Can Digital save Physical?

Emerging technologies for a sustainable built environment

Can Digital Save Physical?

- Introduction
- Digital Technology - **Design**
- Digital Technology - **Construction**
- Digital Technology - **Operation**
- Challenges
- Discussion

Josh Chrystal // **Head of BIM**
Maber Associates

Can Digital Save Physical?

Introduction











"In the UK, the construction industry is responsible for 39% of all greenhouse gas emissions. What role will digital technologies play in ensuring that we meet our net zero carbon targets?"

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Introduction

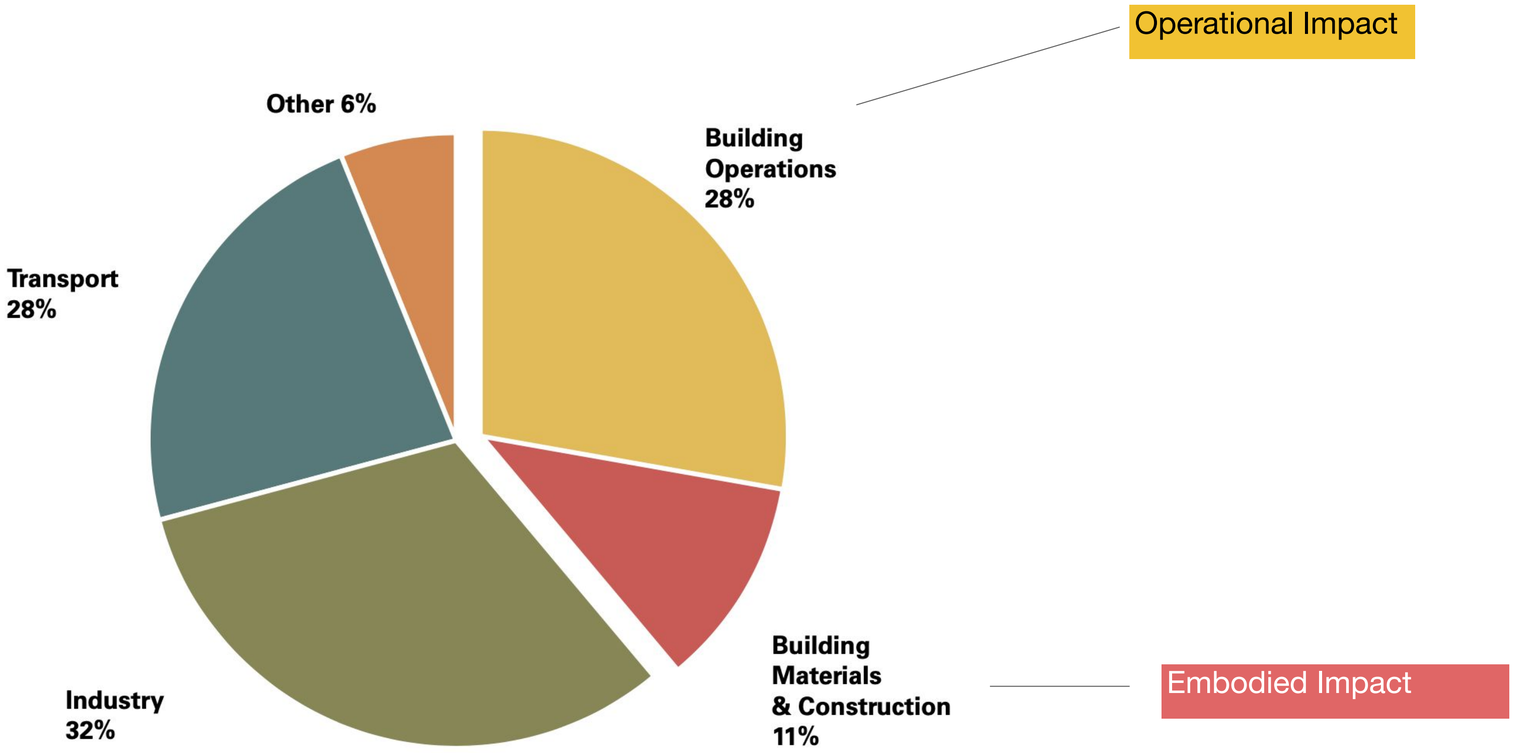
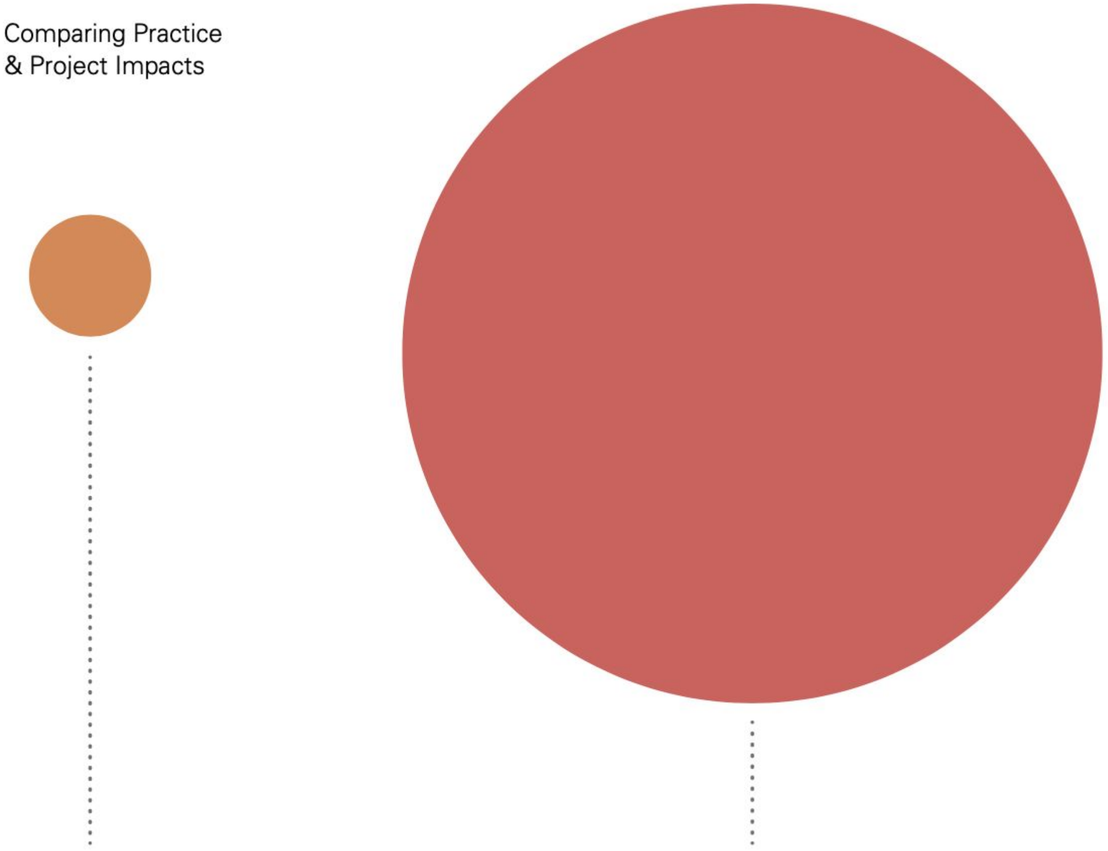


Fig. 1 Global CO_2 Emissions by Sector
Source Global Alliance for Buildings and Construction, 2018 Global Status Report

‘Humans spew more than 44 billion tons of CO2 into the atmosphere every year.’ (National Geographic)

Fig. 5 Comparing Practice & Project Impacts



Large Practice Annual Scope 1–2
73 Tonnes CO_2e
Source—Haworth Tompkins

Embodied Carbon—One Large Project
2,500Tonnes CO_2e
Source—Haworth Tompkins

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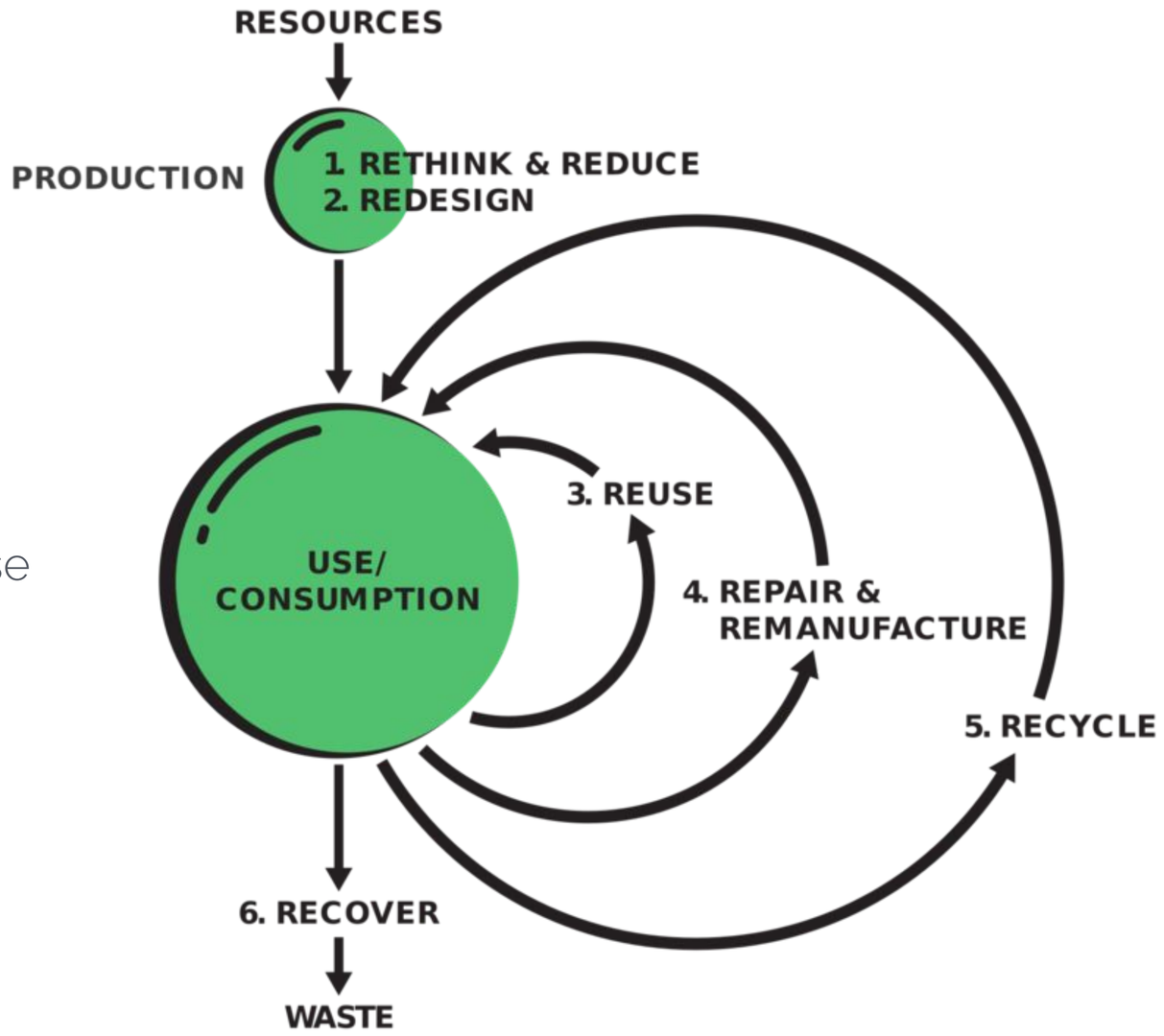
Circular Economy

- Designing out waste and pollution
- Keeping products and materials in use
- Regenerating natural systems



Digital: Design

Digital: Construction

Digital: Operation

Digital: Design

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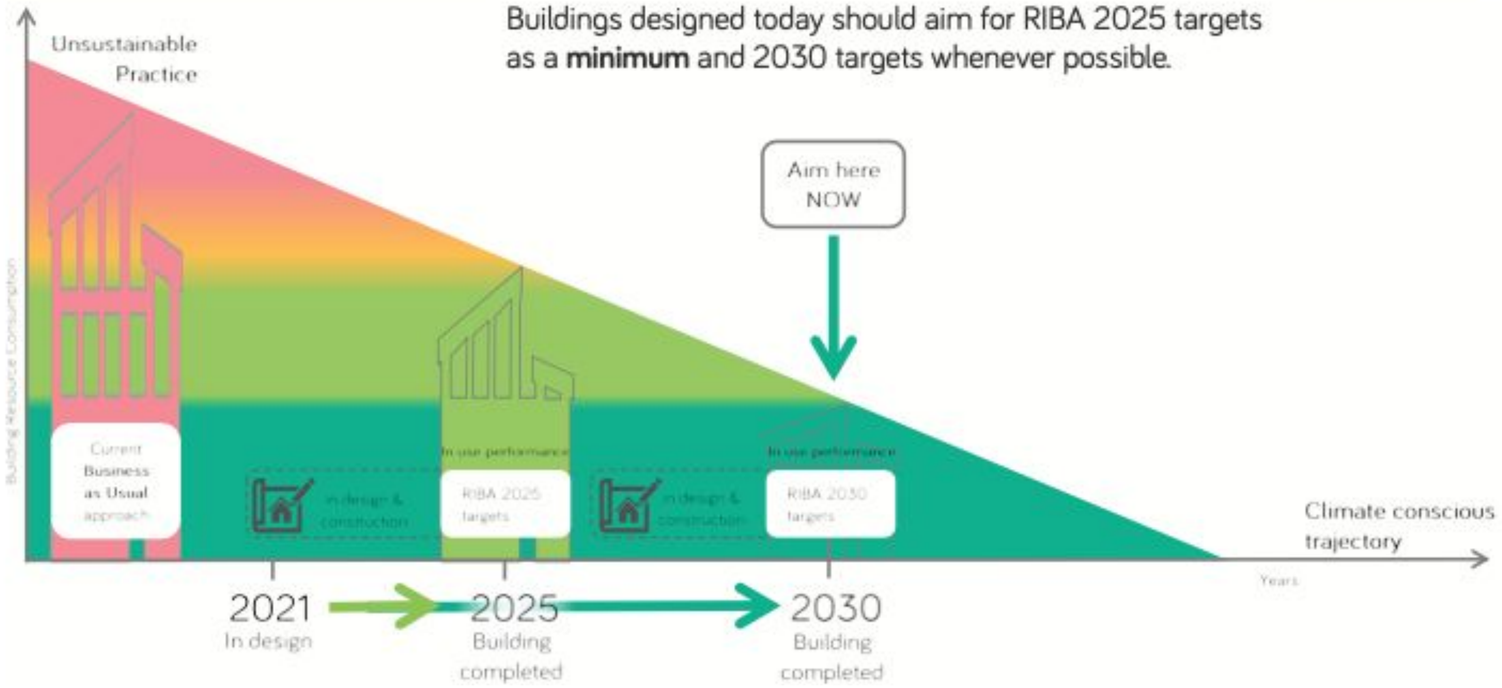
RIBA 2030 Challenge



RIBA 2030 Climate Challenge *as built* target trajectories

The RIBA joined the global 'declare' movement in June 2019 and to ensure that the strong words of the declaration of a climate emergency are matched by actions, the RIBA has set RIBA Chartered Practices a challenge of achieving the following reductions **as soon as possible** but as a minimum for projects in operation in 2030:

1. Reduce operational energy demand by at least 60% from current business as usual baseline figures, before offsetting
2. Reduce embodied carbon by at least 40% from current business as usual baseline figures, before offsetting
3. Reduce potable water use by at least 40% from CIRIA benchmark/ Building Regulation figures
4. Achieve all core health and wellbeing metrics (set out in the table below)

These reductions will also form the basis of RIBA's recommendations to Government for future Building Regulations requirements.

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Rapid Prototyping

Sidewalk labs

Finch 3D

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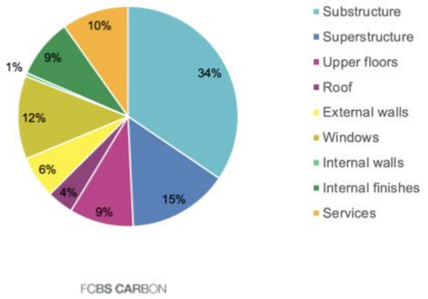
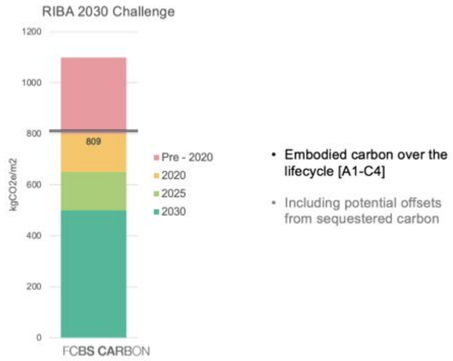
Embedded Carbon Analysis

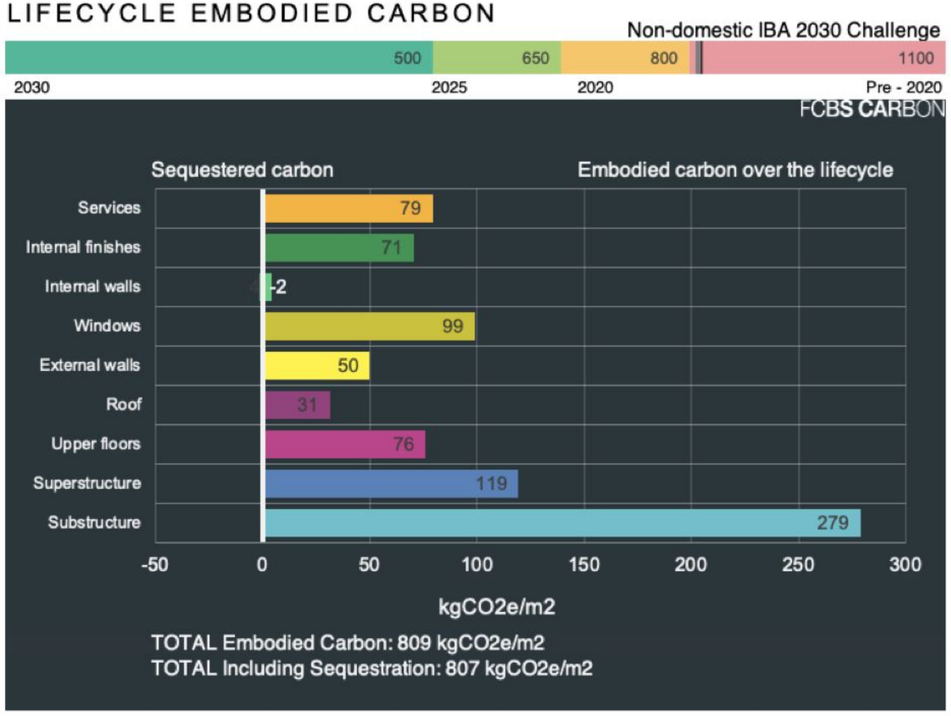
Distribution of Embodied Carbon of New Build by Building Elements



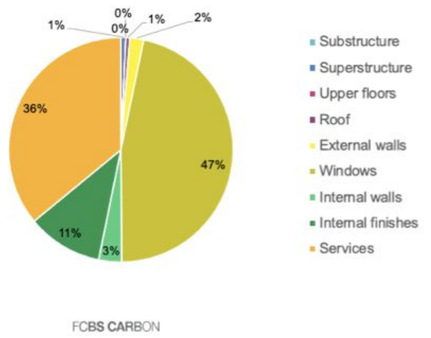


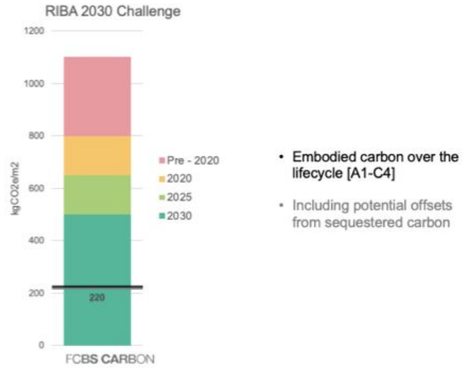
- Embodied carbon over the lifecycle [A1-C4]
- Including potential offsets from sequestered carbon

LIFECYCLE EMBODIED CARBON



Distribution of Embodied Carbon of Retrofit by Building Elements





- Embodied carbon over the lifecycle [A1-C4]
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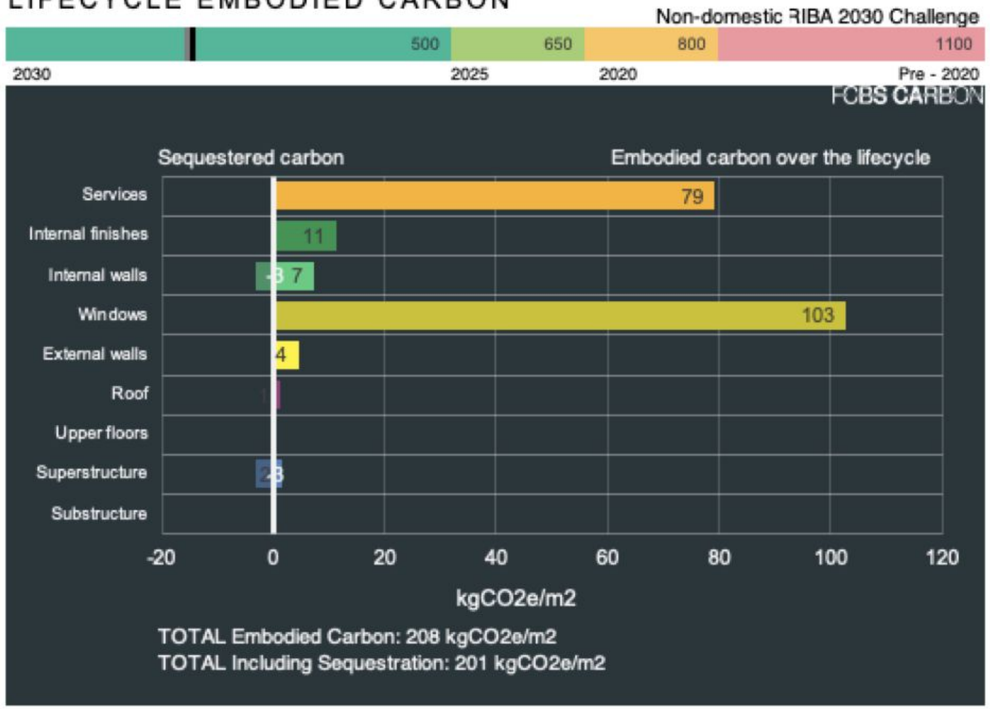
LIFECYCLE EMBODIED CARBON



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DfMA

Factory made off-site components
Moorgate Primary - Maber

Pre-fabricated modular MEP based on 3D model design

"overall DfMA methodology offers a carbon saving of 22% on average. However, DfMA carbon emissions for the transportation phase were greater by 60% on average"

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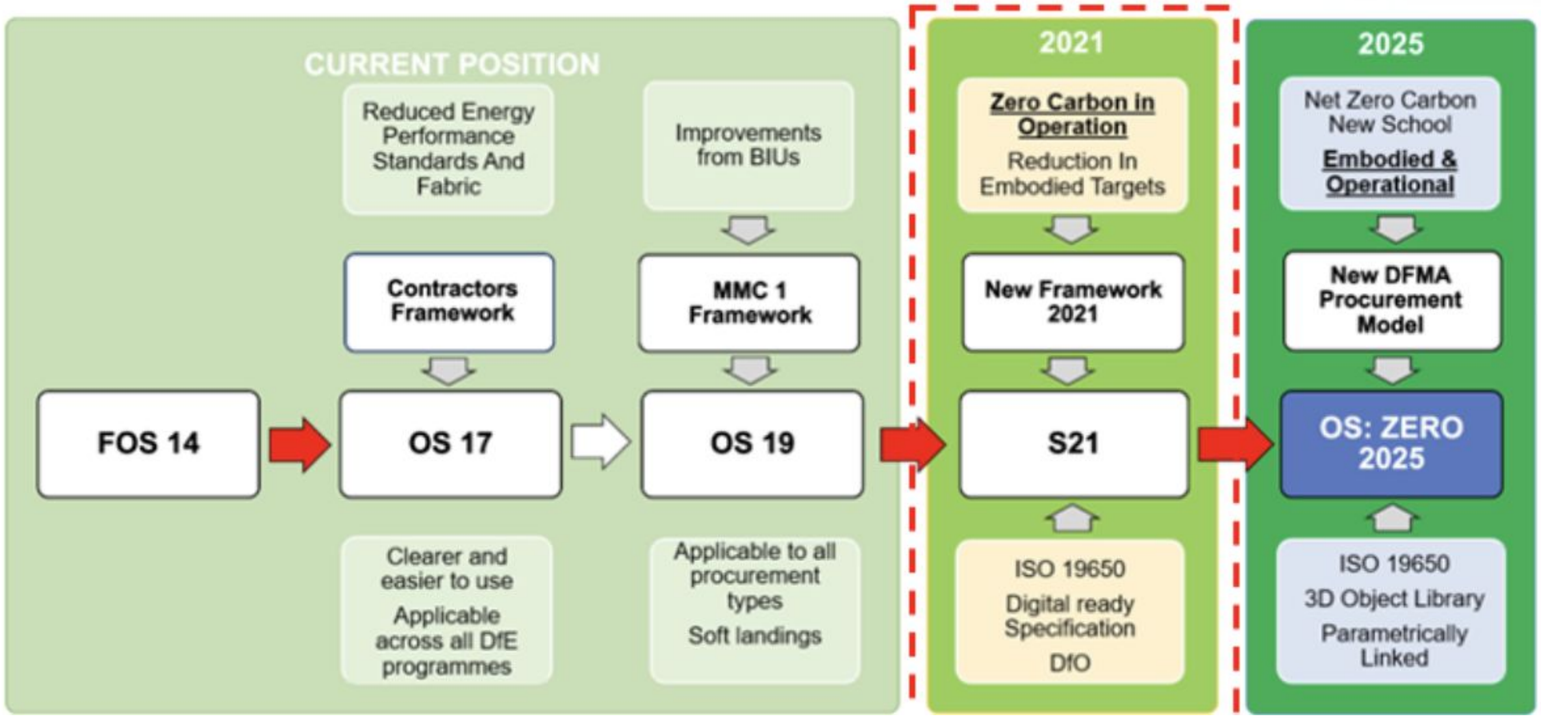
DFE Framework



- Key objective of S21:
  - **Addressing Climate change:** Quality outcomes
  - **Getting digital ready:** Innovation
  - **Design for operation:** Standardisation
- Addressing Climate change: Quality outcomes
  - DfE have adopted **'Fabric First'** as one of th 10pt plan principles.
  - **Gen Zero will be predicated on timber construction.**

DFE Market Engagement Event

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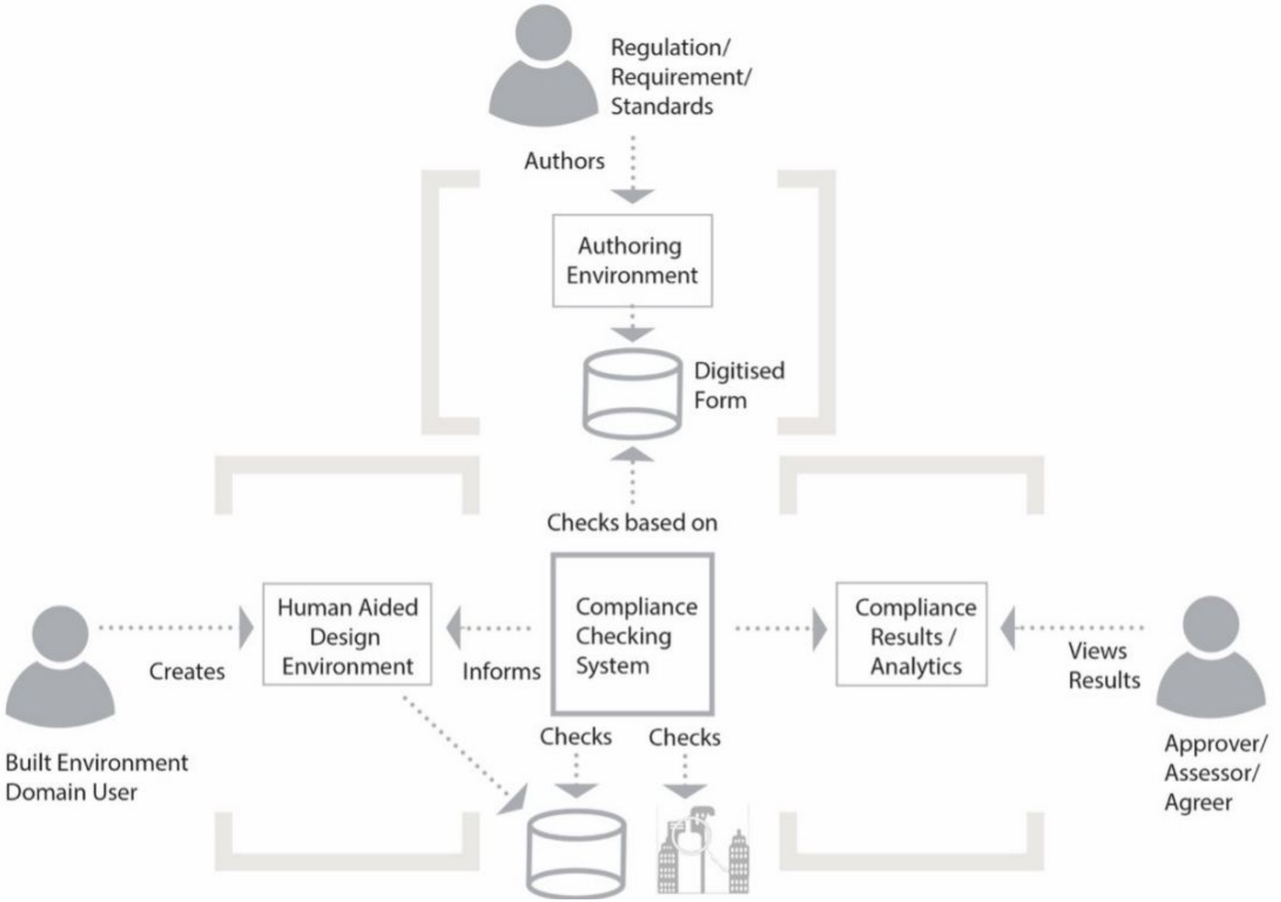
Digital Compliance

- Digitalisation of Building Reg Documents (B,L,M) to be machine readable
- Automated compliance checks of 3D models based on digital Building Regs
- Planning gateways to review proposals vs baseline embodied carbon benchmarks
- Supported with complimentary analysis by approvers / assessors for abnormalities



D-COM Network CIH Briefing Document

Digital: Construction

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Material Verification

FSC™ C110879

Aluminium Window

- Material source location:
- Embodied Carbon:
- Recycled material content:
- Expected life cycle:

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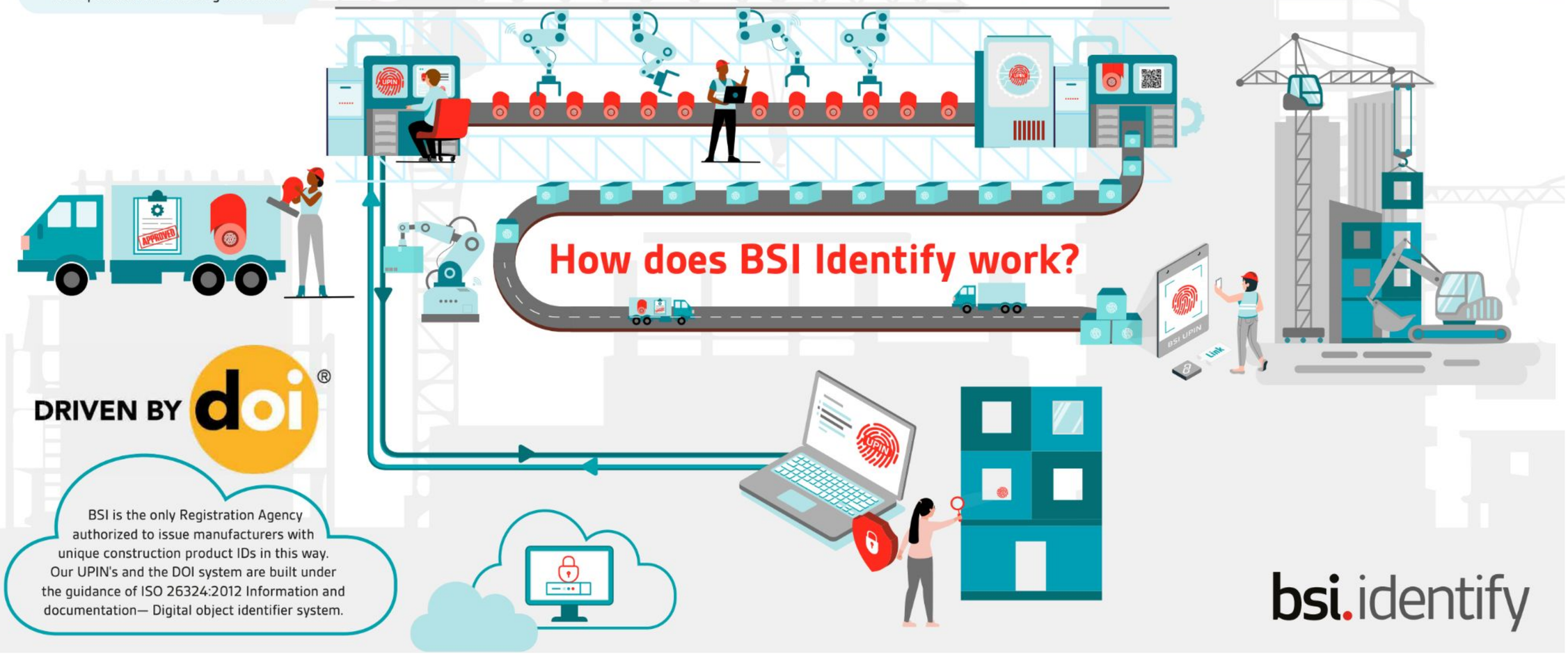
Material Verification

1. BSI Identify issues manufacturers with a unique, enduring and traceable identifier called a BSI UPIN (Universal Persistent Identification Number) to every product that's specified and incorporated in a building structure.
2. It holds these UPINs in an accessible and searchable registry. The technology used ensure that the link cannot be broken.
3. The manufacturer can then mark or tag their products with the UPIN. They can be included on the physical product via labels, within QR codes, NFC or RFID tags, as well as in any digital records of a building.
4. The BSI UPIN then acts as a smart link that can signpost users to a product landing page where they can quickly find all the most up-to-date information on a product. The manufacturer is in control of this open-access page, ensuring that there's one single definitive source of information on the product.



DRIVEN BY doi®

BSI is the only Registration Agency authorized to issue manufacturers with unique construction product IDs in this way. Our UPIN's and the DOI system are built under the guidance of ISO 26324:2012 Information and documentation— Digital object identifier system.

bsi.identify

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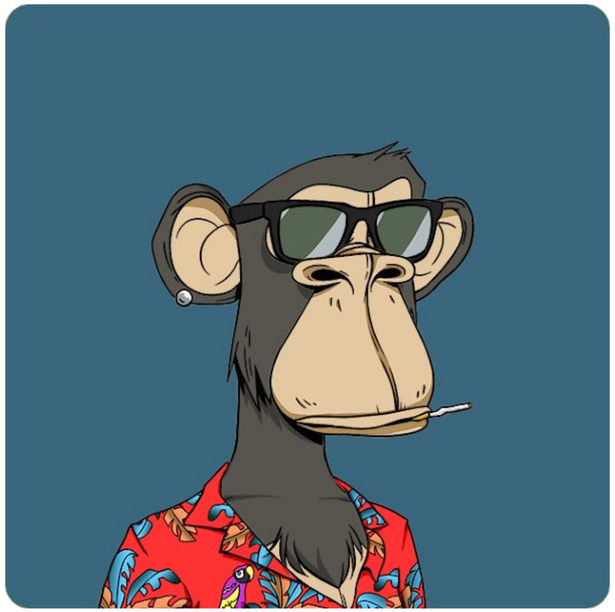
Blockchain Verification



Transactions | Internal Txns | Erc20 Token Txns | Erc721 Token Txns | Contract | Events | Analytics | Comments

Latest 25 from a total of 39,495 transactions (+1 Pending)

Txn Hash	Method	Block	Age	From		To	Value	Txn Fee
0x90faee0b566a73961e…	Transfer From	(pending)	5 hrs 22 mins ago	0x7e428e32f5e687921bf…	IN	Bored Ape Yacht Club: B…	0 Ether	(Pending)
0x6c1bf4e52416b7d546…	Safe Transfer Fr…	14477438	4 mins ago	0x06d37a3d0a912b9389…	IN	Bored Ape Yacht Club: B…	0 Ether	0.0074852106
0xd27a81d91ab59cfb8e…	Transfer From	14477432	6 mins ago	eznft.eth	IN	Bored Ape Yacht Club: B…	0 Ether	0.006131202785
0xc7aa87ca63bf13ebda…	Transfer From	14477430	6 mins ago	0xbc687eee6f9a71e532…	IN	Bored Ape Yacht Club: B…	0 Ether	0.004902914489
0x8eda672b50e409797b…	Transfer From	14477401	12 mins ago	0x2d1194e75b408c9395…	IN	Bored Ape Yacht Club: B…	0 Ether	0.006298513536
0x6401b413e59eb0d3cc…	Transfer From	14477399	13 mins ago	0x8caed19a238929e12c…	IN	Bored Ape Yacht Club: B…	0 Ether	0.005092128737
0xd20f5925ea792bf5499…	Transfer From	14477380	17 mins ago	0x554818c3c5270fa4d8…	IN	Bored Ape Yacht Club: B…	0 Ether	0.00881592
0xc2b08a6855abefadbb…	Set Approval For…	14477379	17 mins ago	cdx.eth	IN	Bored Ape Yacht Club: B…	0 Ether	0.001914812172
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Reducing Waste: Build it once

Avoidable waste - “On average, with every 4 buildings that are constructed, another building could be constructed from the 25% avoidable waste”

AR Technology - XYZ Holosite

VR Technology - Maber

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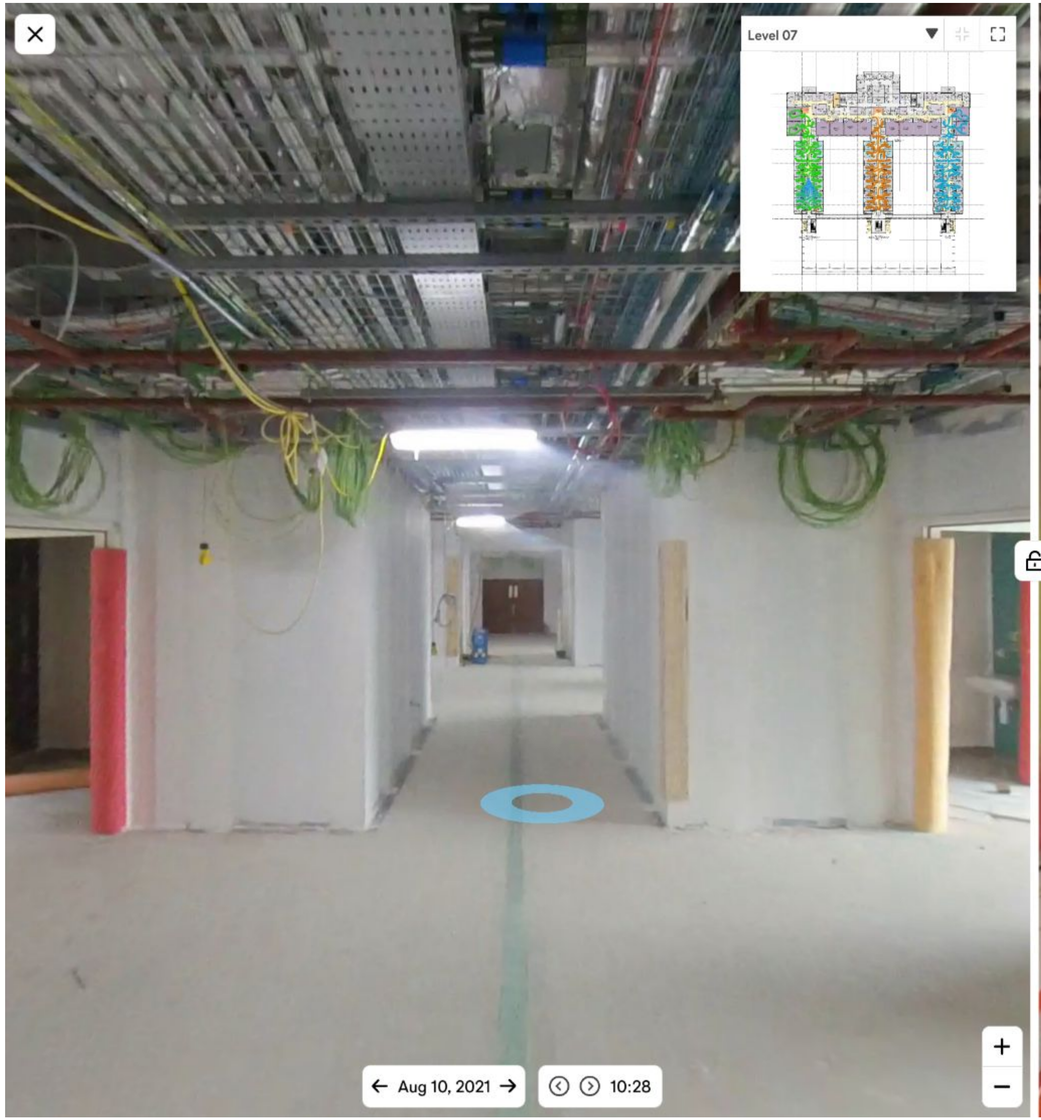
Spotting Issues Remotely



Digital: Operation

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COBie

Name	TypeName	Space	Description	ExtSystem	ExtObject	ExtIdentifier	SerialNumber	InstallationDate	WarrantyStartDate	TagNumber	BarCode	AssetIdentifier	Type.Category
ALA9000_8829905	Furniture_ALA9000	02.EMR072	Panic Alarm	Autodesk Revit 2019, Build: 2021041	IfcFurniture	5dc7b3b0-53c1-4936-8925-9	n/a	n/a	n/a	n/a	n/a	5dc7b3b0-53c1-4936-8925-9	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9355503	Furniture_ALA9000	04.PHA011	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	fe65e2db-004e-4350-aefc-c37	n/a	n/a	n/a	n/a	n/a	fe65e2db-004e-4350-aefc-c3	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9355911	Furniture_ALA9000	04.PHA008	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	fe65e2db-004e-4350-aefc-c37	n/a	n/a	n/a	n/a	n/a	fe65e2db-004e-4350-aefc-c3	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9609000	Furniture_ALA9000	07.WGE034	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	1e5fd353-ec99-4c51-b795-b4	n/a	n/a	n/a	n/a	n/a	1e5fd353-ec99-4c51-b795-b4	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9679317	Furniture_ALA9000	04.PAT001	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	3e59cc6f-377b-47fc-a59e-bfat	n/a	n/a	n/a	n/a	n/a	3e59cc6f-377b-47fc-a59e-bfa	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9703587	Furniture_ALA9000	07.WT2034	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	ffd0fc09-7af4-43b3-aa6b-4a76	n/a	n/a	n/a	n/a	n/a	ffd0fc09-7af4-43b3-aa6b-4a7	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9734435	Furniture_ALA9000	06.WGY034	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	60dba110-fb66-4a17-9a6f-4dc	n/a	n/a	n/a	n/a	n/a	60dba110-fb66-4a17-9a6f-4c	Pr_75_75_04 : Assistance and nurse call devices and control
ALA9000_9778774	Furniture_ALA9000	08.WSS034	Panic Alarm	Autodesk Revit 2019, Build: 2019022	IfcFurniture	ce6b4d3f-5b41-412c-8c8a-91	n/a	n/a	n/a	n/a	n/a	ce6b4d3f-5b41-412c-8c8a-91	Pr_75_75_04 : Assistance and nurse call devices and control
ATER-PRD_PRD DUX500X295_PRD/EC/01/06/001	Air Terminals_ATER-PRD_PRD DUX50(	01.PLA053	Pressure relief damper	Autodesk Revit 2019, Build: 2021041	IfcAirTerminal	0q7fmQAlj149WgajpLk9jW	n/a	n/a	n/a	n/a	n/a	0q7fmQAlj149WgajpLk9jW	Pr_70_65_04 : Air terminals and diffusers
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ATER-PRD_PRD DUX500X505_PRD/EC/01/06/004	Air Terminals_ATER-PRD_PRD DUX50(	01.PLA050	Pressure relief damper	Autodesk Revit 2019, Build: 2021041	IfcAirTerminal	0q7fmQAlj149WgajpLk9h2	n/a	n/a	n/a	n/a	n/a	0q7fmQAlj149WgajpLk9h2	Pr_70_65_04 : Air terminals and diffusers
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AVSU Cabinet_AVSU Cabinet_AVSU-L6-005	Specialty Equipment_AVSU Cabinet_A	06.SGY901	AVSU Cabinet	Autodesk Revit 2019, Build: 2019010	IfcBuildingElem	5226f808-3505-41b5-a3fb-80	n/a	n/a	n/a	n/a	n/a	5226f808-3505-41b5-a3fb-8(	Pr_65_54_33_55 : Medical gas valve service units
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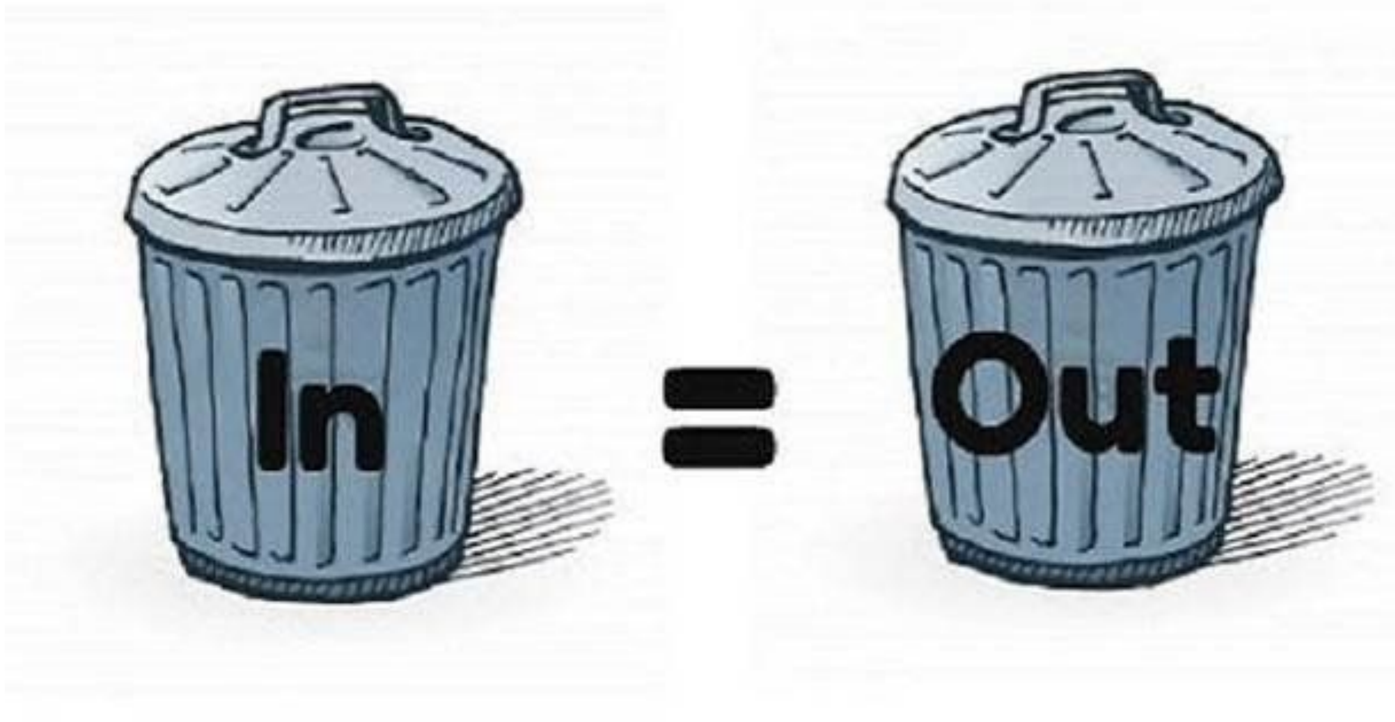
Access Panel_Rect. Access Panel_AD-011	Duct Accessories_Access Panel_Rect. A	01.PLA144	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2pwbaLTcP6BQ78K$Dp3YQz	n/a	n/a	n/a	n/a	n/a	2pwbaLTcP6BQ78K$Dp3YQz	Pr_30_59_36_01 : Access panels
Access Panel_Rect. Access Panel_AD-012	Duct Accessories_Access Panel_Rect. A	01.PLA144	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2pwbaLTcP6BQ78K$Dp3YR0	n/a	n/a	n/a	n/a	n/a	2pwbaLTcP6BQ78K$Dp3YR0	Pr_30_59_36_01 : Access panels
Access Panel_Rect. Access Panel_AD-013	Duct Accessories_Access Panel_Rect. A	01.PLA144	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2pwbaLTcP6BQ78K$Dp3YRB	n/a	n/a	n/a	n/a	n/a	2pwbaLTcP6BQ78K$Dp3YRB	Pr_30_59_36_01 : Access panels
Access Panel_Rect. Access Panel_AD-014	Duct Accessories_Access Panel_Rect. A	01.PLA144	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2pwbaLTcP6BQ78K$Dp3Y9V	n/a	n/a	n/a	n/a	n/a	2pwbaLTcP6BQ78K$Dp3Y9V	Pr_30_59_36_01 : Access panels
Access Panel_Rect. Access Panel_AD-015	Duct Accessories_Access Panel_Rect. A	01.PLA144	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2pwbaLTcP6BQ78K$Dp3YAS	n/a	n/a	n/a	n/a	n/a	2pwbaLTcP6BQ78K$Dp3YAS	Pr_30_59_36_01 : Access panels
Access Panel_Rect. Access Panel_AD-016	Duct Accessories_Access Panel_Rect. A	01.PLA157	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	0C1lk$j5bB5gDhefz0AX3C	n/a	n/a	n/a	n/a	n/a	0C1lk$j5bB5gDhefz0AX3C	Pr_30_59_36_01 : Access panels
Access Panel_Rect. Access Panel_AD-017	Duct Accessories_Access Panel_Rect. A	01.PLA157	AccessPanel	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	3gN1flbs1AYwDjvwQkZYAr	fr	n/a	n/a	n/a	n/a	3gN1flbs1AYwDjvwQkZYAr	Pr_30_59_36_01 : Access panels
Adblue tank_M-EQIP-UREA_ADBLUE TANK-01	Mechanical Equipment_Adblue tank_	00.NGC003	Adblue tank	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2DW$kbL7L4$uUryHWlQv2v	n/a	n/a	n/a	n/a	n/a	2DW$kbL7L4$uUryHWlQv2v	Pr_60_50_47_11 : Liquid fuel service tanks
Adblue tank_M-EQIP-UREA_ADBLUE TANK-02	Mechanical Equipment_Adblue tank_	00.NGC004	Adblue tank	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2DW$kbL7L4$uUryHWlQv5h	n/a	n/a	n/a	n/a	n/a	2DW$kbL7L4$uUryHWlQv5h	Pr_60_50_47_11 : Liquid fuel service tanks
Adblue tank_M-EQIP-UREA_ADBLUE TANK-03	Mechanical Equipment_Adblue tank_	00.NGC007	Adblue tank	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2DW$kbL7L4$uUryHWlQv7y	n/a	n/a	n/a	n/a	n/a	2DW$kbL7L4$uUryHWlQv7y	Pr_60_50_47_11 : Liquid fuel service tanks
Adblue tank_M-EQIP-UREA_ADBLUE TANK-04	Mechanical Equipment_Adblue tank_	00.NGC006	Adblue tank	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	2DW$kbL7L4$uUryHWlQv7b	n/a	n/a	n/a	n/a	n/a	2DW$kbL7L4$uUryHWlQv7b	Pr_60_50_47_11 : Liquid fuel service tanks
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-01-01	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	1m7DR_C7z4SulHRlWSwKio	n/a	n/a	n/a	n/a	n/a	1m7DR_C7z4SulHRlWSwKio	Pr_65_67_78_72 : Rectangular attenuators
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-01-02	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	1mIljzfiDFU9SdM7_Vlp3_	n/a	n/a	n/a	n/a	n/a	1mIljzfiDFU9SdM7_Vlp3_	Pr_65_67_78_72 : Rectangular attenuators
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-01-03	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	1mIljzfiDFU9SdM7_VlpIo	n/a	n/a	n/a	n/a	n/a	1mIljzfiDFU9SdM7_VlpIo	Pr_65_67_78_72 : Rectangular attenuators
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-02-01	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	3N6EOtqpr92A7te4FWg_6m	n/a	n/a	n/a	n/a	n/a	3N6EOtqpr92A7te4FWg_6m	Pr_65_67_78_72 : Rectangular attenuators
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-03-01	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	0$2BlXTGrE7PtoqBld46ii	n/a	n/a	n/a	n/a	n/a	0$2BlXTGrE7PtoqBld46ii	Pr_65_67_78_72 : Rectangular attenuators
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-03-02	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	3BjvtnHbL4uRbEDQjgyMzR	n/a	n/a	n/a	n/a	n/a	3BjvtnHbL4uRbEDQjgyMzR	Pr_65_67_78_72 : Rectangular attenuators
Attenuator_Mechanical-Inlet-Attenuator_ATT-L0-03-03	Duct Accessories_Attenuator_Mechar	00.CPA002	Straight Rectangular Silencer	Autodesk Revit 2019, Build: 2021041	IfcBuildingElem	3BjvtnHbL4uRbEDQjgyMzT	n/a	n/a	n/a	n/a	n/a	3BjvtnHbL4uRbEDQjgyMzT	Pr_65_67_78_72 : Rectangular attenuators

Can Digital Save Physical?

Asset Data

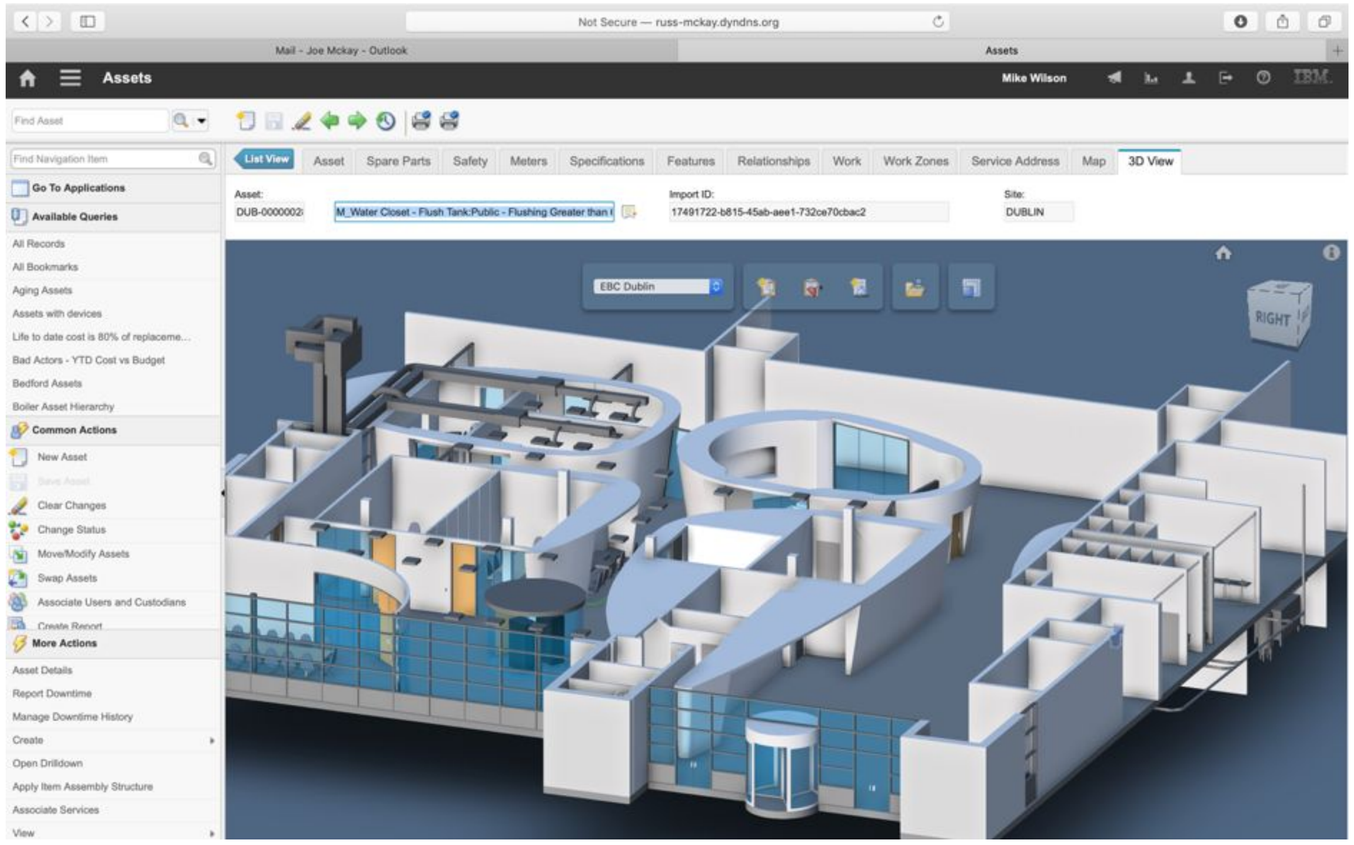
Ask difficult questions of the client / end-user -

- How will you actually be using this COBie data?
- Can we speak to the person who will actually be using it?
- Could data be formatted or supplemented with additional data?
- What do you **actually** need to maintain?
- What data do you need to better understand your buildings operational energy usage?

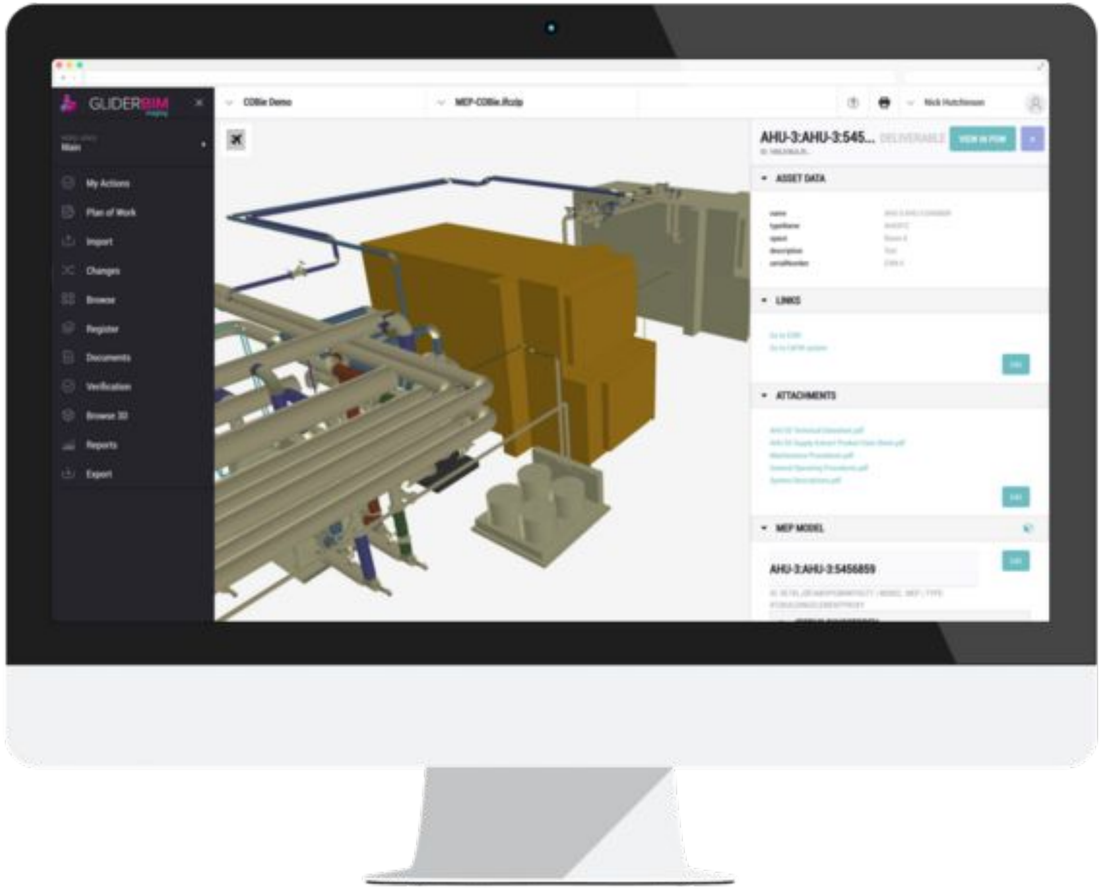


Can Digital Save Physical?

Digital Twins



IBM Maximo - Planon

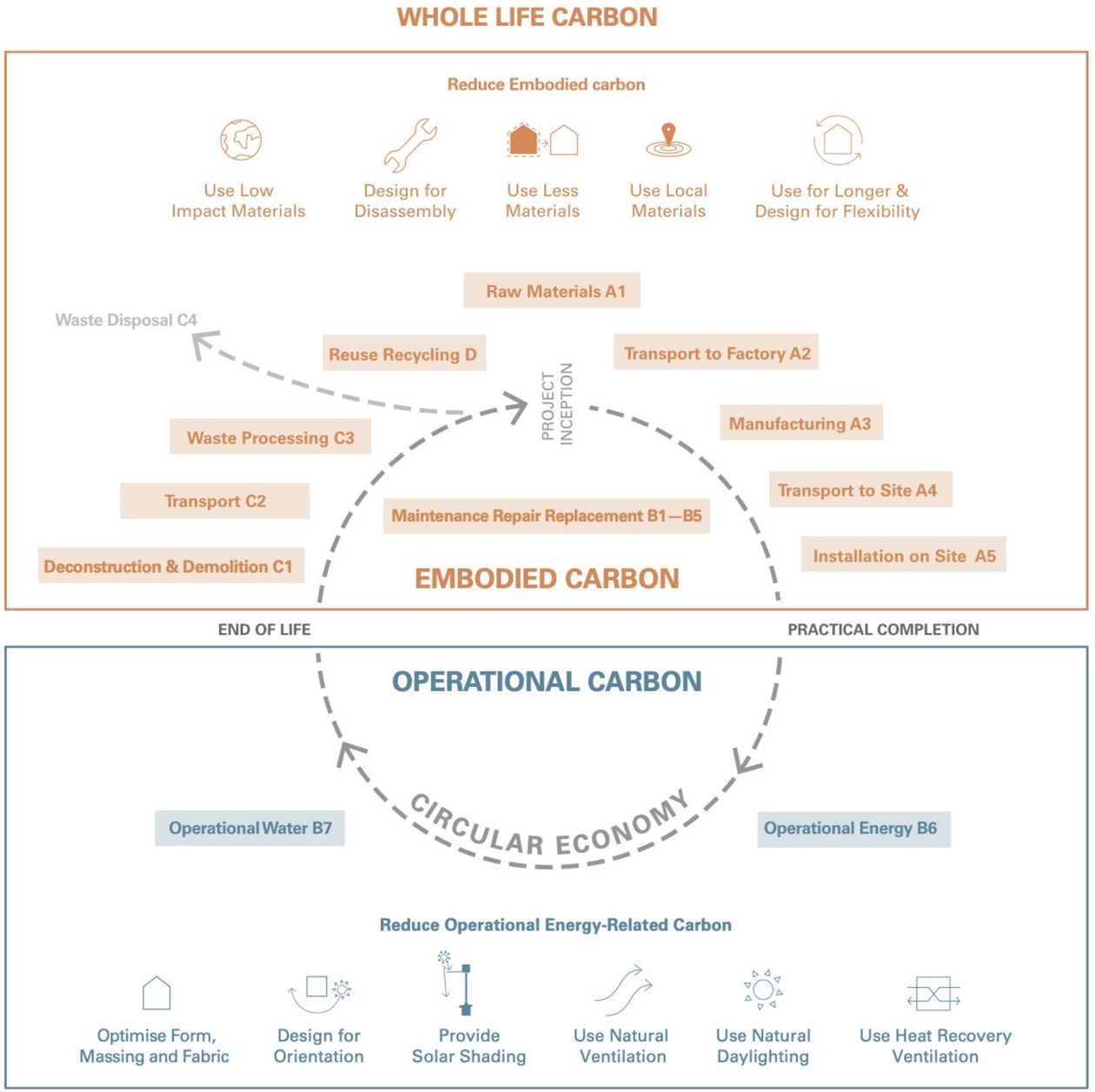


GliderBIM

Can Digital Save Physical?

Whole Life Considerations

- Do we really put enough emphasis into designing to reduce operational energy-related carbon?
- Who on the delivery team is best place to advise clients about operational data (smart sensors etc.) - Do we need a new role?
- Are there other factors to consider above a sustainability agenda?



EN 15978 Introduces a modular approach to whole life cycle analysis of a building:
A1—A5 Products and Construction Processes / B1—B7 Use / C1—C4 End of Life
D Benefits and Loads Beyond The System Boundary

Challenges

What are the biggest factors blocking the adoption of sustainable technologies and processes in the built environment?

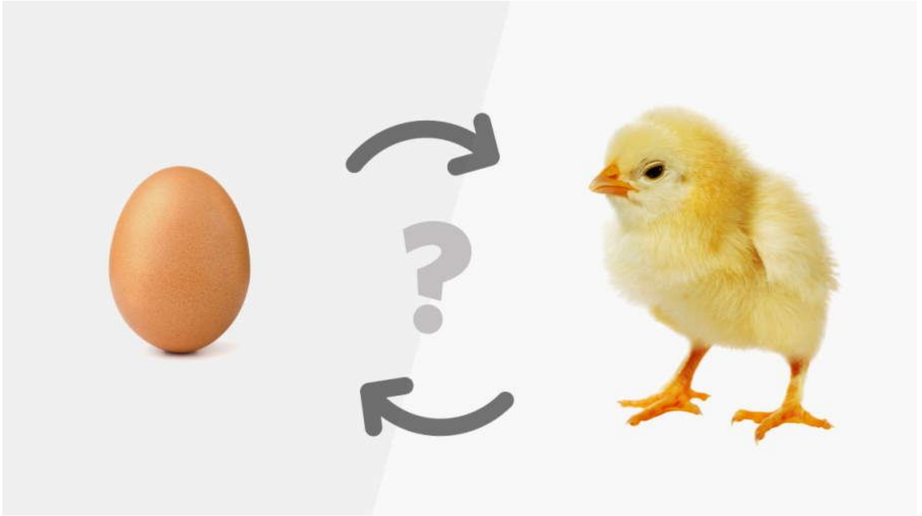
ⓘ Start presenting to display the poll results on this slide.

Can Digital Save Physical?

Challenges

- Rethink traditional design programmes - more time needed upfront to design it right.
- Good quality 3D models with good quality data is imperative from the start.
- But these models and data need a human friendly interface.
- Resetting the mindset that sustainable means expensive.
- Upskilling of the industry to have Information Managers, Data Managers, sustainability champions.
- Utilise an incoming generation of digital natives new to the industry.

What came first?



The Construction Industry recognising sustainable change must happen and leading clients to change perceptions.

OR

A well informed client with clear sustainability goals driving change in the industry.

Digital: Design

Iterate faster, fail faster - come to the right solution quicker.

Digital: Construction

Build it once, build it right. Reduce waste and verify materials.

Digital: Operation

Reduce, reuse, recycle. Ensure the right data is available for effective PPM

Thank you.

Josh Chrystal // **Head of BIM**
Maber Associates