CitA Tech Live
The Museum of the Future, Dubai

Delivering one of the most complex buildings in the world with construction technology at its core

CitA Tech Live
Dublin, 17th June 2022

At BAM We Want The Clicks Before The Bricks

Michael Murphy

Digital Construction Operations Manager for BAM UK&I

CitA Tech Live
Dublin, 17th June 2022

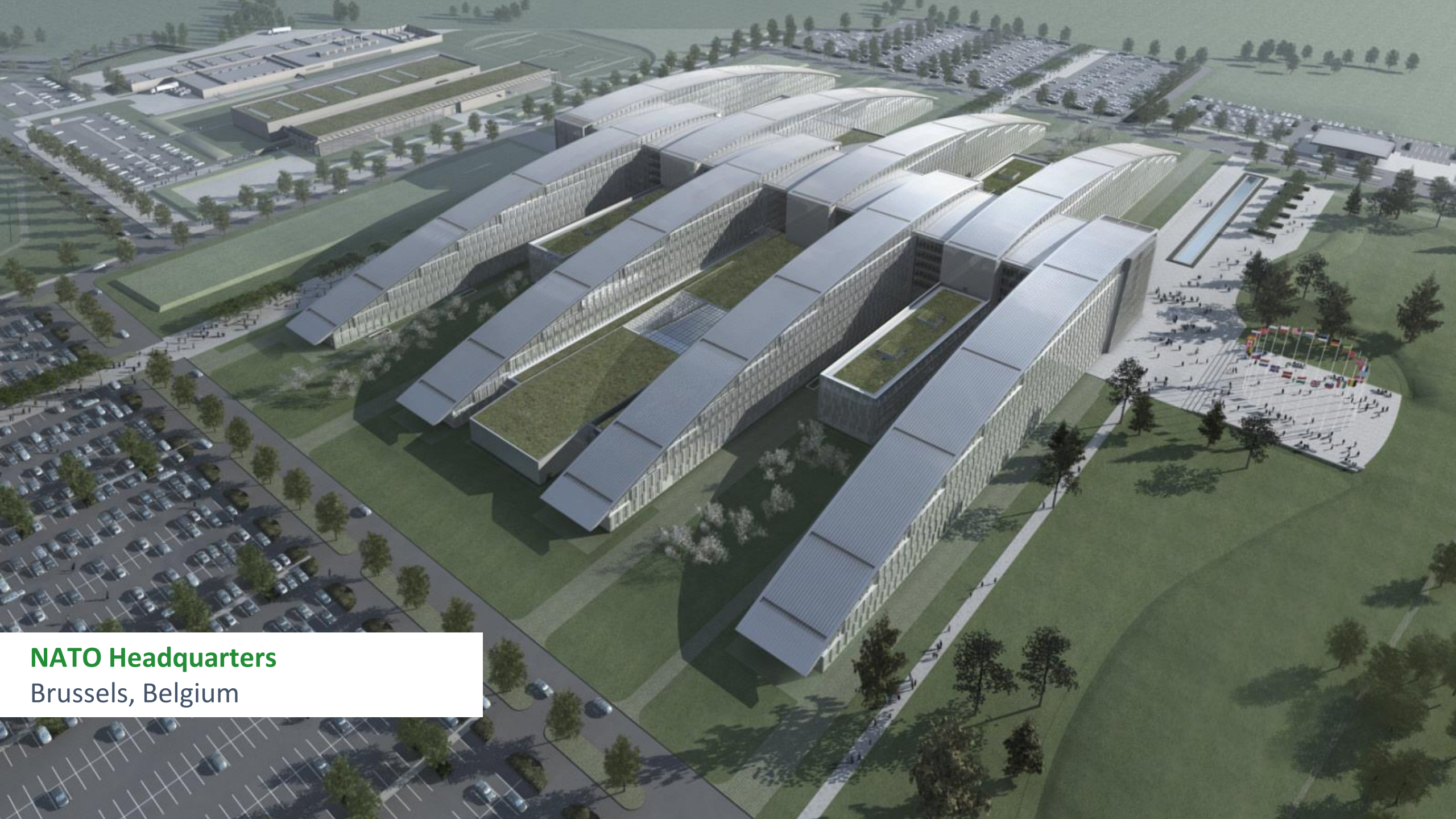
bam

- **Name** BAM *(Bataafsche Aanneming Mij van Bouw-en Betonwerken)*
- **Founded** 1869
- **Turnover** €7.2 billion
- **Employees** 23,500 (fte)
- **Ownership** Public company, listed on Euronext Amsterdam
- **Countries** >30 Worldwide; Two Divisions (UK&Ireland and Netherlands)
- **Activities** Entire spectrum of the construction business

One of the largest and foremost European construction businesses

Bolands Quay

Dublin, Ireland



NATO Headquarters
Brussels, Belgium

Courts Bundle PPP

Drogheda Courthouse, Ireland

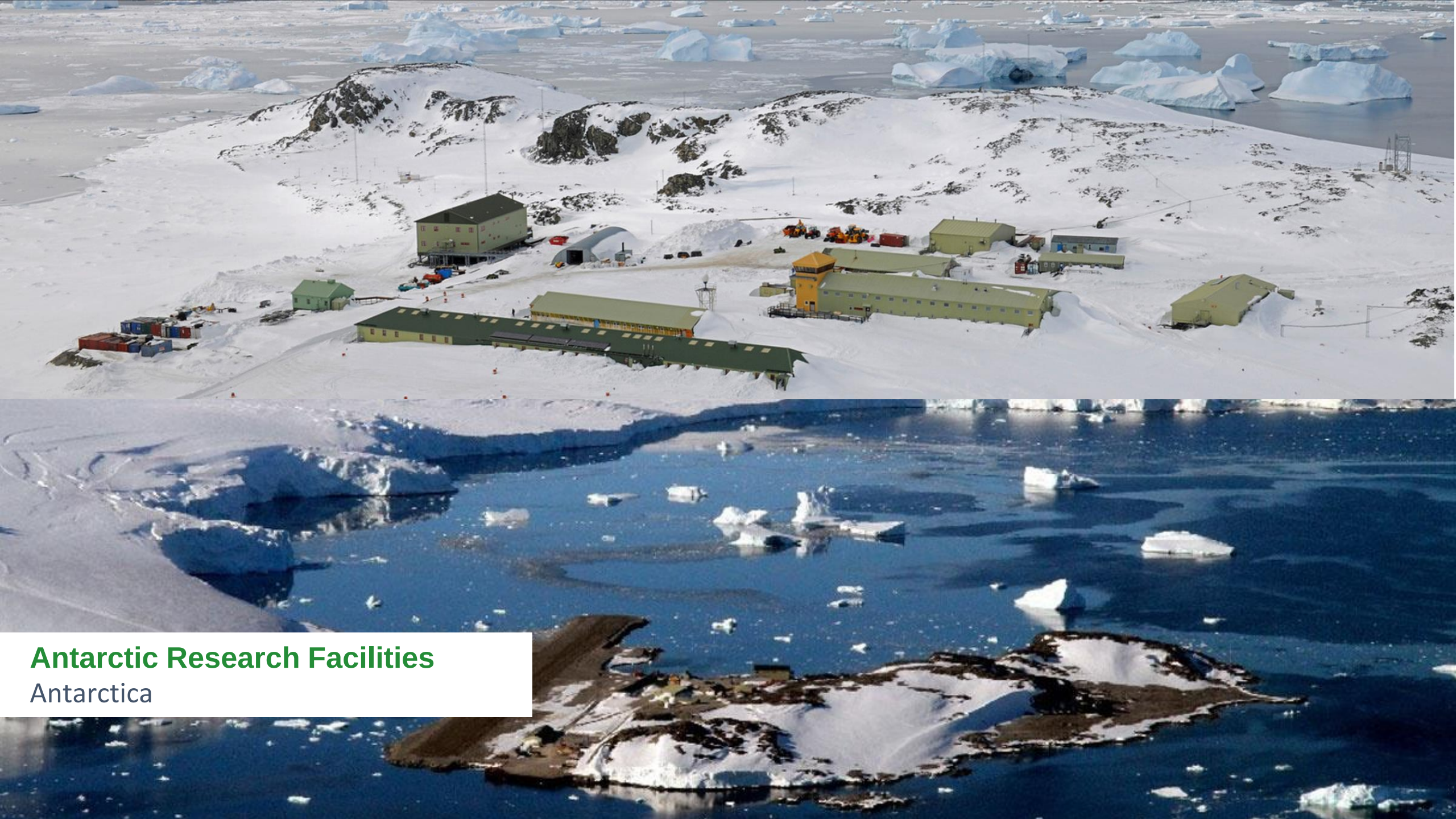
Port House
Antwerp, Belgium

Microsoft European Headquarters
Dublin, Ireland

Victoria & Albert Museum
Dundee, Scotland

Fehmarnbelt Tunnel

Linking Germany to Denmark

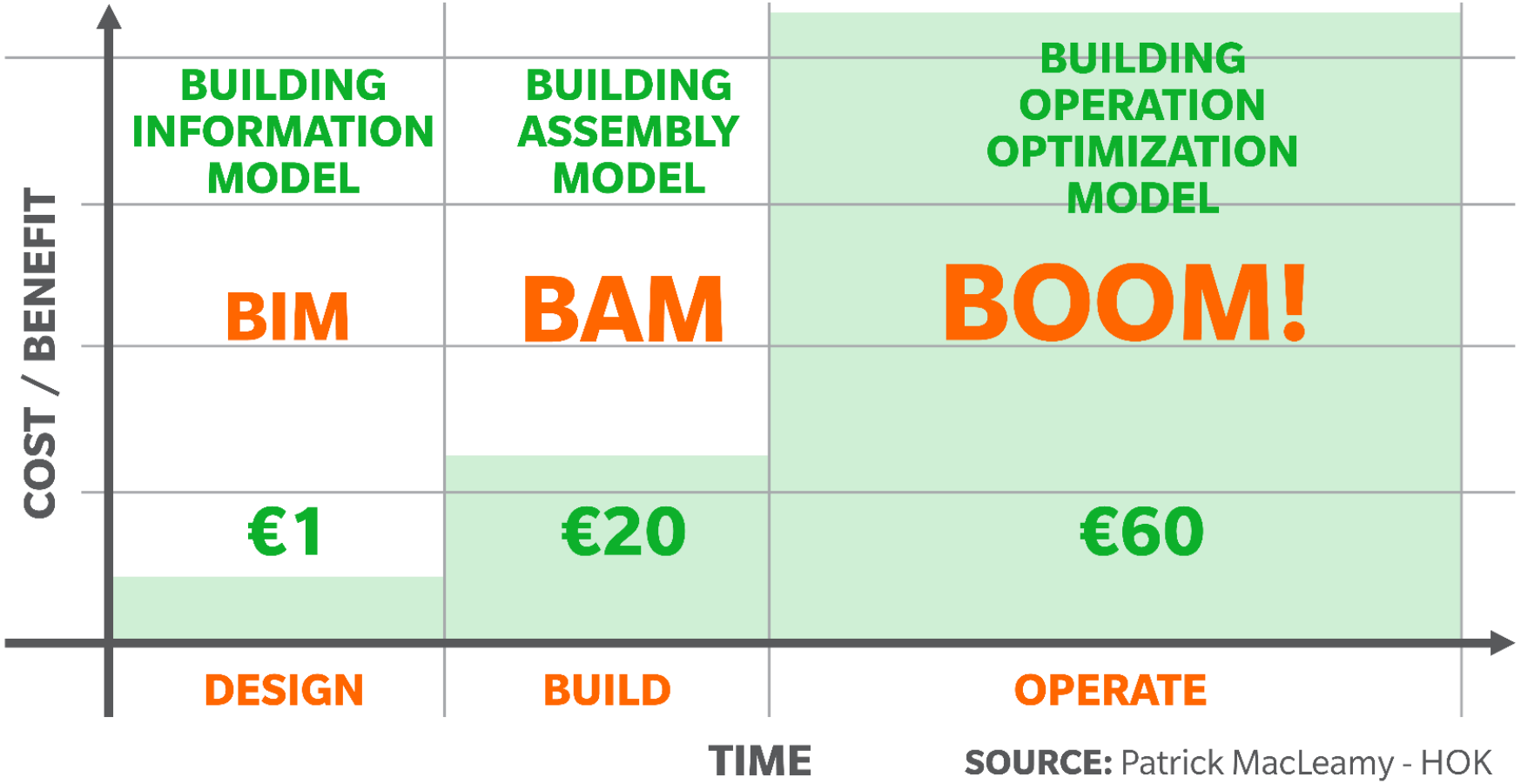


Antarctic Research Facilities

Antarctica

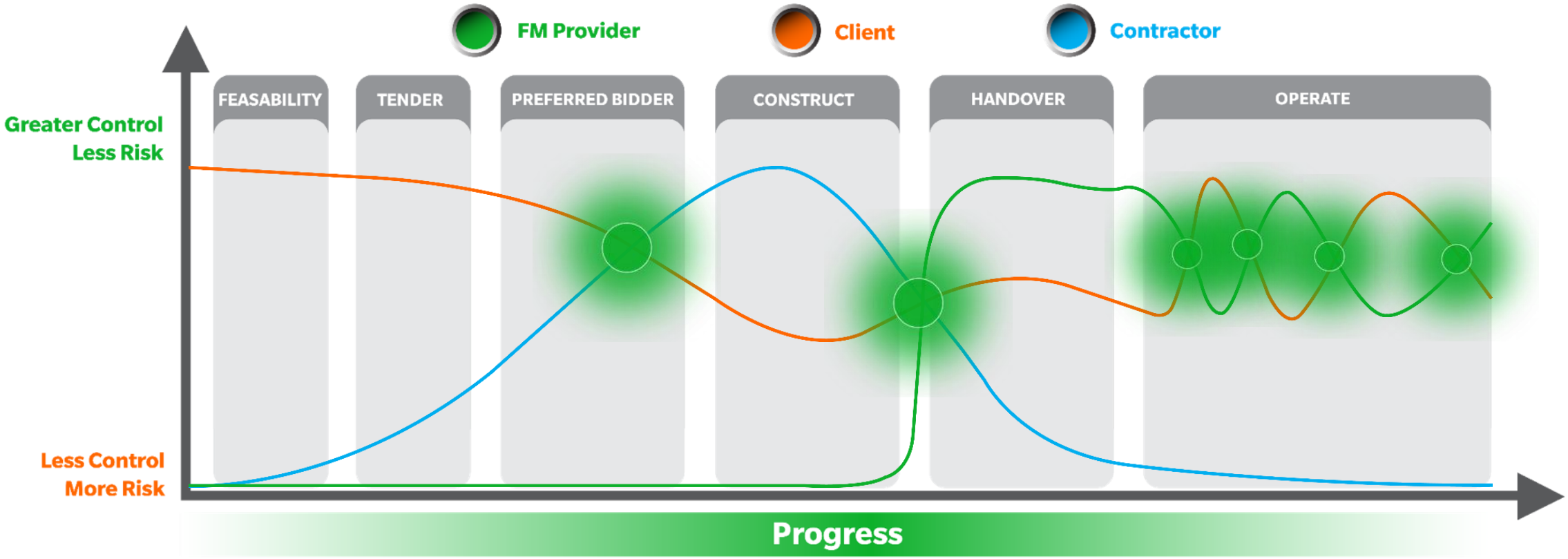
National Children's Hospital
Dublin, Ireland

The why …

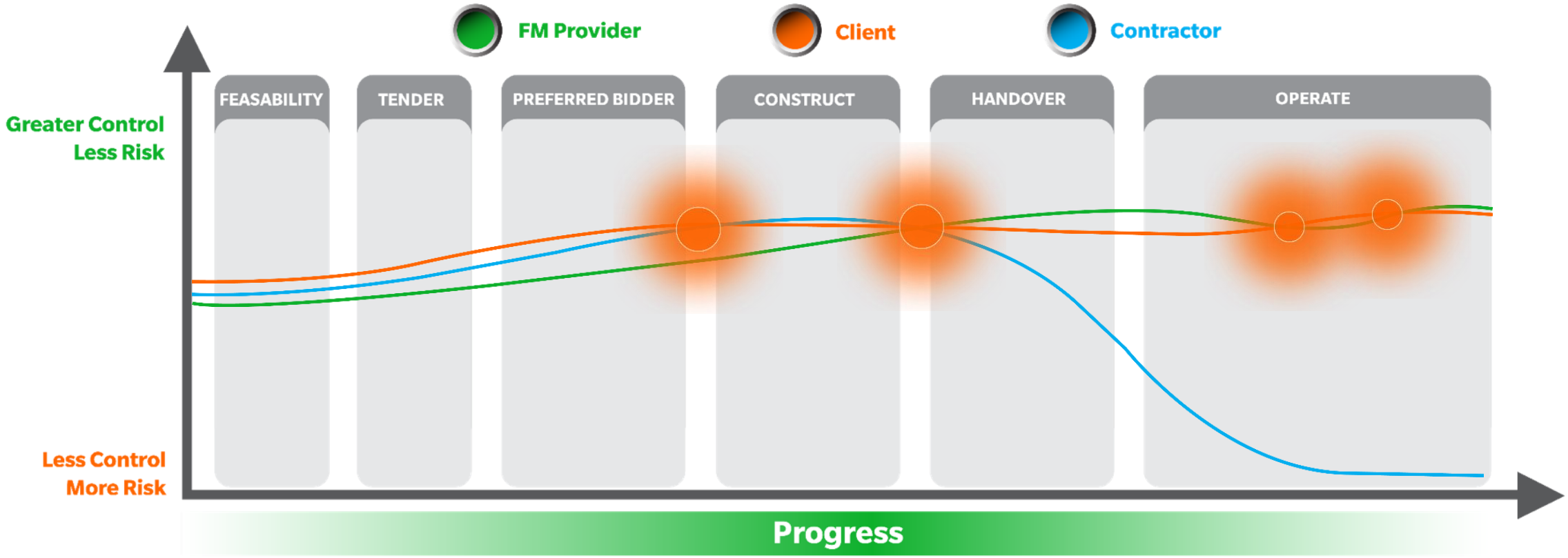


SOURCE: Patrick MacLeamy - HOK

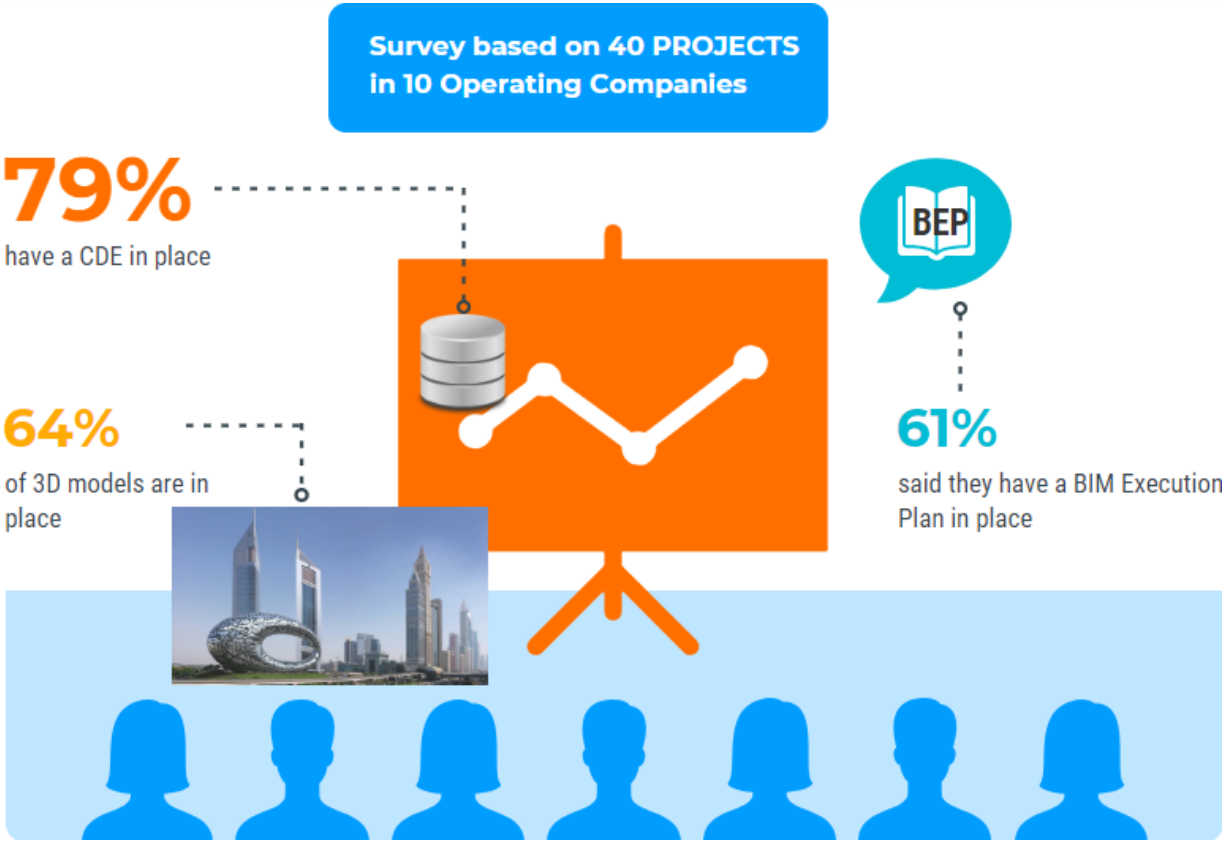
BAM Objectives – Current Data Control

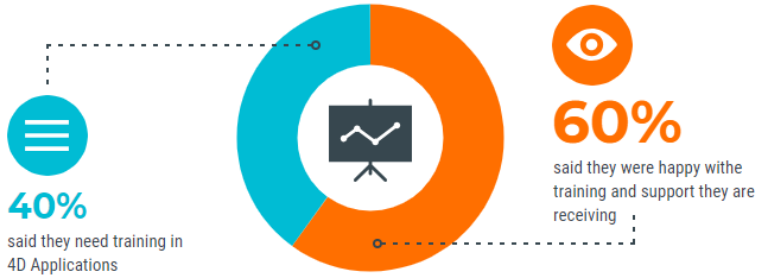


BAM objectives – Preferred Data Control



Digital Construction Maturity in projects (November 2020)





Museum of the Future, Dubai, UAE

BAM International and BAM Ireland

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Project requirements

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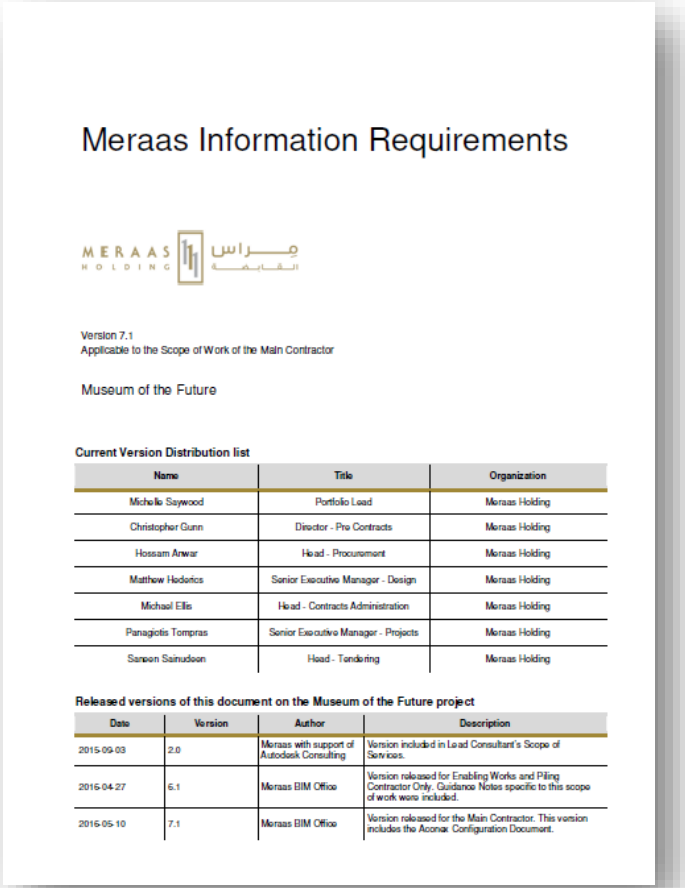
Knowledgeable Client

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

MERAAS HOLDING

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

Museum of the Future

Current Version Distribution list

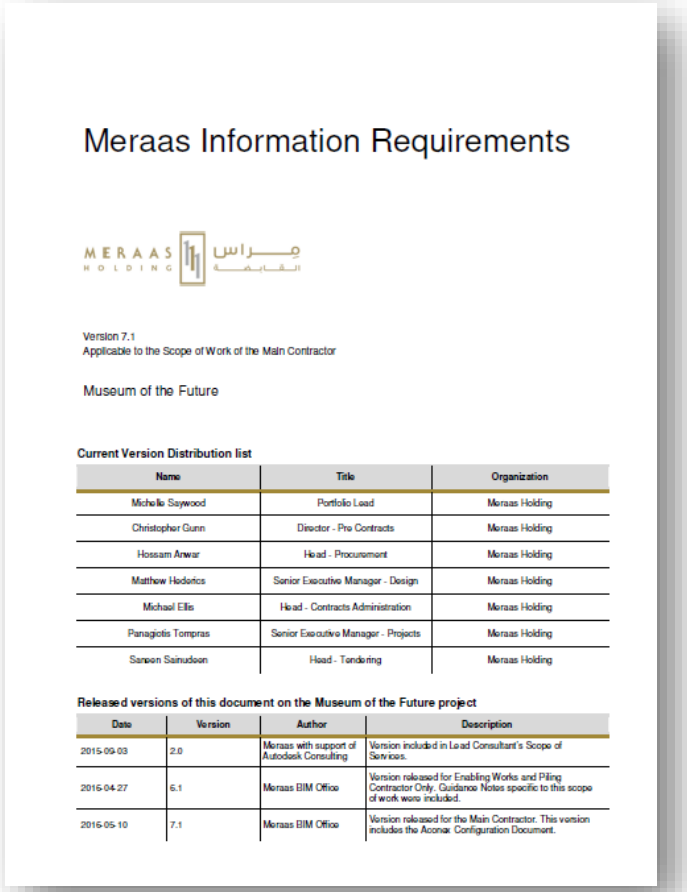
Name	Title	Organization
Michelle Saywood	Portfolio Lead	Meraas Holding
Christopher Gunn	Director - Pre Contracts	Meraas Holding
Hossam Anwar	Head - Procurement	Meraas Holding
Matthew Hedorics	Senior Executive Manager - Design	Meraas Holding
Michael Ellis	Head - Contracts Administration	Meraas Holding
Panagiotis Tompras	Senior Executive Manager - Projects	Meraas Holding
Sareen 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.
2016-04-27	6.1	Meraas BIM Office	Version released for Enabling Works and Piling Contractor Only. Guidance Notes specific to this scope of work were included.
2016-05-10	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



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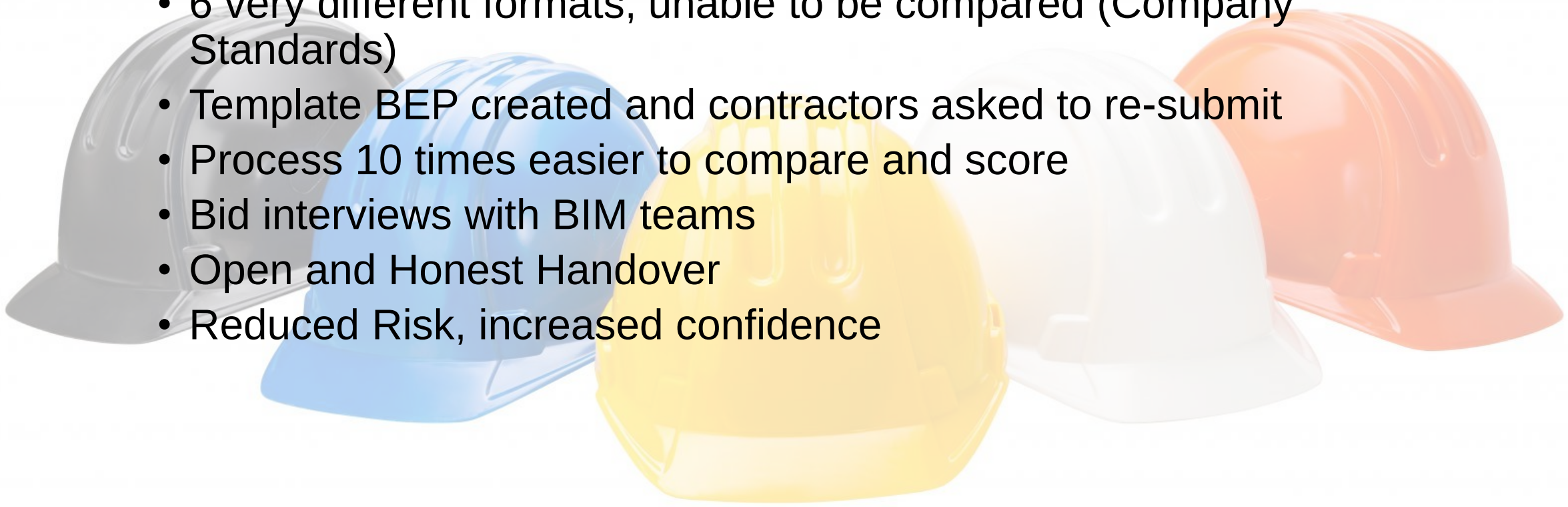
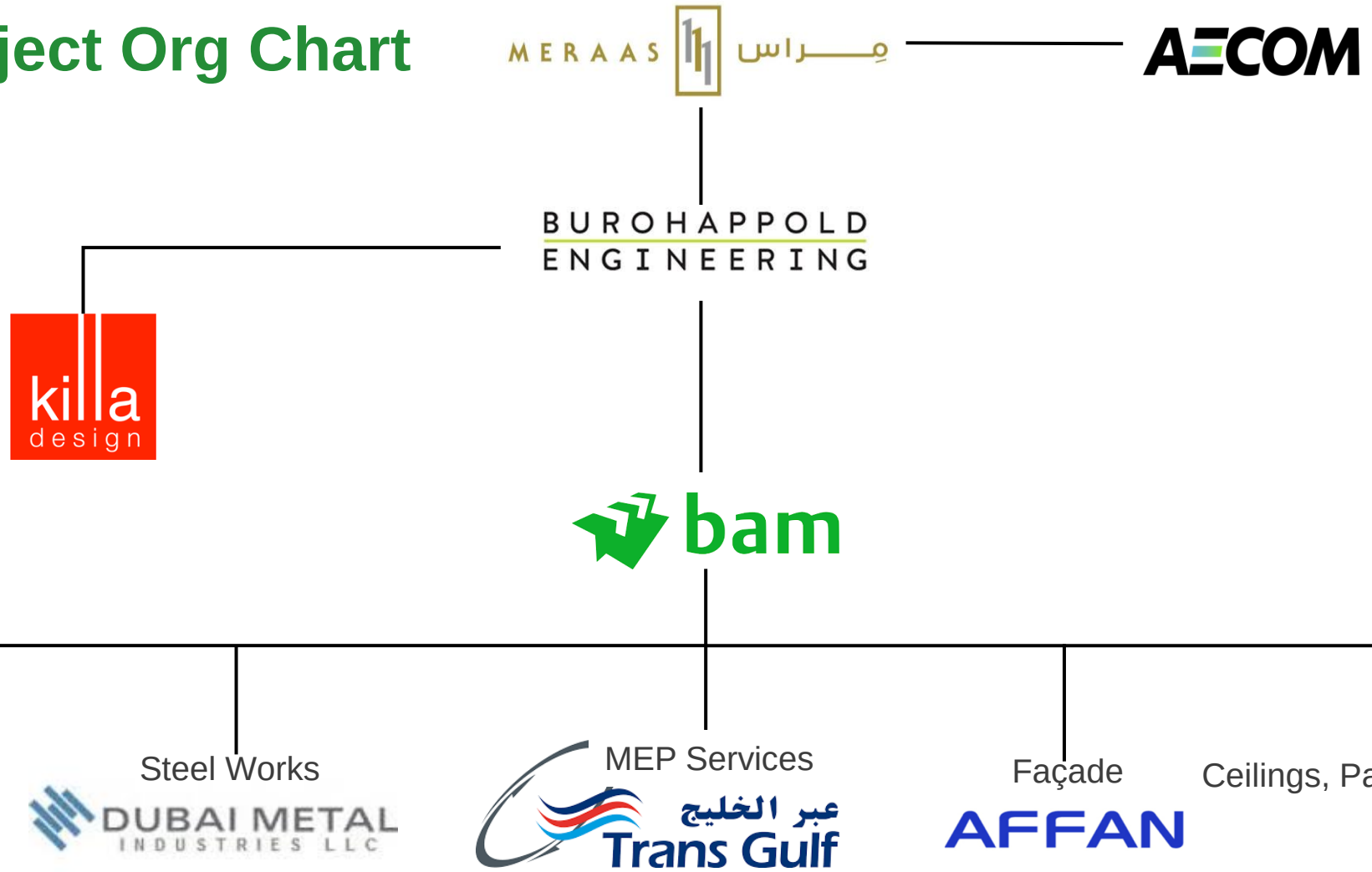
Demonstrate BIM Capabilities

Contractor Selection

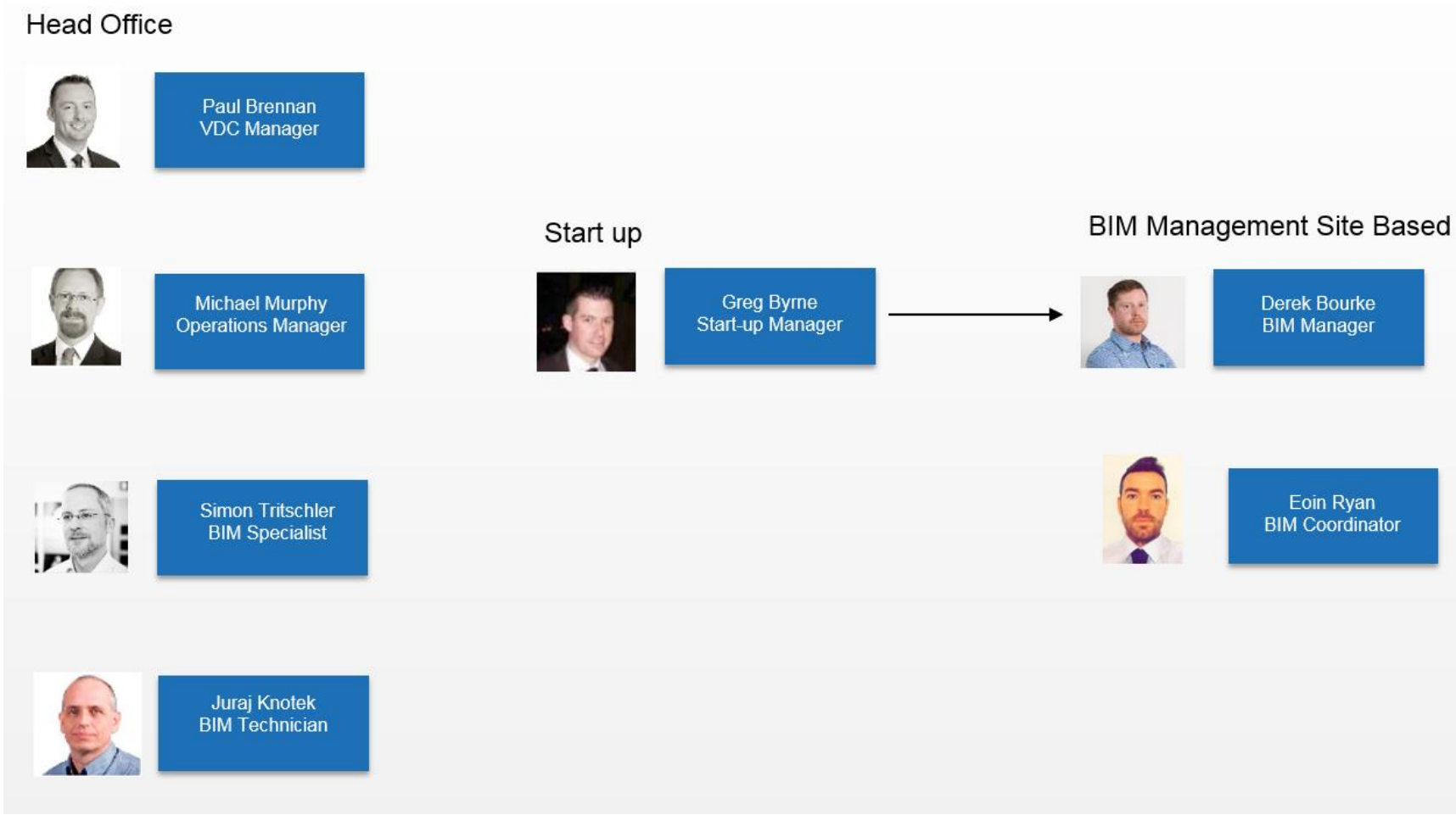
- 6 contractors asked to submit a Pre-Award BEP
- 6 very different formats, unable to be compared (Company Standards)
- Template BEP created and contractors asked to re-submit
- Process 10 times easier to compare and score
- Bid interviews with BIM teams
- Open and Honest Handover
- Reduced Risk, increased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



Project Org Chart

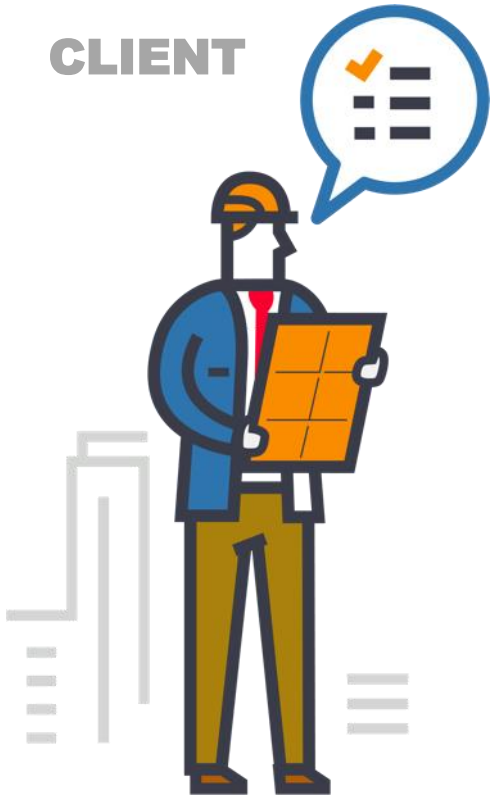


BAM DC Org Chart



The why …

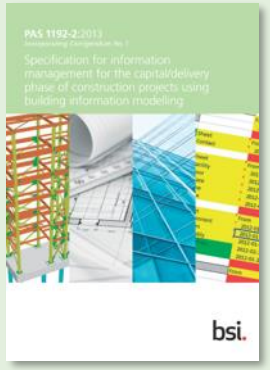
- Client Requirements



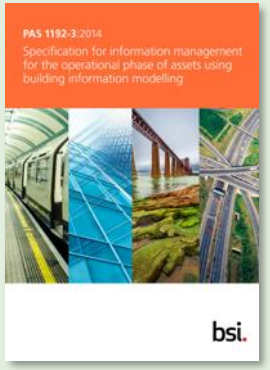
- BAM's Internal Optimisation

A common technical language

bsi.
BIM Design and Construction
KITEMARK™

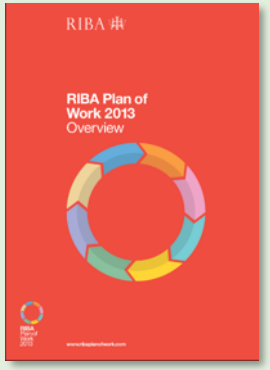


PAS1192-2:2013 Capital Phase



PAS1192-2:2014 Operational Phase

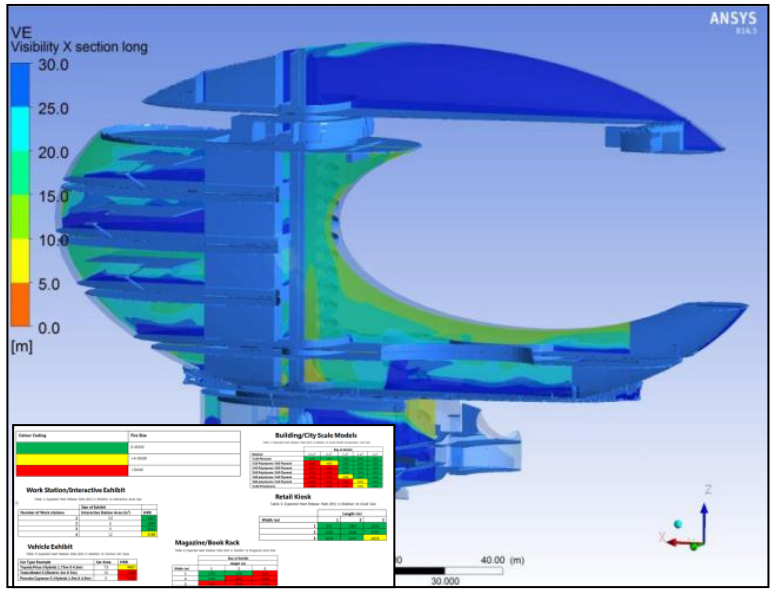
CIC BIM Protocol

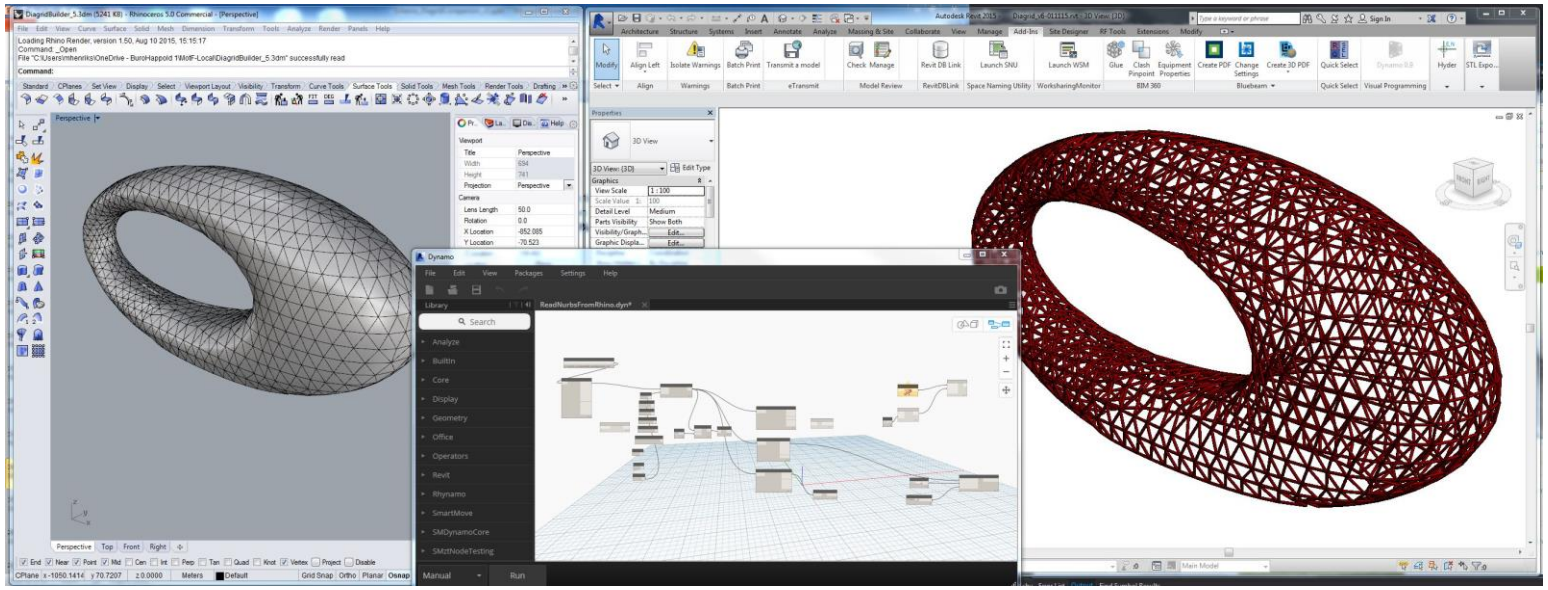


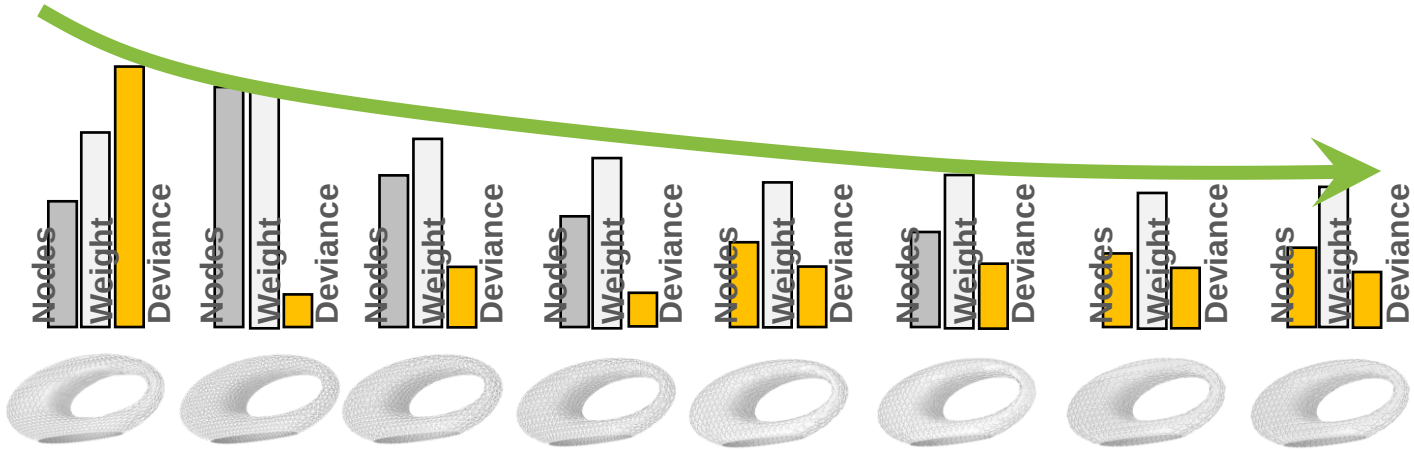
RIBA Plan of Work 2013

Source: British Standards Institution: www.bim-level2.org

Computational Engineering







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

FLOOR AREA
30,000M²

TOTAL CONCRETE
28,000M³

CIRCULAR HOLLOW SECTIONS
457

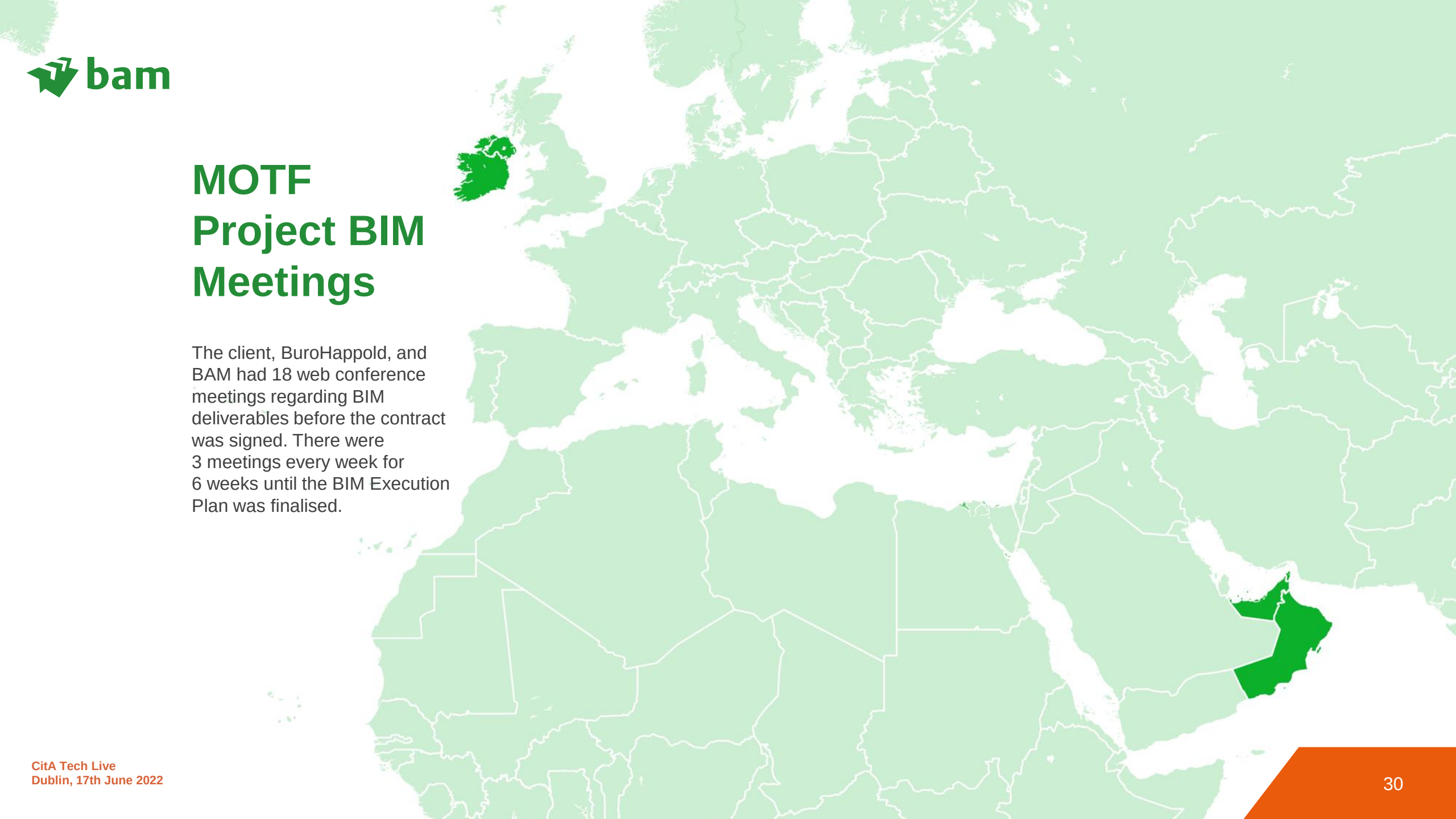
HOLDING DOWN BOLTS
30 TONNES

FAÇADE
17,600M²

CONCRETE RING BEAM
1,400M³

MOTF Project BIM Meetings

The client, BuroHappold, and BAM had 18 web conference meetings regarding BIM deliverables before the contract was signed. There were 3 meetings every week for 6 weeks until the BIM Execution Plan was finalised.



Museum of the Future
BIG NUMBERS

Construction execution

Complex Architecture

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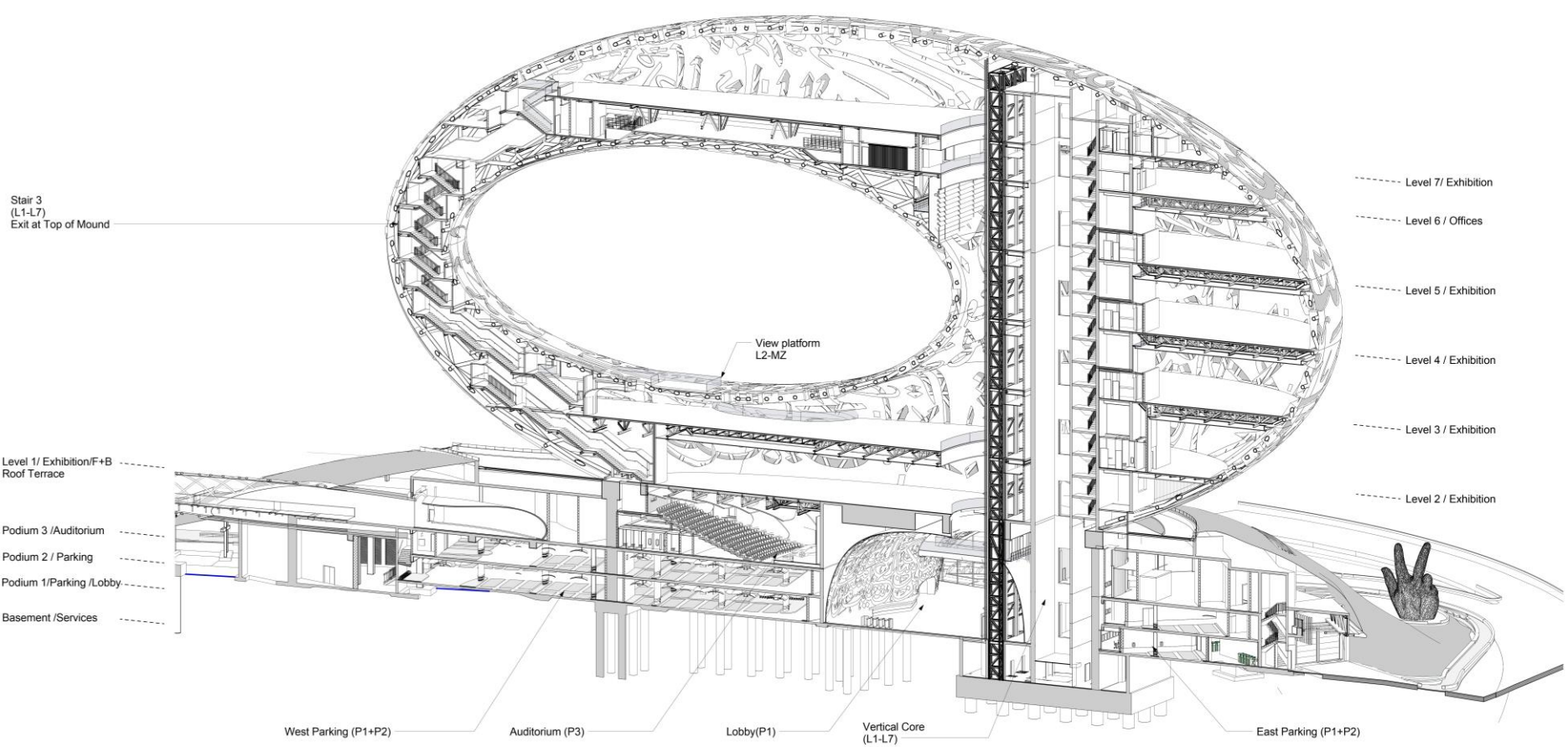
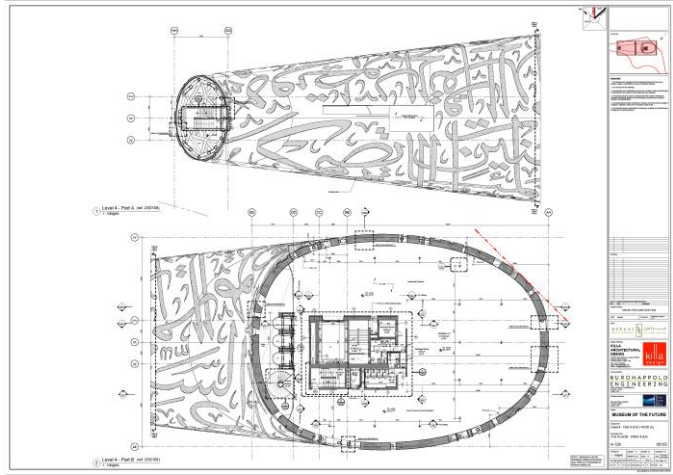
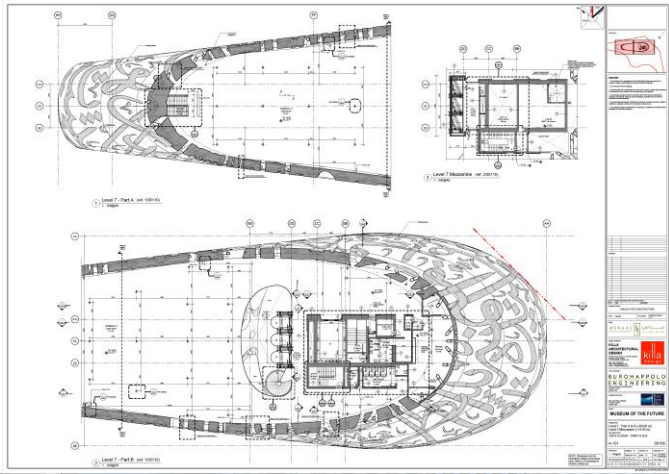

Stair 3
(L1-L7)
Exit at Top of Mound
View platform
L2-MZ
Level 7/ Exhibition
Level 6 / Offices
Level 5 / Exhibition
Level 4 / Exhibition
Level 3 / Exhibition
Level 2 / Exhibition
Level 1/ Exhibition/F+B
Roof Terrace
Podium 3 /Auditorium
Podium 2 / Parking
Podium 1/Parking /Lobby
Basement /Services
West Parking (P1+P2)
Auditorium (P3)
Lobby(P1)
Vertical Core
(L1-L7)
East Parking (P1+P2)



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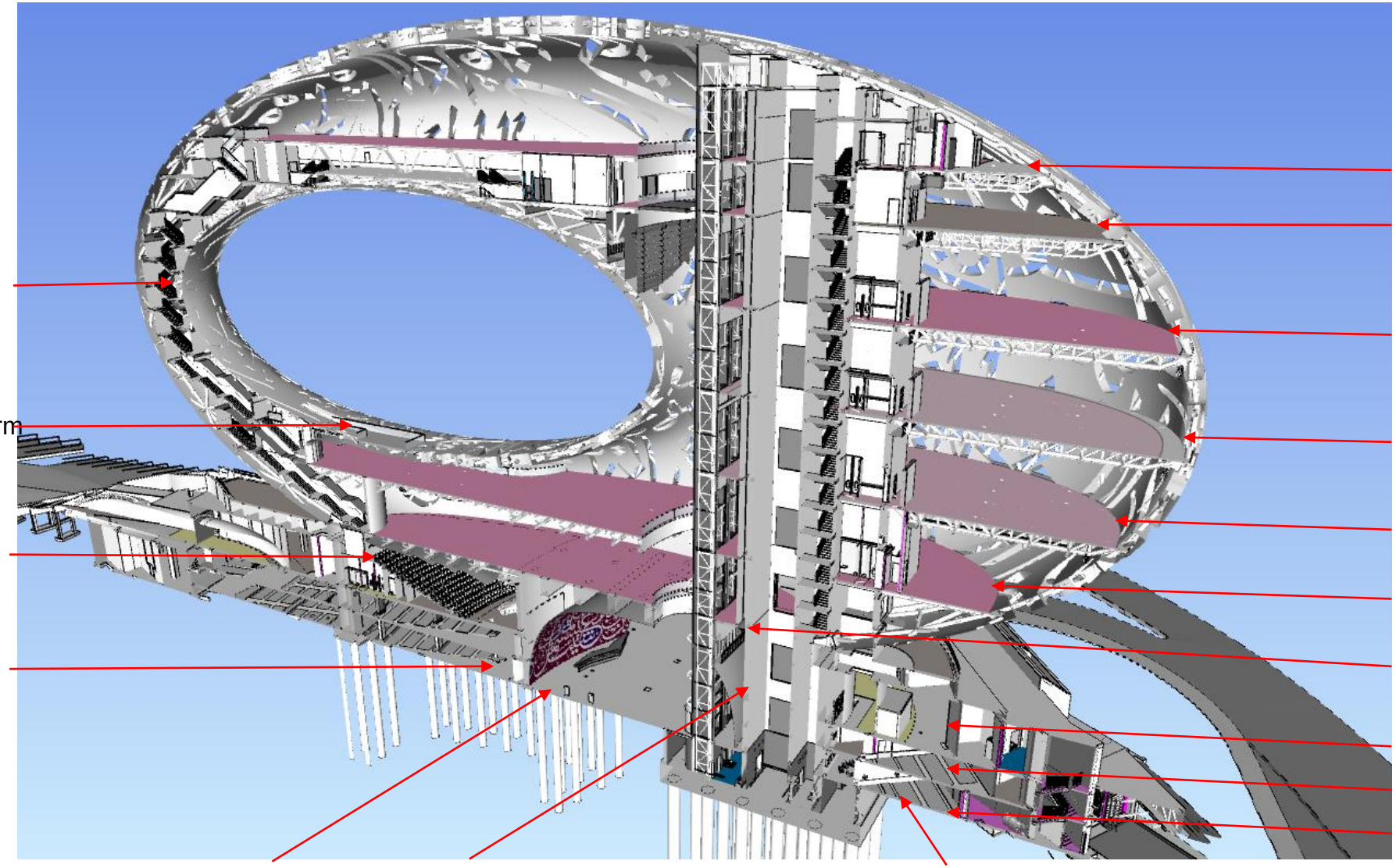
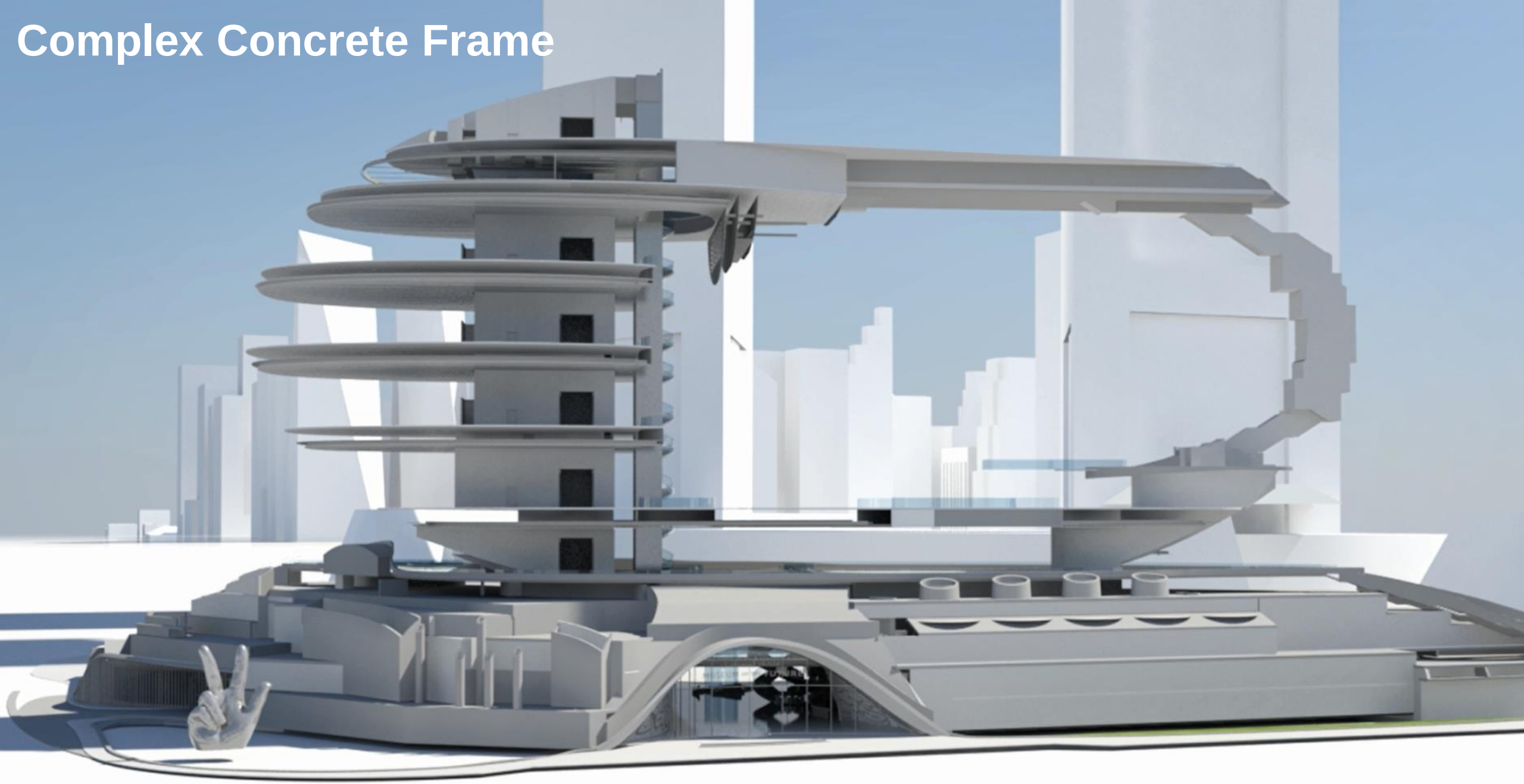

Escape Stair
Viewing Platform
Auditorium
West Parking
Lobby
Vertical Core
East Parking
LEVEL 7 Exhibition
LEVEL 6 Offices
LEVEL 5 Exhibition
LEVEL 4 Exhibition
LEVEL 3 Exhibition
LEVEL 2 Exhibition
LEVEL 1 Exhibition
PODIUM 3
PODIUM 2
PODIUM 1

Complex Concrete Frame



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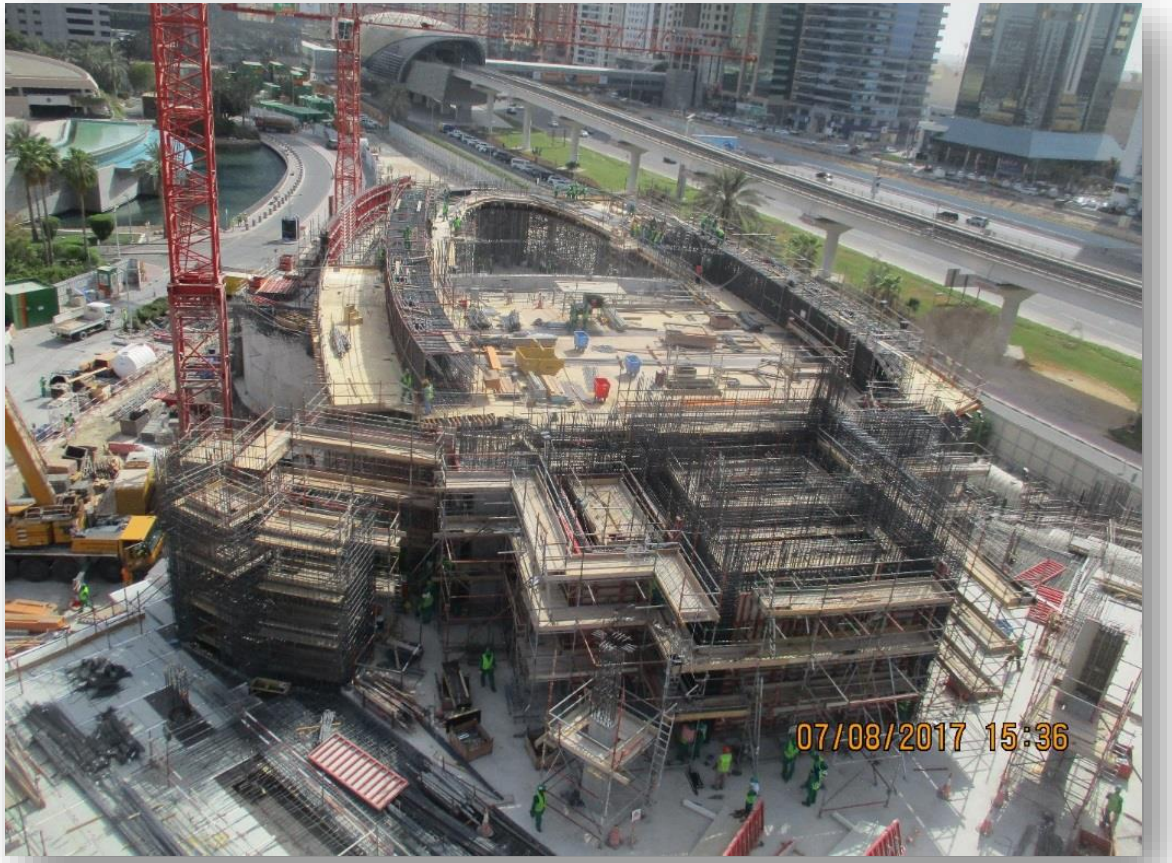
Dubai, UAE

Ring Beam Progress 07 August 2017



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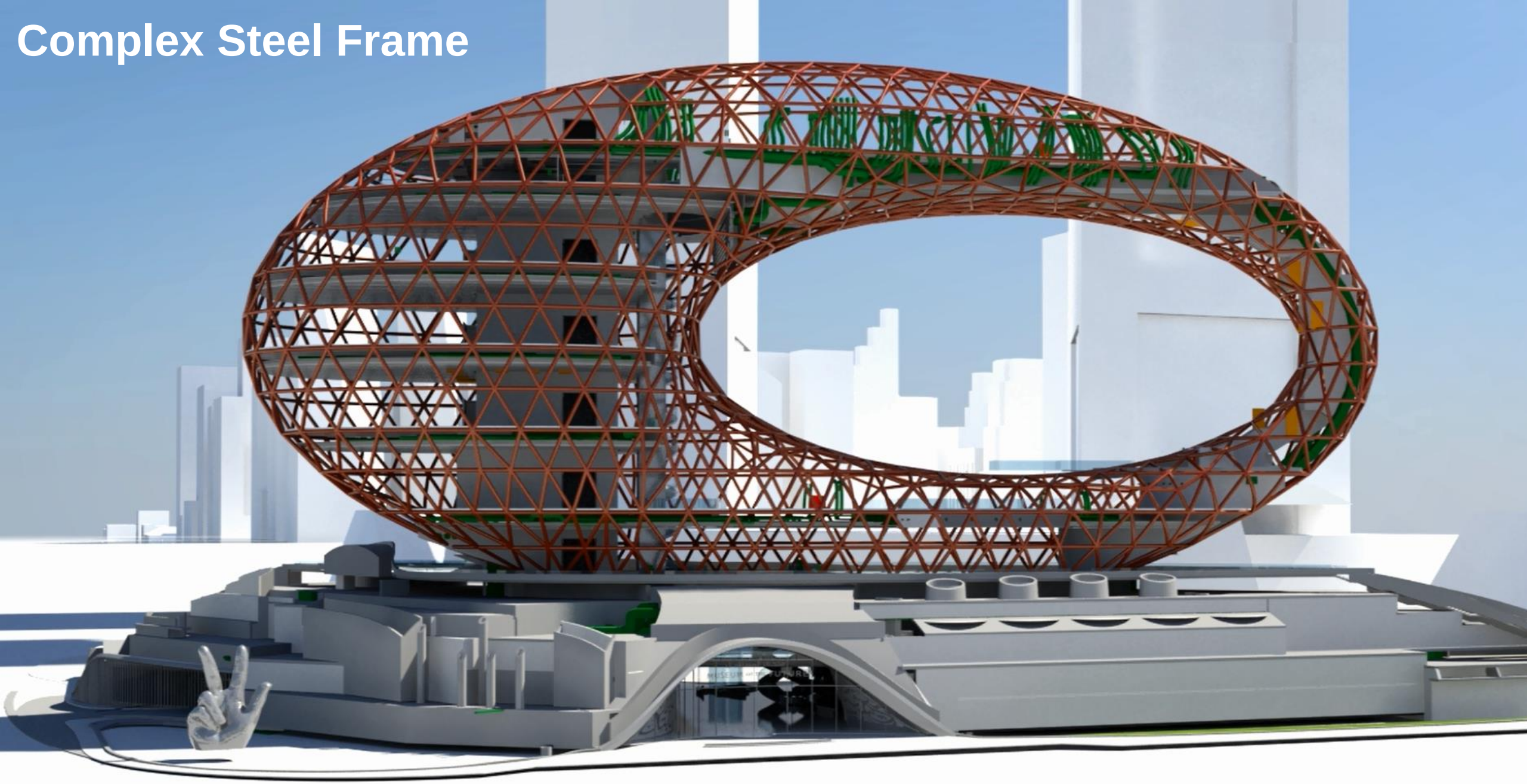
Complex Steel Frame



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Diagrid Sections being craned in to place


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Complex Temporary Works

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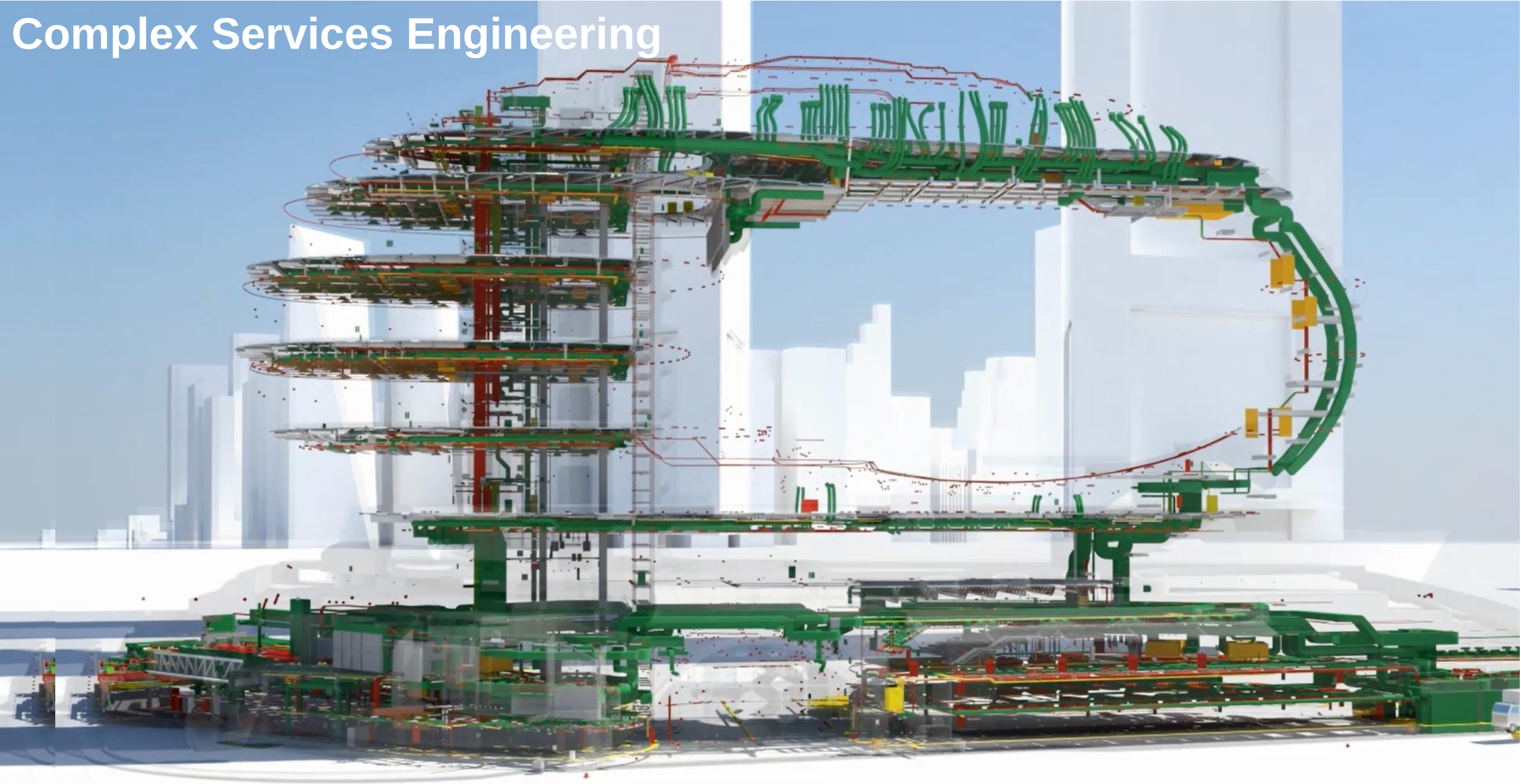
CitA Tech Live
Dublin, 17th June 2022

DFMA

CitA Tech Live
Dublin, 17th June 2022

Complex Services Engineering



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Complex Facade

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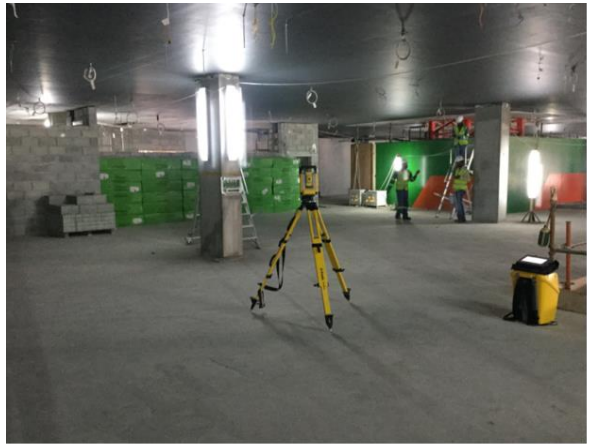
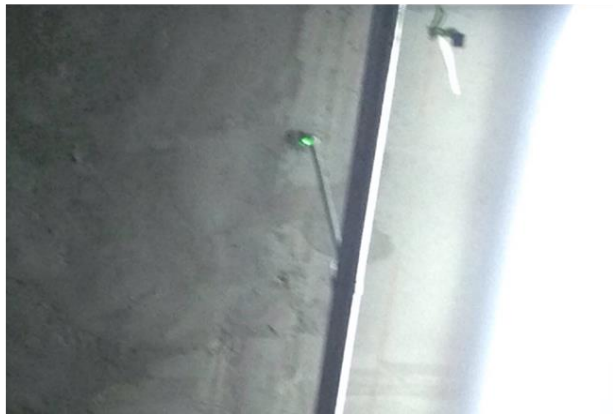
Verification of Complex Construction

Right First Time Install

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

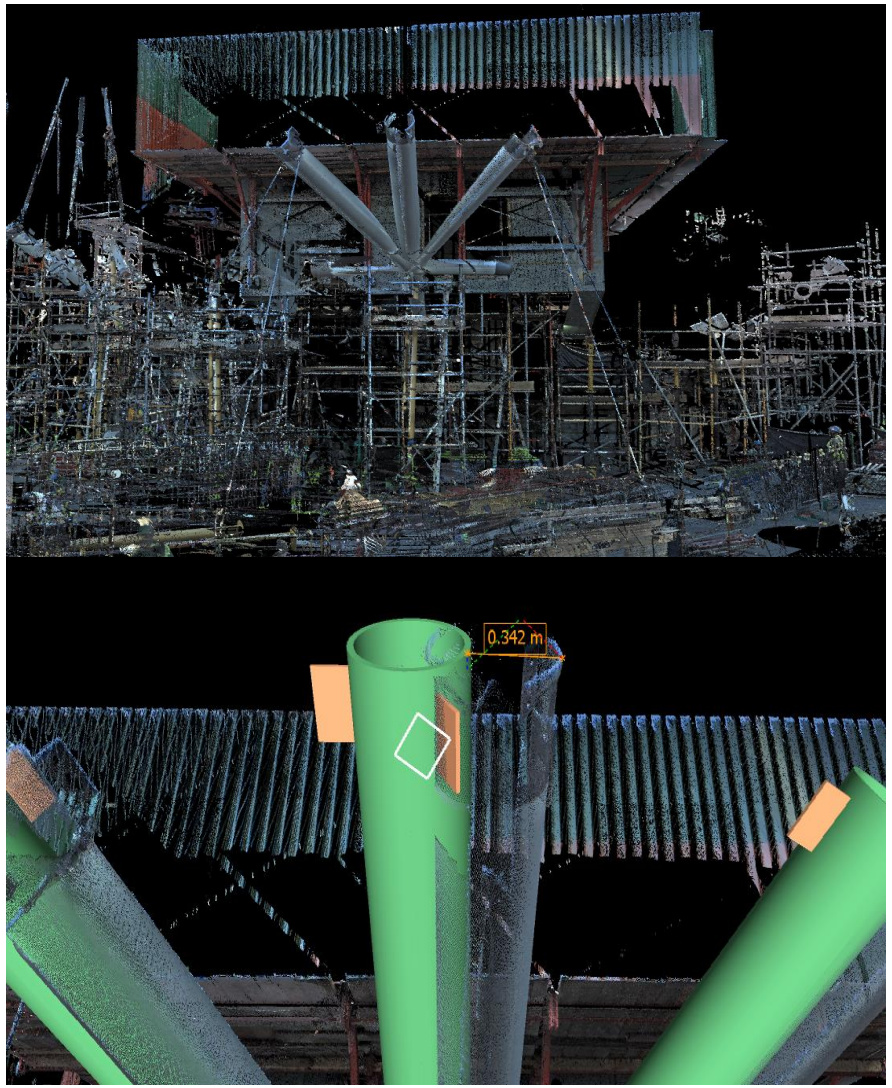
Using link model to field to set out MEP supports.

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 = $ € ¡.د

Verification



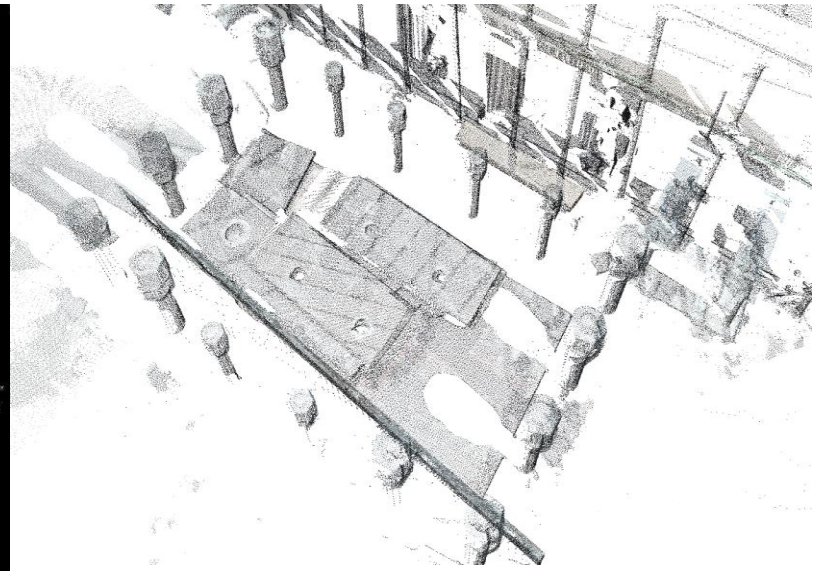
Diagrid at Northern End
13-12-2017

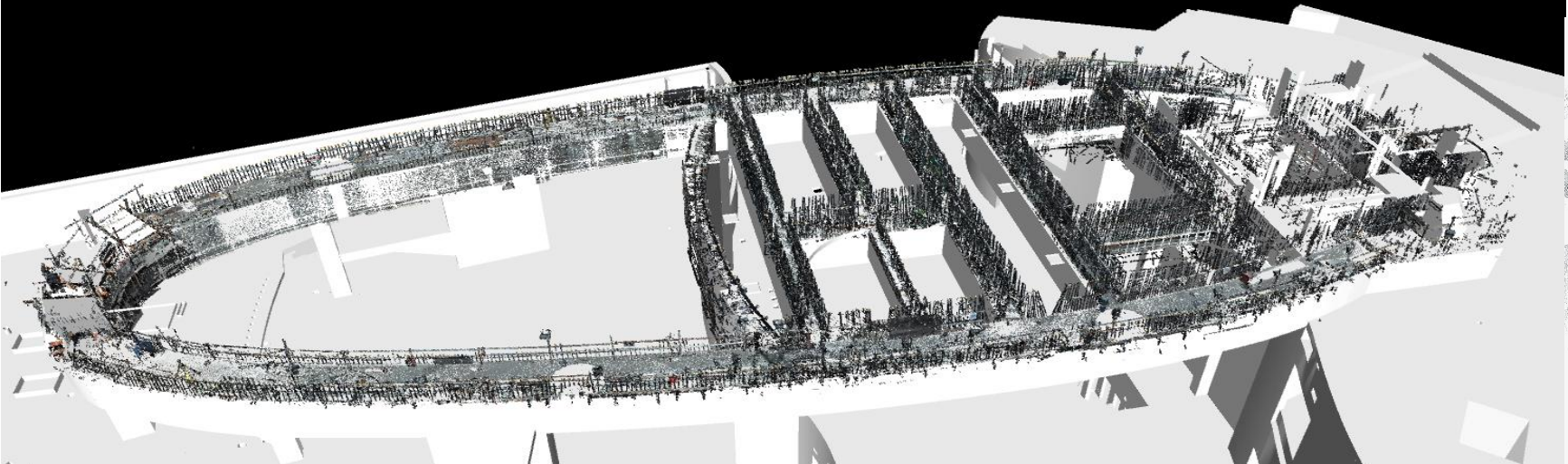
Purpose: Diagrid and Core Wall as built validation.

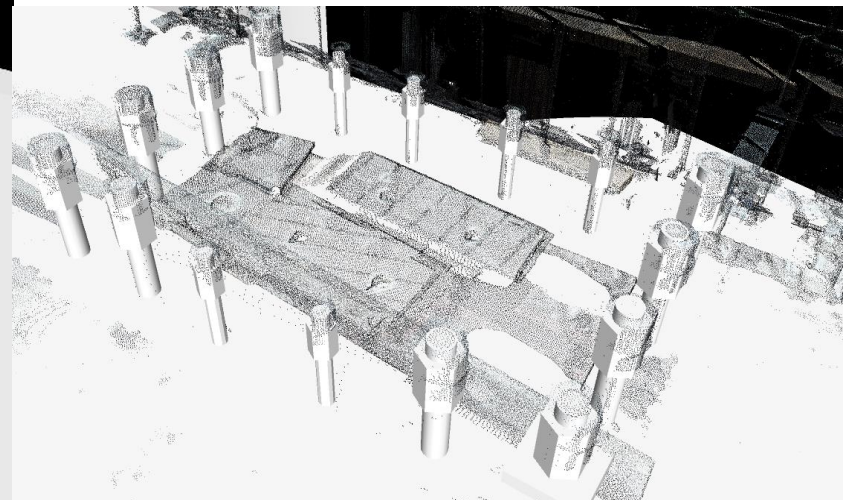
Good result: While the diagrid assembly to the back of the Core Wall was not welded it was being held in place with temporary propping and guy wires. During comparing the scan with the model it was noted that the assembly was over 340mm out of line. This was immediately flagged to our engineering and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







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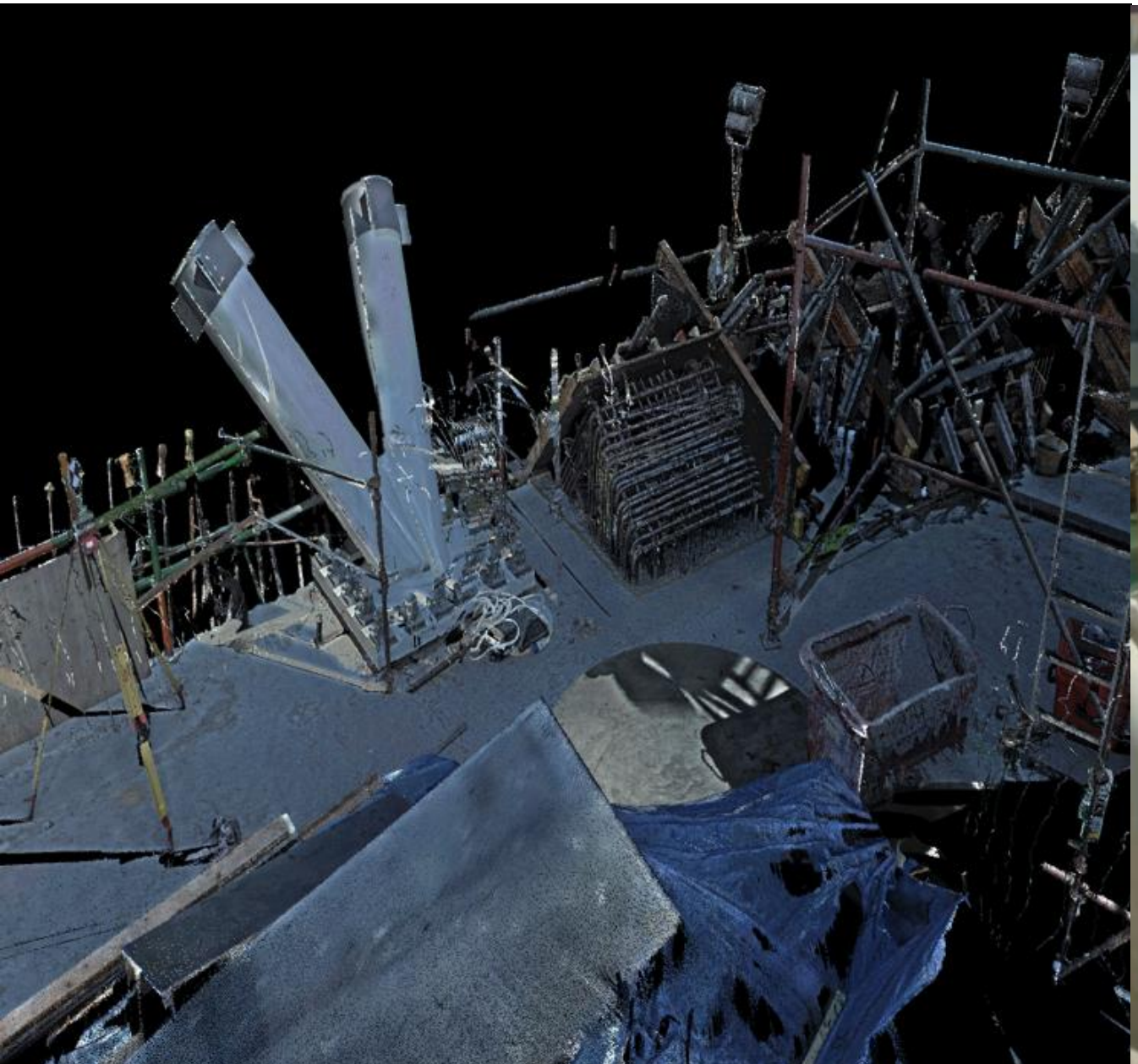
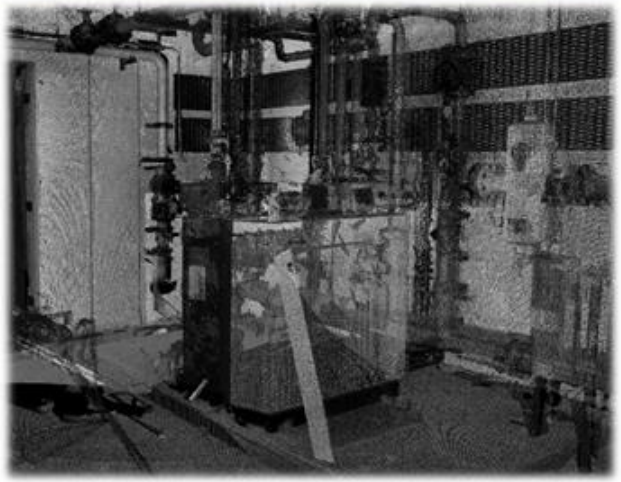
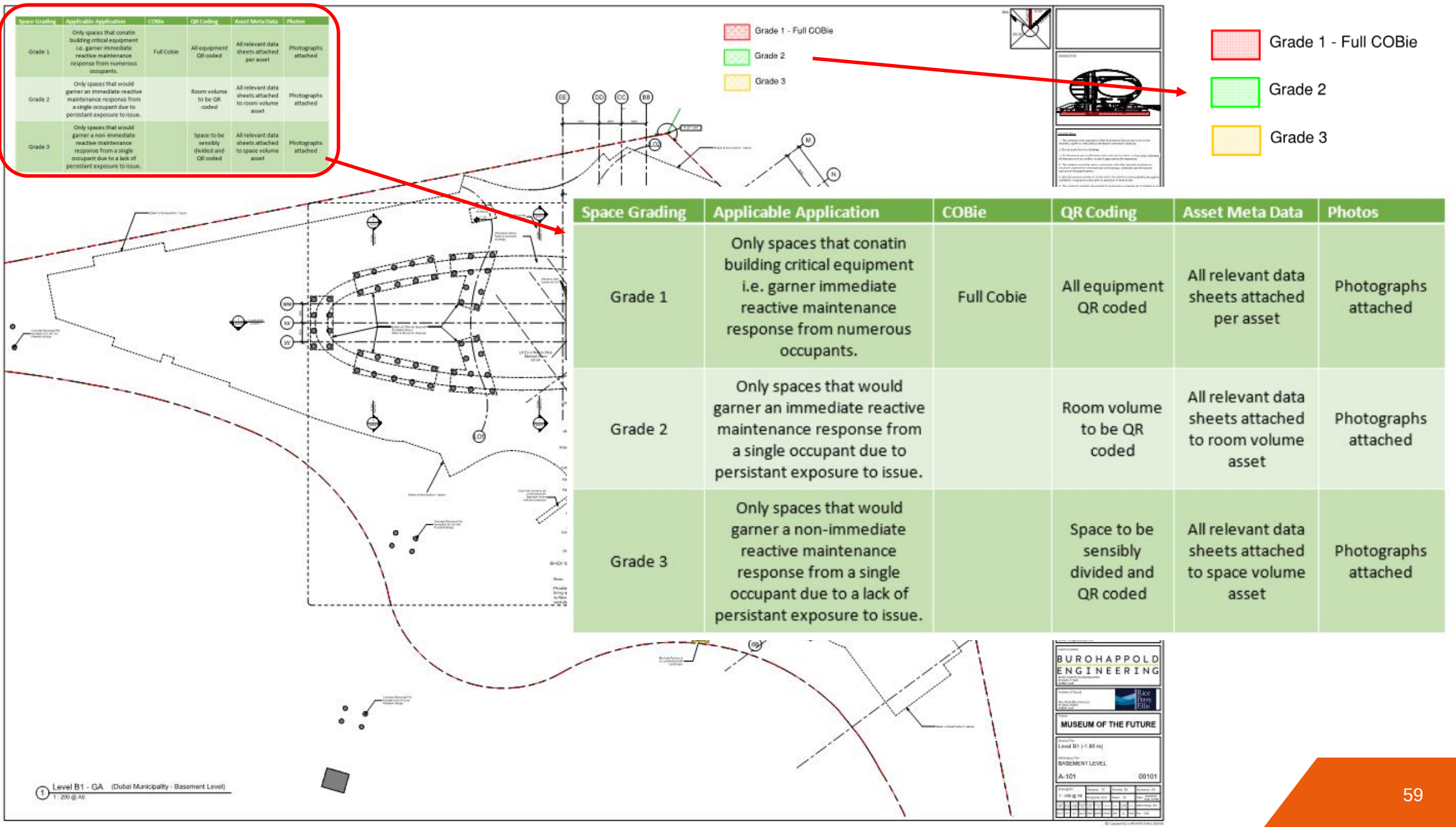


Underpinning all activities

Digital Asset Delivery

- Asset Population during construction delivery
- Linking digital Assets to Physical Assets





Space Grading	Applicable Application	COBie	QR Coding	Asset Meta Data	Photos
Grade 1	Only spaces that conatin building critical equipment i.e. garner immediate reactive maintenance response from numerous occupants.	Full Cobie	All equipment QR coded	All relevant data sheets attached per asset	Photographs attached
Grade 2	Only spaces that would garner an immediate reactive maintenance response from a single occupant due to persistant exposure to issue.		Room volume to be QR coded	All relevant data sheets attached to room volume asset	Photographs attached
Grade 3	Only spaces that would garner a non-immediate reactive maintenance response from a single occupant due to a lack of persistant exposure to issue.		Space to be sensibly divided and QR coded	All relevant data sheets attached to space volume asset	Photographs attached

Digital Technologies are now fully enabling the AEC Industry to design and construct ever more complex an intriguing buildings. Our future industry will be an exciting, creative, and rewarding option for the best and brightest. A place where their creativity will directly and positively impact our day to day lives.

Digital construction at BAM

Our vision is to be global leader in Digital construction

Follow us at www.bam.com/en/digital

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Dublin, 17th June 2022

https://museumofthefuture.ae/en