

BIM Lifecycle

Client Led, Consultant Designed, Contractor Delivered

Craig Garrett, Project Technology Leader, Buro Happold. Dubai, UAE.

Michael Murphy, VDC Operations Manager, BAM. Ireland

Simon Tritschler, BIM Specialist, BAM. Ireland



Museum of the Future

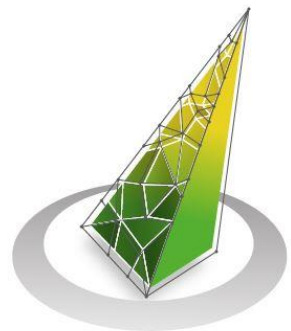
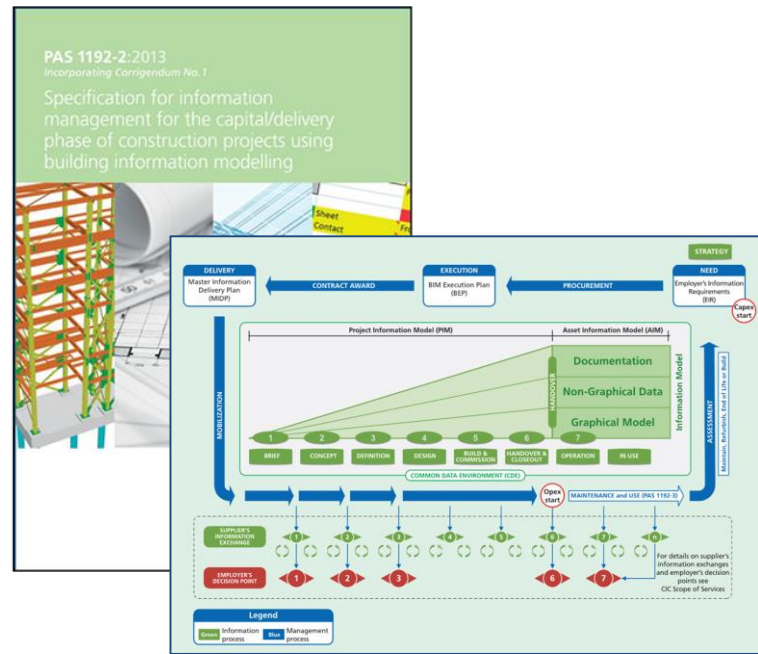
Killa Design Architects (Completion Mid 2019)



Craig Garrett



BUROHAPPOLD
ENGINEERING



AEC
Excellence
Awards
2017



EXCELLENCE IN BIM IMPLIMENTATION

BUROHAPPOLD
ENGINEERING



MUSEUM OF THE FUTURE

Design Stage Organization

مؤسسة دبي للمستقبل
Dubai Future Foundation



MERAS 11 مِرَاس — AECOM

BUROHAPPOLD
ENGINEERING



STRUCTURAL



BUILDING SERVICES



FACADE



FIRE



LIGHTING



SUSTAINABILITY



SAFE & SECURE



WASTE



ACOUSTICS



GEOTECHNICAL



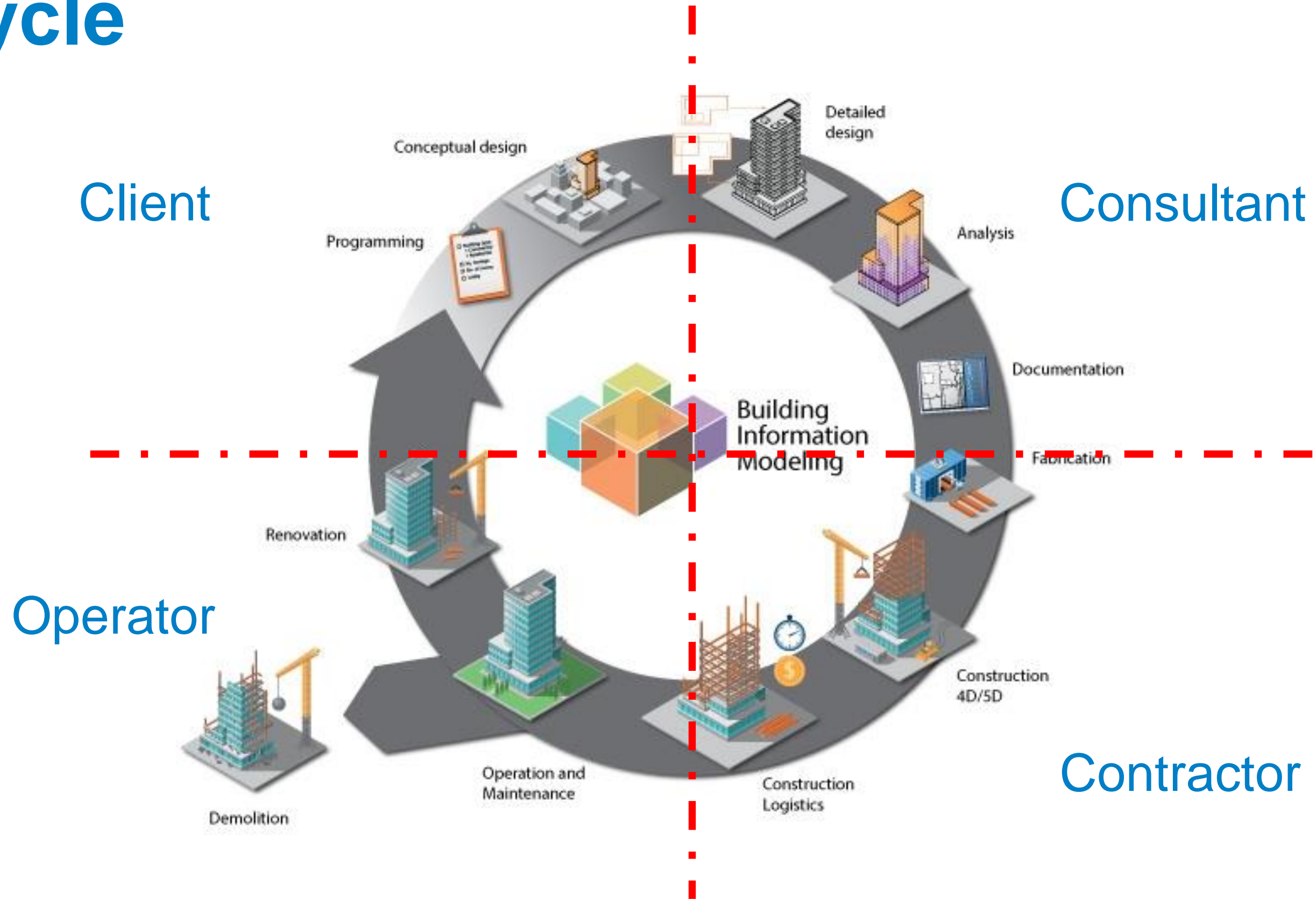
TRANSPORT



INFRASTRUCTURE



Lifecycle

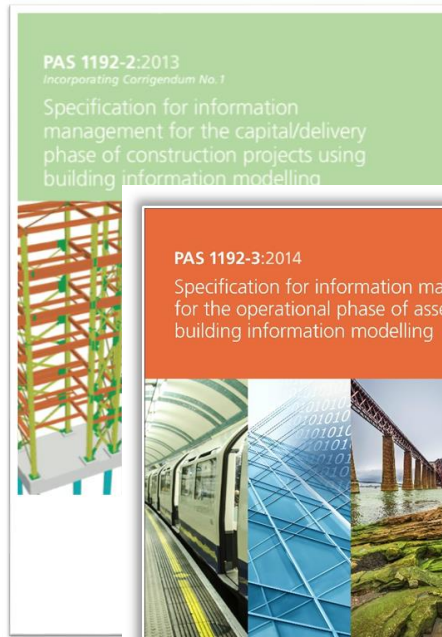


Michael Murphy

Technical Operations Manager, BAM Ireland

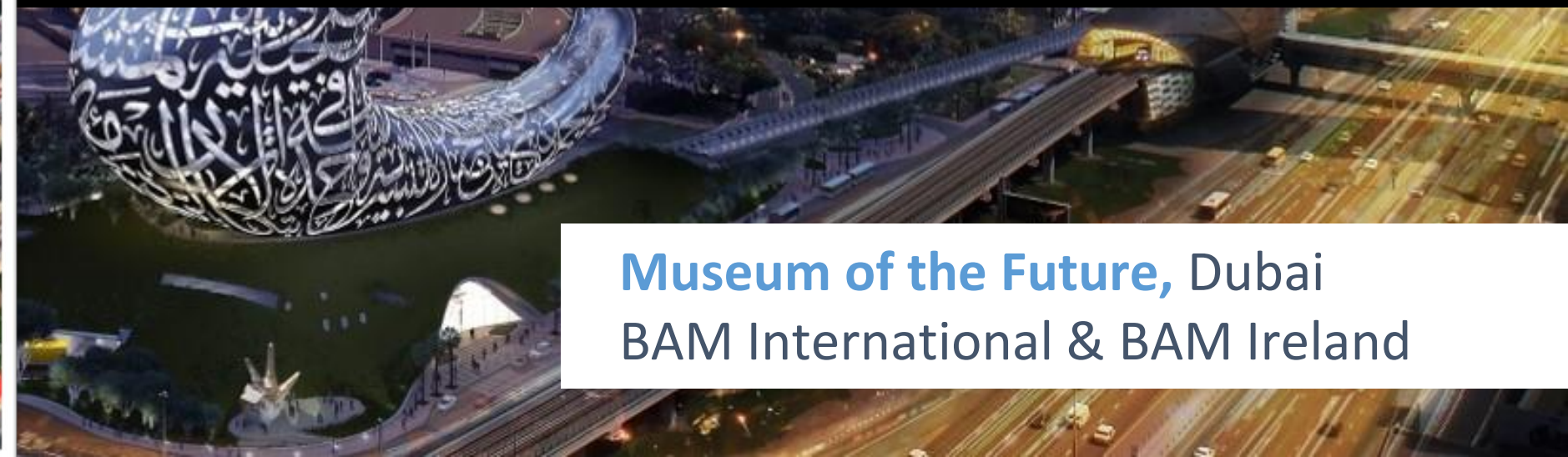
Simon Tritschler

Technical Deployment Specialist, BAM Ireland

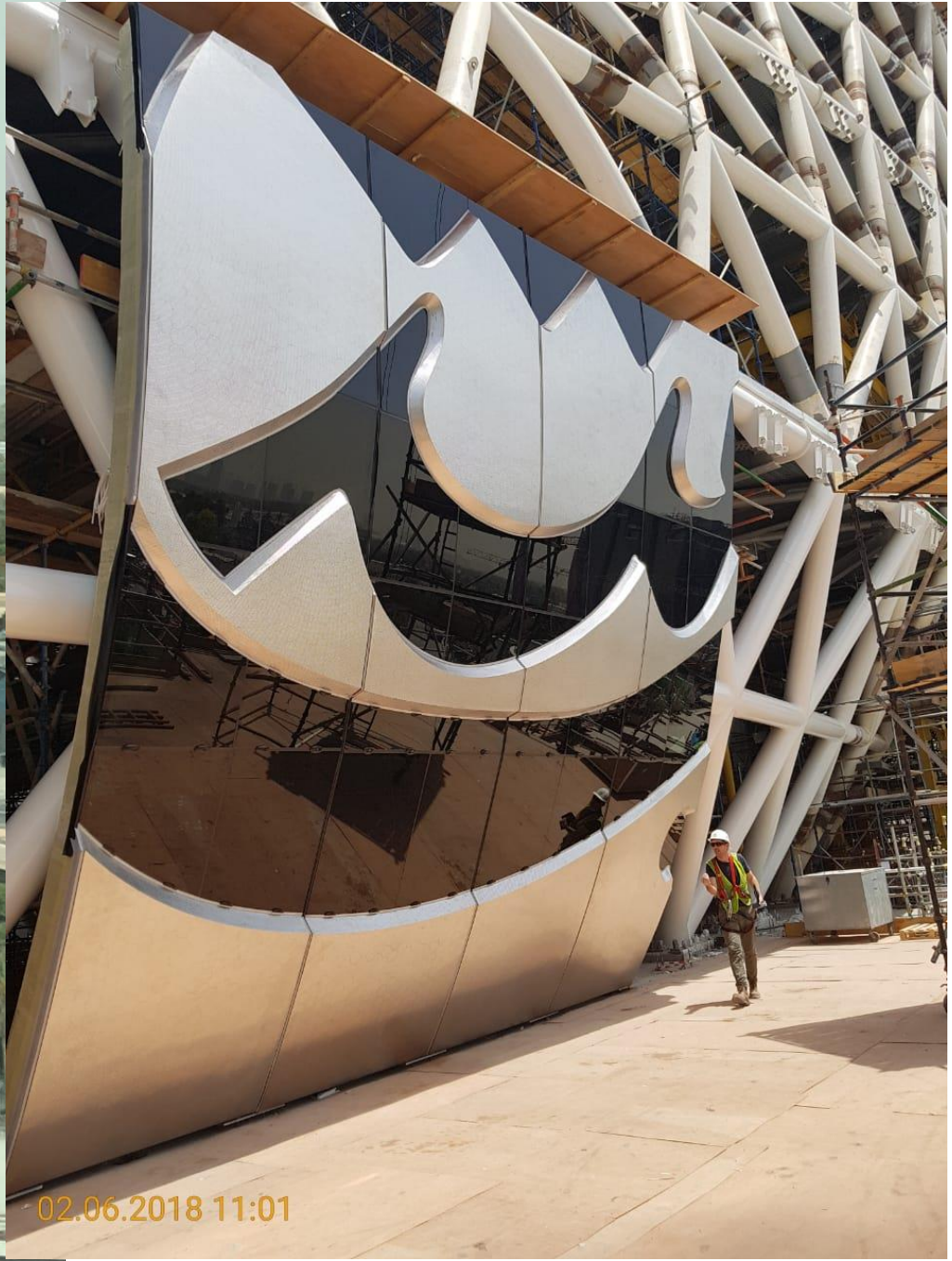




Museum of the Future Dubai, UAE



Museum of the Future, Dubai
BAM International & BAM Ireland



Construction Stage Organization

مؤسسة دبي للمستقبل
Dubai Future Foundation



MERASAS مِرَاس AECOM

BUROHAPPOLD
ENGINEERING



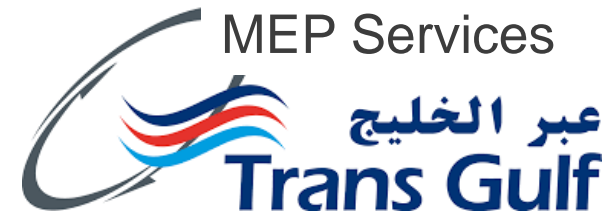
Structural Steel Works

EVERSENDAI

Steel Works



MEP Services



Façade

AFFAN

Ceilings, Partitions & Internal Lining

plafond

Client Led

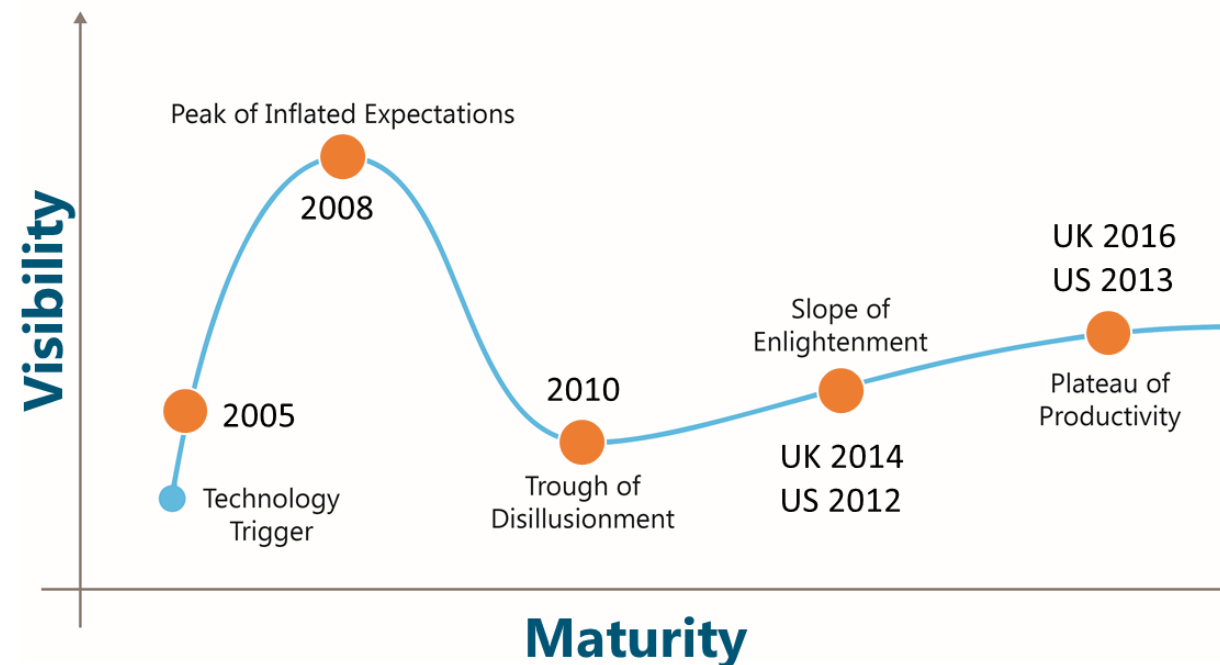


M E R A A S  مِرَاس

Knowledgeable Client

Digital Transformation Journey

- Meraas Digital Transformation
- Original Involvement by Autodesk
- Taken over by Meraas BIM Office
- BIM Manager, Anthony Lapierre



Employers Information Requirements

- What does the client want
- Why do they want it
- What format do they want it in
- What are they going to do with it
- When do they want it

Meraas Information Requirements



Version 7.1
Applicable to the Scope of Work of the Main Contractor

Museum of the Future

Current Version Distribution list

Name	Title	Organization
Michelle Saywood	Portfolio Lead	Meraas Holding
Christopher Gunn	Director - Pre Contracts	Meraas Holding
Hossam Anwar	Head - Procurement	Meraas Holding
Matthew Hoderics	Senior Executive Manager - Design	Meraas Holding
Michael Ellis	Head - Contracts Administration	Meraas Holding
Panagiotis Tompras	Senior Executive Manager - Projects	Meraas Holding
Sarpen Sainudeen	Head - Tendering	Meraas Holding

Released versions of this document on the Museum of the Future project

Date	Version	Author	Description
2015-09-03	2.0	Meraas with support of Autodesk Consulting	Version included in Lead Consultant's Scope of Services.
2015-04-27	6.1	Meraas BIM Office	Version released for Enabling Works and Piling Contractor Only. Guidance Notes specific to this scope of work were included.
2015-05-10	7.1	Meraas BIM Office	Version released for the Main Contractor. This version includes the Aconex Configuration Document.

What's normally not in the document

- Sense of Behavior
- Collaborative Approach
- Willingness to discuss
- Personal Relationships
- Social Style Communication
- Shared Experience

Meraas Information Requirements



Version 7.1
Applicable to the Scope of Work of the Main Contractor

Museum of the Future

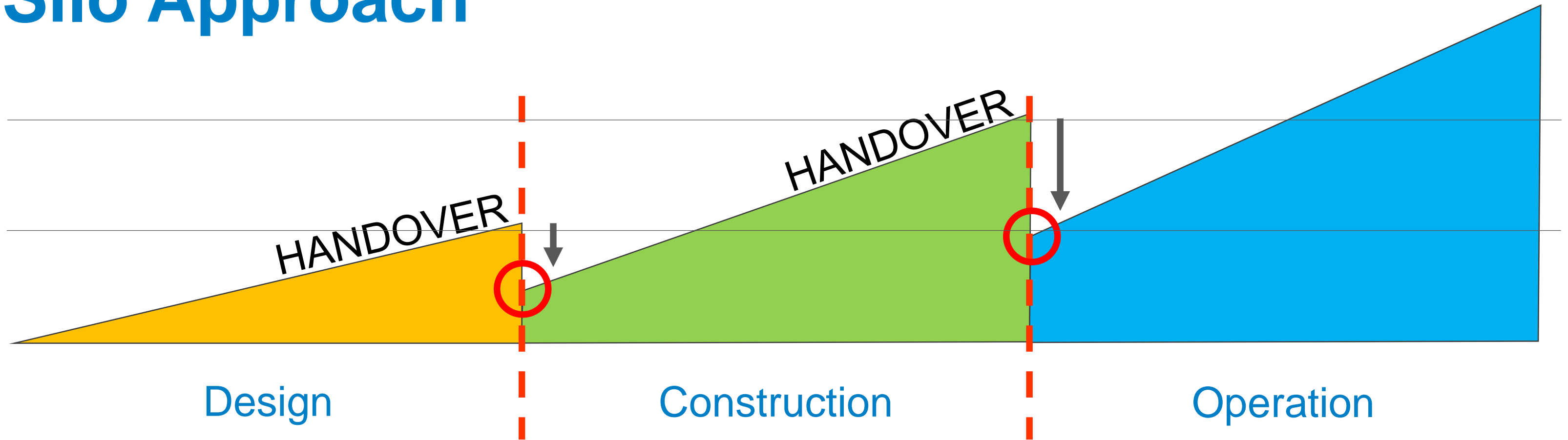
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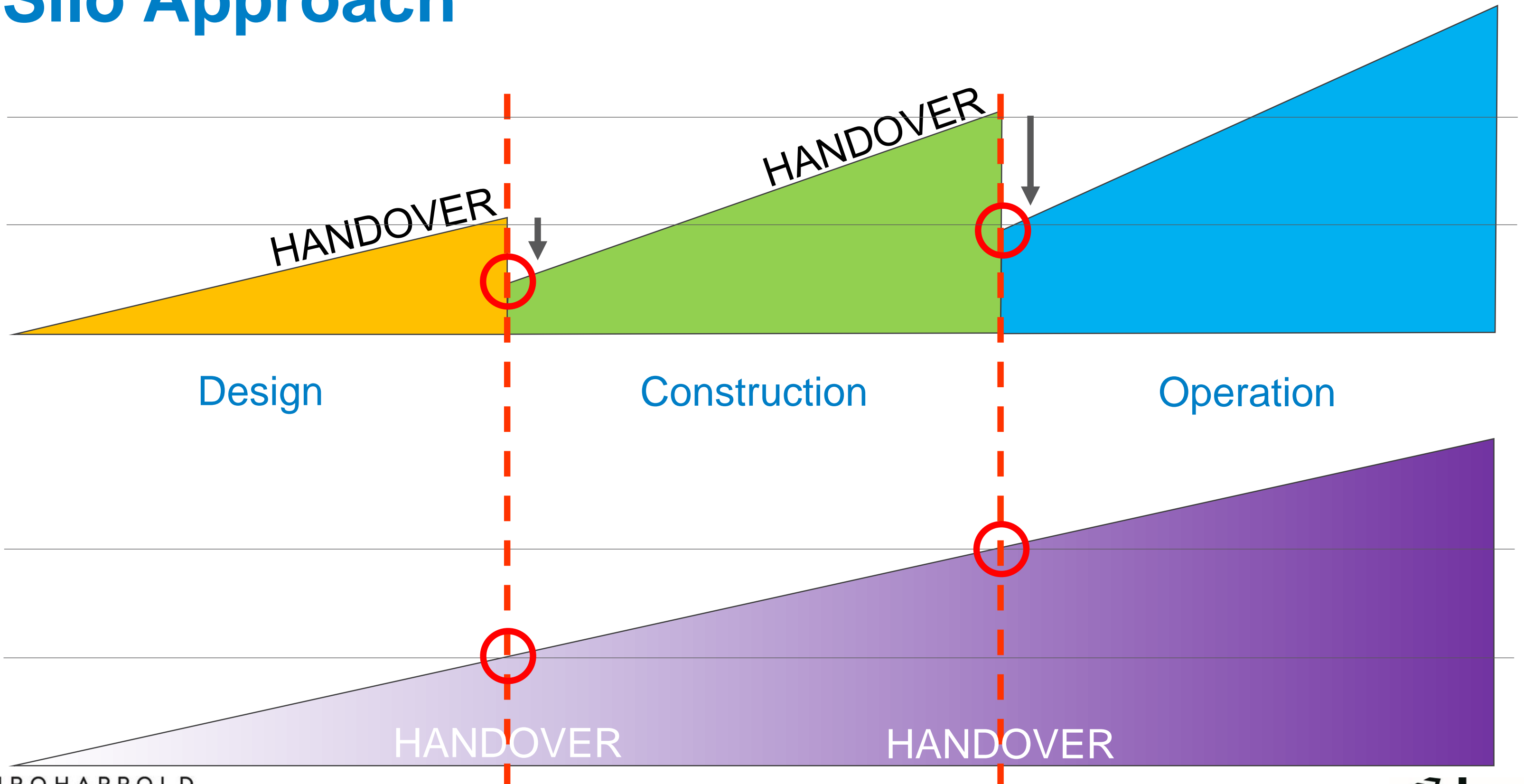
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Silo Approach



- No Data Integration
- No Document Continuity
- No Process Simulation

Silo Approach



Consultant Designed



BUROHAPPOLD

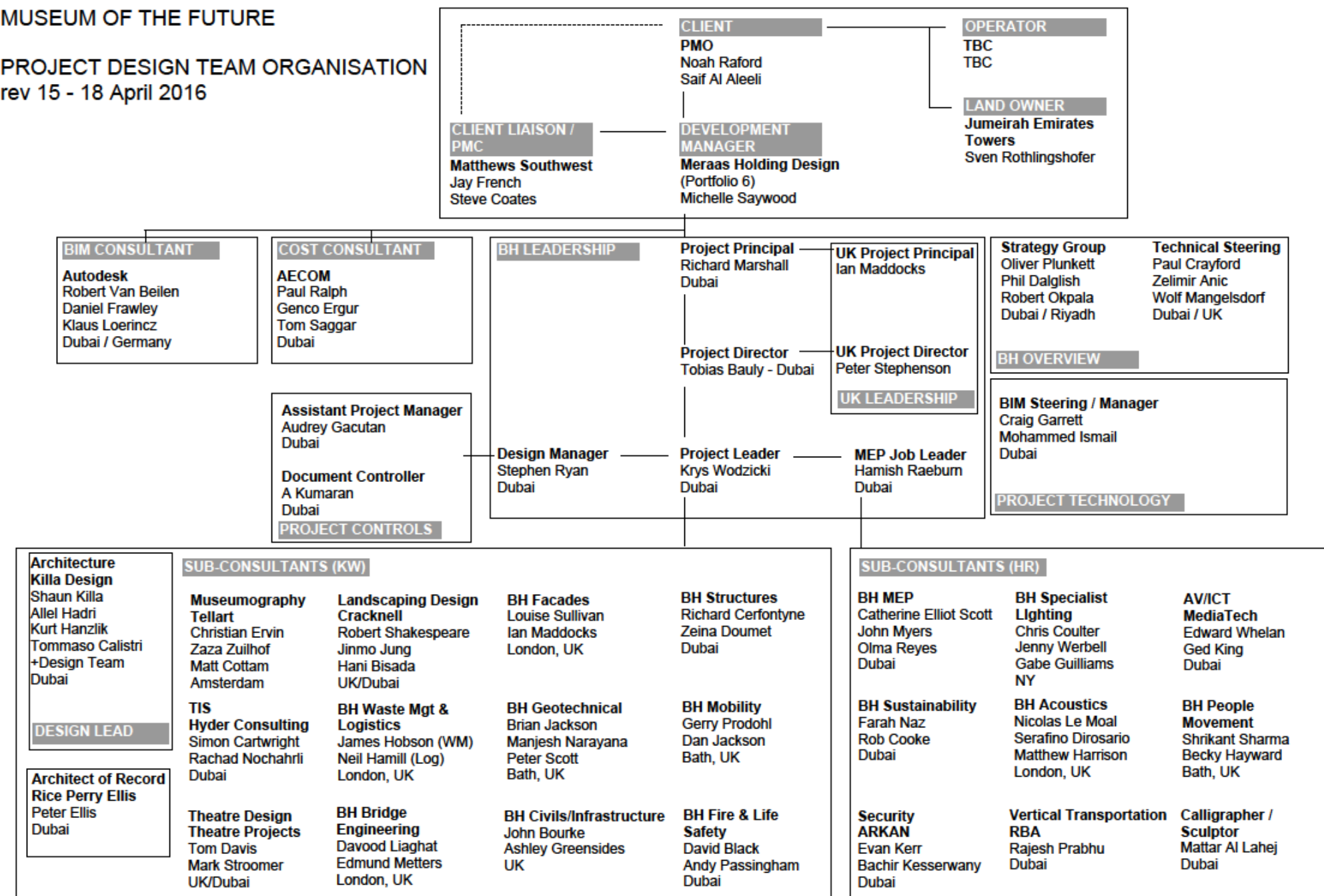
ENGINEERING

Lead Consultant

Design Team



MUSEUM OF THE FUTURE PROJECT DESIGN TEAM ORGANISATION rev 15 - 18 April 2016



**BUROHAPPOLD
ENGINEERING**

Core BIM Team (Dubai)

Company	Position	BIM Rep
Meraas	Client	Anthony Lapierre
Killa Design	Architect	Tommaso Calistri
BuroHappold	Lead Consultant	Craig Garrett



BIM Implementation

- Developed for mutual benefit
 - Options explored together
 - Shared Experience
 - Common Sense Approach
 - Weekly Meetings
 - UK Level 2 Standard
- Everyone's Input Welcomed
 - Autodesk Field vs Aconex Field
 - Varied Backgrounds & Knowledge
 - Keep it simple to understand
 - Regular Contact
 - Dubai Mandate

Common Data Environment (CDE)

- Compliance with EIR
- Compliance with PAS 1192-2
- Single source of shared project data
- Single source of truth
- File naming & revision control

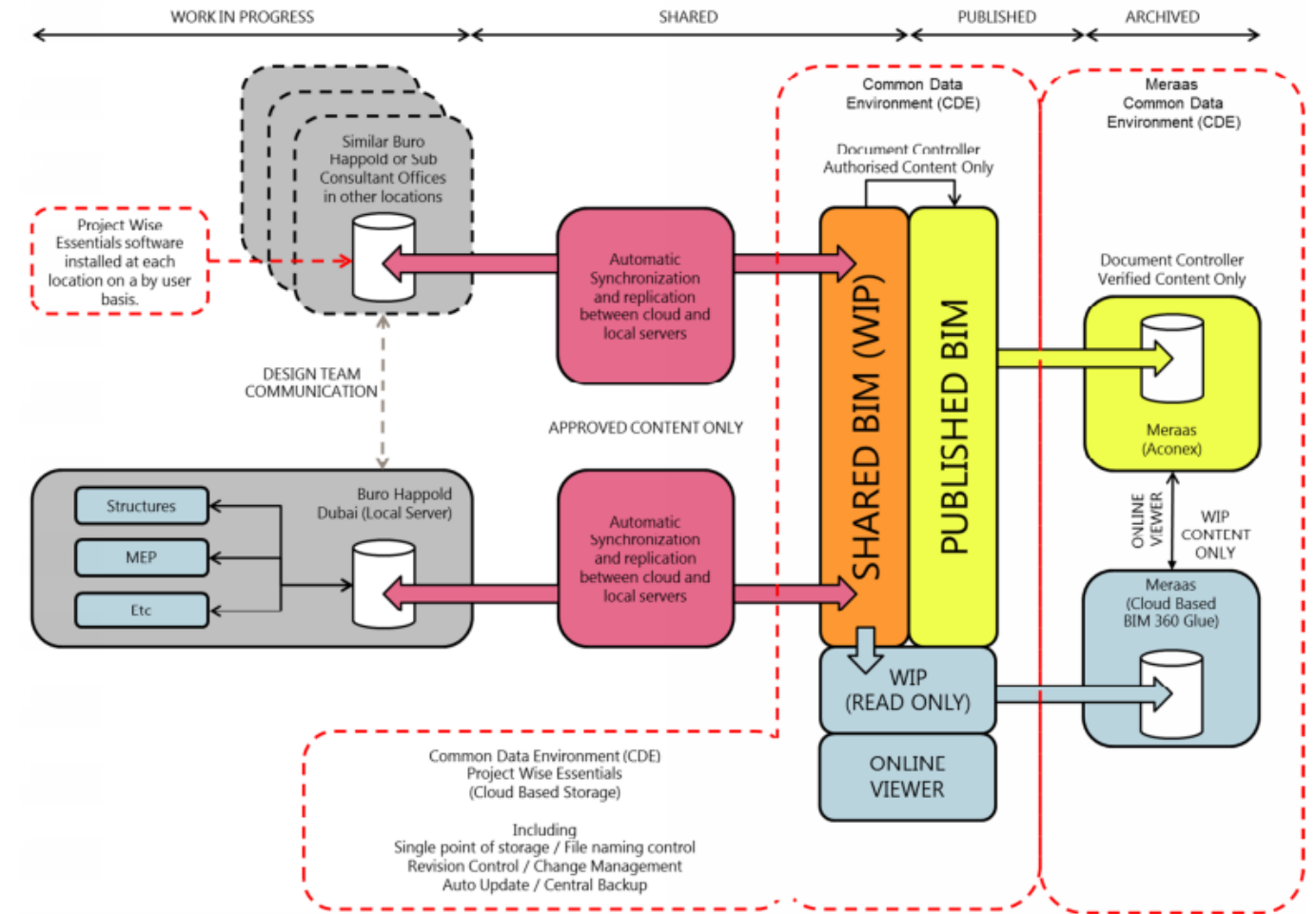
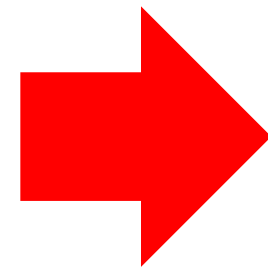
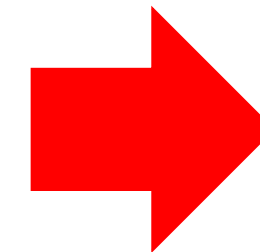


Figure 4 - BIM Data Exchange



ProjectWise® V8i



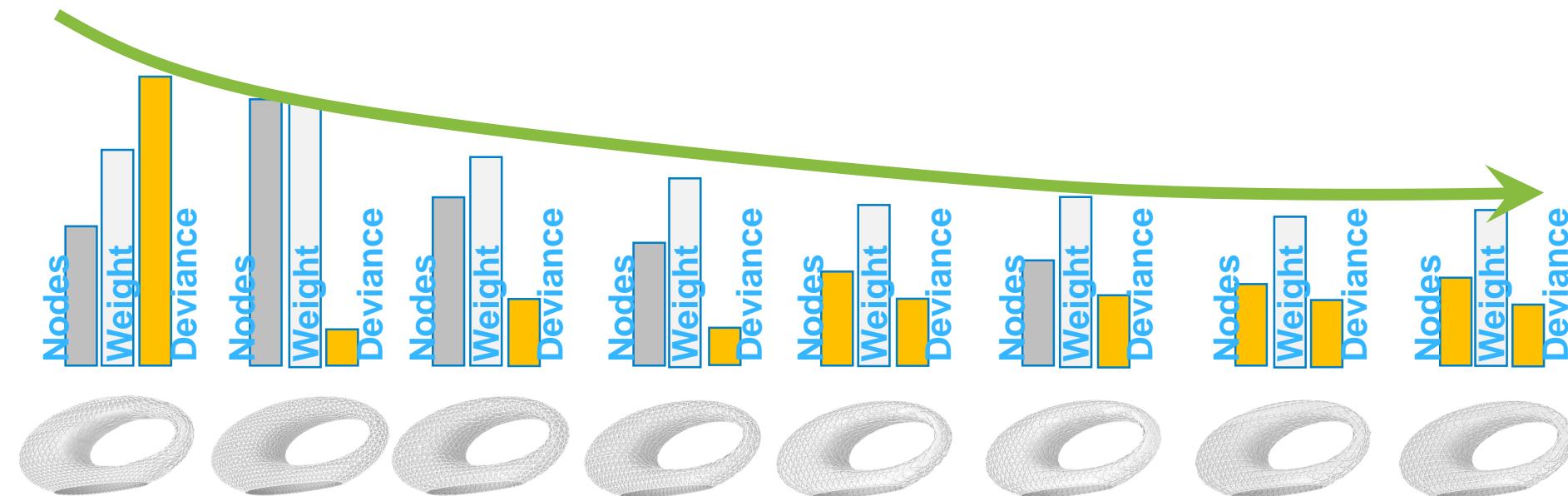
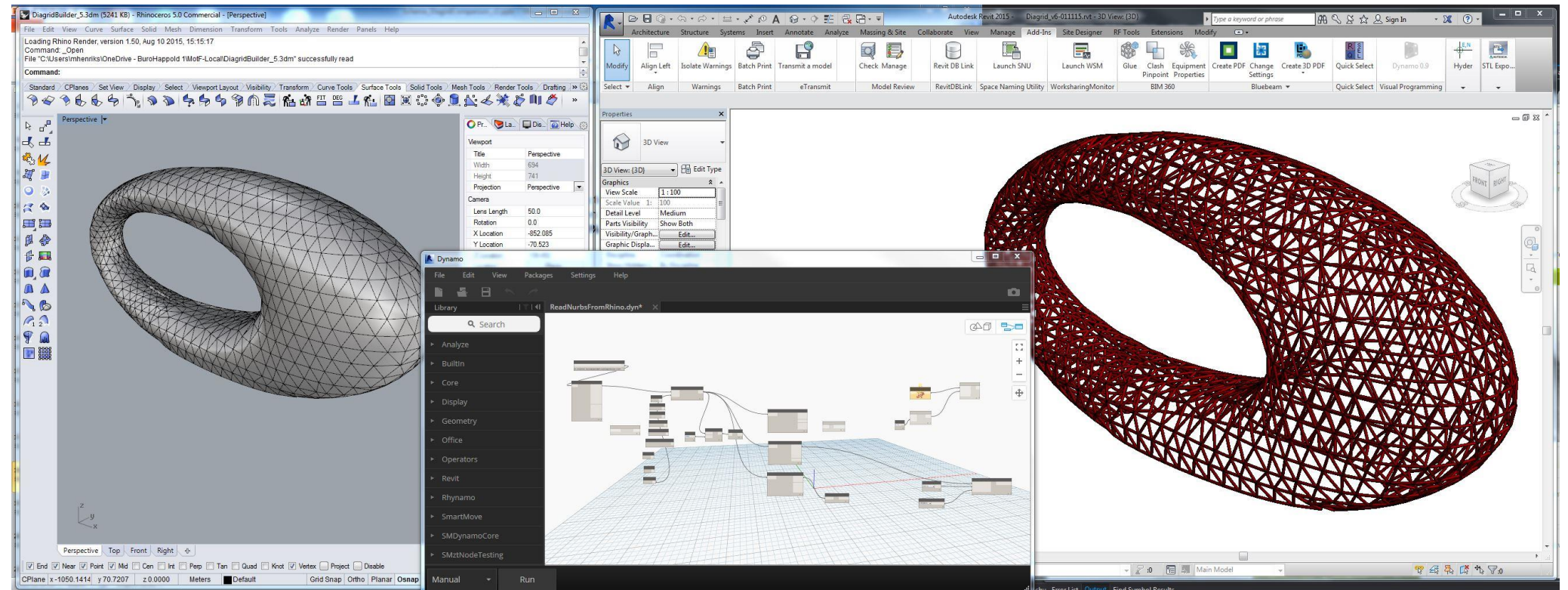
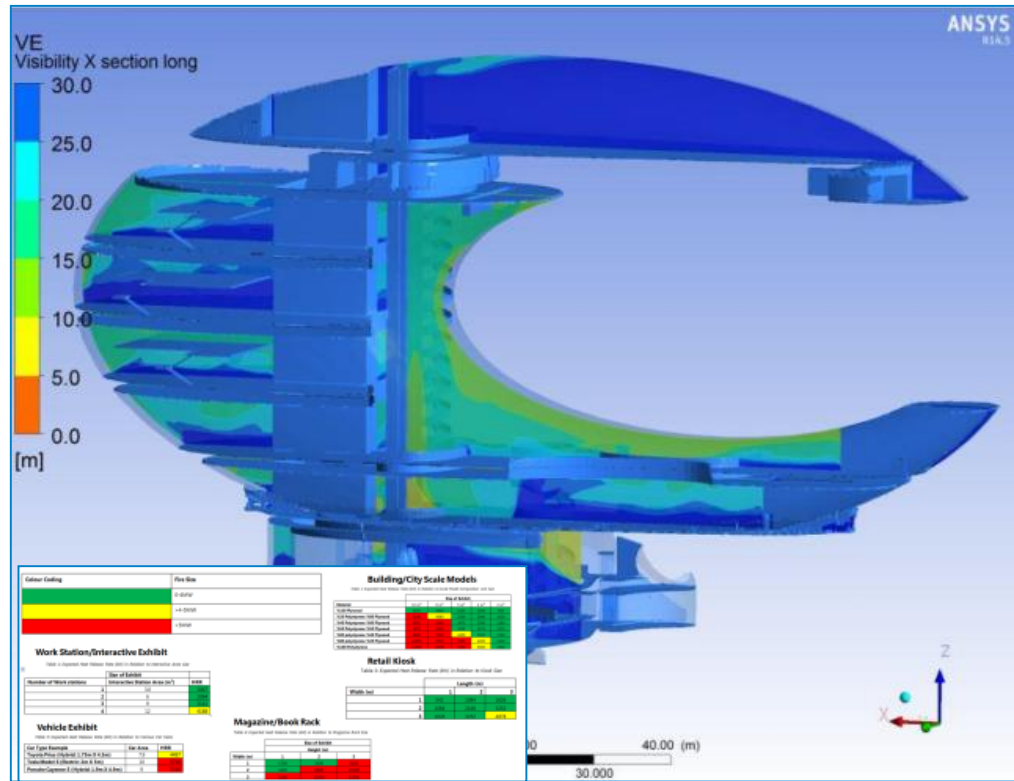
aconex

Push the Boundaries

- Museum of the **Future**
- Technology Incubator
- Innovative Project
- Innovative Technologies
- Iconic Architecture
- Unique Facade
- Sustainability Goals



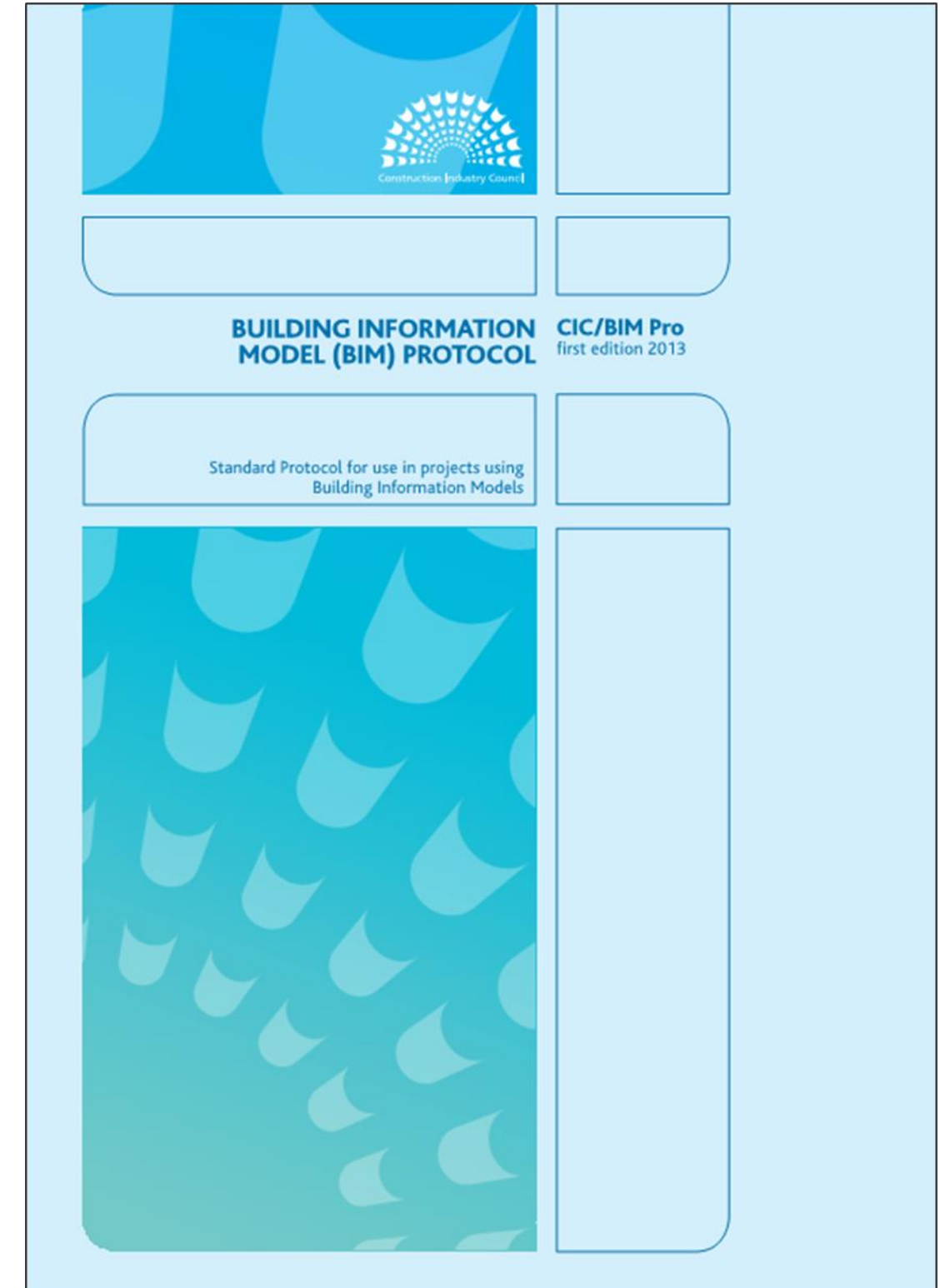
Computational Engineering



40% less nodes → Less construction cost
30% less weight → Less material cost
80% less variation → Easier construction

Contracts

- BIM Documentation is now contractual
- EIR / BEP Included in contract documents (Signed)
- Model Ownership
- Intellectual property (IP)
- Who does what



Cloud Collaboration

- BIM 360 Glue
- Live Information
- Work in Progress
- Remote Access
- Real time data
- Options & Temporary Works
- Design Reviews

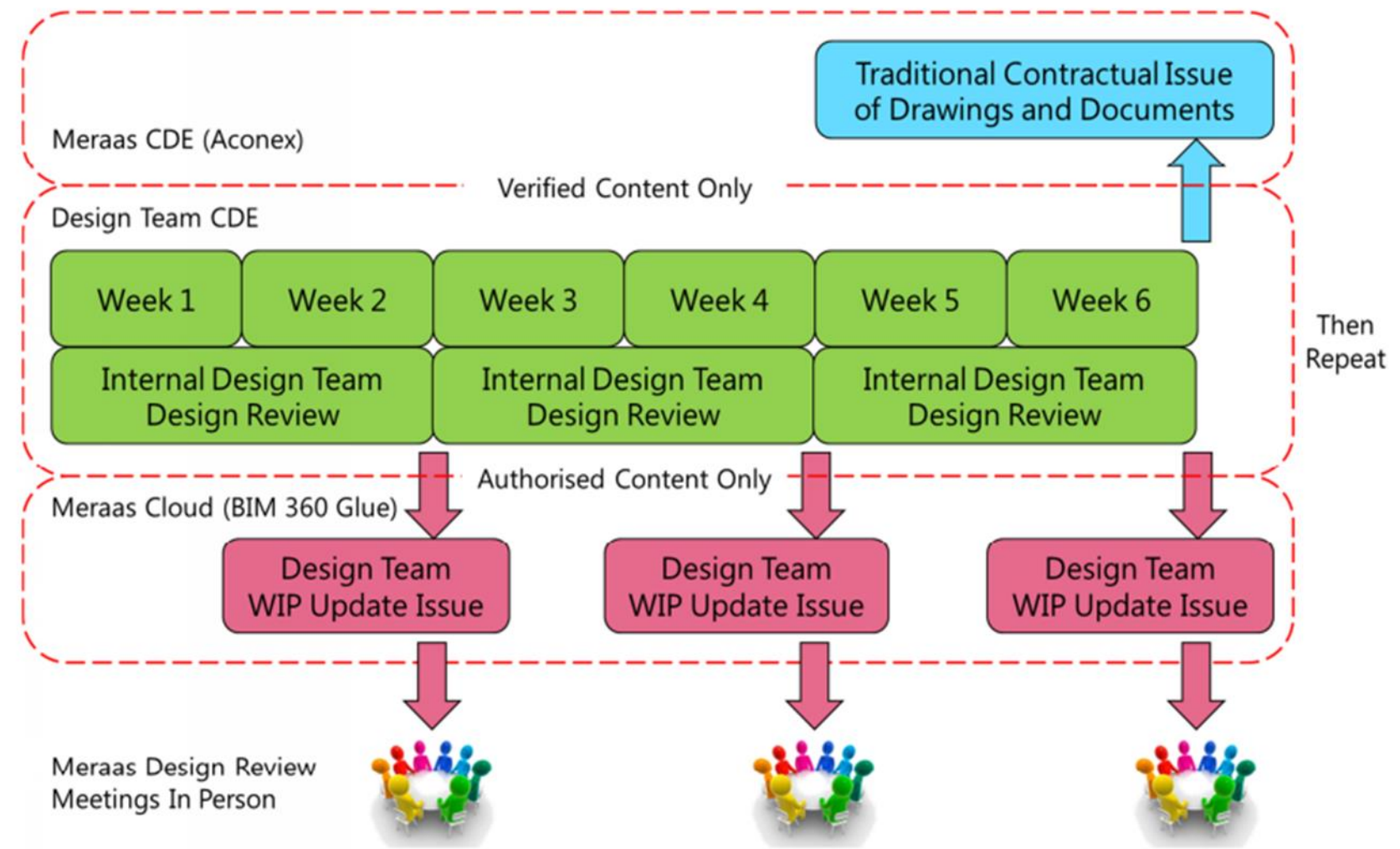
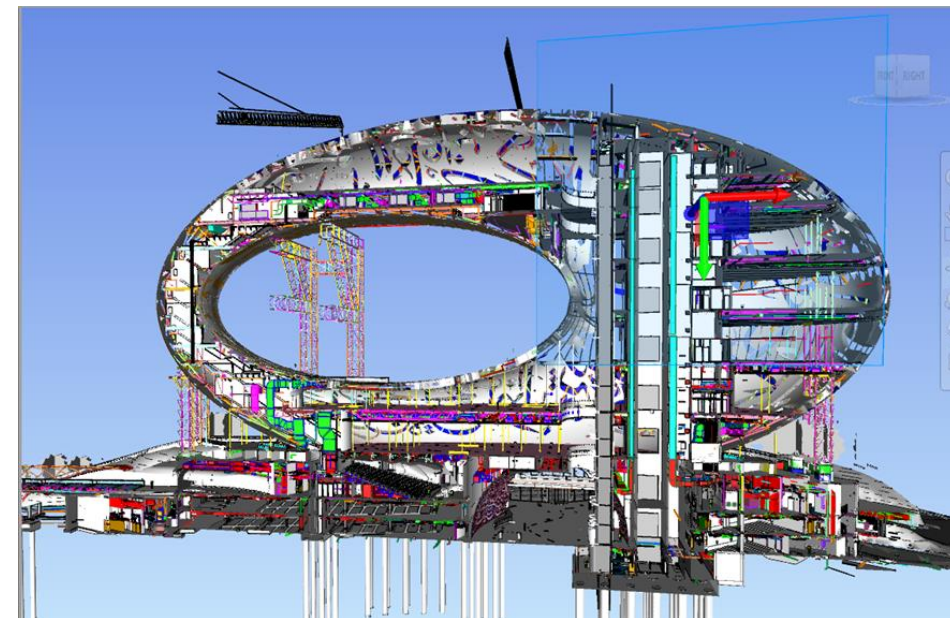


Figure 1 – Typical six week BIM collaboration and information issue diagram



Contractor Selection

- Example of contractor bid review
 - 6 contractors asked to submit a Pre-Award BEP
 - 6 very different formats, unable to be compared (Company Standards)
 - Template BEP created and contractors asked to re-submit
 - Process 10 times easier to compare and score
 - Bid interviews with BIM teams
 - Open and Honest Handover
 - Reduced Risk, increased confidence

Contractor Delivered





Lead Contractor

BAM Construction – VDC Department

Head Office



Paul Brennan
VDC Manager



Michael Murphy
Operations Manager



Simon Tritschler
BIM Specialist



Juraj Knotek
BIM Technician

Start up



Greg Byrne
Start-up Manager



BIM Management Site Based

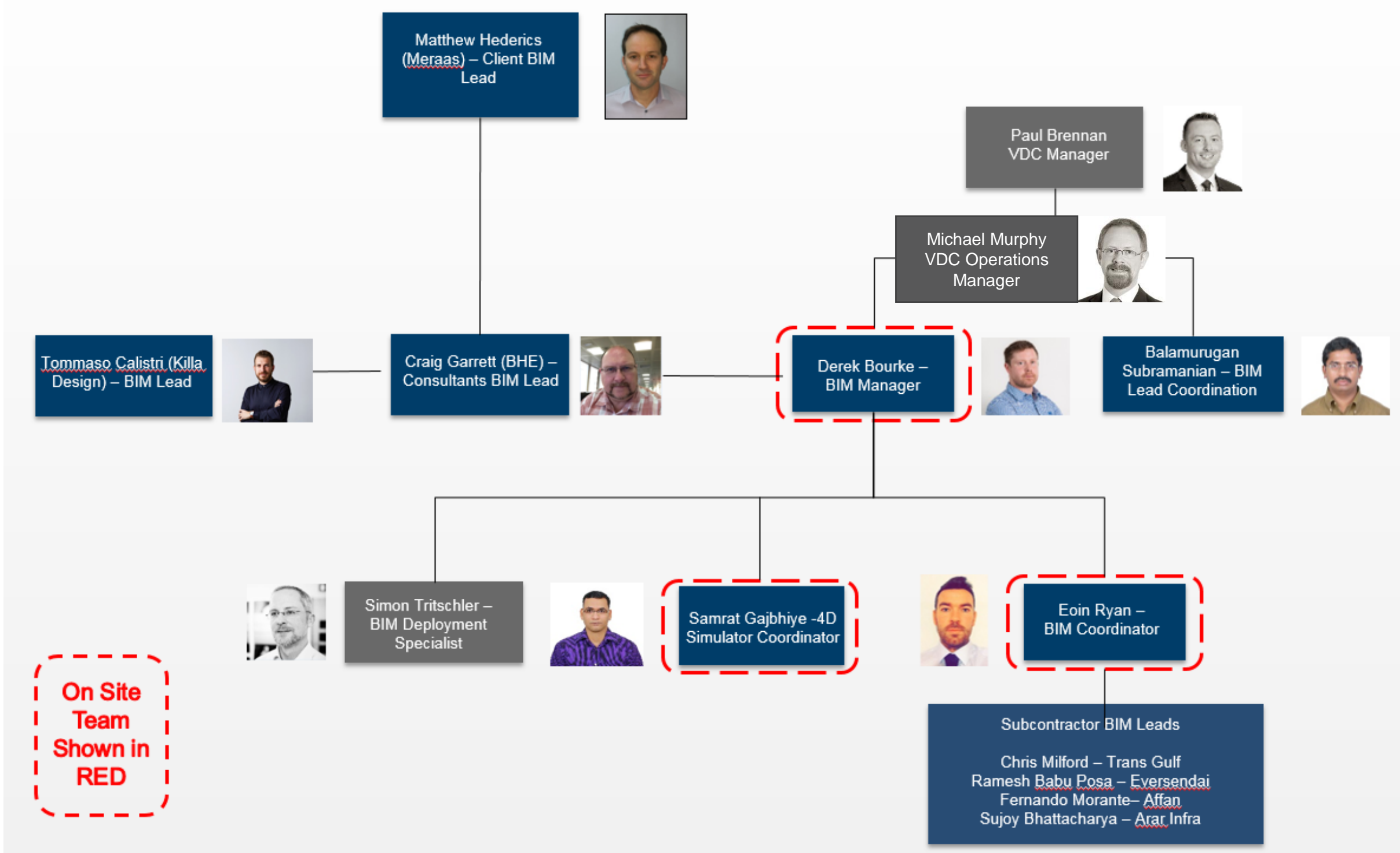


Derek Bourke
BIM Manager



Eoin Ryan
BIM Coordinator

BAM Construction – VDC Department



Project BIM Information Requirement

Meraas Information Requirements

MIR 7.1 (EIR)

Oversee overall delivery of clients

EIR requirements

Meraas Information Requirements



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Project BIM Information Requirement

BEP

Incorporating and developing the requirements of the MIR into a structured approach.

Inherited document from the clients lead consultant Buro Happold (BH).

BAM and BH developed it for Construction.

Live document that changes throughout the project

BIM Execution Plan

ميراس MERAAS

BUROHAPPOLD
ENGINEERING

bam
Higgs & Hill

AECOM

kill
design

Version 11 for Construction Kick-off

File Name : 0121-P101-BHH-PRC-BIM-00001

Publish Date: 2017-03-14

Meraas Holding

Museum of the Future



Issue	Description	Created by	Date
00	Draft for review	Craig Garner - Buro Happold	2015-05-08
01	Updated for review	Craig Garner - Buro Happold	2015-06-08
02	Final for issue	Craig Garner - Buro Happold	2015-07-02
03	Official Issue	Craig Garner - Buro Happold	2015-08-09
04	Updates in line with PPP document & client comments	Craig Garner - Buro Happold	2016-01-05
05	Updates in line with PPP document & numbering system changes	Craig Garner - Buro Happold	2016-03-10
06	Updates in line with BIM Methodology and CTO alignment meetings	Craig Garner - Buro Happold	2016-05-08
07	Updates to align with BIM Model Briefing Document	Craig Garner - Buro Happold	2016-05-15
08	Pre-Construction Preparation BEP created jointly by Meraas and Buro Happold. This version was submitted to the Tenderers.	Anthony Legiens - Meraas Craig Garner - Buro Happold	2016-08-25
09	Completed Pre-Contract Award BEP by BMM Higgs and Hill	Michael Murphy - BMM Grag Byrne - BMM	2016-09-22
10	BEP for mobilization on site created jointly by Buro Happold and BMM with the support of the Meraas BIM Office.	Craig Garner - Buro Happold Grag Byrne - BMM	2017-03-14
11	Updated to clarify shop drawing production, process diagram updated.	Craig Garner - Buro Happold Grag Byrne - BMM	

Project BIM Information Requirement

CMDS

Contractors Model Development Specification

CONTRACTORS MODEL DEVELOPMENT SPECIFICATION (CMDs)				Meraas Level of Development (MLOD) and Model Component Author (MCA)																	
MUSEUM OF THE FUTURE PROJECT (DUBAI)				0121-BHH-PRC-SPE-00001																	
Unit				50% Concept Design		100% Concept Design		Scheme Design		Detailed Design		Tender Submittal		Construction				Handover			
Tot				25/07/15		25/07/15		18/11/15		04/11/2016		15/5/16		See Project Schedule				Date TBC			
UC Level 2	UC Level 3	UC Level 4		MLOD	MCA	MLOD	MCA	MLOD	MCA	MLOD	MCA	Notes	MLOD	MCA	4D	5D	Notes	MLOD	MCA	Notes	
A	Foundations	A1010 Standard Foundations	A1010.10	2	STR	3	STR	4	STR	5	STR		6	BHH	Y	Y					
			A1010.30	2	STR	3	STR	4	STR	5	STR		6	BHH	Y	Y					
			A1010.90	3	STR	3	STR	4	STR	5	STR		6	BHH	N	Y					
	A1020 Special Foundations	A1020.10	2	STR	3	STR	4	STR	5	STR		6	BAU/BHH	Y	Y						
		A1020.15	2	STR	3	STR	4	STR	5	STR		6	BAU/BHH	Y	Y						
		A1020.20	3	STR	3	STR	4	STR	5	STR		6	BAU/BHH	N	Y						
		A1020.30																			
		A1020.40																			
		A1020.50																			
	Subgrade Enclosures	A2010 Walls for Subgrade Enclosures	A2010.10	2	ARC	2	ARC	3	STR	4	STR	5	STR		6	BHH	N	Y			
			A2010.20																		
			A2010.90																		
	Slabs-On-Grade	A4010 Standard Slabs-on-Grade		2	ARC	2	ARC	3	ARC/STR	4	STR	5	STR		6	BHH	Y	Y			
				2	ARC	2	ARC	3	ARC/STR	4	STR	5	STR		6	BHH	Y	Y			
		A4020 Structural Slabs-on-Grade																			
A4030 Slab Trenches																					
A4040 Pits and Bases																					



MLOD

Meraas Level of Development

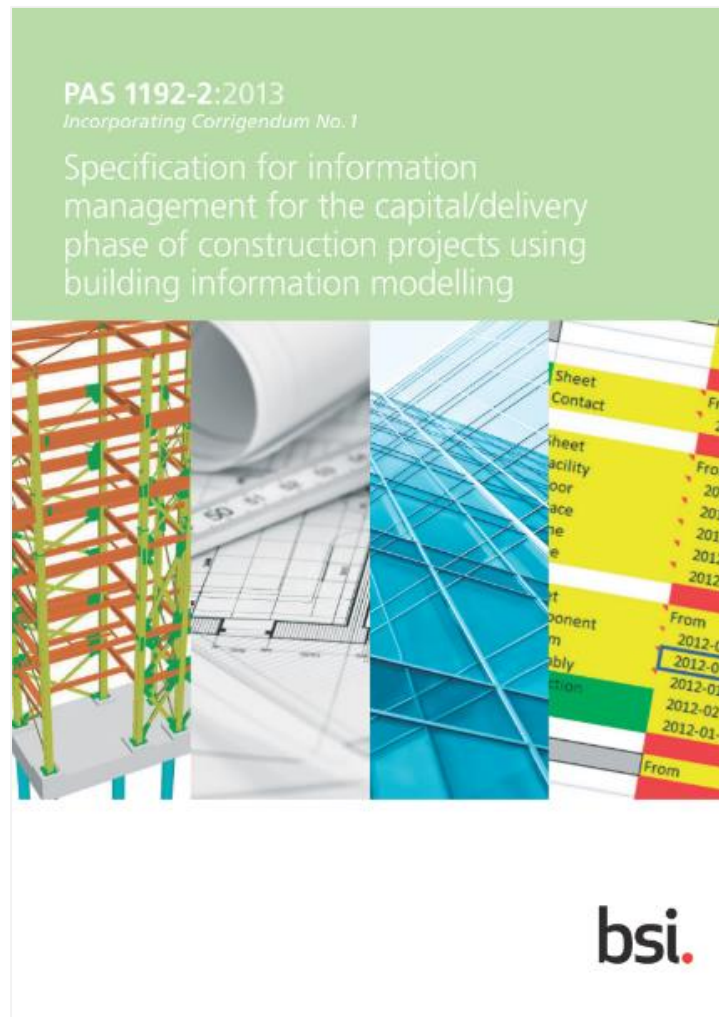
MLOD		6
Approximate Graphical Representation		
What the model can be relied upon for	In this phase the detailed instructions and specification to construct the building are defined. This includes a coordination with the design, materials and product choices of the Contractors.	
Output	Integrated production information. Complete fabrication and manufacturing details, system and element verification, operation and maintenance information. Modify to represent as installed model with all associated data references	
Minimum Geometric and Parametric Information	Model Objects are graphically represented within the Model as a specific system, object or assembly accurate in terms of quantity, size, shape, location and orientation, with detailing, fabrication, assembly, and installation information. Non-graphic information will also be attached to the Model Element. Production record for the project: Specific systems, objects and assemblies accurate in terms of specification, size, form, function and location with detailing, fabrication, assembly, and installation information. Detailed routing of systems. Fittings and interface details to be used Updated: energy use and embodied and in use carbon, detailed design and construction programme	
Critical Interfaces and Logic	Progressive capture of actual dimensional data for critical interface dimensions. Progressive capture of information for calculating material requirements for follow on packages. Capture of object status for progress reporting and collaborative planning	
BIM Uses		
Design Review	Design review meetings are conducted to support decision making (led by the design team), e.g. Design Meetings and Value Engineering Meetings. The 2D and 3D design is submitted to be reviewed digitally.	
3D Coordination	The models updated by subcontractors are clash free. All clashes that involve elements defined as 'A', 'B' and 'C' priority must be resolved.	
Construction Sequencing	Utilising objects in the model to create detailed simulation of the construction of the building including applicable context. Additional simulations regarding specific workflows or activities to enable reviewing of the planning for corresponding tasks in 3D. Detailed Project schedule used for sequencing purpose.	
Model for sequencing available?	Yes	
Project schedule provided by	Contractor	
Work Breakdown Structure	Meraas	
Object naming convention	NBS BIM Object Standard	
Site Management	The Site management application is used for issue tracking and inspection as specified in the MR.	
Quantification		
Model quantities available?	Yes	
Meraas Estimating Dept	BQ Benchmarking	
Cost Breakdown Structure	Meraas	
Work Breakdown Structure	Meraas	
Target accuracy % (±)		
Measurement standards	Proprietary	
Cost Consultant	Detailed BQ (e.g. Variation Order estimates and other post-tender estimates)	
Cost Breakdown Structure		
Print Date: 2016-05-10	121 of 133	0121-MER-PRM-MIR-00003_V7.1.docx
This document is applicable to the Main Contractor's Scope Only.		



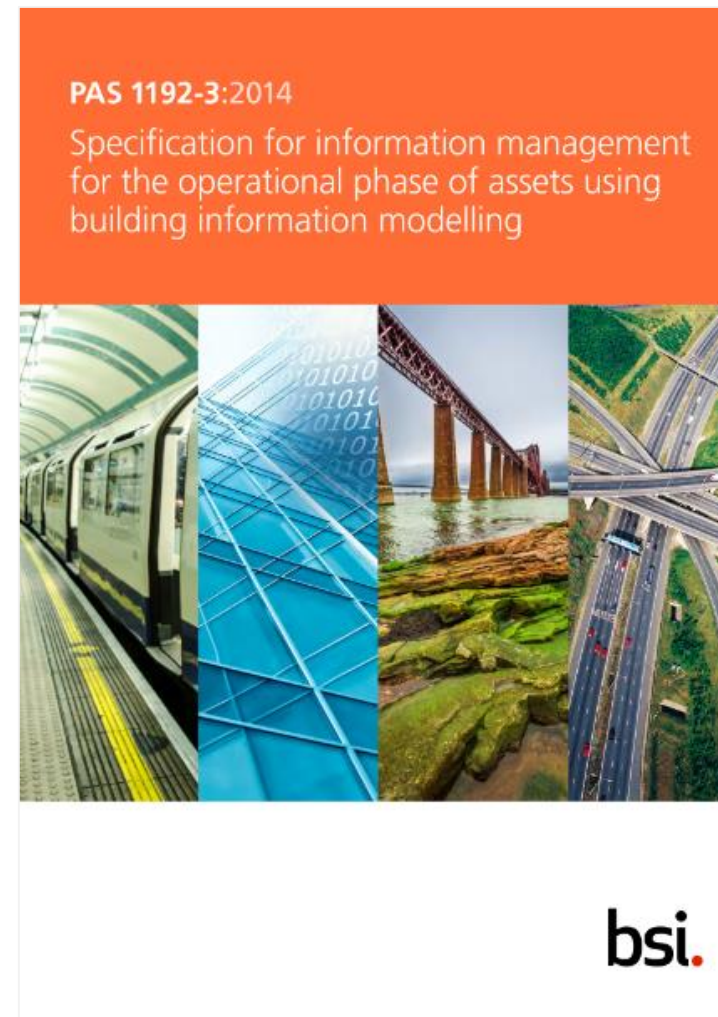
A Common Language

Project BIM Information Requirement

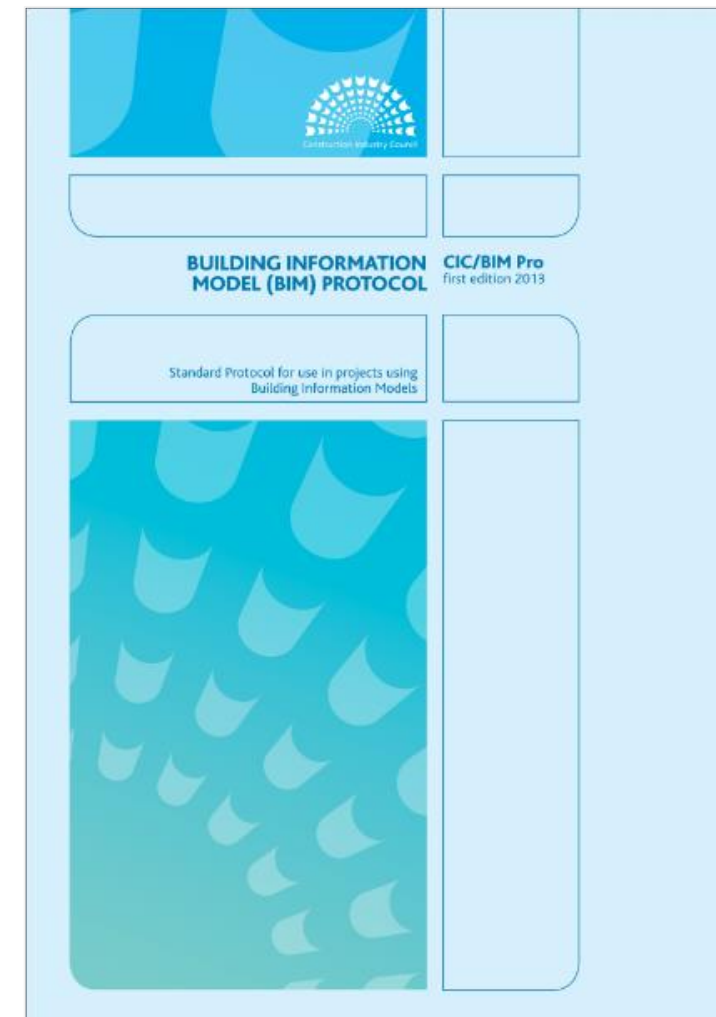
Standards - Common language & consistency



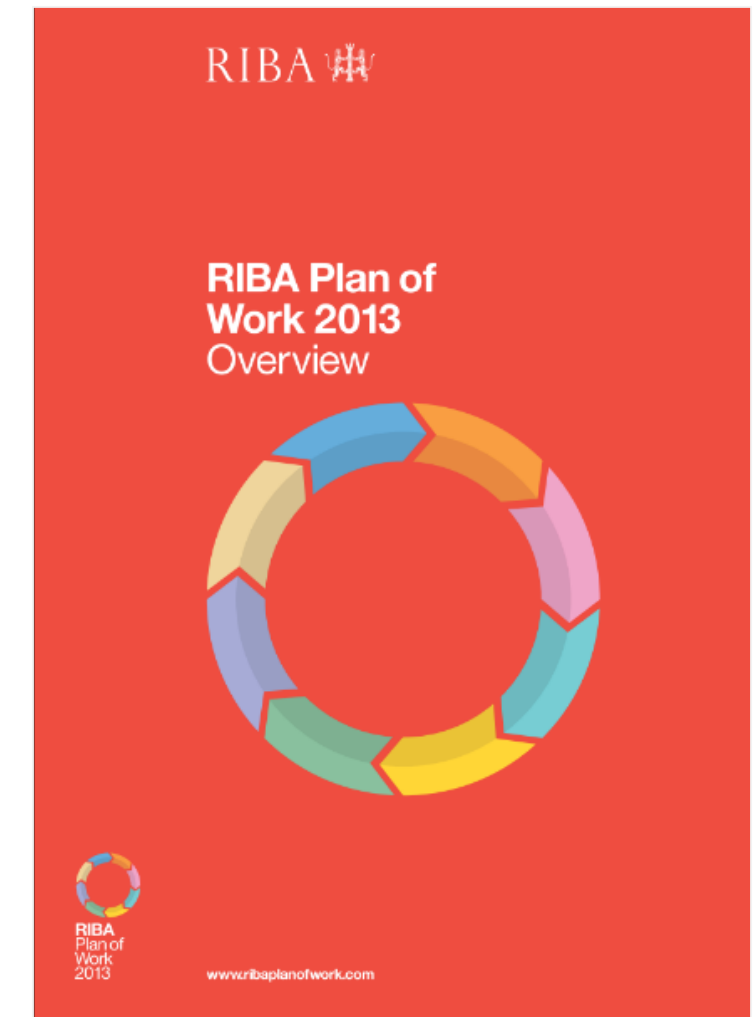
PAS1192-2-2013
capital/delivery phase



PAS1192-3-2014
operational phase

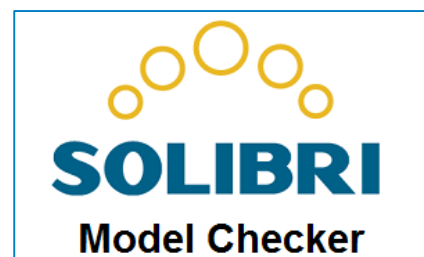
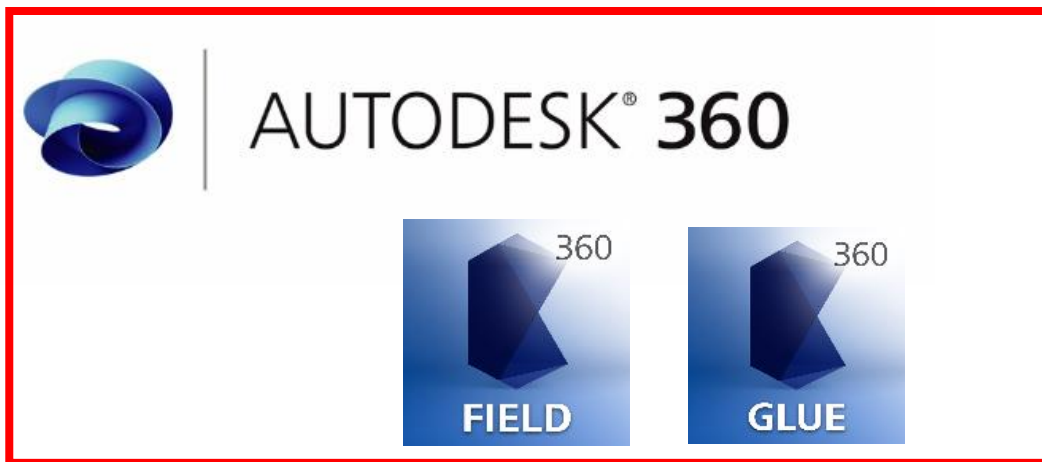
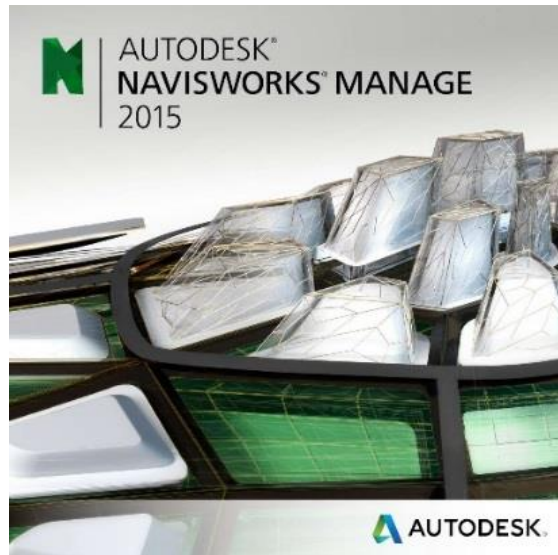


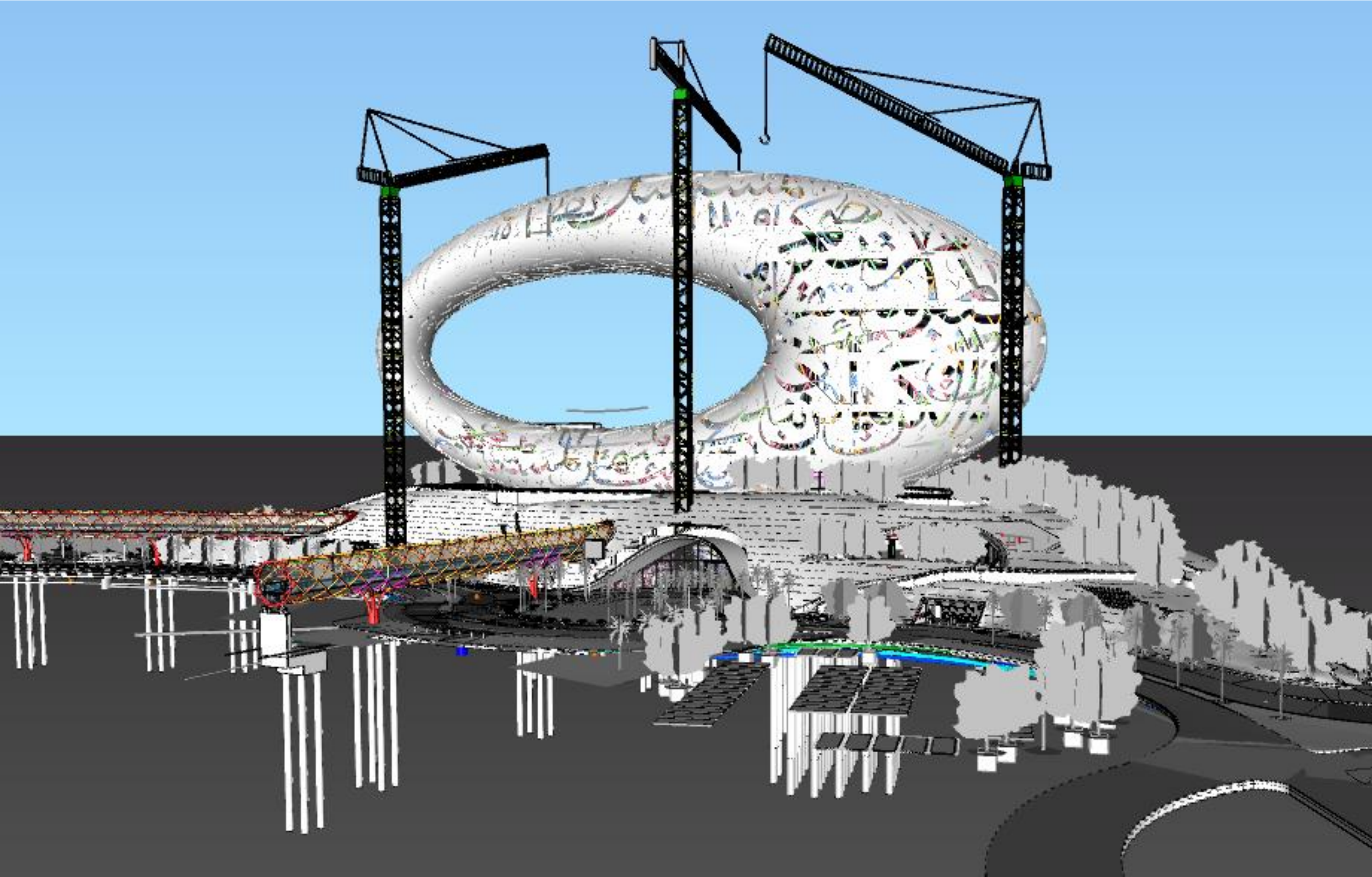
CIC BIM Protocol



RIBA Plan of Work 2013

Software







We expect more...

Trimble Field Link RTS

Link model to field to set out MEP supports, etc

Use of Trimble Field Link RTS on MotF

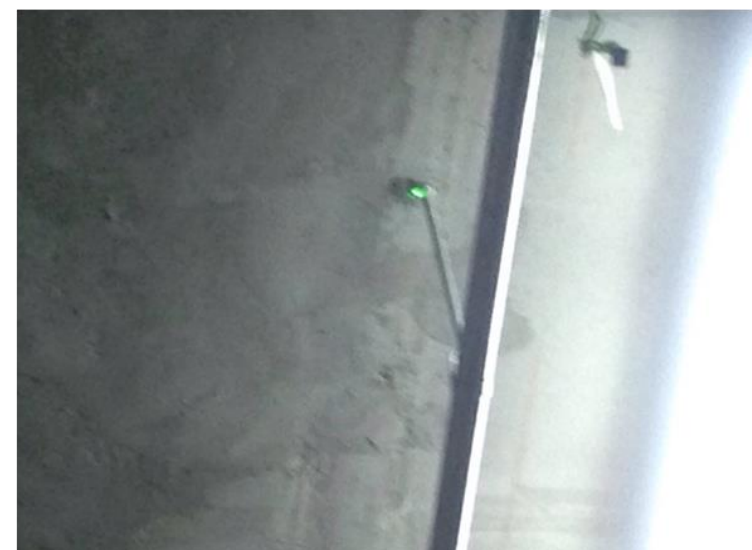
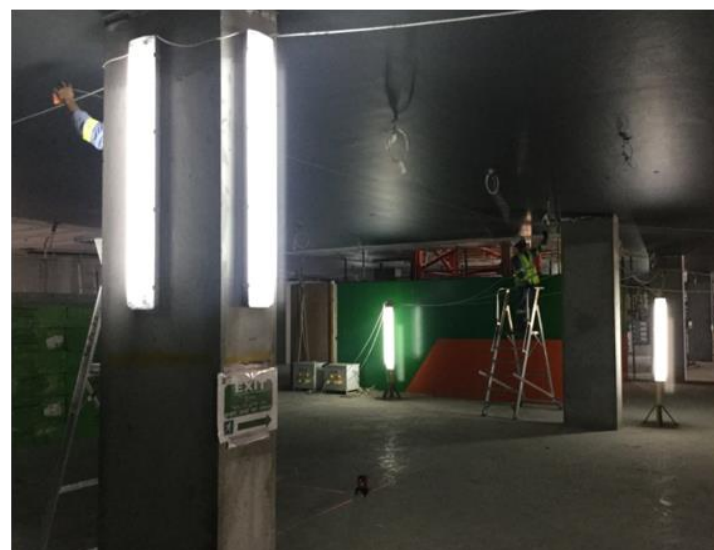
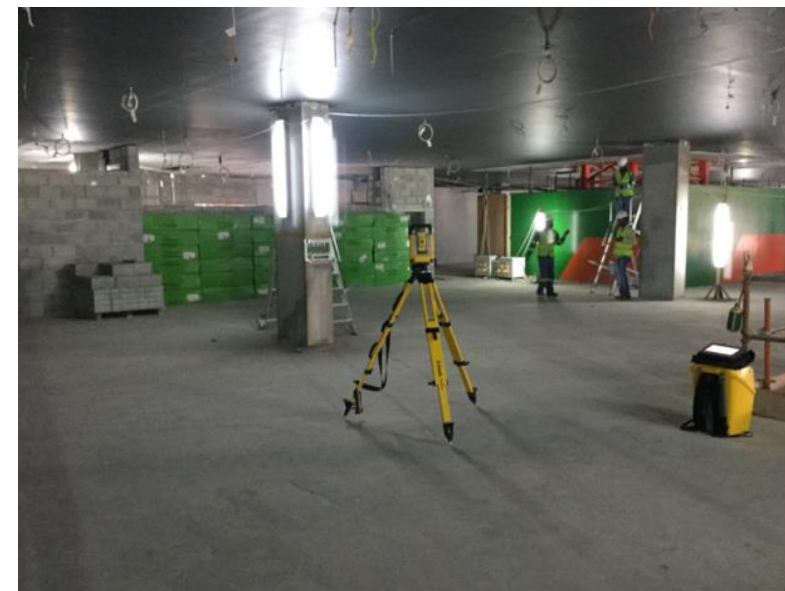
TGM – MEP Subcontractor

Using link model to field to set out MEP supports.

Case study 7000 Bracket Points in basement
(Based on Working 12 hours/day 7 days/week)

- 3 Teams of 3 men = 25 weeks
- RTS operator + 2 men = 11 days

Labour costs + Time saved + Accuracy = \$ €!.



Verification

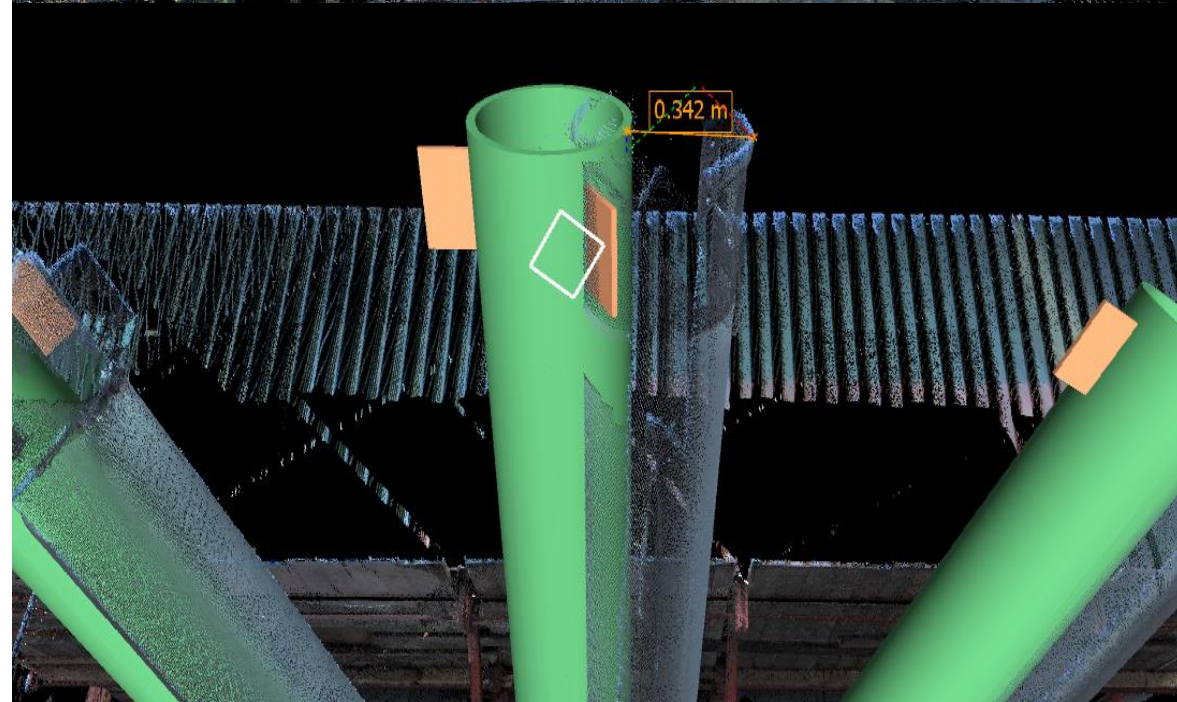
LEICA P40

Laser scanner on site.

Verification of concrete works, diagrid, façade etc.



Verification

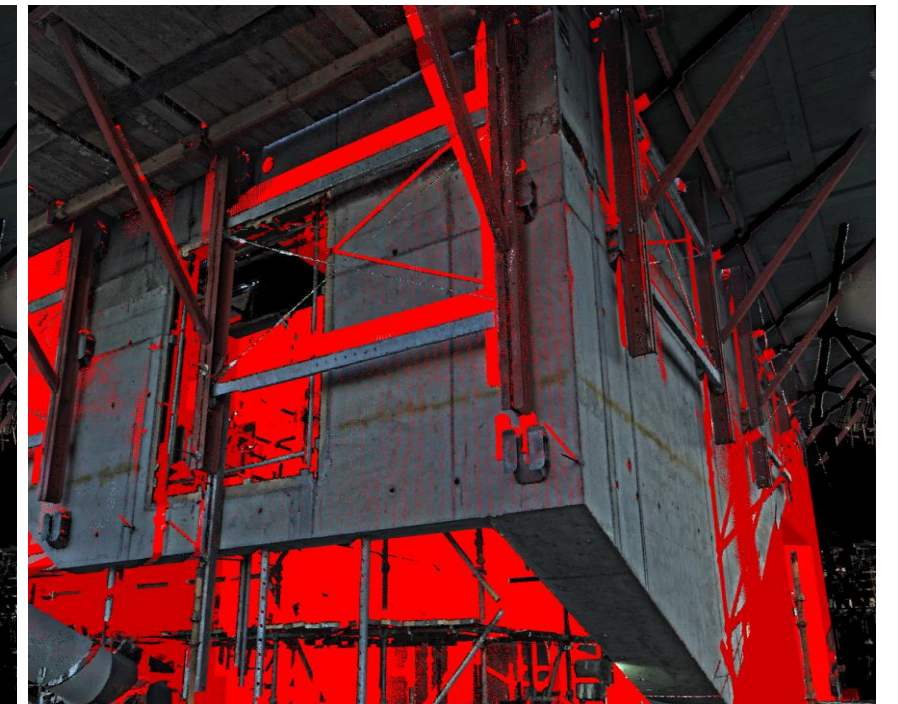


Diagrid at Northern End
13-12-2017

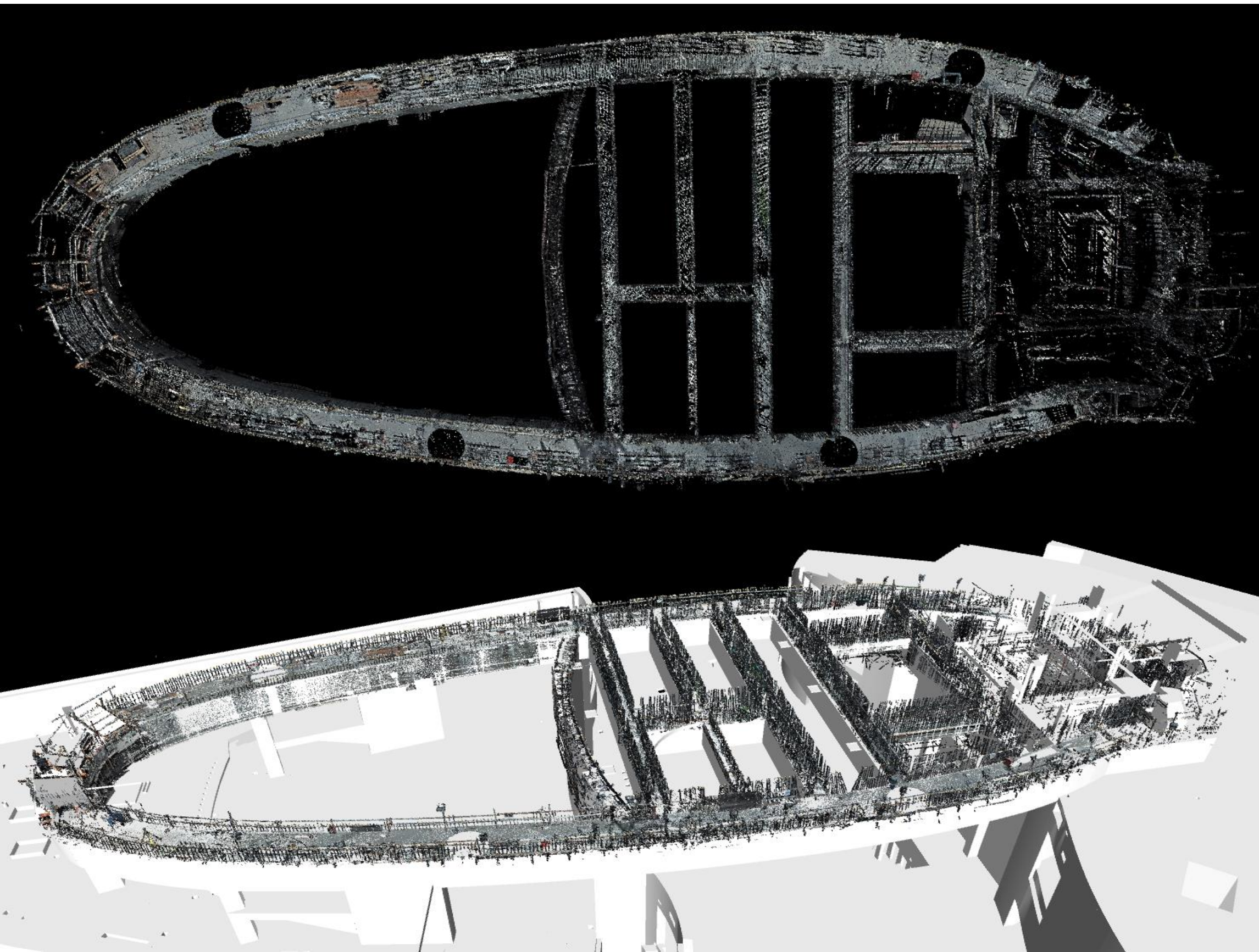
Purpose: Diagrid and Core Wall as built validation.

Good result: While the diagrid assembly to the back of the Core Wall was not welded it was being held in place with temporary propping and guy wires. During comparing the scan with the model it was noted that the assembly was over 340mm out of line. This was immediately flagged to our engineering and surveying teams and was a good catch for the scanner.

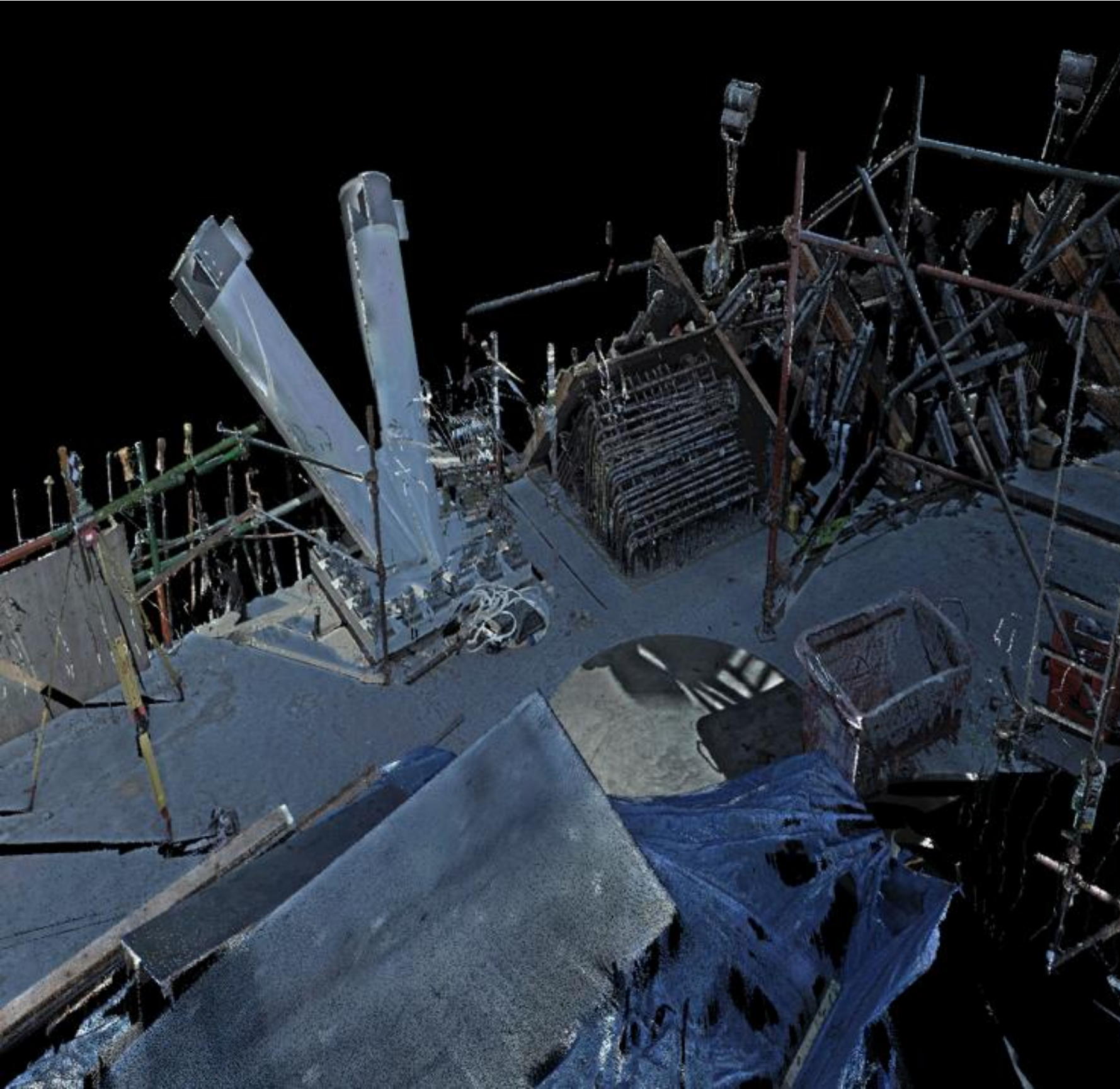
In terms of the core wall when compared with the model it was found to be within 10-15mm of the design (red) below.



Verification



Verification



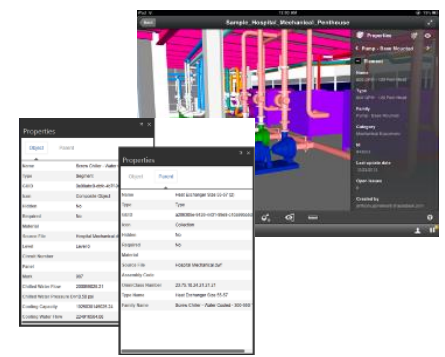
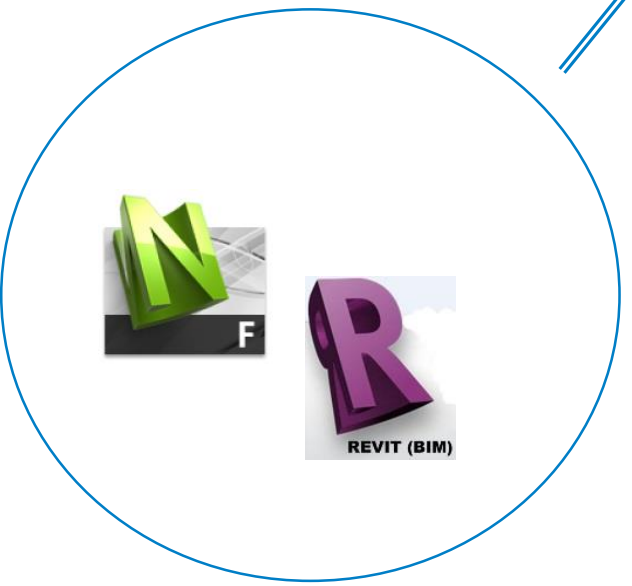
Lifecycle BIM

(BIM to FM)

Diagram illustrating the Configuration of Technology to deliver "BIM for FM"

BIM Model → BIM 360 Field → FSI Workflow

NWD model file output with plant_ref AHU1, AHU2, AHU3 as a Navis selection set



Navis Model Plant_ref is mapped to BIM 360 Field Asset Identifier

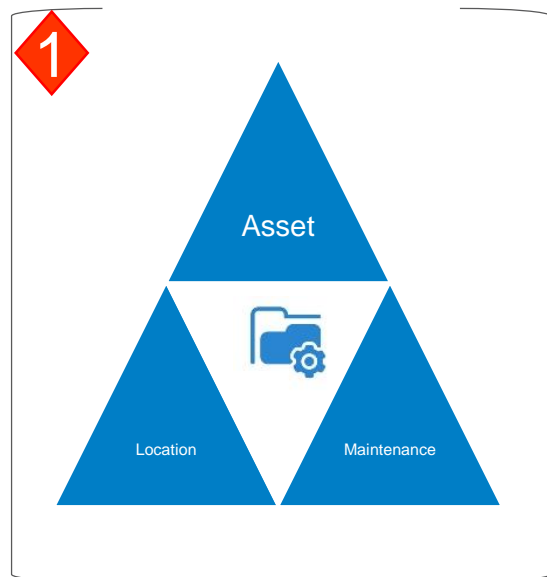
Update plant_ref AHU1 in COBie file with Asset Identifier AHU1 from data field

Update plant_ref AHU1 in FSI (FM manager) file with Asset Identifier AHU1 from BIM 360 Field

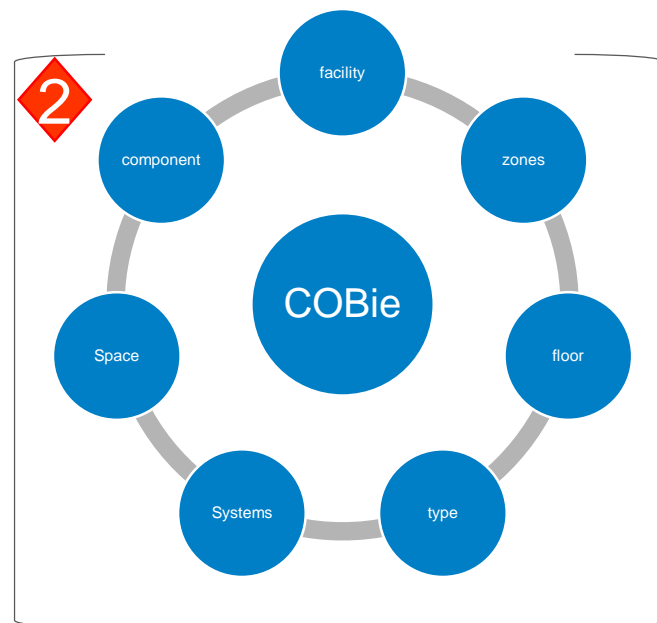
Item	Quantity	Material	Category	Company	Phone	ItemIDSystem	ItemIDObject	ItemIDMaterial	Department	QuantitativeCode	QuantName	ItemSystem
1	1	Production Information	Design	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
2	1	Quality Management	ACI	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
3	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
4	1	Quality Management	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
5	1	Quality Management	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
6	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
7	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
8	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
9	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
10	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
11	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
12	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
13	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
14	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
15	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
16	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
17	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
18	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
19	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
20	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
21	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
22	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
23	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
24	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
25	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
26	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
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28	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
29	1	Manufacturers	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls	Walls
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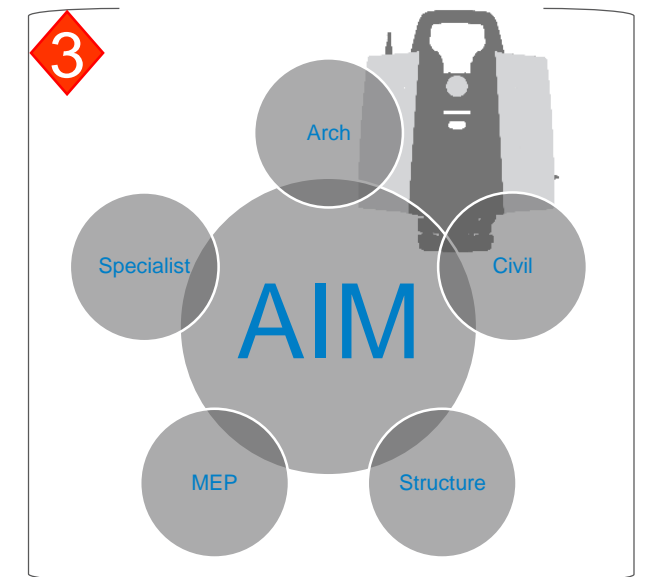
FM Integration (COBie)



Identify assets



COBie completeness check

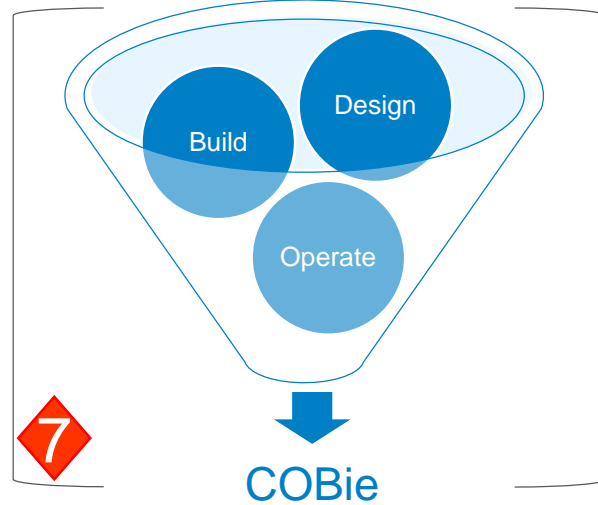


Verify VCM

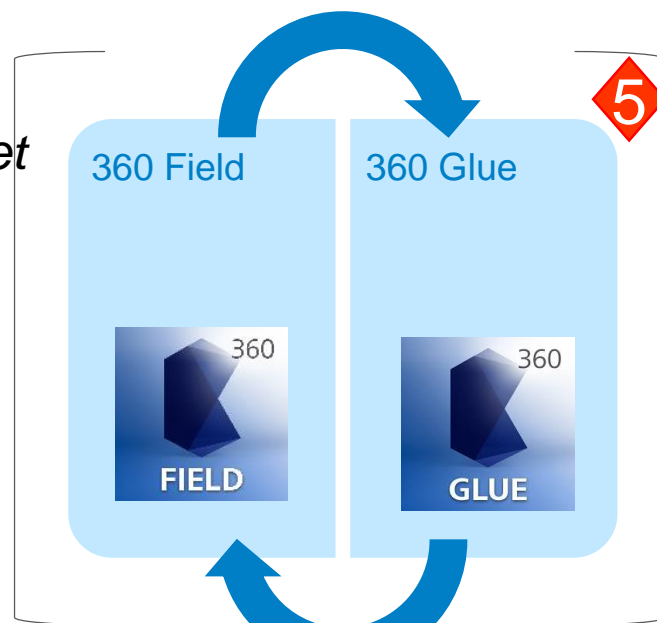
Lifecycle BIM (data management)



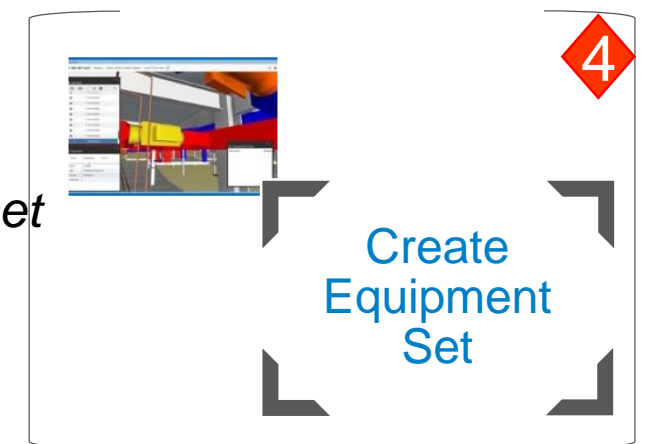
Assign the unique asset identifier



Capture all outstanding COBie information



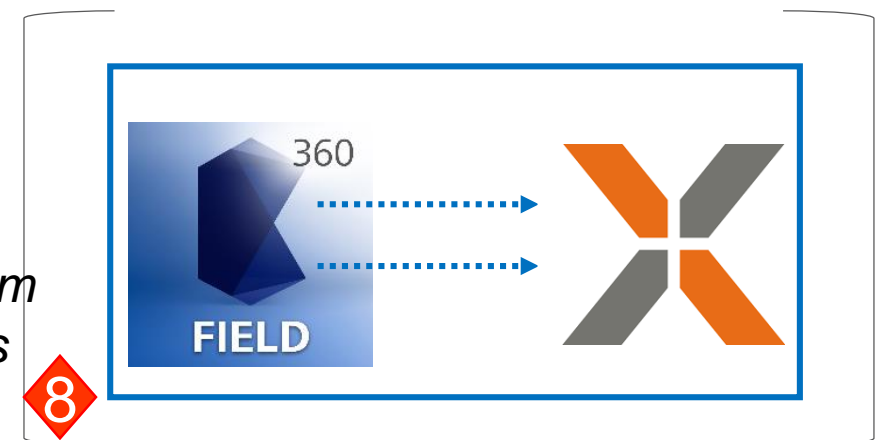
Link the equipment set With 360 Field



Create an equipment set through 360 Glue



Send asset information from 360 Field to Building Ops



8

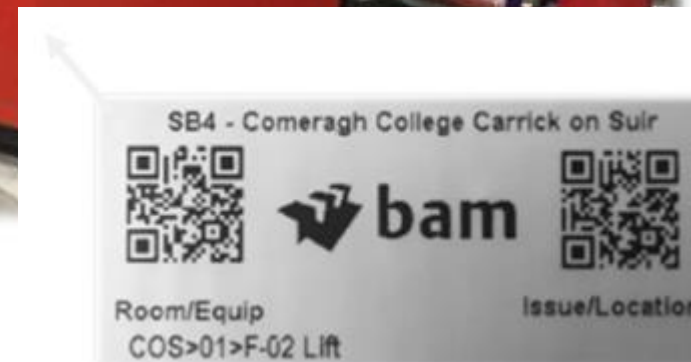
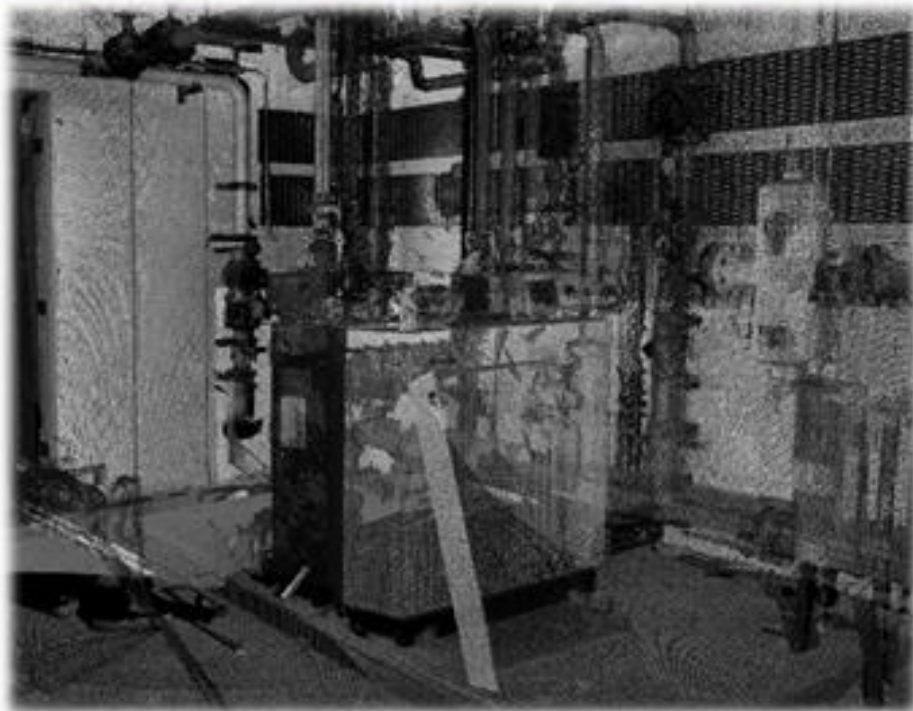
Digital Asset Delivery



Asset Population during construction delivery



Linking digital Assets to Physical Assets



Recommendation



Communicate more

- There really is no substitute for face to face meetings
- If your client isn't proactive, do it yourself, its worth it
- Develop a collaborative environment where everyone's input is valued
- The side effect of the need for technology is the depletion of social skills



Questions



BUROHAPPOLD
ENGINEERING



craig.garrett@burohappold.com

mmurphy@bamcontractors.ie

stritchler@bamcontractors.ie