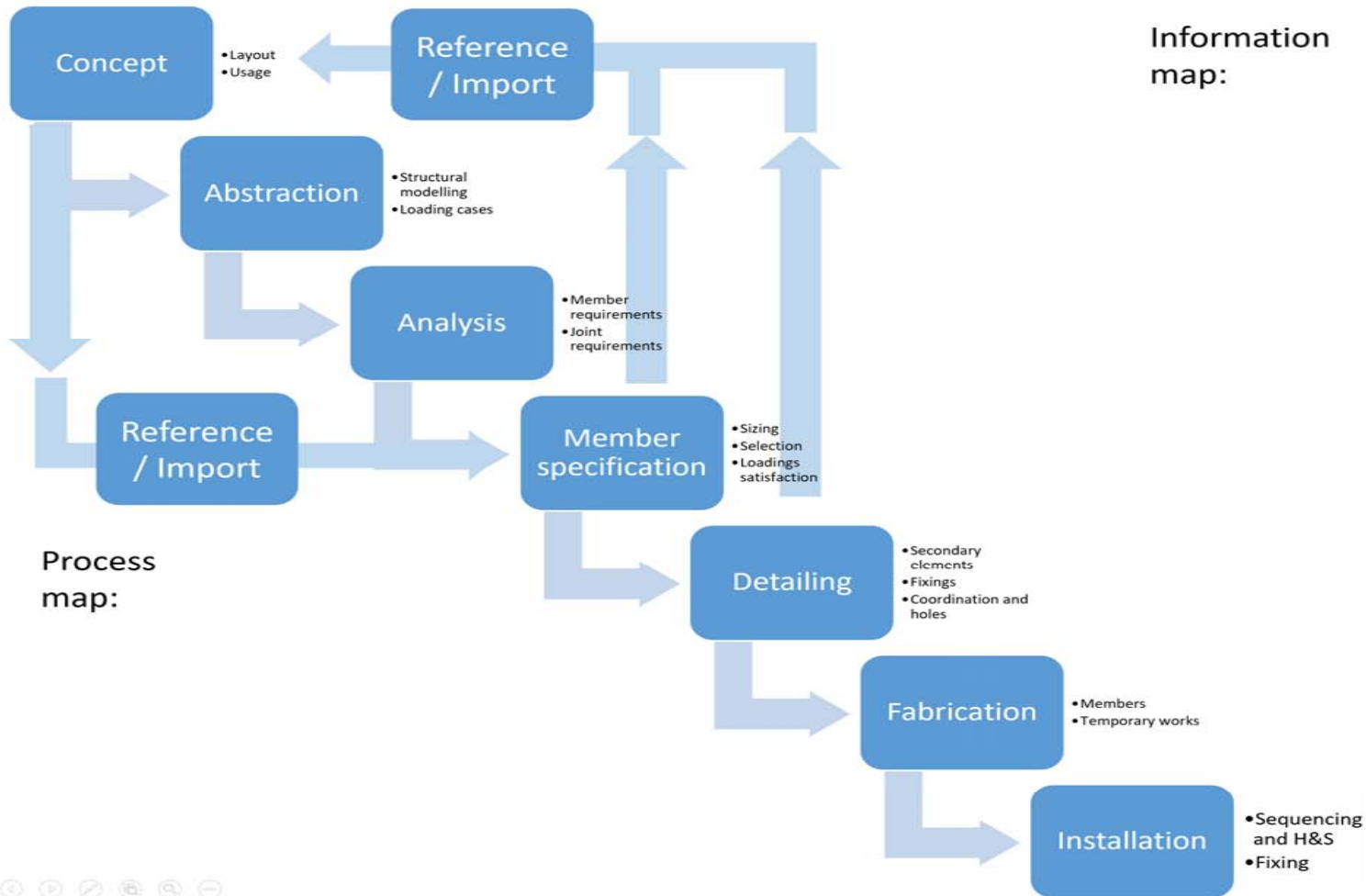




The role of BIM to support structural steel reuse.

Nicholas Nisbet

Where do we lose information?



Stage	Gained	Lost
Concept	identity, location, use	
Abstraction	loading	identity
Analysis	loads	use
Member specification	stresses, material	loads
Detailing		stresses
Fabrication		location
Installation	location	material

What makes BIM useful?

The image shows a screenshot of a BIM software interface, specifically 'usBIM.viewer+ BIM ONE (64 bit)'. The central part of the interface displays a 3D model of a steel beam grid, which is a square structure with a grid of blue beams supported by columns. A red callout box labeled 'Shape' points to the grid. To the left, there is an 'Entity' list with multiple 'BEAM' entries, each with a small icon. A red callout box labeled 'Name' points to the 'BEAM' entries. To the right, there is a 'Properties' panel with a tree view of properties. A red callout box labeled 'Class' points to the 'Class' property, which is 'IfcBeam'. Another red callout box labeled 'Assembly' points to the 'IfcObjectPlacement' property, which is 'IfcElementAssembly 'Steel Assembly''. A red callout box labeled 'Position' points to the 'Location' property, which is '[0.0000; 23.4000011114; 2.1550001024] [Meters]'. A red callout box labeled 'Material' points to the 'IfcMaterial' property, which is 'STEEL_S235JR'. A red callout box labeled 'Loadbearing' points to the 'LoadBearing' property, which is 'True'. A red callout box labeled 'Quantity' points to the 'Takeda Quantity' property, which is '1159.7000 [kilogram]'. The interface also includes a toolbar with various tools like 'Select', 'Misuratore', 'View Style', 'Aspect', 'Visibility', 'Copy', 'Select', 'Edit IFC', 'Add model', 'Export IFC', and 'Options...'. The top of the window shows the title bar and window controls.

Property	Value
Class	IfcBeam
Assembly	IfcElementAssembly 'Steel Assembly'
Position	[0.0000; 23.4000011114; 2.1550001024] [Meters]
Material	STEEL_S235JR
Loadbearing	True
Quantity	1159.7000 [kilogram]

What can we retain by using open BIM?

The screenshot displays the Tekla BIMsight interface for a project named 'Astron_Z13-01'. The central 3D view shows a complex steel truss structure with yellow and red beams. Three purple ovals are overlaid on the image, each containing a label: 'Single Model' in the top-left corner, 'Detailing (Tekla)' in the middle-right, and 'Production (MRP)' in the bottom-right. The right-hand side of the interface features a detailed property table for a selected beam object.

Property	Value
Product	RAFTER
Product Description:	IPE300
Product Object Type:	IPE300
Owning User:	1655@atsavr@Tekla Corporation
Creation Date:	2017-09-29 08:21:17
Change Action:	10 Change
State:	1 Defined
Application:	Tekla Structures (Multi material modeling v21.1 Service Release 9)
ifc2x3Product	
ifcMaterial	STEE1 (S355J2)
Scia_MemberCommon	
MemberId:	113
MemberTypeName:	EP_DSG_Elements.EP_Beam.1
Css:	MainBeams_Roof_4 - 1 + lw var
Mat:	S235
MaximumCapacityFactor:	2.40534484386444E-1
ALC... ..Element... ..apture	
Overall	3 E-1
Length:	8.1
Weight:	438.5
Type:	H
PARTDATC:	2013-11-21T00:00:00.000
PARTTIME:	1899-12-31T12:00:00.000
PARTDATM:	2017-09-22T00:00:00.000
PARTUSRM:	na
PARTDATSH:	2017-09-22T00:00:00.000
PARTLOCK:	FO
Project:	174412.
Composition:	PR43 PL1054 PL1055 PL264 PL265 PL361 PL400 PL859
Width2:	3 E-1
PARTCOMPQ:	1 1 1 1 1 1 2 1
PARTORIGIN:	10.
PartType:	1.
Assembly:	0.
Section:	IPE300
PARTINDEX:	

Physical provenance

Production date

Mill yard

Receipt date

Stock yard

Machining date

Transport yard

Installation date

Site

Virtual provenance

Concept design

Location

Detailing design

Identifier or Tag

ERP records

Identifier or Tag

Logistics

Identifier or Tag or location



Virtual provenance

REDUCE demonstrated **tools to convert multiple information resources**

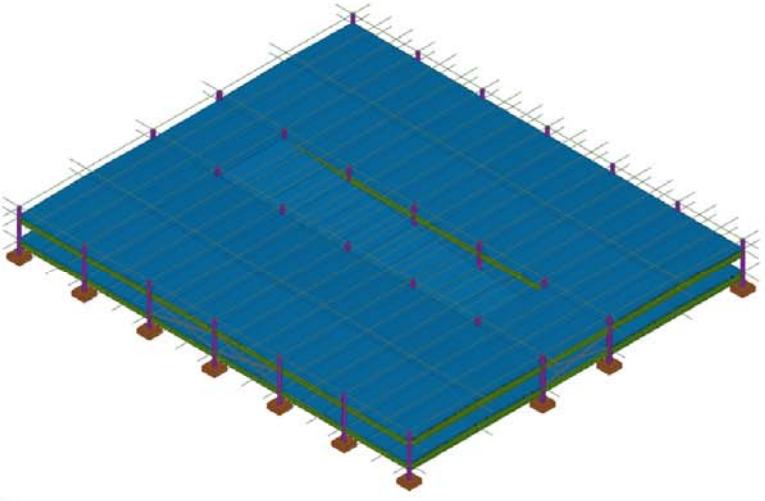
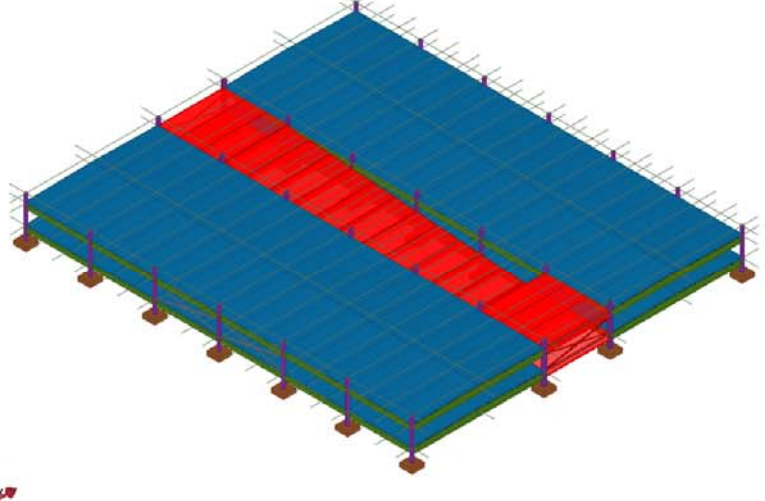
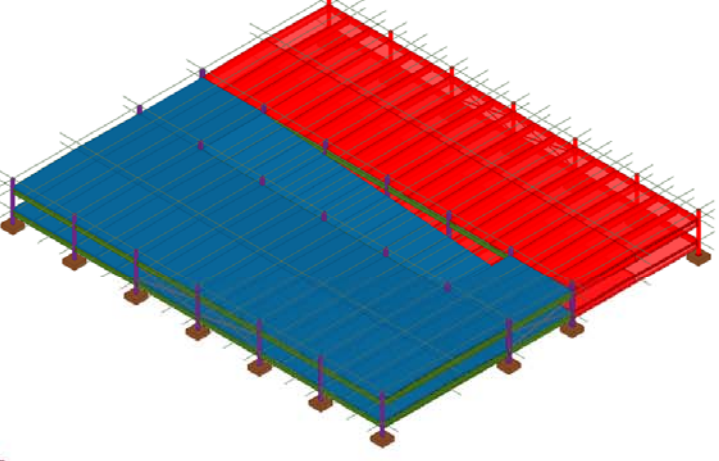

into a single information model in the ISO 16759 IFC open standard.

REDUCE proposes information requirements that improve:

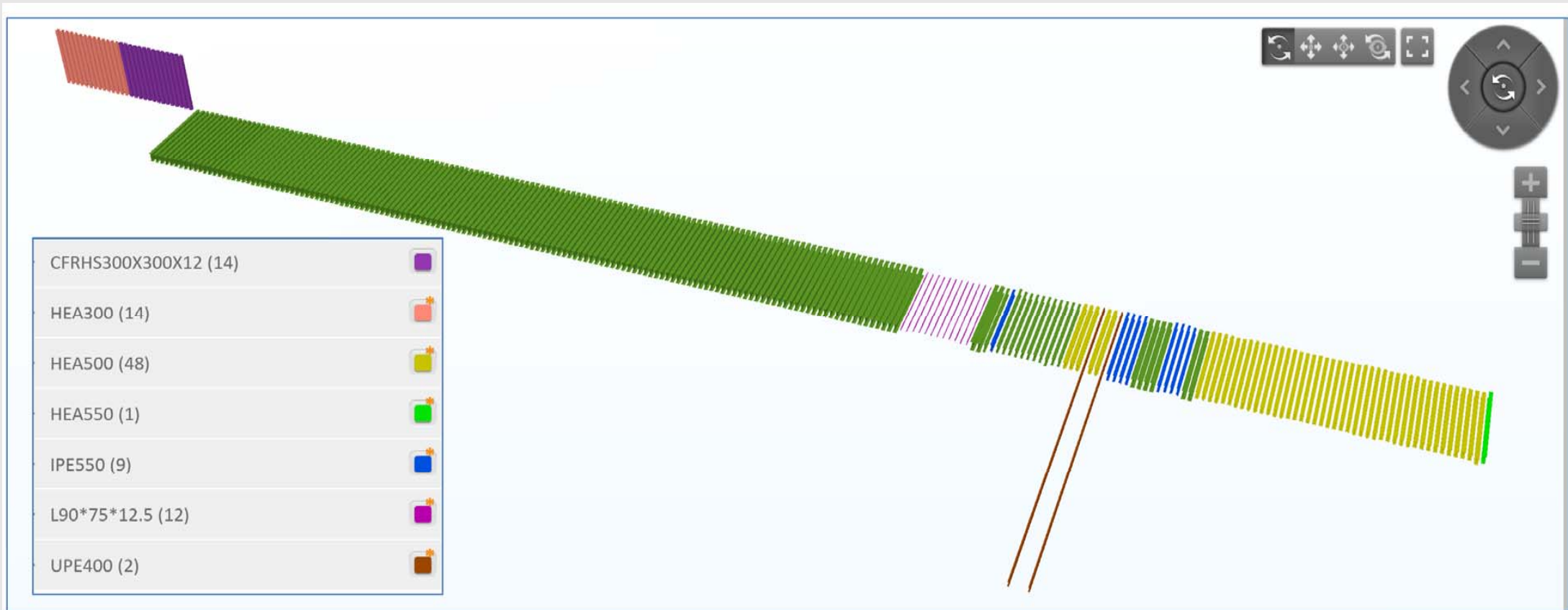
- QTO for LCA
- Serviceable Life prediction
- the probability of circularity

Aspect	Information requirement	Used to ...
Context	Project name and description	Confirm context where production codes are unique
	Site name and address	Confirm context where location is unique
	Facility name and description	Confirm context where any asset codes are unique
	Facility classification	-
Identification	Member identifier	Uniquely identify the member
	Member name and description	Recognise the member
	Type mark	Uniquely identify a set of identical members
	Location and orientation	Recognise a member in situ
	Execution class	Indicate the intended level of execution including its traceability.
Provenance	Mill / supplier	Confirm the origination of the material
	Batch / composition	Confirm the production characteristics and date
	Receipt date	Track the actual member
	Processing date	Track the actual member
	Transport date	Track the actual member
	Installation date	Track the actual member
Capacity	Size and features	Prescribe potential second use
	Role	Prescribe potential second use
	Material/ strengths/grades	Prescribe potential second use
	Batch certificate	Prescribe potential second use
	Capacity factors	Indicate the likelihood of past overstressing
	Treatments and finishes	Prescribe potential second use

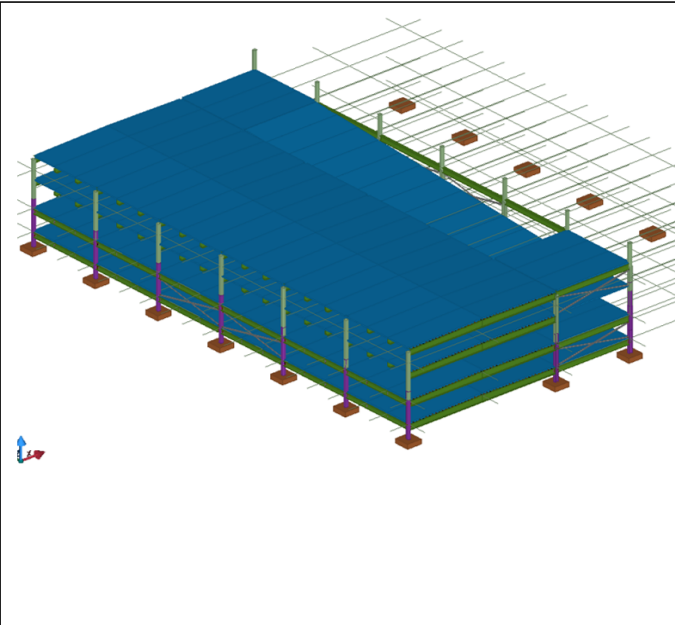
REDUCE took
TuD's Car Park
as a first life...

	
<p>First Life configuration</p>	<p>Members needing reordering (duplication) (red)</p>
	
<p>Members to be re-purposed (red)</p>	<p>Footings to be abandoned (red)</p>

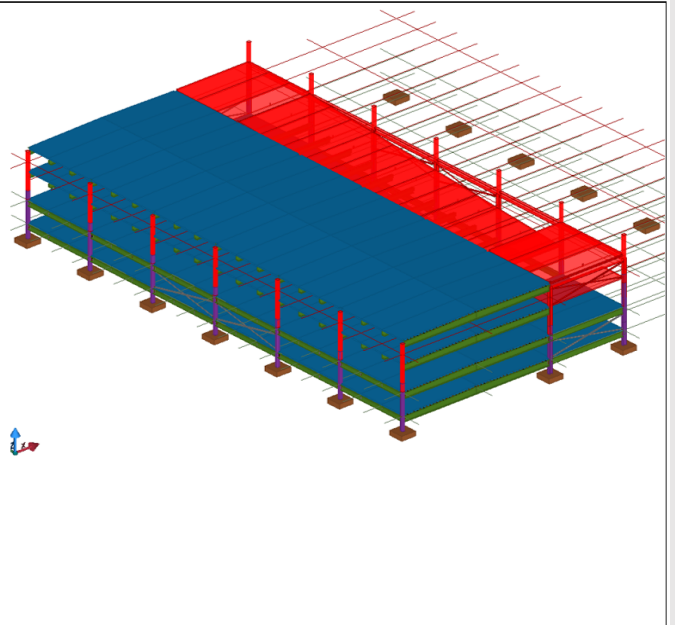
... to show it as a material bank ...



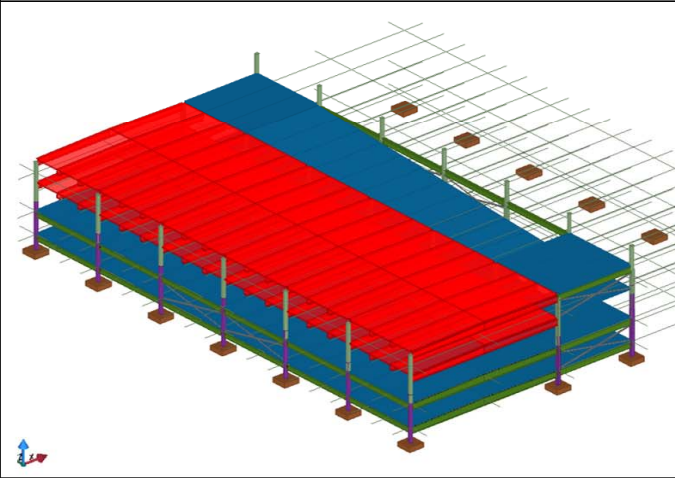
... and envisaged the car park having a second life.



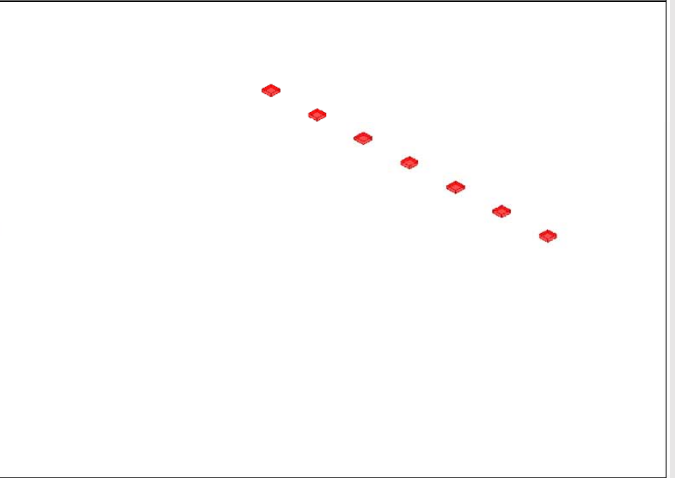
Second Life configuration – four storey car park



New members (red)



Re-purposed members (red)



Abandoned footings (red)

The role of BIM to support structural steel reuse.

- Circular re-use depends on retaining open information about:

Identify, Provenance, Capacity, Context

- REDUCE makes 18 recommendations towards creating:

A secure single consolidated information model using ISO16759 IFC with consistent member, grid, loading, material and section names.

- Similar expectations are appearing elsewhere:

- ISO 20887:2019, Annex C. Properties to support design for disassembly and adaptability.
- EU BAMB “Building as Material Banks”