Pump-End Suction-Decant-Close-Coupled.rfa	Pump-End Suction-Decant-Close-Coupled.rfa
Pump-Sewage Churn-Submersible-Cast Iron.rfa	Pump-Sewage Vortex-Submersible-Cast Iron.rfa	Pump-Sewage-Submersible-Cast Iron.rfa	Pump-Solids-Vertical-High Efficiency.rfa	Pump-Submersible-Dry Pit.rfa	Pump-Transfer.rfa	Pump-Wastewater-Submersible.rfa	Pump-Wastewater-Submersible.rfa	Pump-Wastewater-Vertical-Centrifugal.rfa	Pump-Wastewater-Vertical-Immersion.rfa	Pump-Wastewater-Vertical-Immersion.rfa	Pump-Wastewater-Vertical-Immersion.rfa	Surge Relief Valve-2.5-8 inch-DI.rfa

Complex ?
Rail / hospital...

Entity ?
N. / S.
wing...

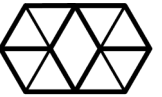
Activity ?
Waste water
treatment...

Space ?
Control
room...

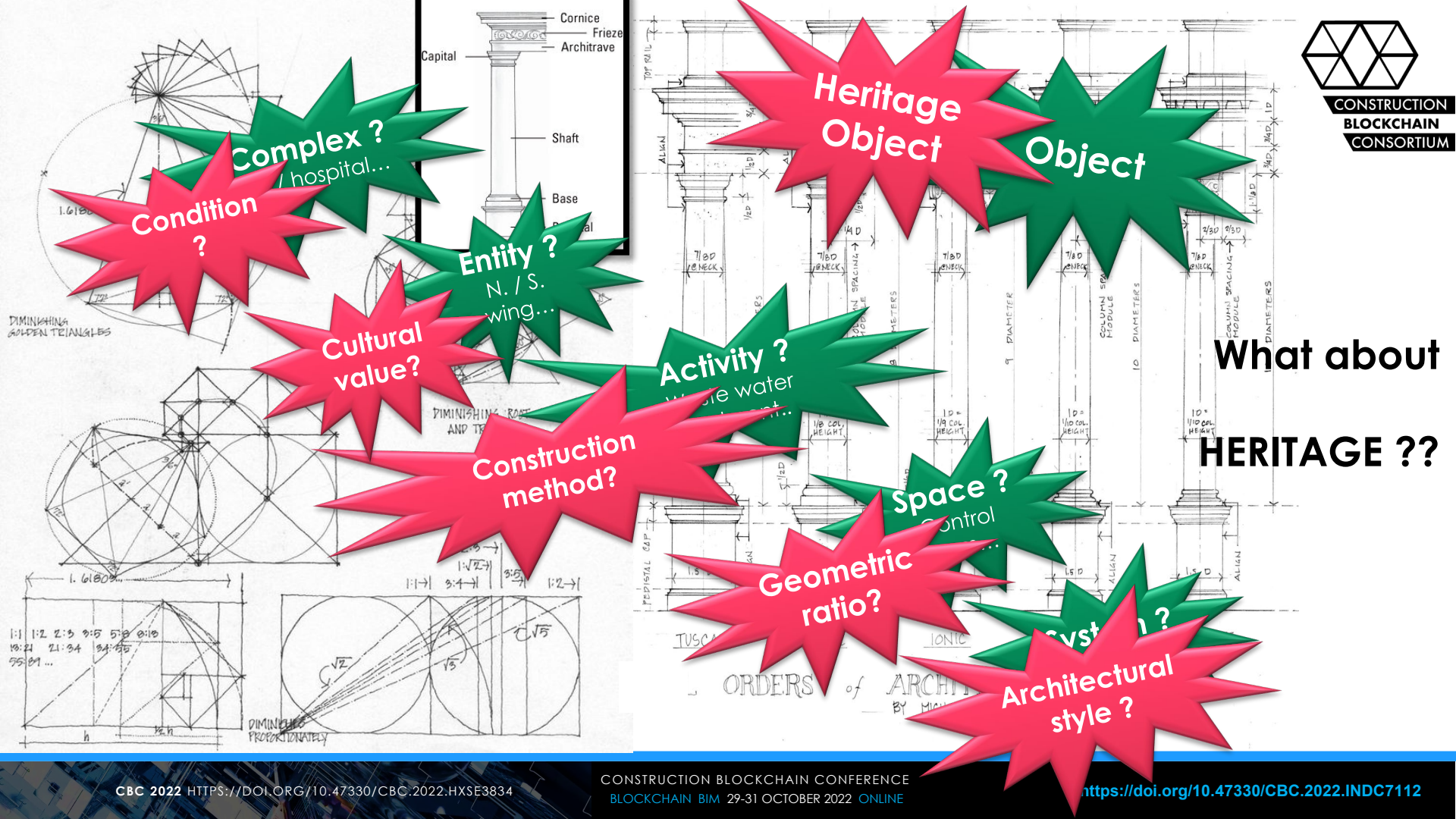
System ?
Hot water....

Object

What
system
does the
object
belong
to ?



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Complex ?
hospital...

Condition ?

Entity ?
N. / S.
wing...

Cultural
value?

Construction
method?

Activity ?
Water water

Space ?
Control

Geometric
ratio?

Architectural
style ?

What about
HERITAGE ??

More Hierarchical Attributes



What's missing...

- *Architectural age*
- *Construction restrictions*
- *Condition (deterioration, material durability etc.)*
- *Maintenance constraints*
- *Heritage value*
- *Reflectance attributes.....*

Framework for Restoration of Heritage using BIM

FRESH-BIM

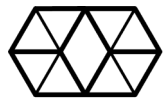
British Council Grant
- Newton Fund
Institutional Links

Toson Palace
(Cairo - 1869)

(Baroque / Renaissance...)



Heritage Ontological Classification System



لوحة رقم (١٨) القسم الشمالي - على ميمين المدخل (من الواجهة الشرقية للقصر الأمير طوسون ويتضح هنا توافر الأروحة التي تعبر معها البهو)



لوحة رقم (٢٠) القسم الشمالي - على يسار المدخل (من الواجهة الغربية للأمير طوسون)



لوحة رقم (٢١) القسم الجنوبي - على ميمين المدخل (من الواجهة الغربية للقصر الأمير طوسون)



لوحة رقم (٢٢) أحد الصناديق المعدنية الأربعة المعلقة لسقف البهو الرئيسي بقصر طوسون وخلفه قبة بارتفاعها ٨ أمتار



FARO: detailed scanning for components / structural analysis
 Matterport: VR / AR / tagging
 Back end expert system for renovation techniques



لوحة رقم (٢٣) عرشات غامضة تزين سقف البهو الرئيسي بقصر الأمير طوسون



لوحة رقم (٢٤) زخرفة الدرع يبدأ عليها التيجان والهلال (شكل شيبان) (تحت سقف القبة الأوسط من البهو الرئيسي بقصر طوسون)

Scanned by CamScanner



لوحة رقم (٢٥) زخارف الصناديق الحجرية من ركن السقف بقصر الأمير طوسون



لوحة رقم (٢٦) تفاصيل الترسود البرونزية بسقف الصناديق الشمالية الغربية بالطاقم الثاني بقصر الأمير طوسون

Scanned by CamScanner



لوحة رقم (٢٧) زخارف هندسية ونباتية متشعبة بألوان على الأرواح الخشبية بسقف القاعة الكبرى بالطاقم الثاني بقصر الأمير طوسون



لوحة رقم (٢٨) زخارف زرين في الحجرة الشمالية الغربية متشعبة بألوان على الأرواح الخشبية بقصر الأمير طوسون

Scanned by CamScanner



لوحة رقم (٢٩) سائر زخارف السقف بالبهو الرئيسي بقصر

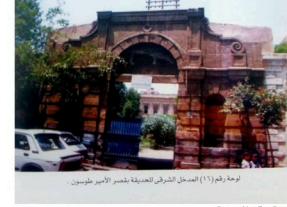


لوحة رقم (٣٠) شعار زرين أو بستان يعطون في الخشب بين أحد مصاريع الأبواب التي تفتح على البهو الرئيسي بقصر

Scanned by CamScanner



لوحة رقم (٣١) لوحة زينتة لتبديده صندرها الأمير غازي وبجانها طليخ مستطع بكارتيد على السقف الخشبي (عصر اسماعيل سعيد العنتاش)



لوحة رقم (٣٢) المدخل الشرقي للحديقة بقصر الأمير طوسون

Scanned by CamScanner



لوحة رقم (٣٣) المدخل الشرقي للقصر الأمير طوسون بارتفاعه أربعة أمتار فوق الأرض وعلى الطابق الثاني كورنيش مزخرف منزهة بممرحات المنوت وبأحداث الزخرفيات



لوحة رقم (٣٤) منظر عام للواجهة الشرقية وجزء من الواجهة الغربية (قصر الأمير طوسون)

Scanned by CamScanner

Heritage Ontological Classification Classes & Subclasses



Assembly Category

Structural components / Attached Architectural Components
Independent Components / Cladding



Orientation

Horizontal Support / Vertical Support / Inclined Support



System

e.g. Columns / Load bearing walls. / Sanitary Fittings



Type

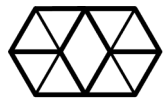
e.g. Doric Architrave / Ionic Frieze / Retaining Walls / Sink



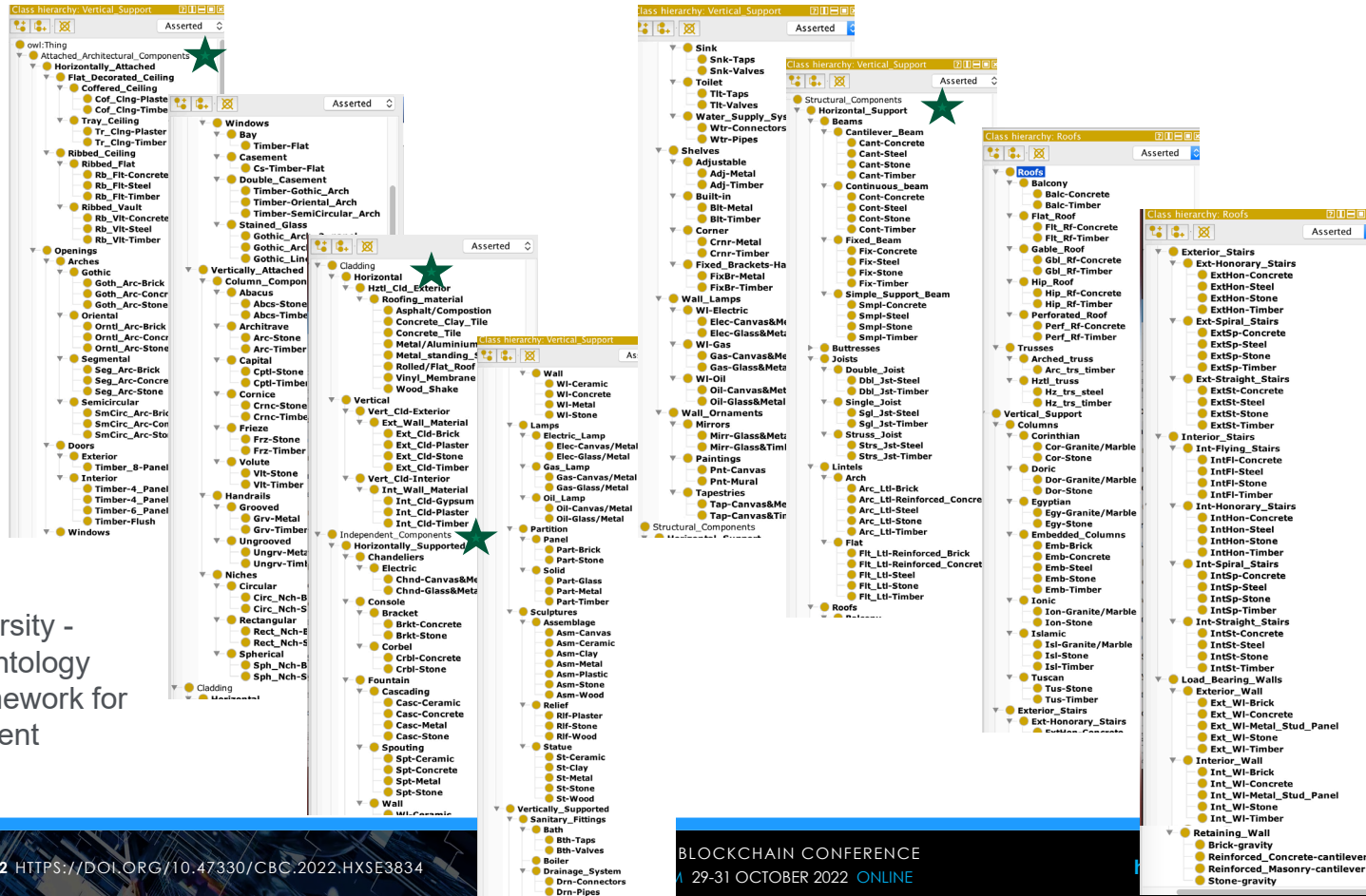
Composition

e.g. Concrete. / Stone / Brick / Timber / Steel

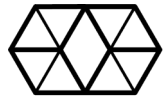
PROTÉGÉ Classes & Sub-classes



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Stanford University -
open-source ontology
editor and framework for
building intelligent
systems



Example

3 Dimensions

Class 1 Assembly Category	Class 2 Orientation	Sub-Class 3 System	Sub-Class 4 Type	Sub-Class 5 Composition
Structural components	Vertical Support	Columns	Egyptian	
			Doric	
			Ionic	
			Corinthian	
			Tuscan	
			Islamic	
		Embedded Columns	Concrete	
			Stone	
			Brick	
		Load bearing walls	Timber	
			Steel	
		Interior Stairs	Interior wall	
			Exterior wall	
			Retaining wall	
	Exterior Stairs	Flying stairs		
		Honorary stairs		
		Spiral stairs		
	Horizontal Support	Beams	Flying stairs	
			Honorary stairs	
			Spiral stairs	
		Joists	Simple support beam	
			Fixed beam	
			Cantilever beam	
		Lintels	Continuous beam	
			Single Joist	
			Double Joists	
		Roofs	Stress Joists	
			Flat	
			Arch	
Flat roof				
Gable roof				
Hip roof				
	Shed Roof			
	Butterfly			
	Mansard			
	Gambrel			
	Perforated			
	Balcony			

Object properties
5th Dimension

Data properties
4th Dimension

Next....

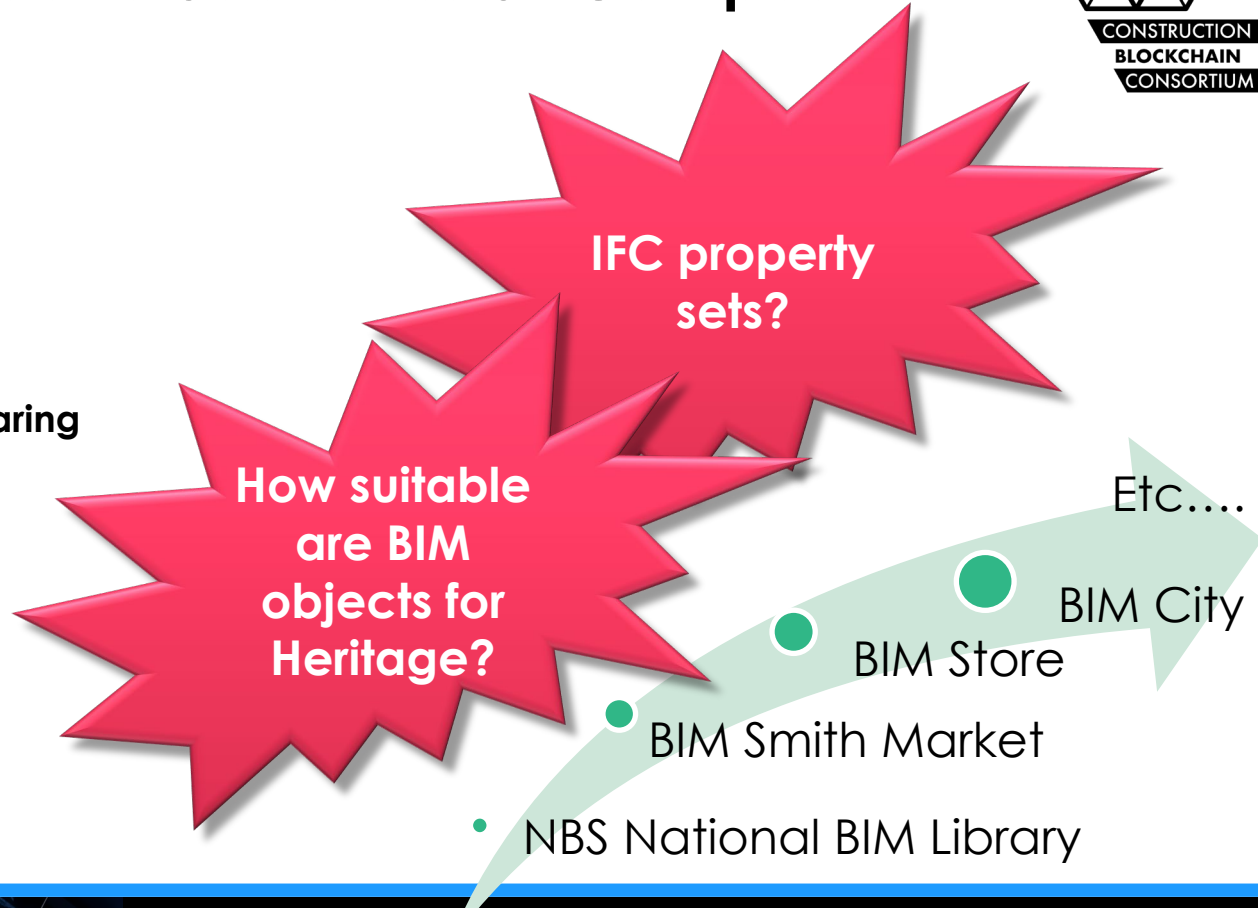


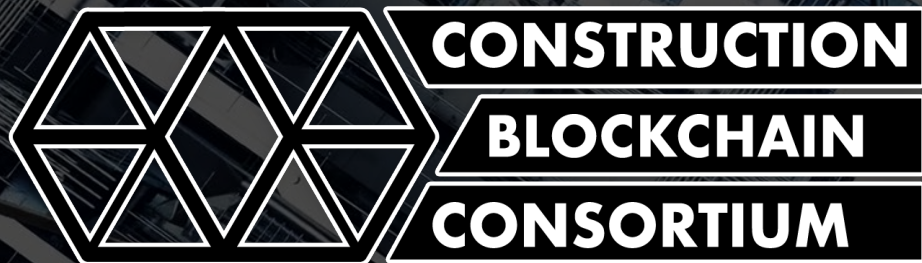
1. Add *Data Properties* – 4th D - which describe the common attributes for instances of a class i.e. the relationship between instances and their data values. In this case of sub-class level 5 giving the opportunity to document all the different components with their different characteristics that are actually available onsite.
2. Add *Object Properties* – 5th D - which describe the relationship between the instances of the different classes / sub classes and each other at sub-class 3 level. These change the relationship and relevance between different components from one heritage asset to another hence affect the way these components are maintained

Data Properties to add to Sub-class 5 "Composition"



1. Code ID
2. Architectural style
3. Age
4. Geometric ratio
5. Origin
6. Material name
7. Allowed stresses / load bearing
8. Construction method
9. Condition (deterioration)
10. Life expectancy
11. Maintenance constraints
12. Cultural Heritage value
13. Reflectance
14. Space function





B L O C K C H A I N B I M



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Thank you!

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constructionblockchain.org/2022