



BACKGROUND OF BIM PROJECT EXECUTION & MANAGEMENT

20 May 2019

BUILDING A NEW DIMENSION

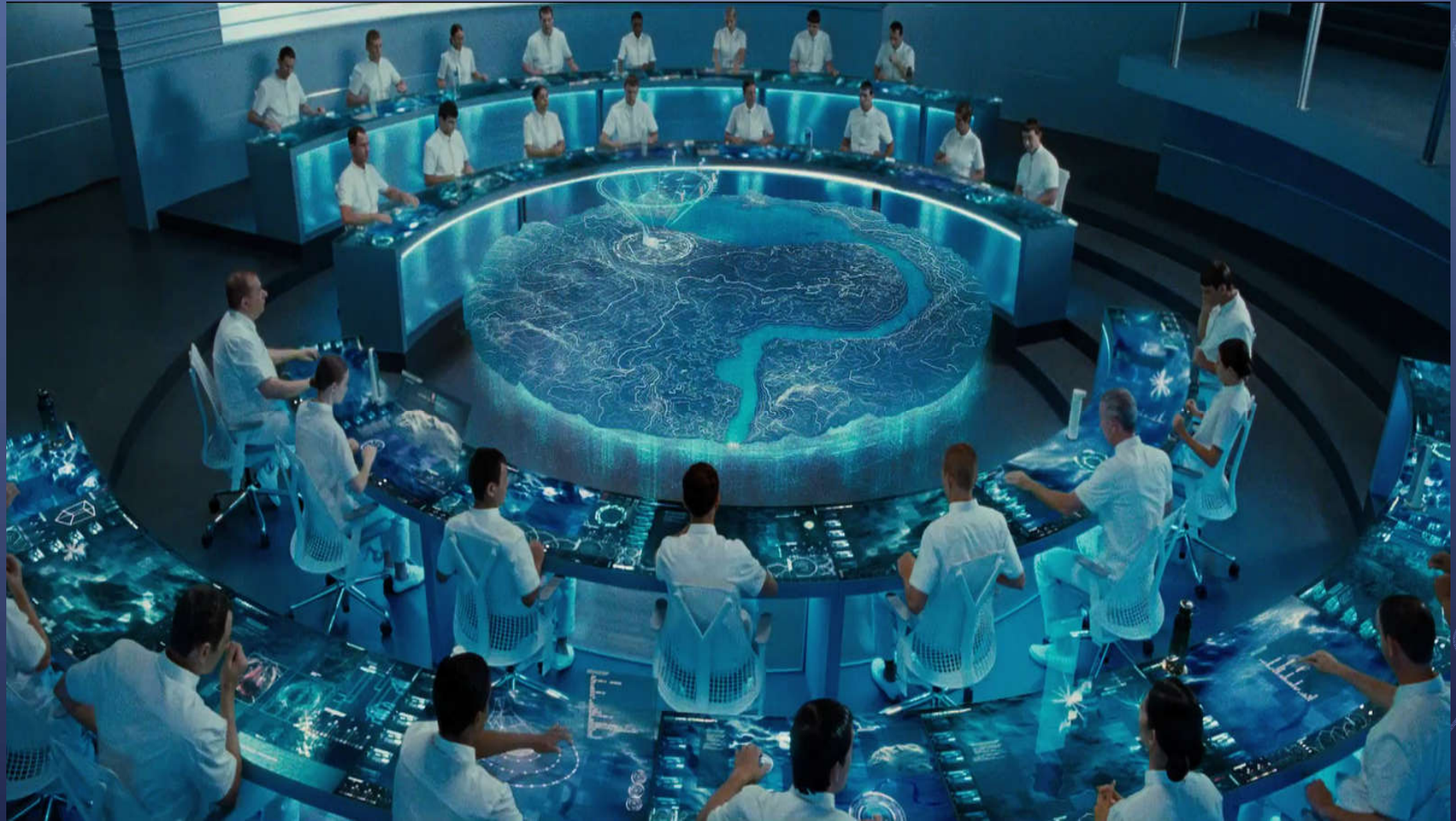
Destination

Sustainable Building Construction

A road map to the future



REMOTE CONSTRUCTION/ BEYOND IMAGINATION



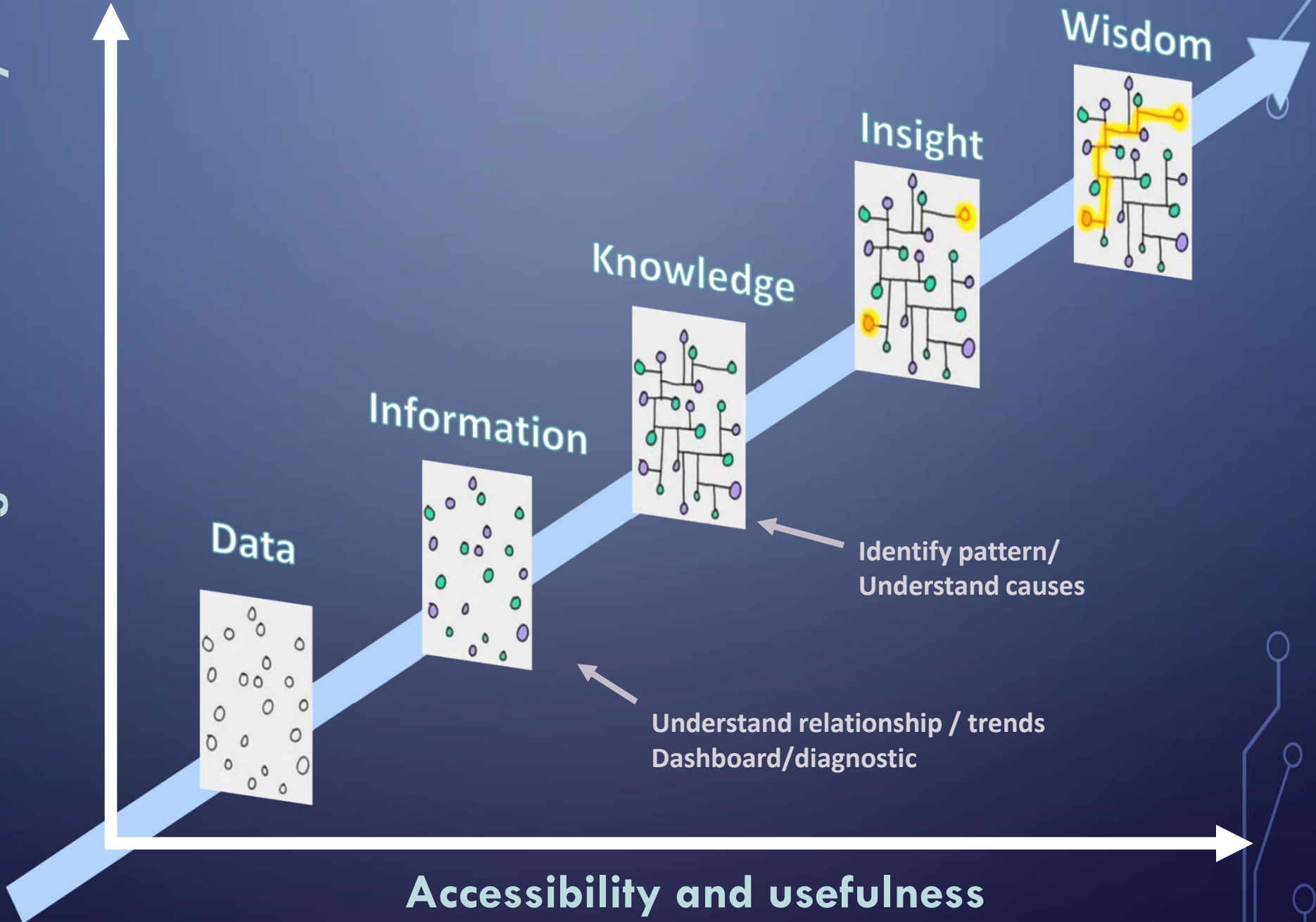
DRIVERS FOR SUSTAINABLE CONSTRUCTION

- **Safety & Wellbeing** *Enhanced safety, health and welfare*
- **Quality** *High precision and remarkable workmanship*
- **Productivity** *More efficient working, less down time*
- **Environment** *Efficient resource use, less waste*
- **Revenue** *Breakthrough revenue growth*
- **Cost** *Saving materials and labour costs*

UNLEASH THE POWER OF INFORMATION

SUSTAINABLE BUILDING CONSTRUCTION HIERARCHY FRAMEWORK

Level of Integration and Maturity





Centralized and integrated

Digitalized

User-friendly

Accessible

Consistent


Fast and flexible

Secured

End-users empowered to be Chief Data Officers (CDO)!

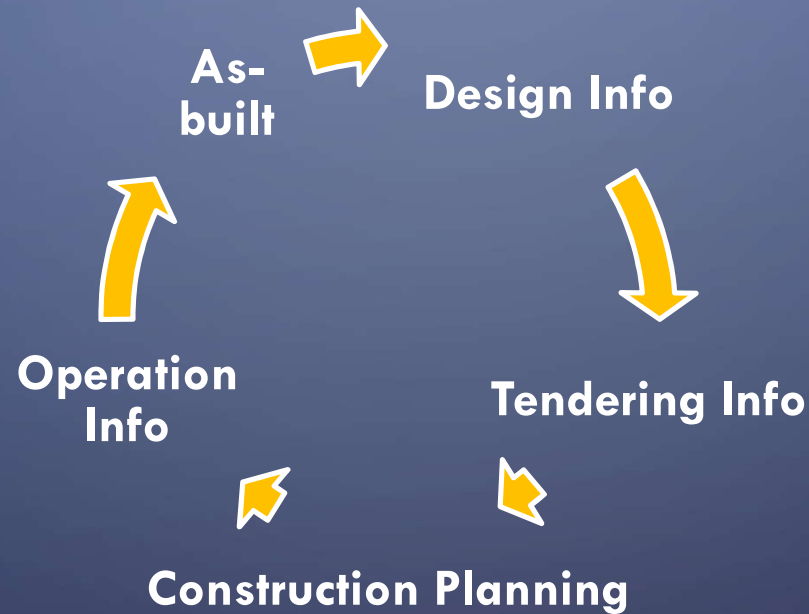
INFORMATION IN CONSTRUCTION

HOW CAN INVISIBLE DATA CHANGE REALITY, AND GENERATE VALUE FOR CONSTRUCTION INDUSTRY?



INFORMATION CONTROL IN CONSTRUCTION

- Target is to deliver the right information to the right people at the right time with zero cost, so that people can respond to external events and make the best decision.



- Set up systems and workflows that instantly collect, store and transform data, and generate a seamless information flow across different parties.

BIM APPLICATIONS

3D



10-D

10:90



Automation & Robotics

9-D

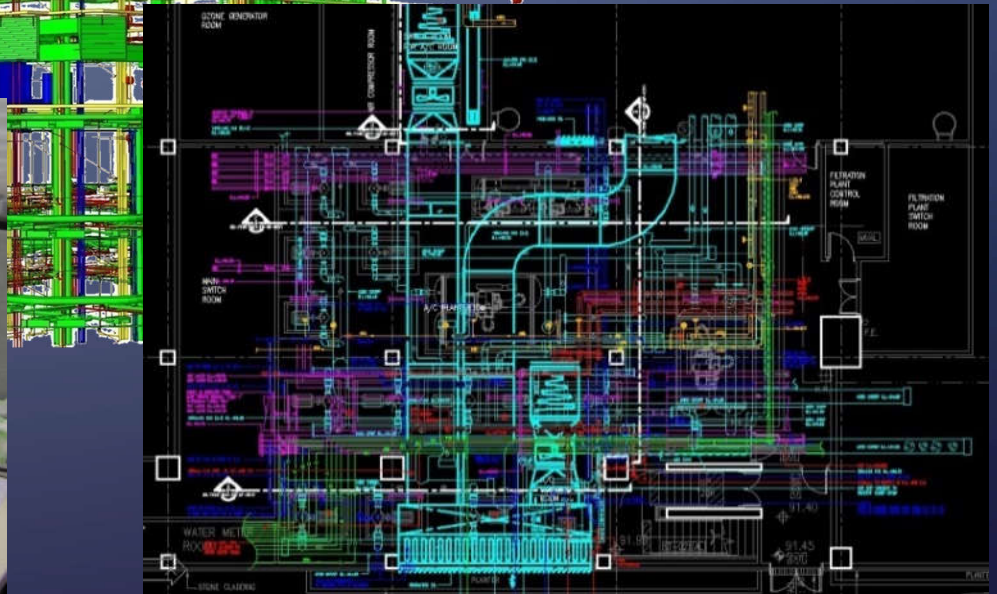
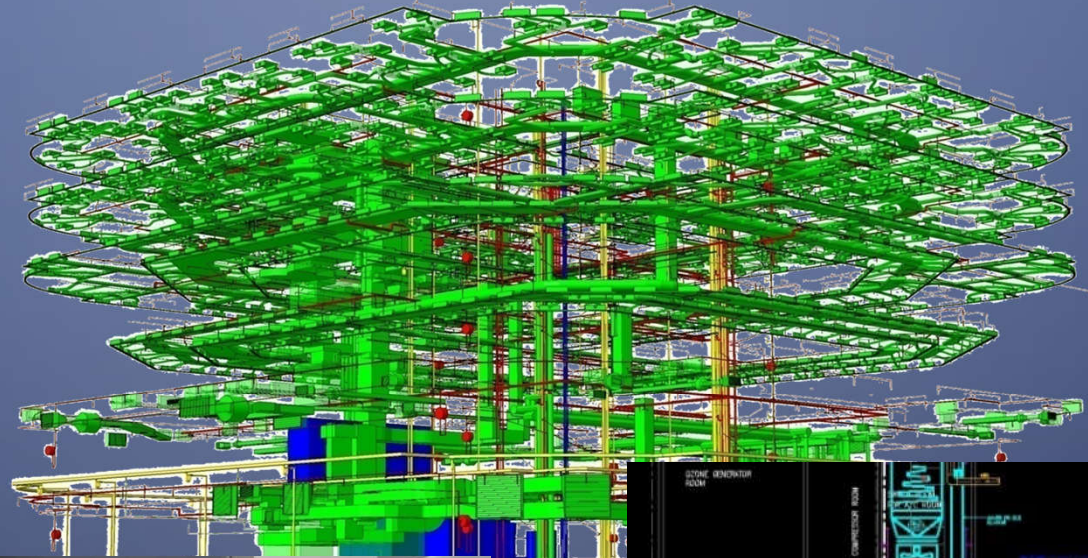
Artificial Intelligence

10-D

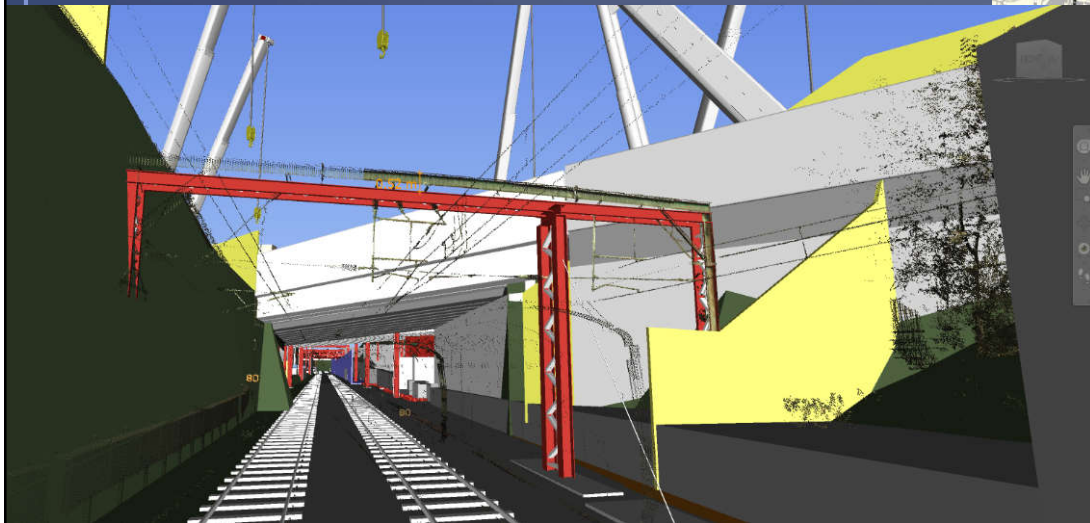
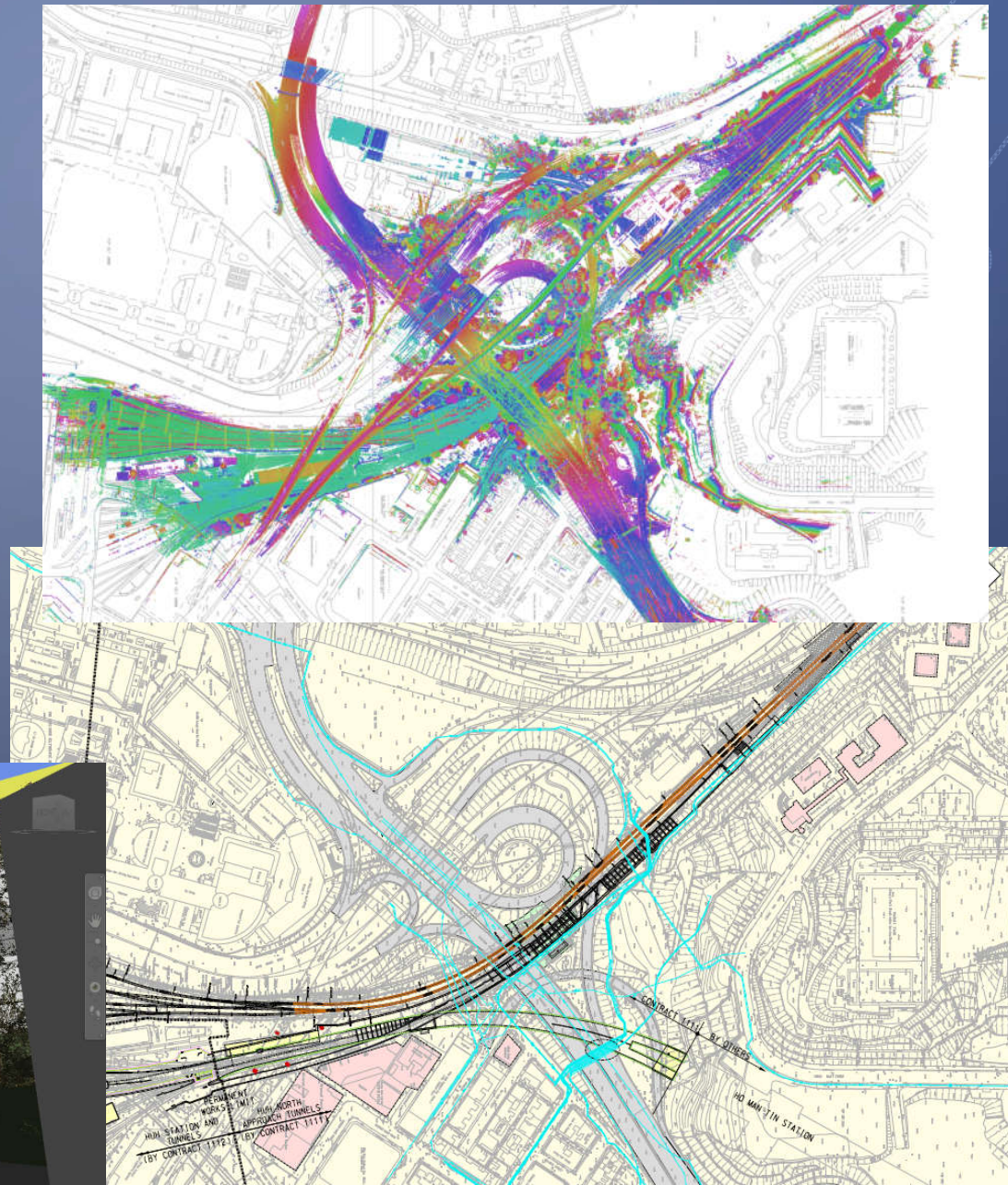
OUR LIFE IS CHANGING...



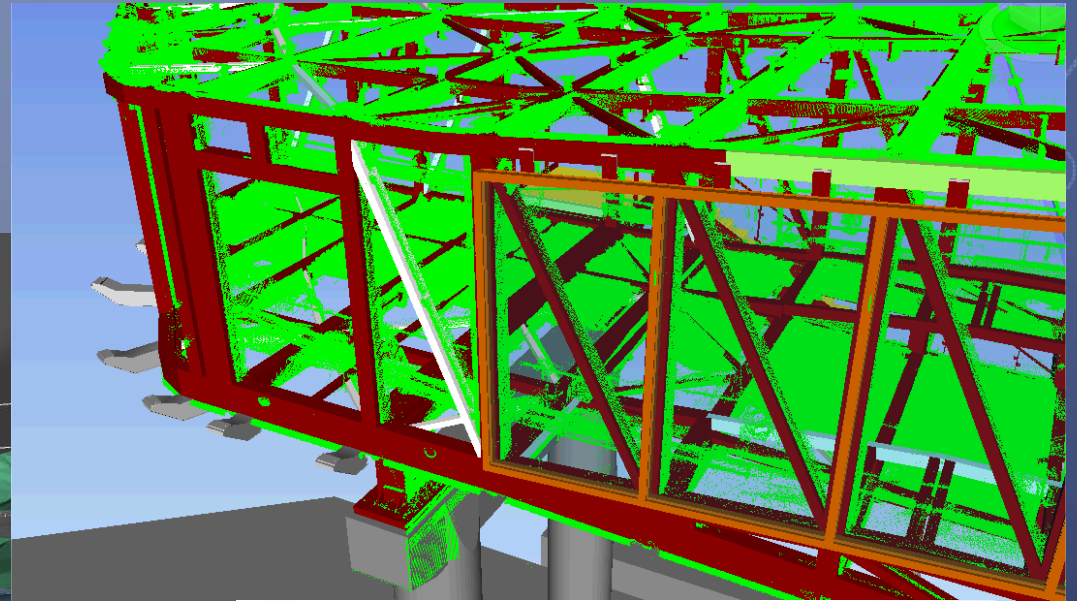
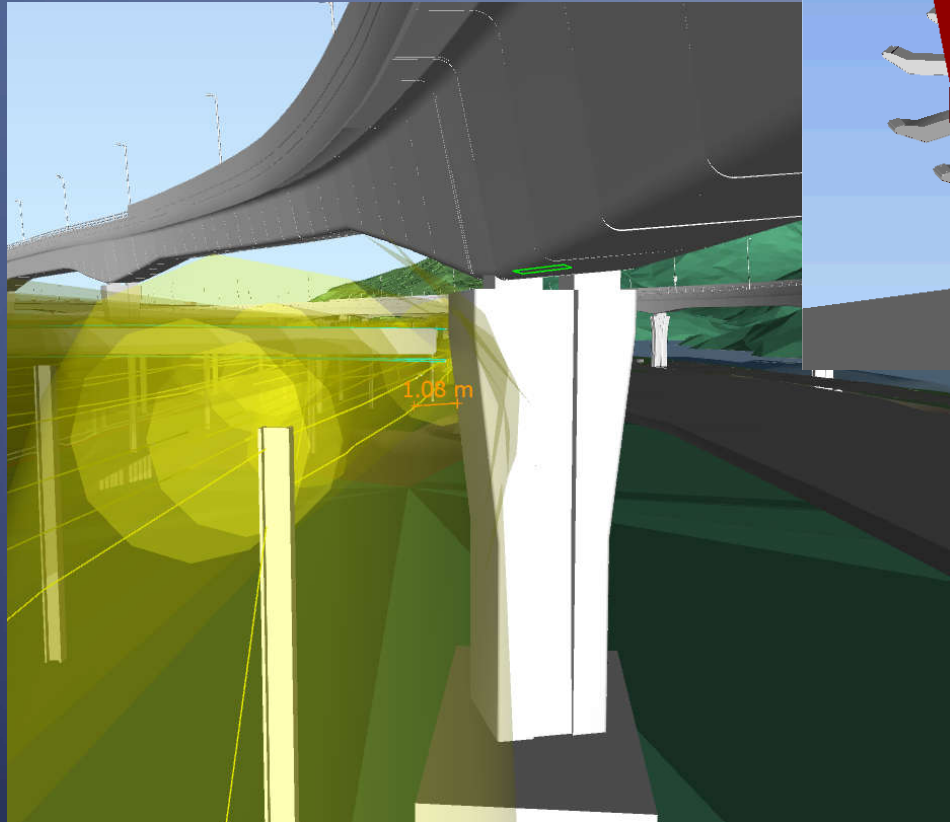
SOME 13 YEARS AGO...



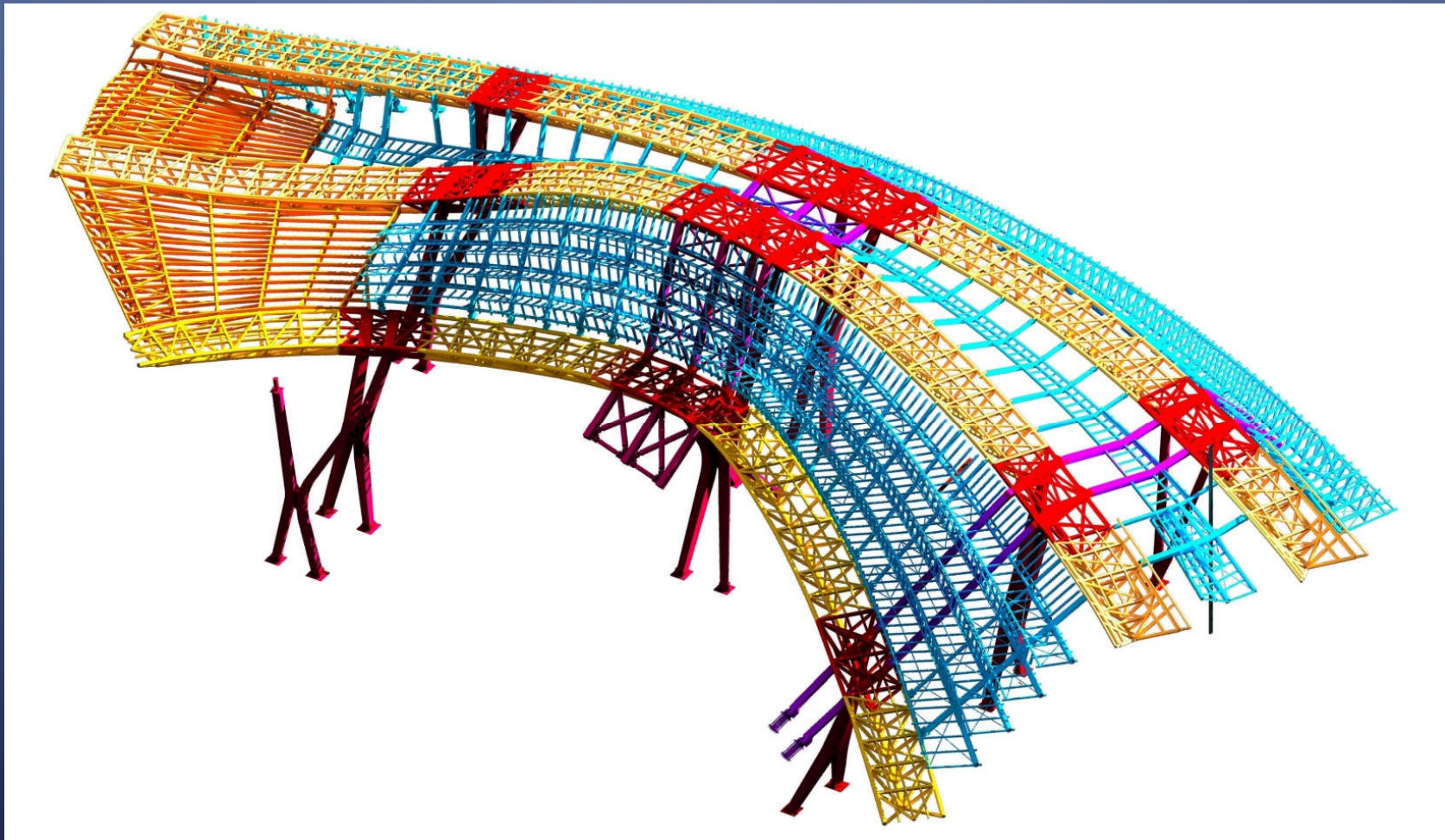
7 YEARS AGO...



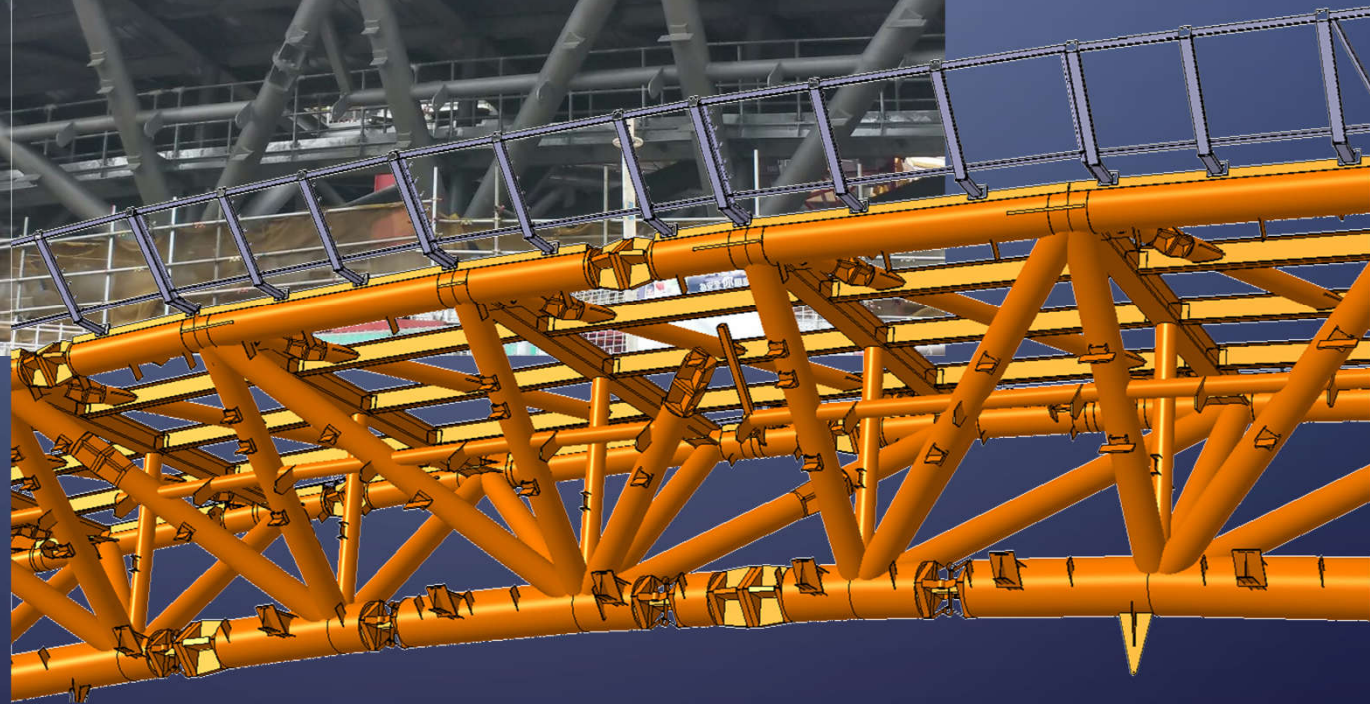
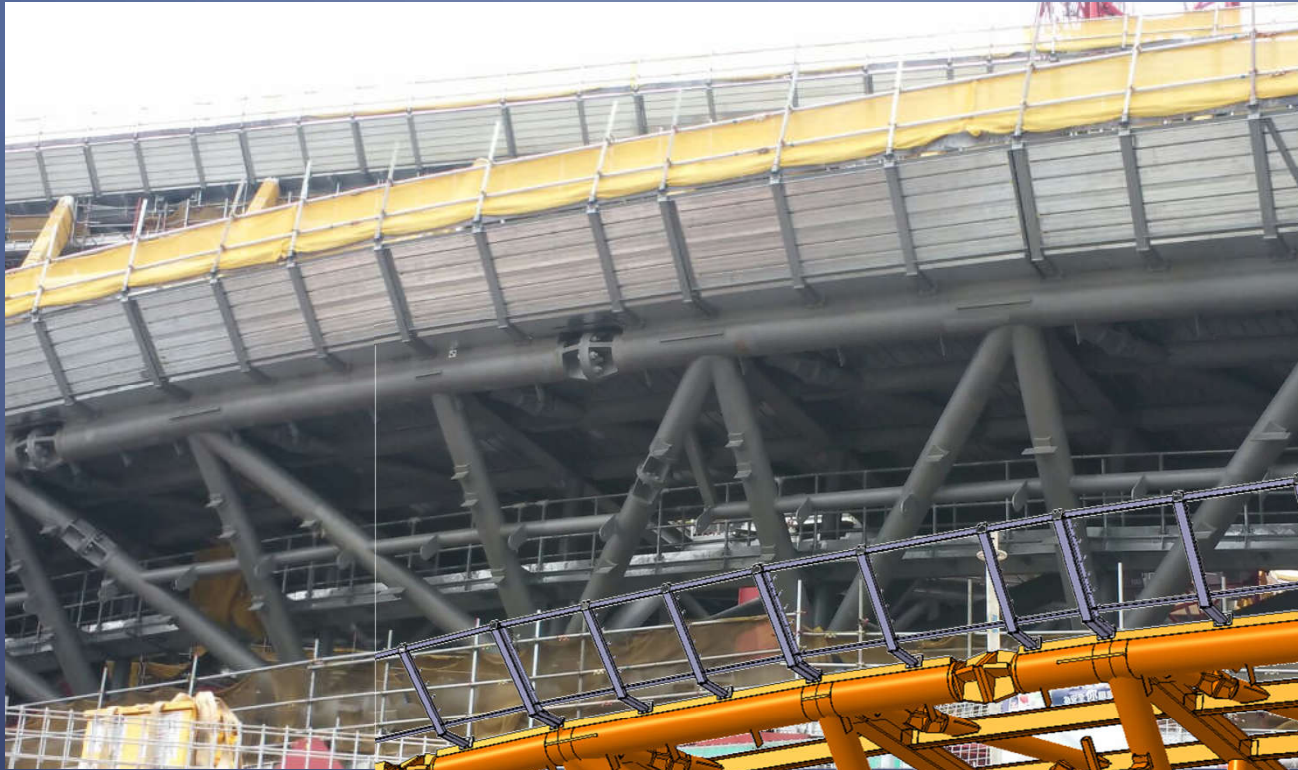
5 YEARS AGO...

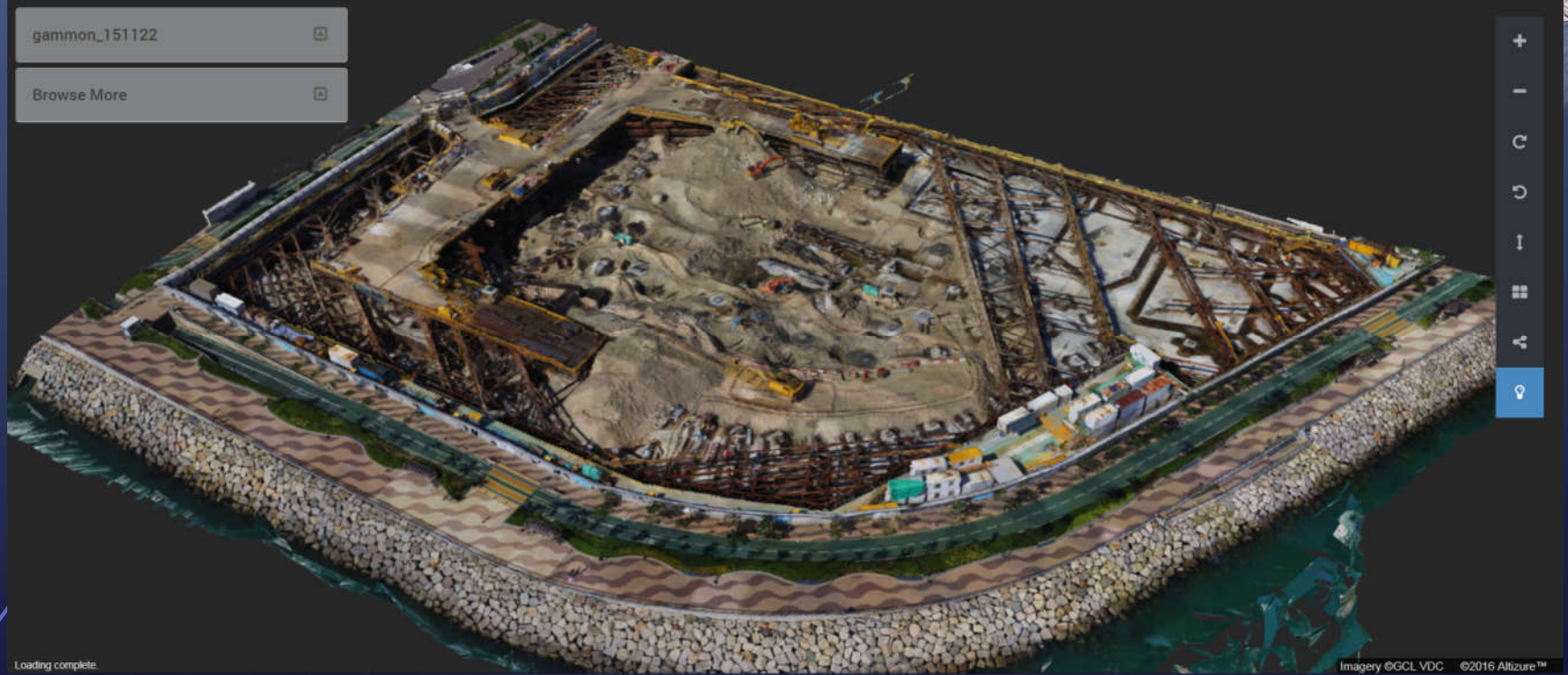
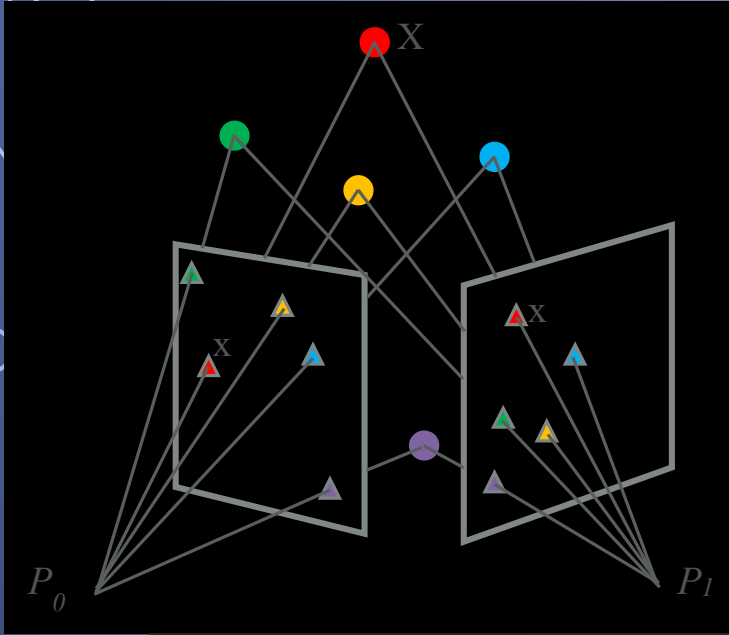


ROOF STEEL STRUCTURE



RECENTLY

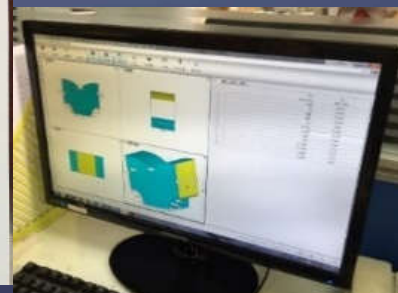
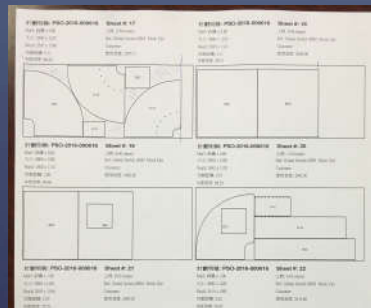
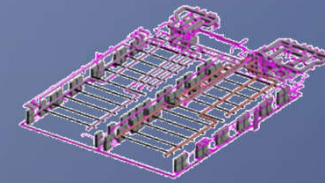




BIM DESIGN FOR MANUFACTURING & ASSEMBLY (DFMA)

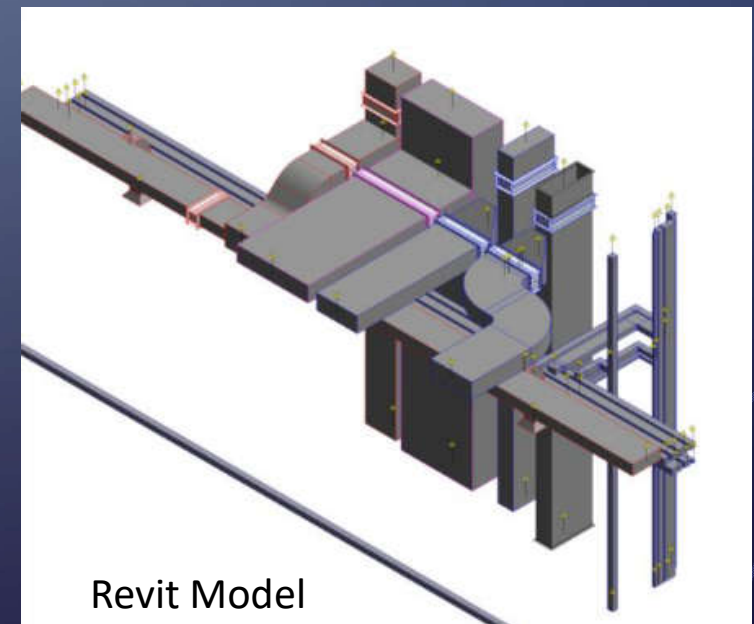
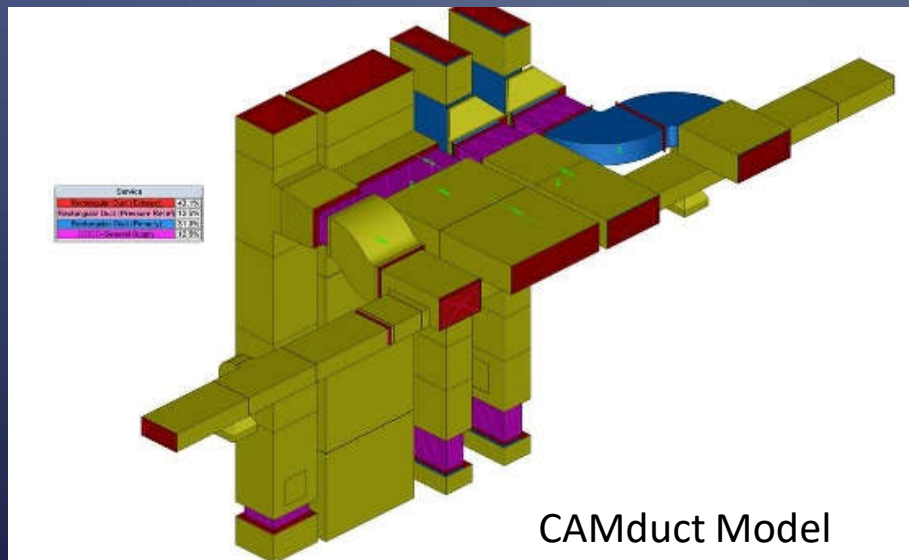
- Benefits:

- DW144 Standard compliance
- Right design & coordinate before right production
- Eliminate human error between different stage of manual input & ordering process

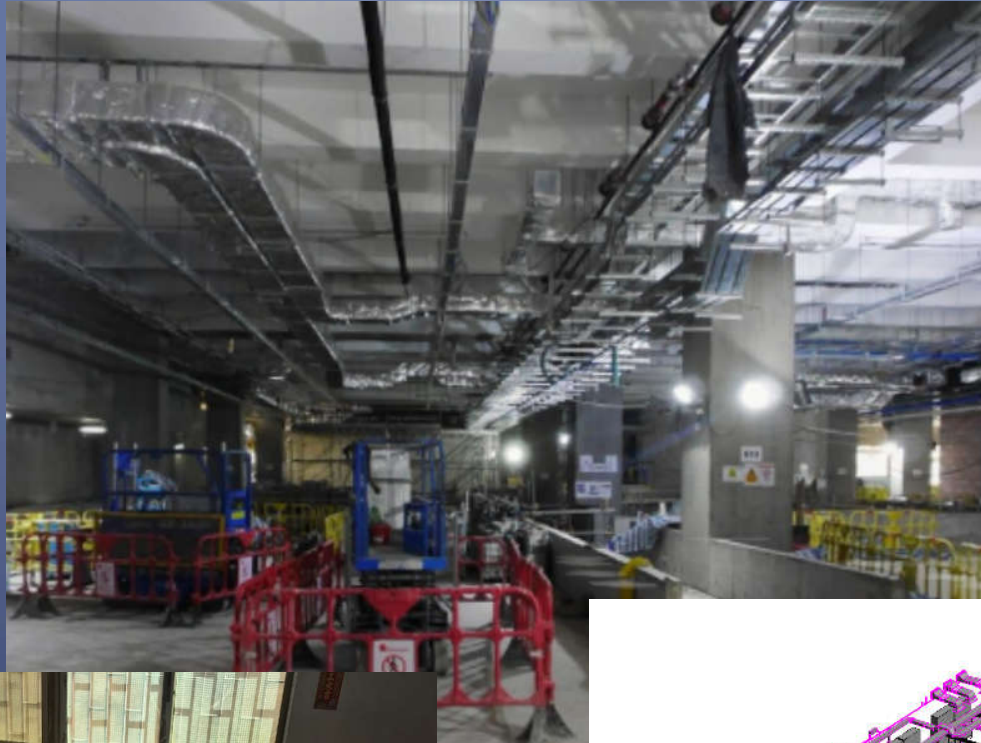


Digital VS Sketch

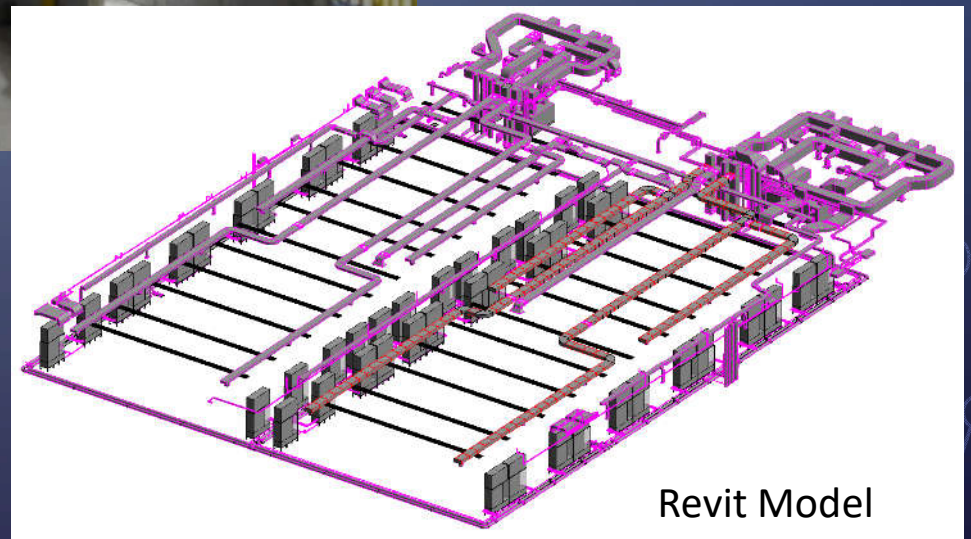
DFMA - MOCKUP PRACTICE



DFMA - REAL PRACTICE



CAMduct to Manufacturing



Revit Model

STAGE 1 - DESIGN STAGE

- Capture and store design information in BIM
- Synchronize design calculation with BIM, such that BIM model is updated automatically as design calculation is

LAMBETH

Job: 23618 Sheet: Formwork Design for Plan E10
 Title: Formwork Design for Plan E10 Design: TL Date: 5/2/18
 Check: All Date: 5/2/18

Assumptions
 Max concrete pouring height occur when casting the lower half of single post, which is the most critical case. Therefore, this report will design formwork for concrete casting at lower half of single post, and apply this design to upper half.
 Moreover, design calculation ignores concrete cast in pour and assumed it is filled with concrete. It also adopts max concrete pressure through out each design section. This over-estimate the applied load and therefore this design has additional margin for safety.

Max Concrete casting height is 5.20 m
 Height of formwork is 1.00 m (assumed)
 Design Vertical Pressure is 160 kPa (assumed)
 Design Horizontal Concrete Pressure P is 160 kPa (assumed)

Scaffold Plan Layout

Truss Support Location

Support	LHS						RHS						
	Location (m)	Level (m)	Supported Span (m)	Height (m)	Span Length (m)	Inclination (deg)	Location (m)	Level (m)	Supported Span (m)	Height (m)	Span Length (m)	Inclination (deg)	
1	2.37	18.12	34	35	42.75	0.38	49.56	18.12	35	34	42.75	0.41	56.20
2	15.13	17.13	37	37	37.76	0.88	22.71	17.13	37	37	37.76	0.88	49.56
3	15.13	16.16	37	48	38.58	1.07	48.13	16.16	37	48	38.58	1.07	49.56
4	15.13	15.19	40	43	32.74	1.15	43.07	15.19	40	43	32.74	1.07	49.56
5	15.13	14.22	43	42	28.88	1.22	42.00	14.22	43	42	28.88	1.07	49.56
6	15.13	13.25	45	40	25.03	1.29	38.12	13.25	45	40	25.03	1.07	49.56
7	15.13	12.28	48	35	21.18	1.35	34.27	12.28	48	35	21.18	1.07	49.56
8	15.13	11.31	49	30	17.33	1.41	30.42	11.31	49	30	17.33	1.07	49.56
9	15.13	10.34	50	25	13.48	1.46	26.57	10.34	50	25	13.48	1.07	49.56
10	15.13	9.37	50	20	9.63	1.51	22.72	9.37	50	20	9.63	1.07	49.56

Supporting Post Loading

Support	LHS						RHS					
	Location (m)	Level (m)	Area (m ²)	Height (m)	Horizontal Force (kN)	Vertical Force (kN)	Location (m)	Level (m)	Area (m ²)	Height (m)	Horizontal Force (kN)	Vertical Force (kN)
1	1.00	3.00	0.75	4.20	47.24	48.24	1.00	3.00	0.75	4.20	48.24	47.24
2	1.00	2.00	1.50	4.20	48.24	47.24	1.00	2.00	1.50	4.20	47.24	48.24
3	1.00	1.00	2.25	4.20	49.28	46.20	1.00	1.00	2.25	4.20	46.20	49.28
4	1.00	0.00	3.00	4.20	50.32	45.24	1.00	0.00	3.00	4.20	45.24	50.32
5	1.00	-0.50	3.75	4.20	51.36	44.28	1.00	-0.50	3.75	4.20	44.28	51.36
6	1.00	-1.00	4.50	4.20	52.40	43.32	1.00	-1.00	4.50	4.20	43.32	52.40
7	1.00	-1.50	5.25	4.20	53.44	42.36	1.00	-1.50	5.25	4.20	42.36	53.44
8	1.00	-2.00	6.00	4.20	54.48	41.40	1.00	-2.00	6.00	4.20	41.40	54.48
9	1.00	-2.50	6.75	4.20	55.52	40.44	1.00	-2.50	6.75	4.20	40.44	55.52
10	1.00	-3.00	7.50	4.20	56.56	39.48	1.00	-3.00	7.50	4.20	39.48	56.56

Design Loading
 (Lateral Force taken by these action)

Support	Location (m)	Level (m)	Area (m ²)	Height (m)	Horizontal Force (kN)	Vertical Force (kN)
1	1.00	3.00	0.75	4.20	47.24	48.24
2	1.00	2.00	1.50	4.20	48.24	47.24
3	1.00	1.00	2.25	4.20	49.28	46.20
4	1.00	0.00	3.00	4.20	50.32	45.24
5	1.00	-0.50	3.75	4.20	51.36	44.28
6	1.00	-1.00	4.50	4.20	52.40	43.32
7	1.00	-1.50	5.25	4.20	53.44	42.36
8	1.00	-2.00	6.00	4.20	54.48	41.40
9	1.00	-2.50	6.75	4.20	55.52	40.44
10	1.00	-3.00	7.50	4.20	56.56	39.48

Scaffold Level and Vertical supporting post length

Support	LHS				RHS			
	Location (m)	Level (m)	Concrete Top (m)	Post Length (m)	Location (m)	Level (m)	Concrete Top (m)	Post Length (m)
1	2.37	18.12	18.12	15.85	49.56	18.12	18.12	15.85
2	15.13	17.13	17.13	14.85	22.71	17.13	17.13	14.85
3	15.13	16.16	16.16	13.85	38.58	16.16	16.16	13.85
4	15.13	15.19	15.19	12.85	43.07	15.19	15.19	12.85
5	15.13	14.22	14.22	11.85	42.00	14.22	14.22	11.85
6	15.13	13.25	13.25	10.85	38.12	13.25	13.25	10.85
7	15.13	12.28	12.28	9.85	34.27	12.28	12.28	9.85
8	15.13	11.31	11.31	8.85	30.42	11.31	11.31	8.85
9	15.13	10.34	10.34	7.85	26.57	10.34	10.34	7.85
10	15.13	9.37	9.37	6.85	22.72	9.37	9.37	6.85

Information exchange between BIM and design

Design

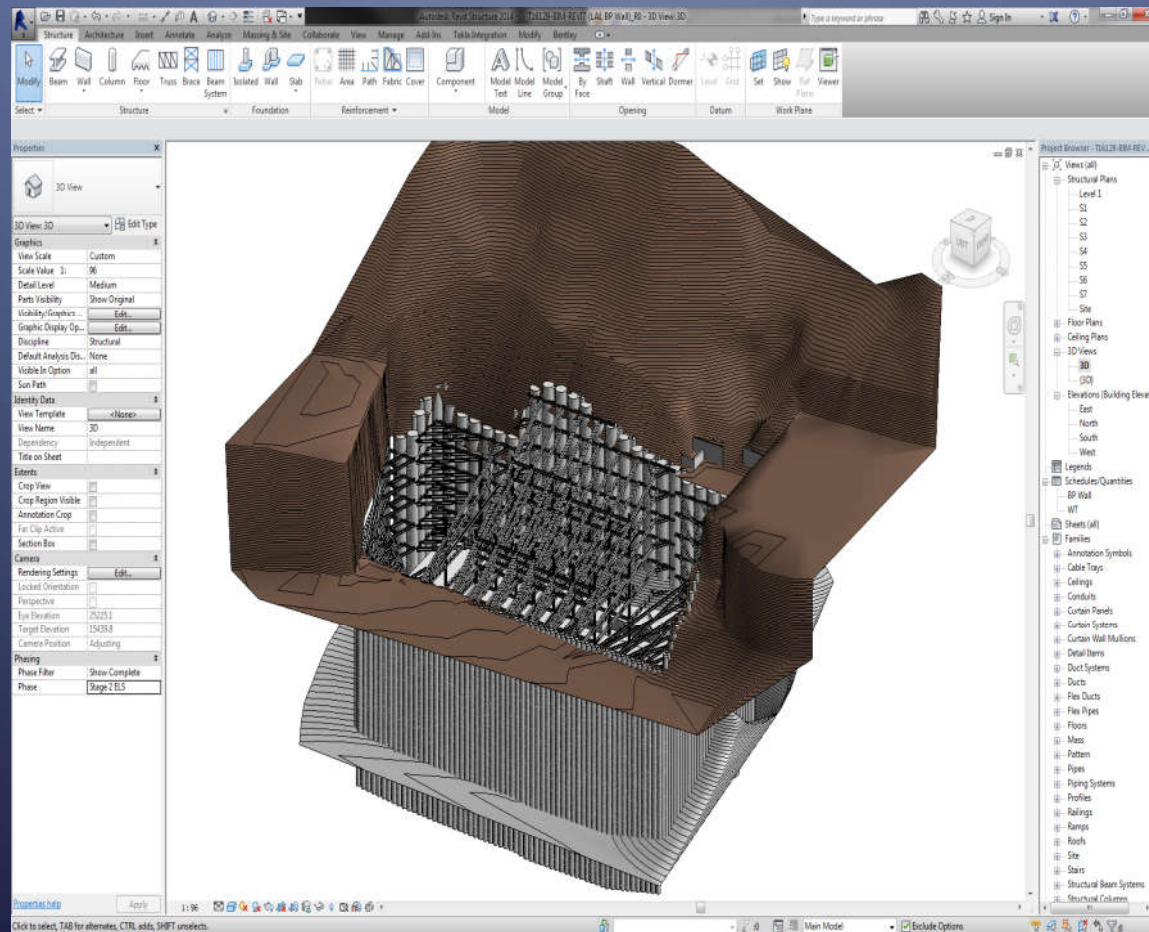
Tendering

Operation

Analytic

STAGE 1 - DESIGN STAGE

- Update model in seconds
- Create updated BIM model for every single tender and project



STAGE 3 - CONSTRUCTION

Design

Tendering

Operation

Analytic

Construction Record

Planning Information

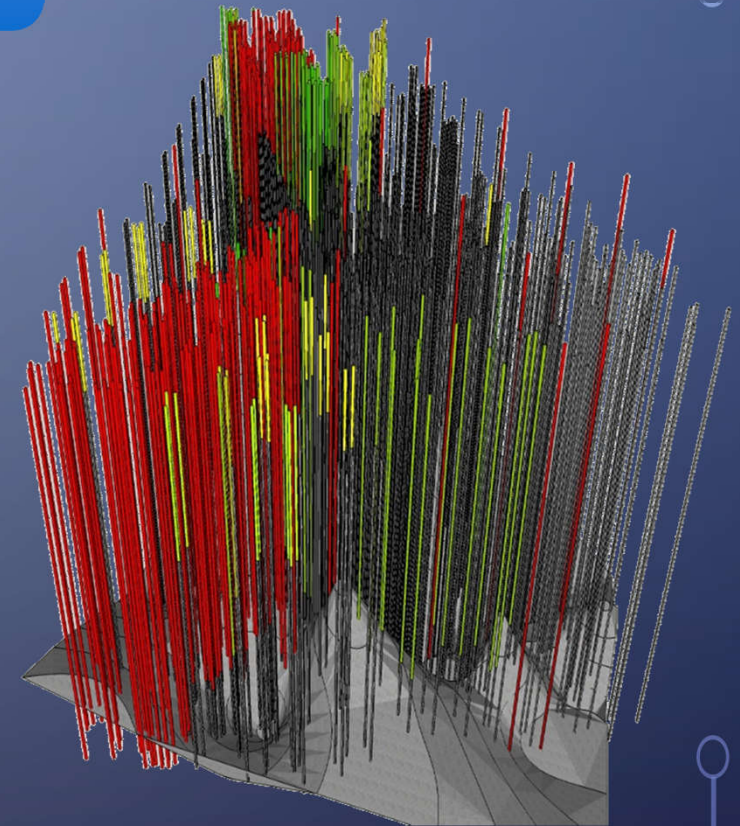
Database

Monitor reality and
Compare with
planning

React to information
Solve problems and
improve productivity

Combine
reality
and
virtual
world

Understand and
react



**Combine Planning and
Reality Information**

Design

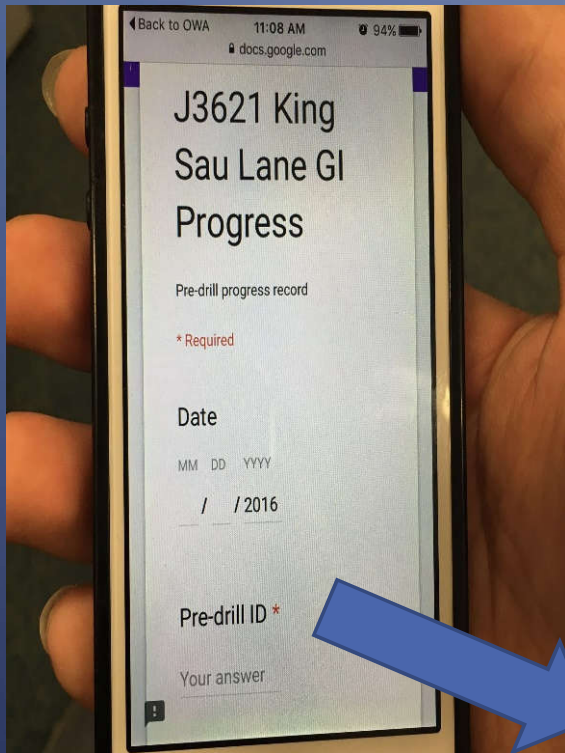
Tendering

Operation

Analytic

STAGE 3 – CONSTRUCTION DIGITIZING CONSTRUCTION EVENTS

Free Mobile App/IoT

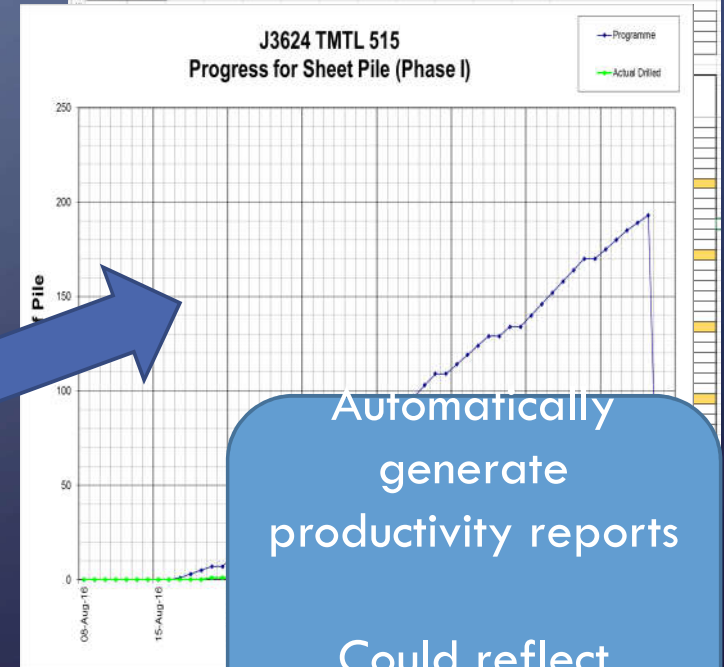
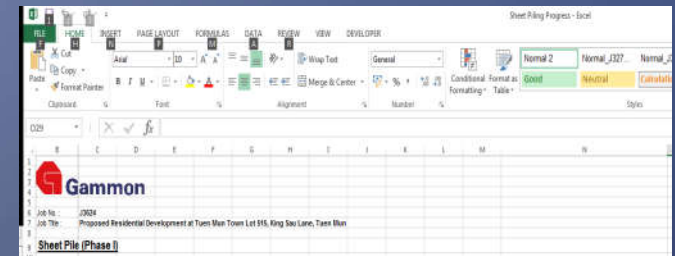


Directly into database

Systematic Excel Construction Record

	A	B	C	D	E	F
1	Date	Pile	Task	Depth		
2	07/06/2016	BP1	Excavation	-2		
3	07/06/2016	BP1	Casing	-3		
4	07/06/2016	BP2	Steel Cage	-10		
5	07/06/2016	BP3	Casing	-1		
6	08/06/2016	BP1	Excavation			
7	08/06/2016					
8	08/06/2016					
9	08/06/2016					
10	08/06/2016	BP3	Excavation	-4		

Centralized Record



Automatically generate productivity reports

Could reflect today's progress after work

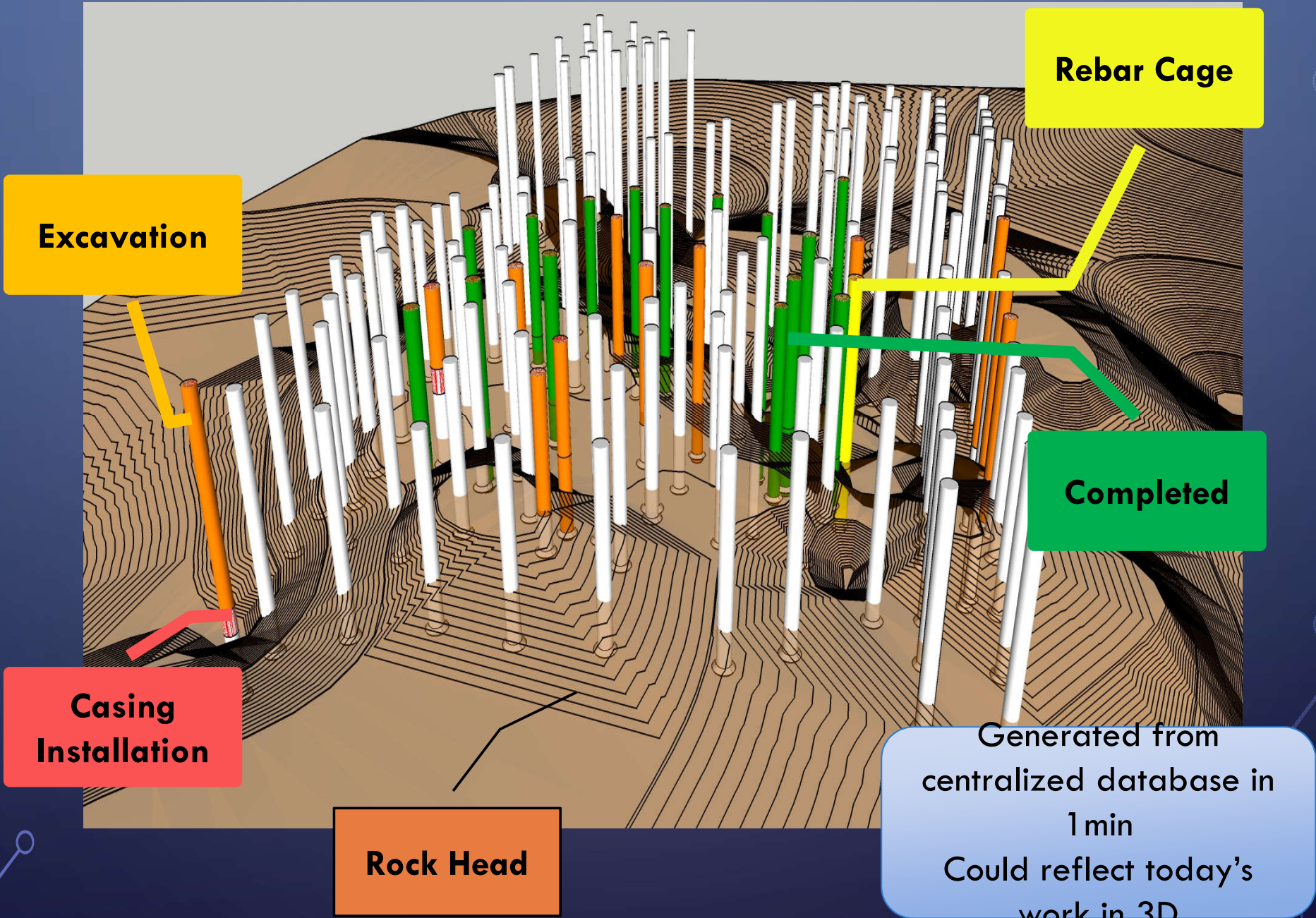
STAGE 3 – CONSTRUCTION BIM AS-BUILT PROGRESS

Design

Tendering

Operation

Analytic



Excavation

Rebar Cage

Completed

Casing Installation

Rock Head

Generated from centralized database in 1 min
Could reflect today's work in 3D

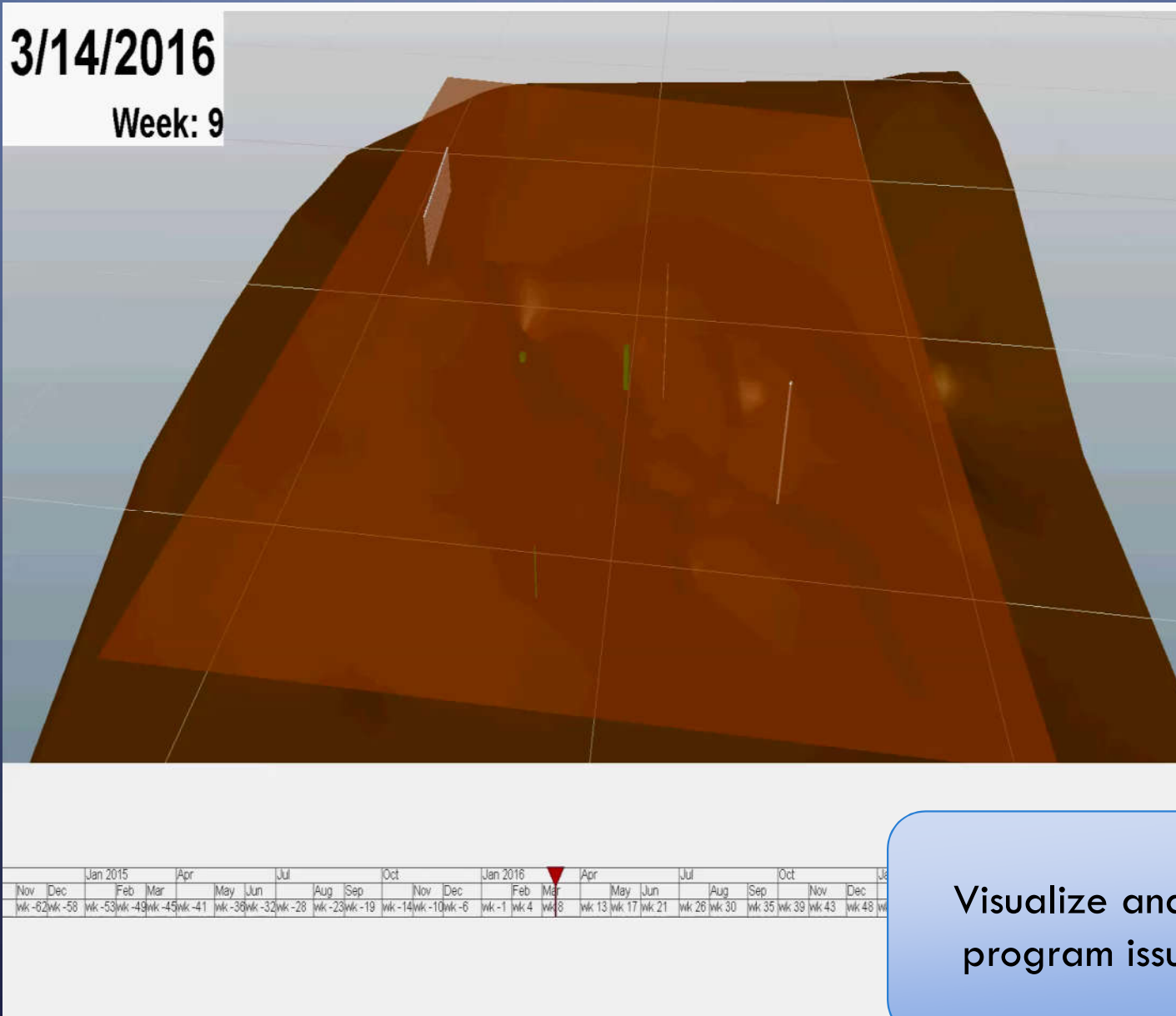
STAGE 3 – CONSTRUCTION 4D AS-BUILT PROGRESS

Design

Tendering

Operation

Analytic



Visualize and identify
program issues in 4D

Design

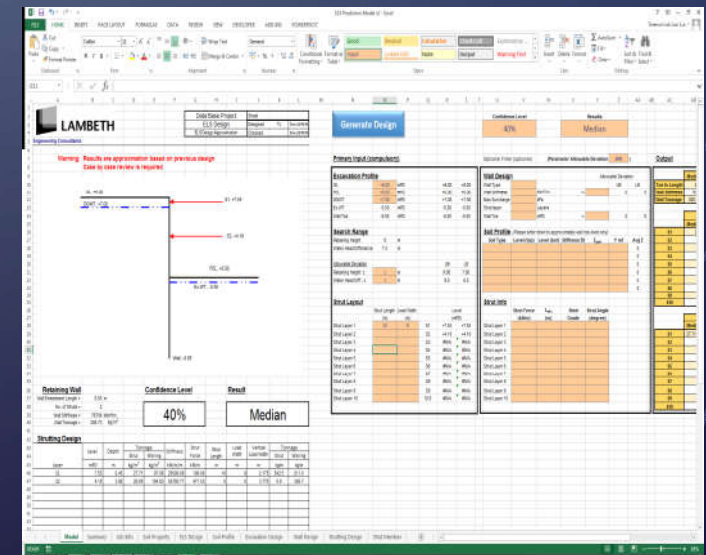
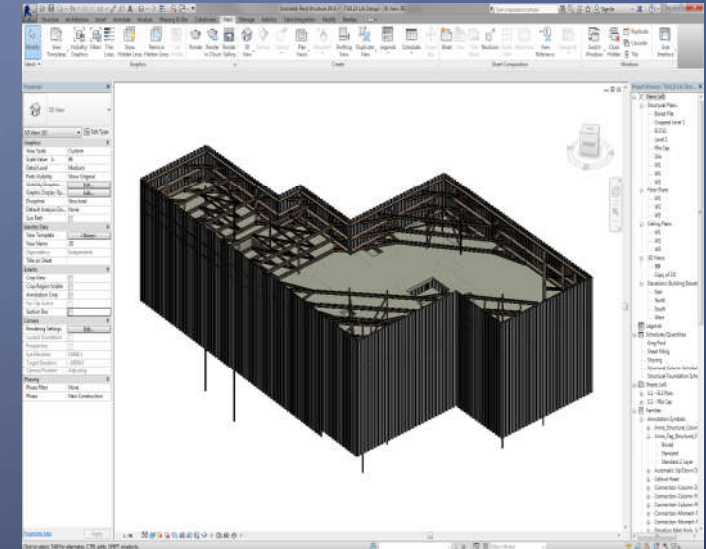
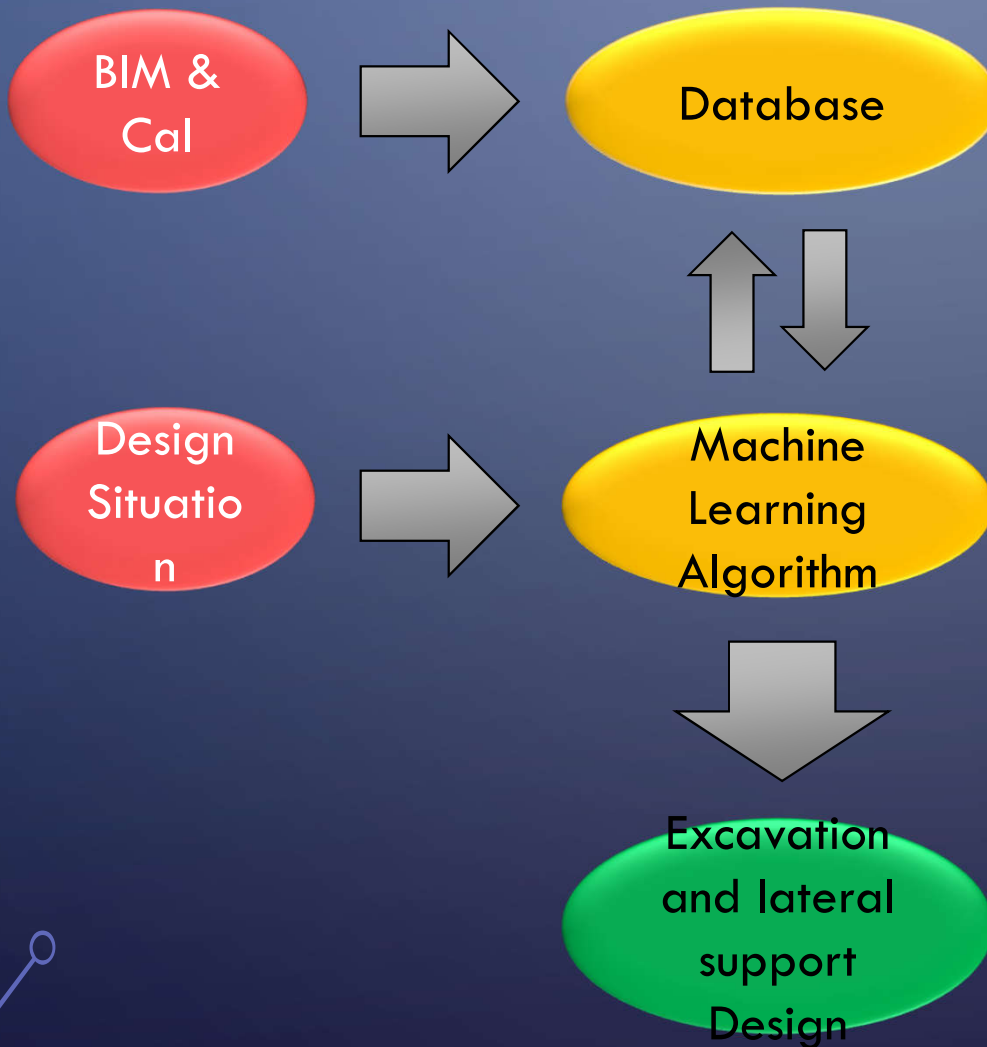
Tendering

Operation

Analytic

STAGE 4 – ADVANCE ANALYTICS

- Based on collected design and as-built data, produce design and evaluate risk.



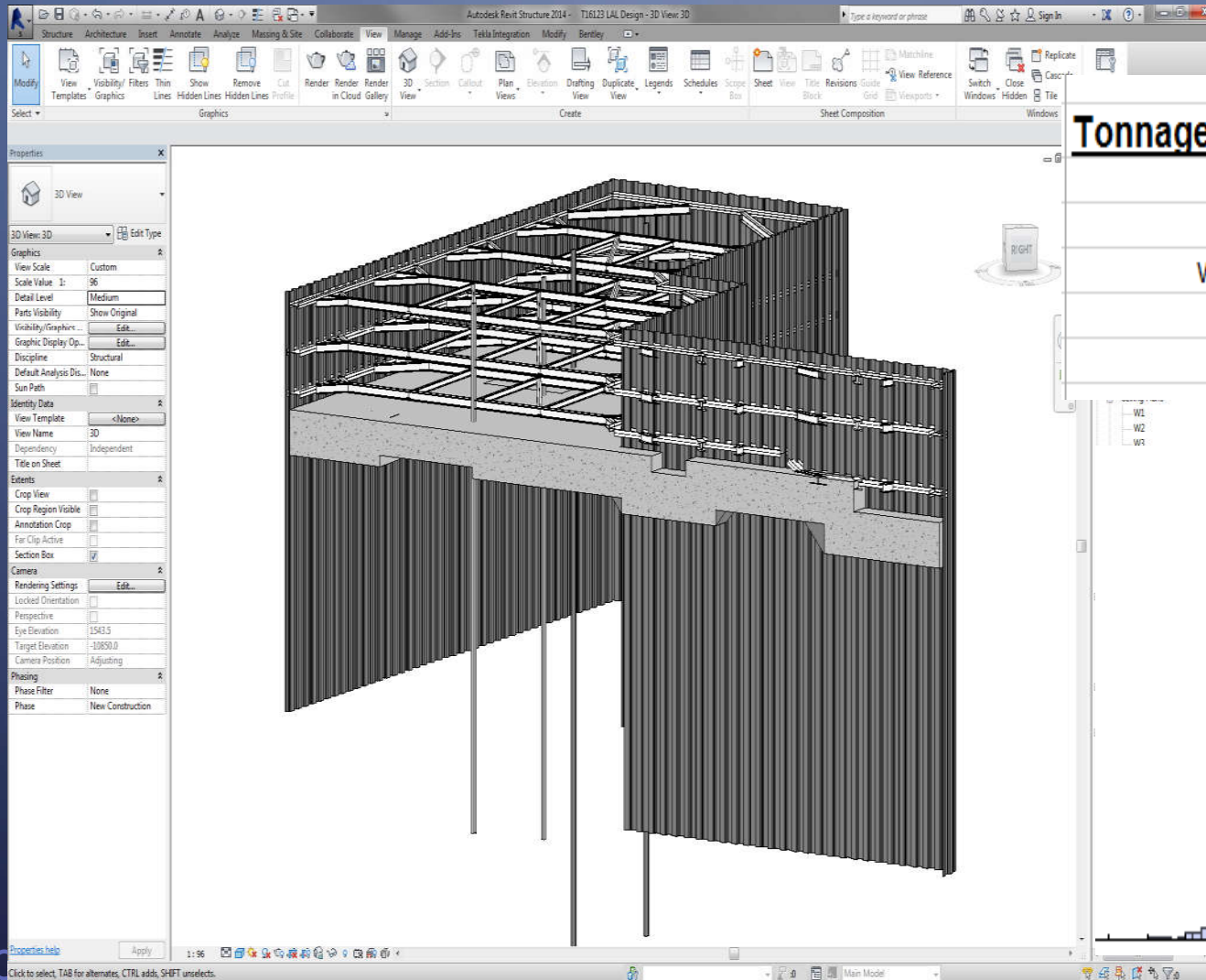
Design

Tendering

Operation

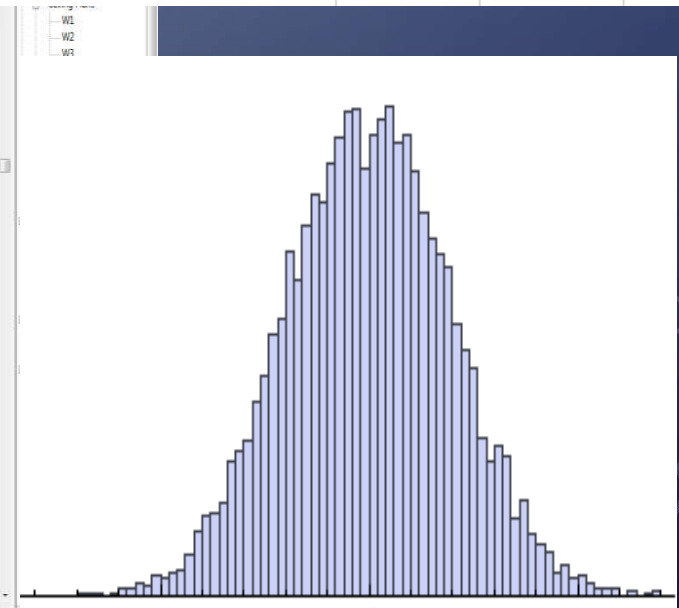
Analytic

STAGE 4 – ADVANCE ANALYTICS



Tonnage Estimation

Strut Tonnage =	602.8 kg/m
Waling Tonnage =	606.7 kg/m
Wall Tonnage =	4955.2 kg/m
Total Tonnage =	6164.7 kg/m



BENEFIT OF INFORMATION CONTROL

- Stage 1 Implementation

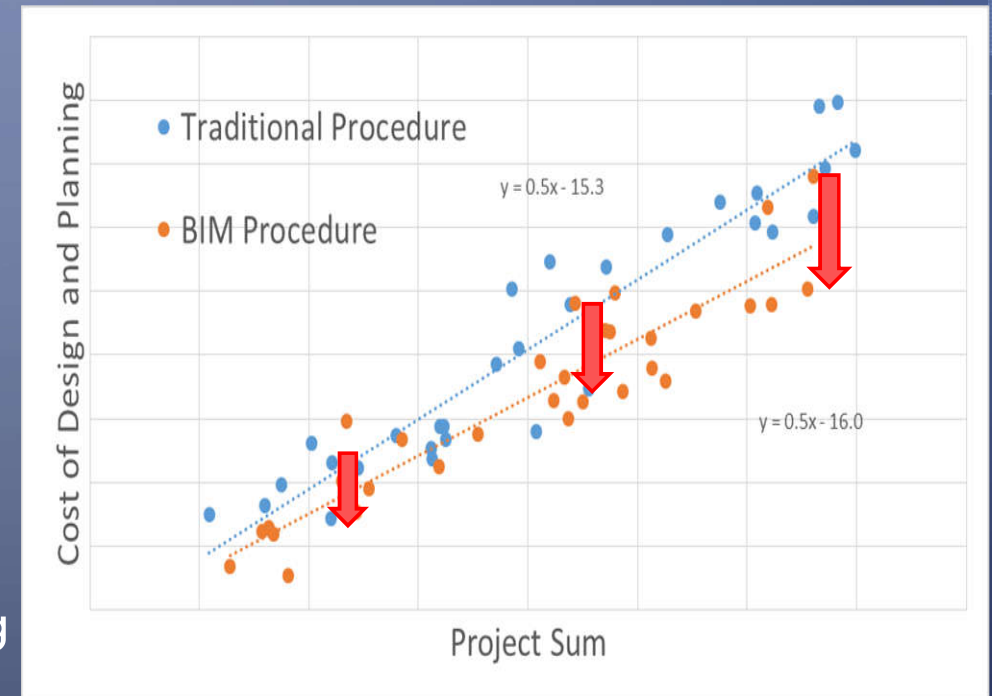
- Engineering Design **10%**
- Tendering **-**
- Progress Monitoring **20%**
- 80%**

- Stage 2 Implementation

- Improve design and planning
- Improve decision making

- Stage 3 Implementation

- Better collaboration between internal and external parties





FAILURE OF BIM APPLICATION

- Resource / out-source
- True BIM or just a presentation
- Inappropriate LOD
- BIM adoption / understanding
- BIM culture / promotion



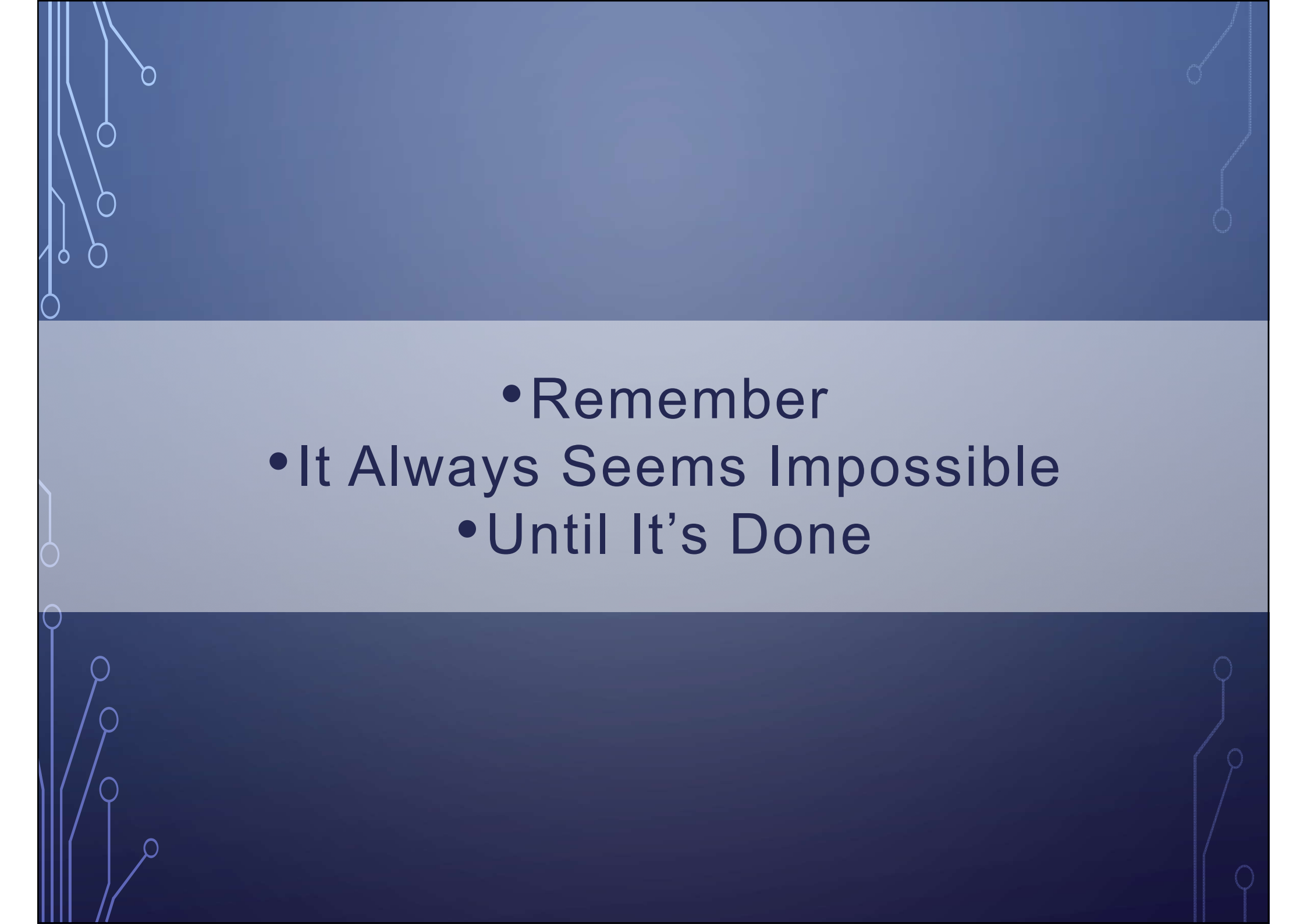
CHALLENGES

- Increase workload and liability
- BIM catalogues not up to standard
- Incompliance with regulations, codes
- Enormous clashes
- Super fast track project – considerable changes
- Industry trade practice / culture
- Too much competition
- Quality is not priority
- Not fully utilizing the power of BIM
- Not in the same pace
- No driving force



SOLUTIONS

- Drivers
- Training of BIM Professionals
- BIM + Digital Integration Project Delivery
- Common Platform for Collaboration
- BIM Quality
- BIM Appreciation and Buy-in
- Systematic Approach – not just a tool
- Cloud Base Technology Framework
- BIM as Core Technology
- BIM standards and requirements

- 
- Remember
 - It Always Seems Impossible
 - Until It's Done