Welcome

BIM Fundamentals

By BIMInnovage Solutions

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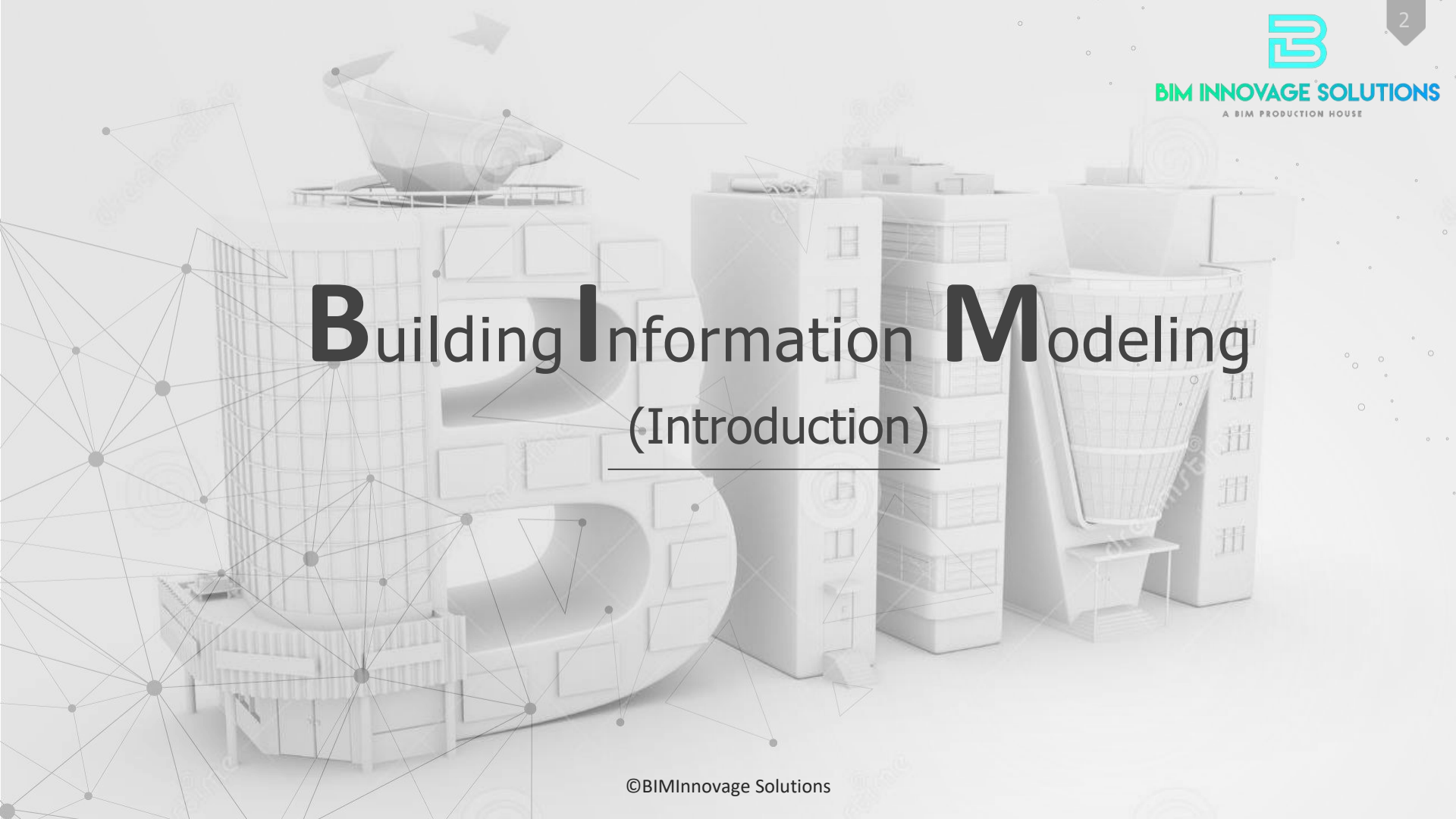

Building Information Modeling

(Introduction)

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Purpose:

- Understanding the BIM process, advantages of BIM, common practices and brief understanding on implementation process and BIM dimensions.

Aim:

- Gain the completive edge

01

What is BIM ?

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BIM is NOT !!

BIM is not New
BIM is just 3D modelling
BIM's just a type of software

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Building Information Modeling

is

BIM is a process we follow to create a digital record and a central source of shared knowledge of an asset from design through construction and into operation.

- BIM is more than a 3D visualisation of a project created by some design software.
- The Building Information Model is ALL the data pertaining to a project.
- A graphical representation of the project, which is commonly known as the 3D model.
- A database of information associated with the asset, this could be cost, performance or construction information.

02

Origins Of BIM

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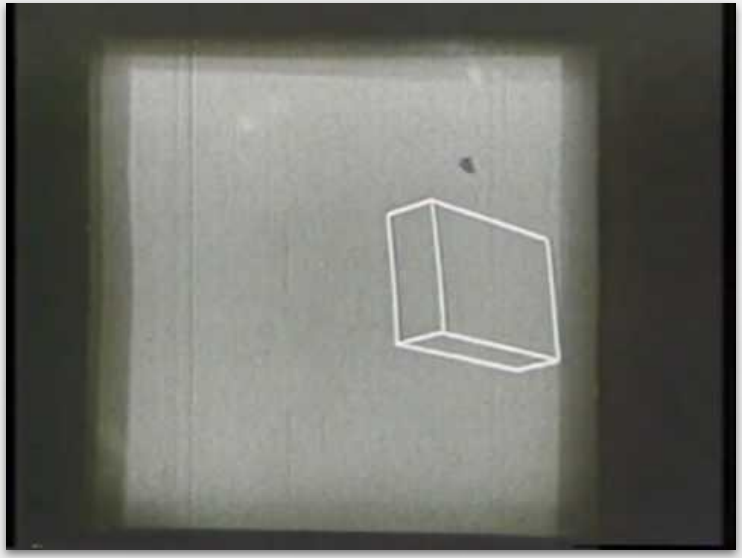
Origins Of BIM

- In 1963 Ivan Sutherland develops SketchPad as a drawing assistant for part of his Ph.D dissertation.
- In 1970 BIM concepts was born.



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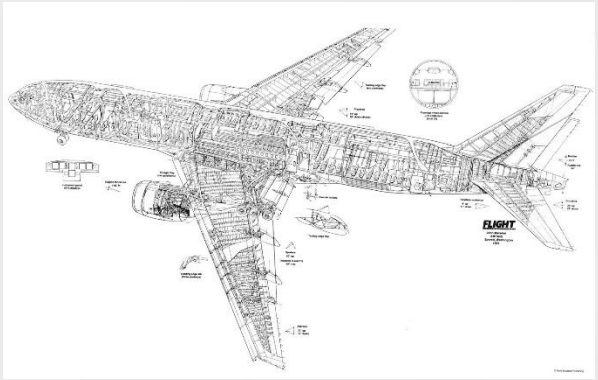
BIM Concept

Aerospace Industry



Build Digitally on the computer!

Adopted in automotive company such as BMW, Porsche, Honda, Audi, Volkswagen, Volvo, Ford etc.

Automobile Industry

Used for car structures-door beams, IP support, bumper beams, roof rails, side rails, body components because CATIA capabilities in Computer Representation of surfaces.

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Benefits of BIM

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Construction Challenges

- Inefficiency
- Poor coordination
- Poor value for money
- Lack of understanding
- Reluctance to change
- Lack of Proper Planning.
- Poor Decision Making.
- Lack of Mediation.

- Lack of Project Monitoring/ Program Monitoring.
- Reluctance in adoption of new technology.
- Lack in Value Engineering adoption.
- Lack of Integrated Project Delivery.

30% of projects do not meet original program or budget
92% of clients said that designers drawings are typically not sufficient for construction.
37% of materials used in construction become waste.
10% of the cost of a project is typically due to change orders.
38% of carbon emissions are from buildings not cars.

CMAA Owners survey,CMAA Industry Report, Economist Magazine

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Benefits Of Using BIM

- 3D coordination.
- Clash detection.
- Construction simulation.
- Cost estimation.
- Building systems analysis.
- Energy analysis.
- Lighting analysis.
- Wind Analysis.
- Mechanical analysis.
- Structural analysis .
- Visualisation / design communication.

- Building Performance Analysis.
- Asset and a central source of a shared Knowledge
- Material Quantity Take-off
- BIM allows us to show the CLIENT the END USER and all STAKEHOLDERS to look around the building before it has been built.
- With a VIRTUAL MODEL you can run scenarios.
- Iron out problems before you build – Try Before you buy.

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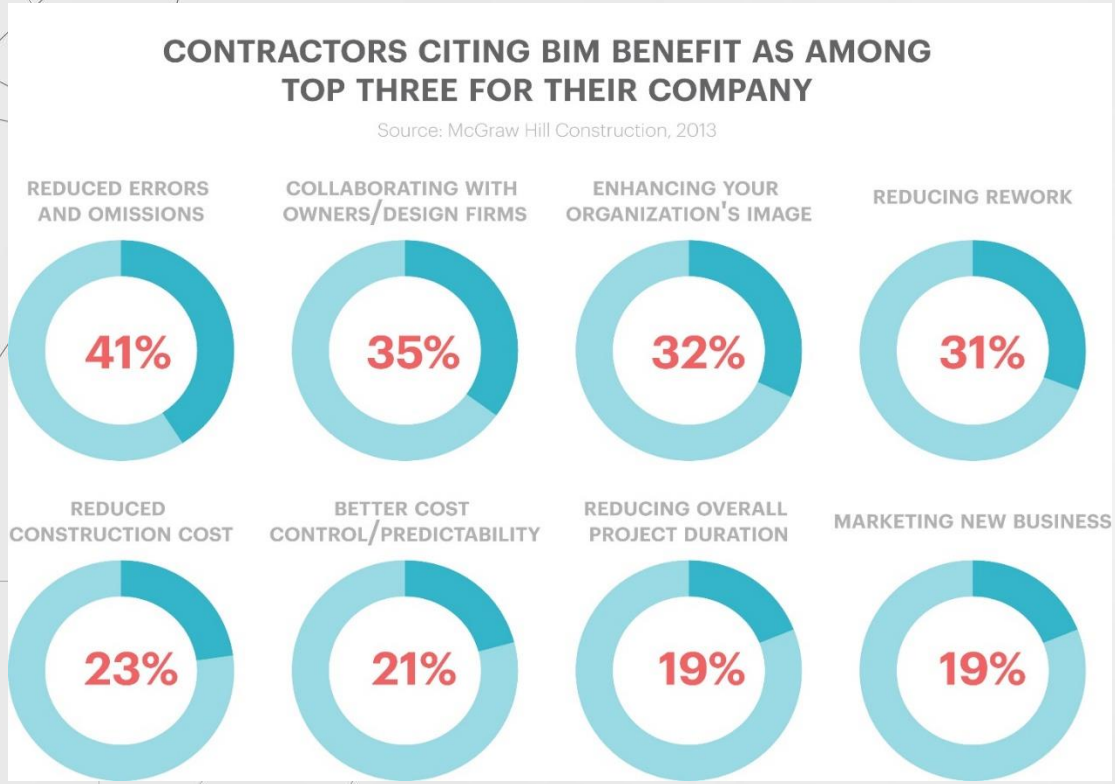
Benefits Of Using BIM



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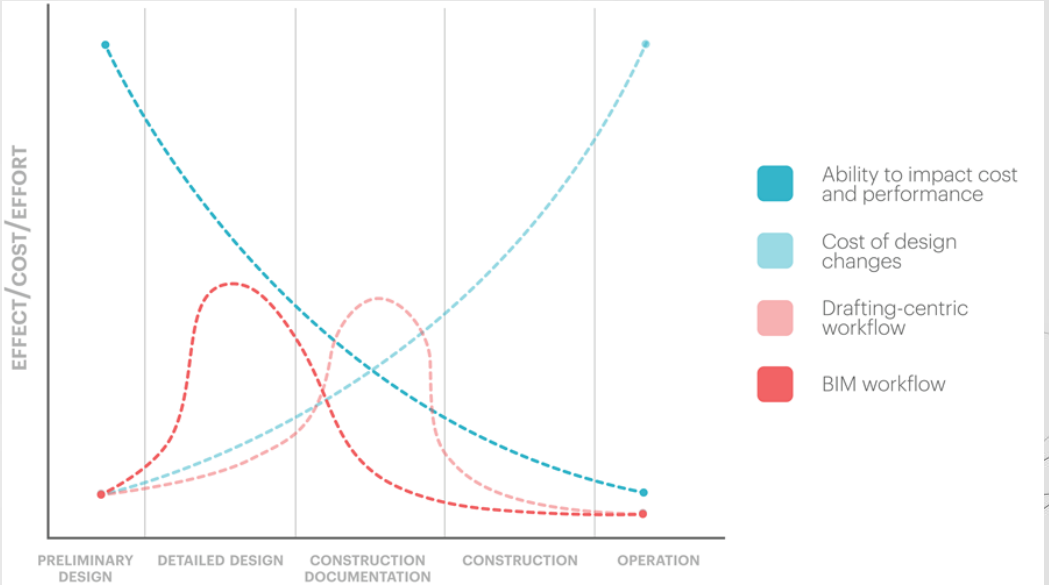
When to Implement BIM?

By dynamically connecting design, analysis, and documentation in a BIM workflow, most of the effort in a design project is shifted back into the detailed design phase when the ability to impact project performance is high and the cost of making design changes is low



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BIM Schools?

- Higher employability
- Higher Pay
- Helps you produce drawings more efficiently
- Allows you to access various visualization and analysis tools
- Easy collaboration in group work
- Clash detection
- Less duplication of work

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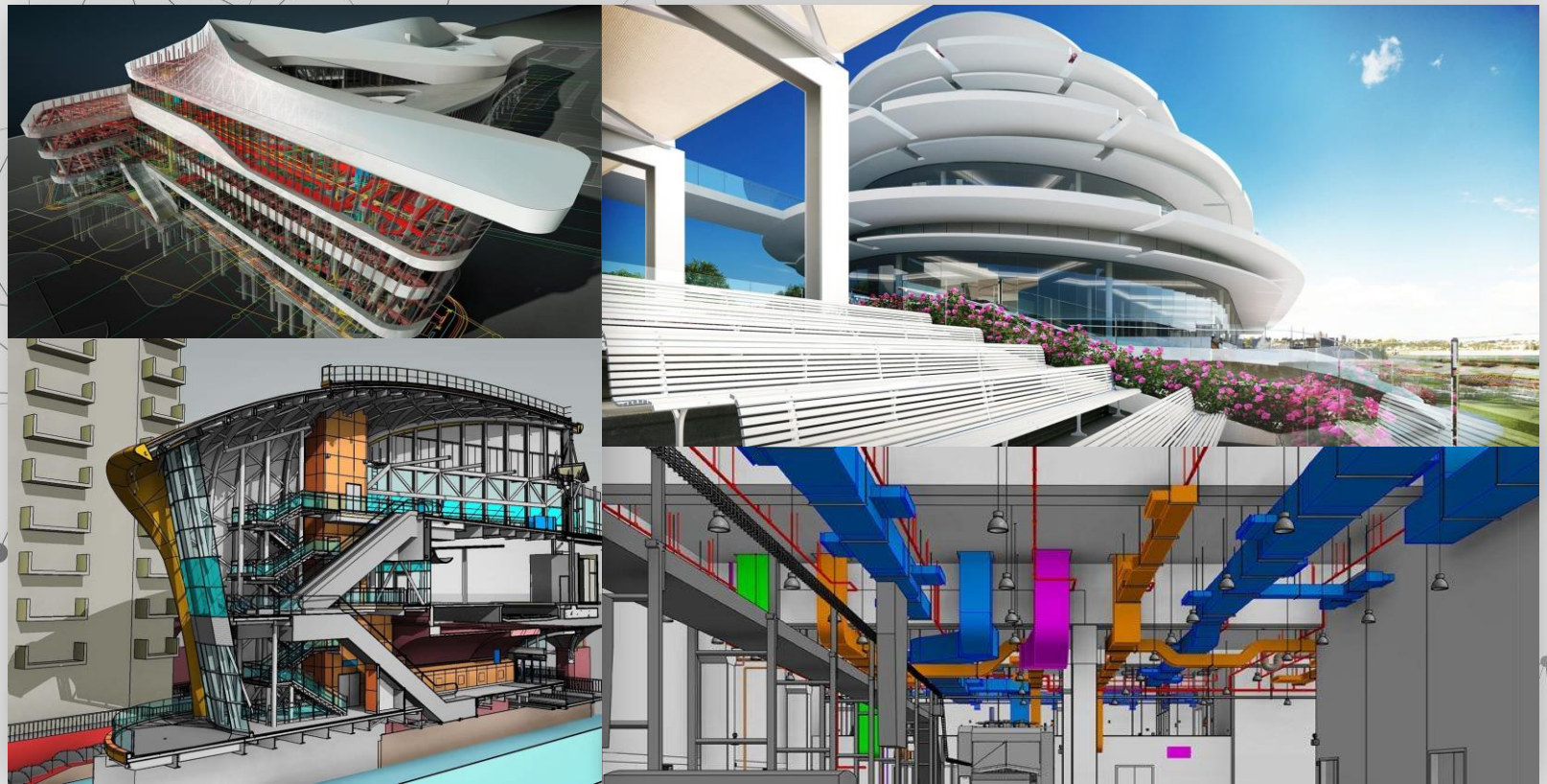
Central source of a shared Knowledge

3D Visualization

BIM’s inherent 3D-rendering of the project views, which help understanding of what the project is all about, and how sophisticated the work is.



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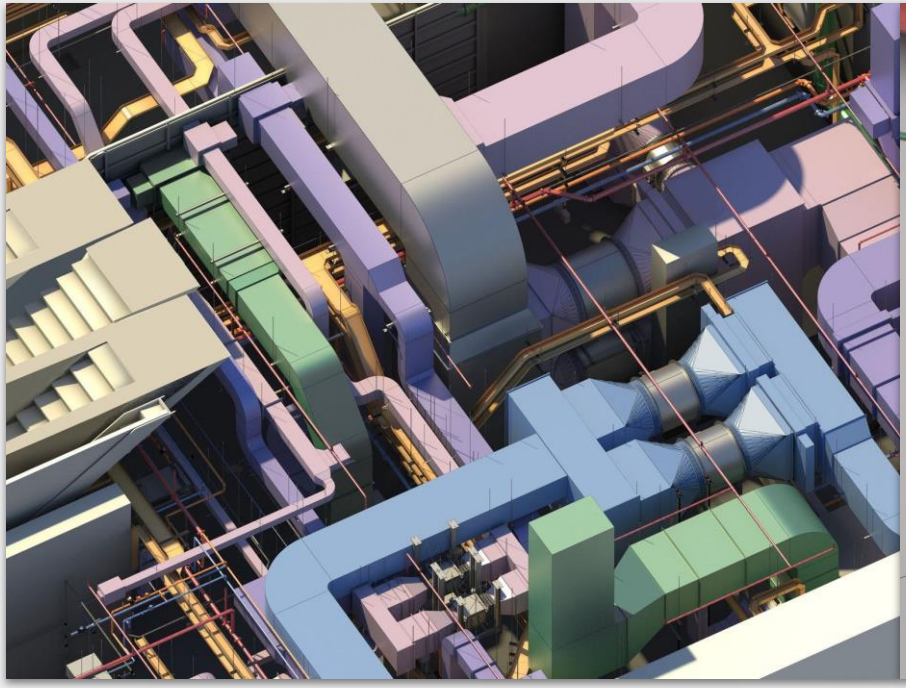
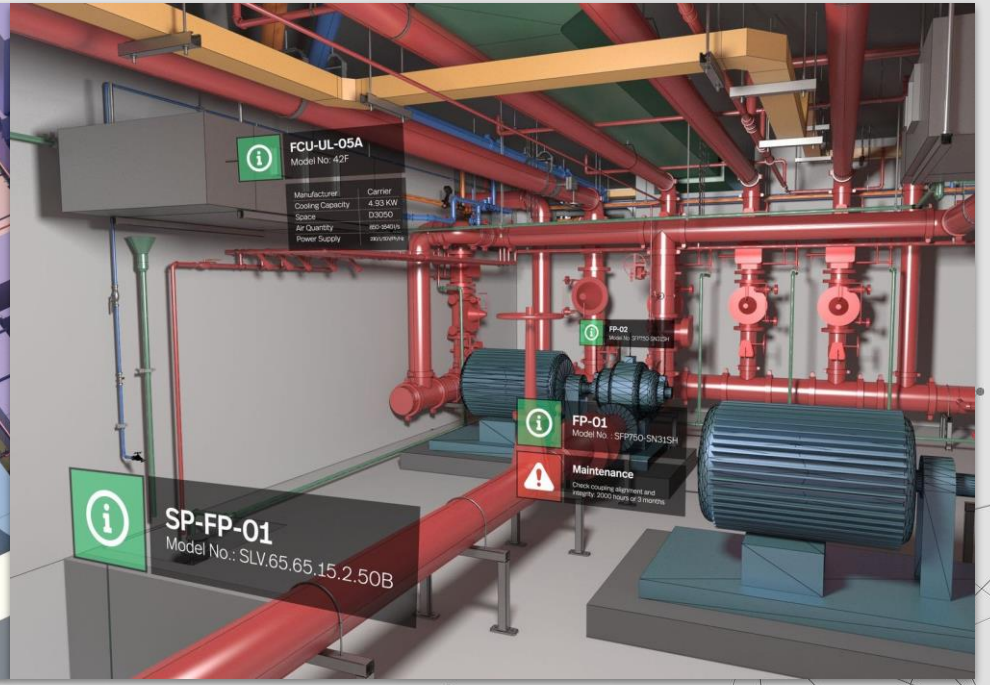
3D Visualization





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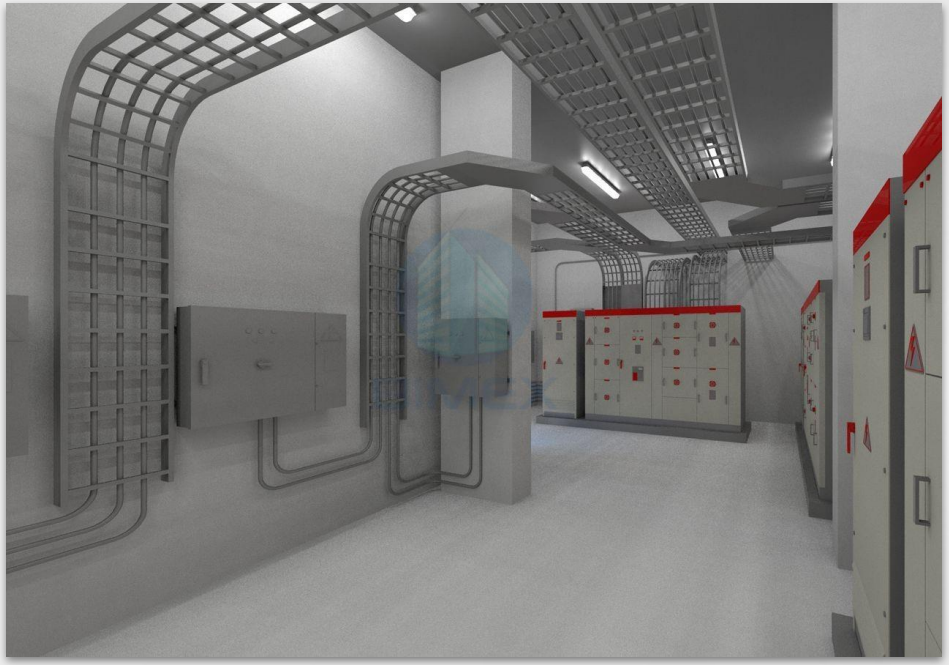
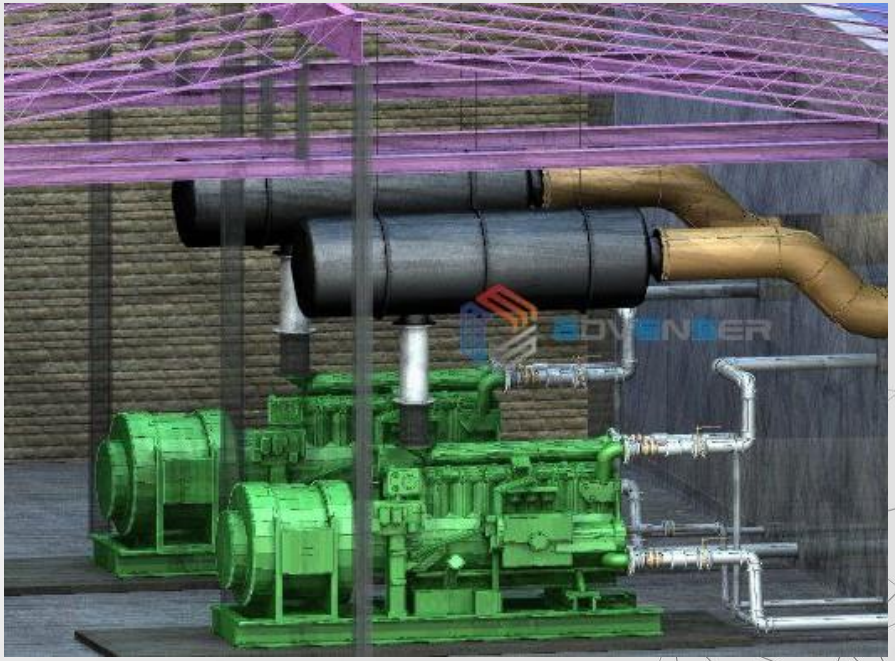
3D Visualization





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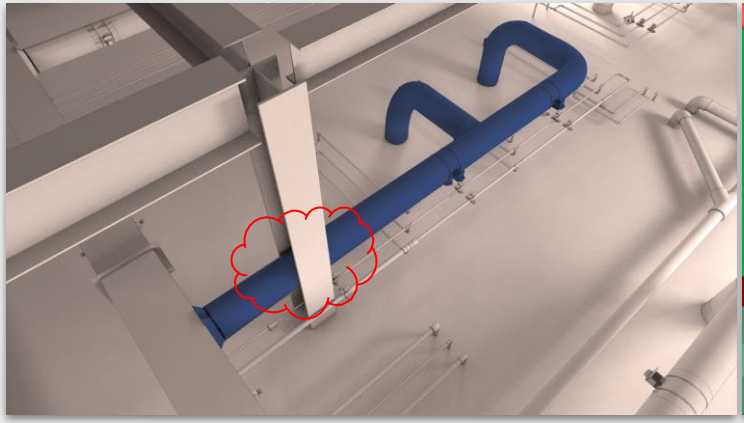
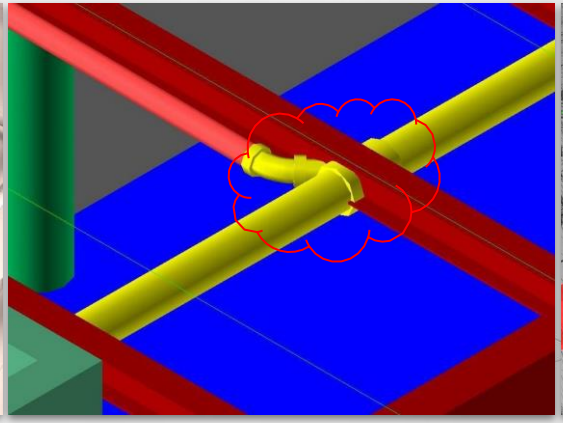
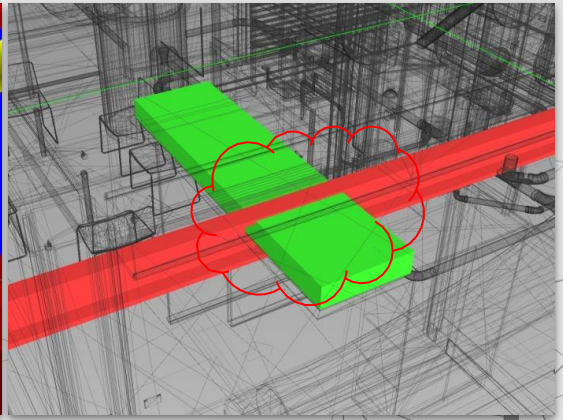
Clash detection

Coordination between the different disciplines leads to.

- Minimize conflicts between all systems.
- Minimize the overall cost of project at the installation and construction stages.







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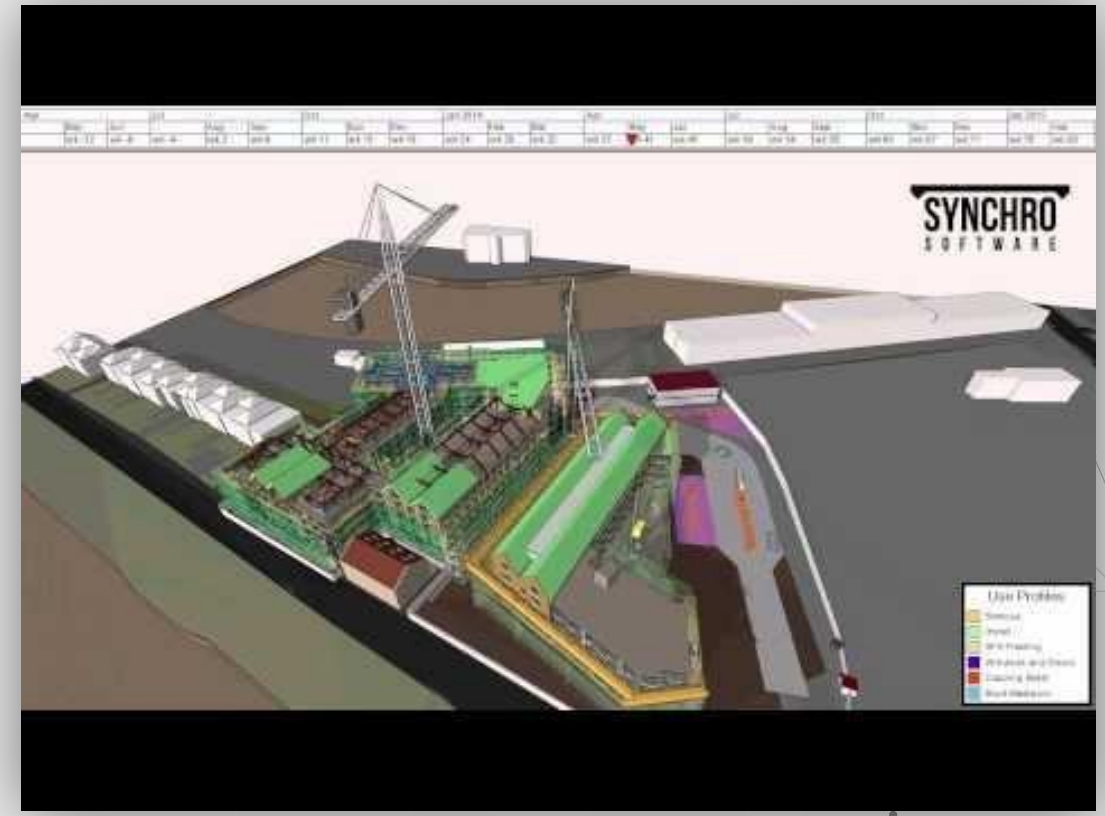
Construction simulation



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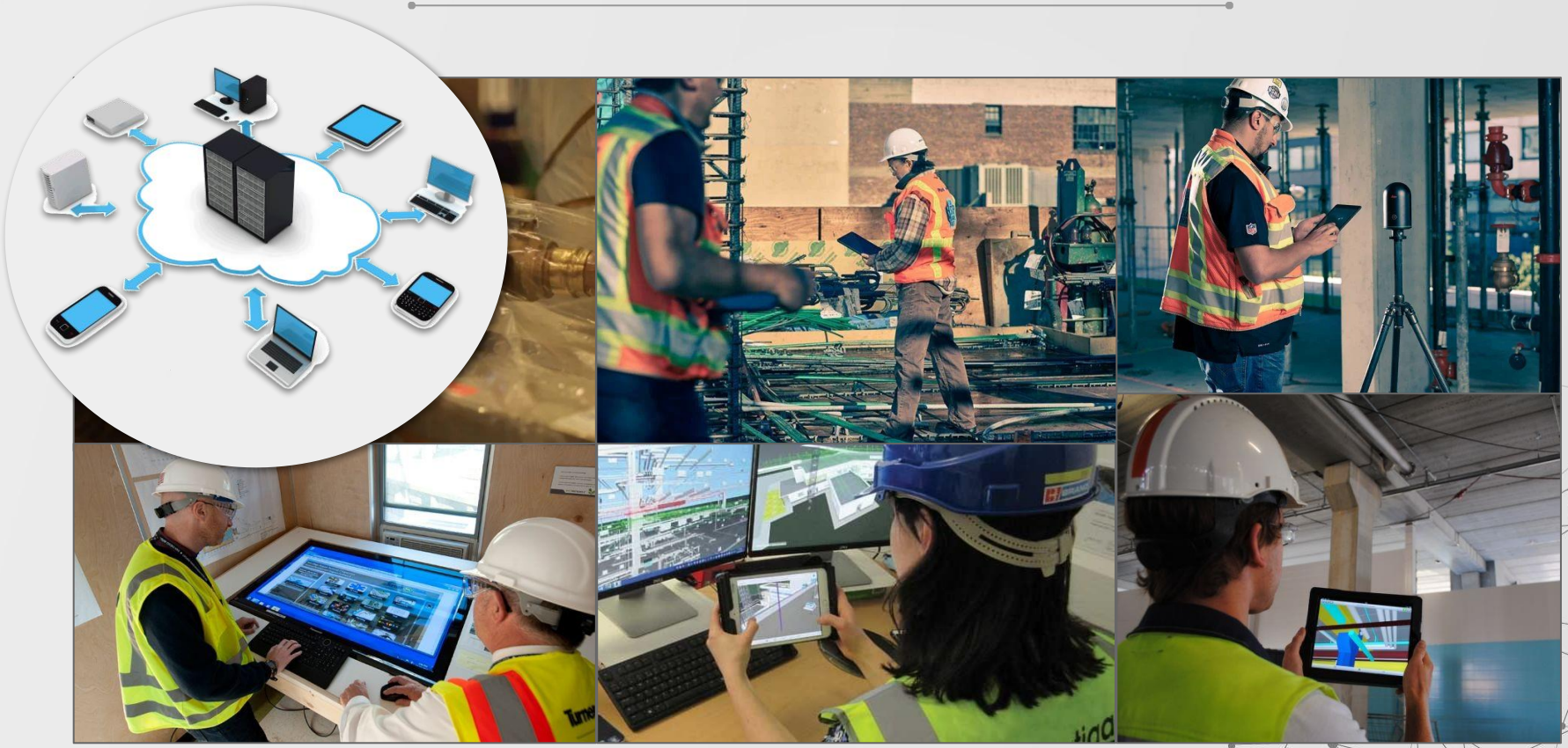
Remote Access to Project Data



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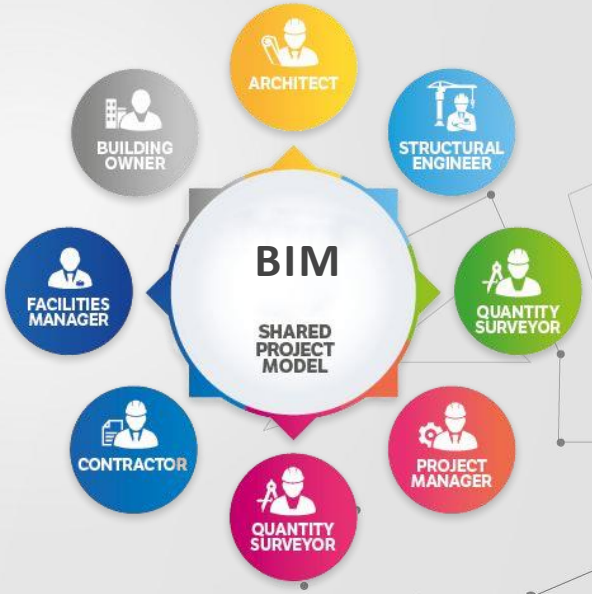
Communication and Knowledge Exchange

2D Data Exchange

BIM Interoperability



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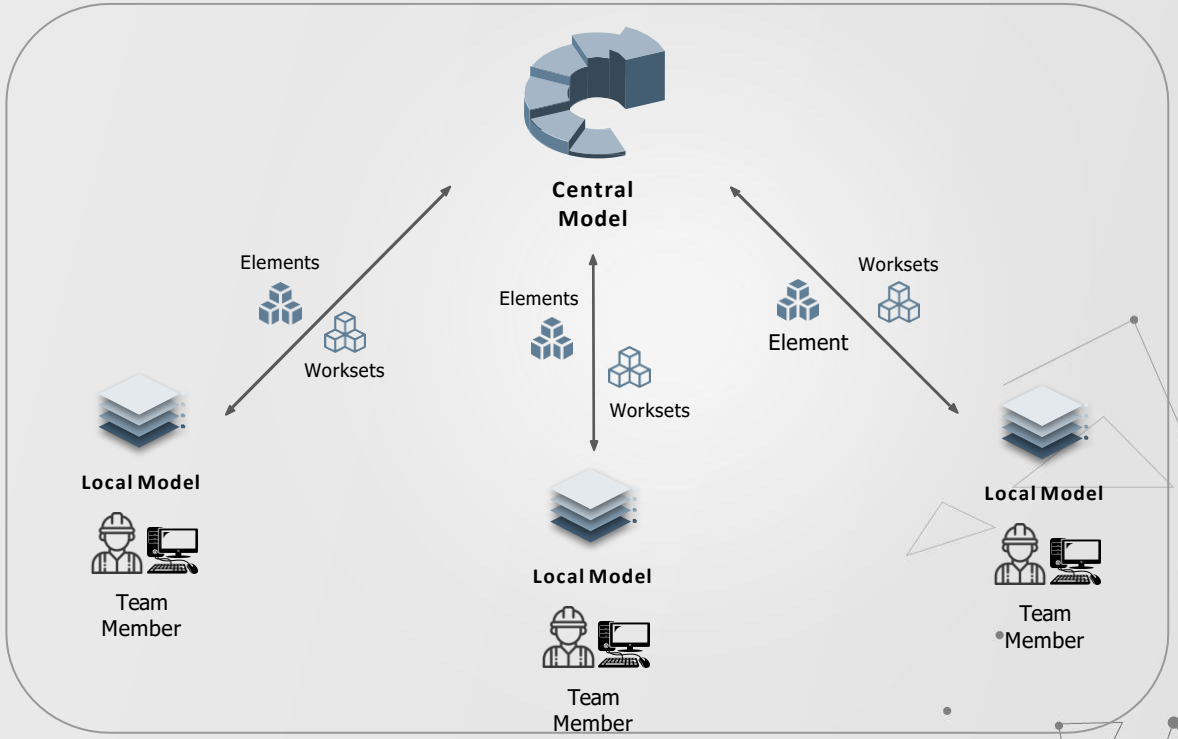
Team Collaboration.

Working Sharing among Team.



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Interoperability “Integration”

BIM process provides the ability of two separate systems or software programs to communicate and exchange data with each other.

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Building Simulation

With a VIRTUAL MODEL you can run scenarios.

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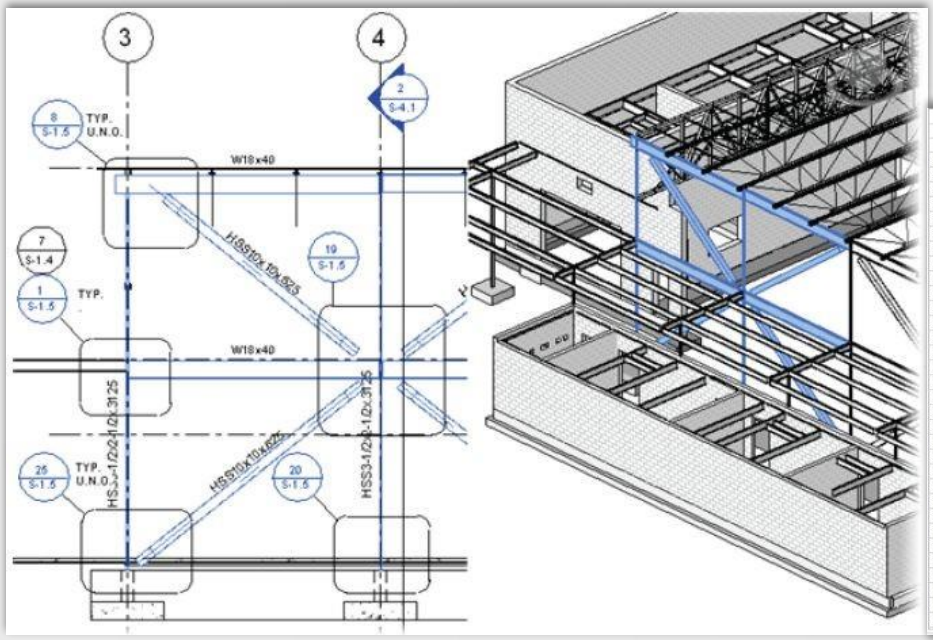
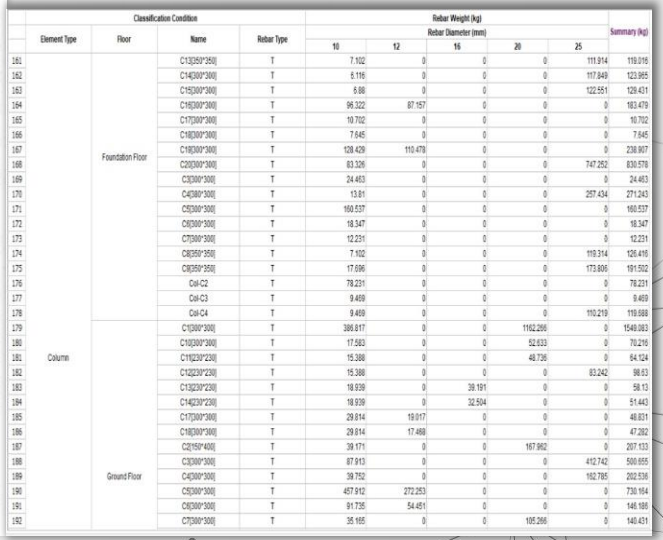
Bidirectional Associativity.

Since data is stored in a central place in a BIM model, any modification to the building design will be automatically replicated in each view, such as floor plans, sections, elevations and also the schedules.
This not only helps in creating the documentation faster, but also provides automatic coordination of different views.





	Classification Condition				Rebar Weight (kg)					
					Rebar Diameter (mm)					Summary (kg)
	Element Type	Floor	Name	Rebar Type	10	12	16	20	25	
161			C13[350*350]	T	7.102	0	0	0	111.914	119.016
162			C14[300*300]	T	6.116	0	0	0	117.849	123.965
163			C15[300*300]	T	6.88	0	0	0	122.551	129.431
164			C16[300*300]	T	96.322	87.157	0	0	0	183.479
165			C17[300*300]	T	10.702	0	0	0	0	10.702
166			C18[300*300]	T	7.645	0	0	0	0	7.645
167		Foundation Floor	C19[300*300]	T	128.429	110.478	0	0	0	238.907
168			C20[300*300]	T	83.326	0	0	0	747.252	830.578
169			C3[300*300]	T	24.463	0	0	0	0	24.463
170			C4[380*300]	T	13.81	0	0	0	257.434	271.243
171			C5[300*300]	T	160.537	0	0	0	0	160.537
172			C6[300*300]	T	18.347	0	0	0	0	18.347
173			C7[300*300]	T	12.231	0	0	0	0	12.231
174			C8[350*350]	T	7.102	0	0	0	119.314	126.416
175			C9[350*350]	T	17.696	0	0	0	173.806	191.502
176			Col-C2	T	78.231	0	0	0	0	78.231
177			Col-C3	T	9.469	0	0	0	0	9.469
178			Col-C4	T	9.469	0	0	0	110.219	119.688
179			C1[300*300]	T	386.817	0	0	1162.266	0	1549.083
180			C10[300*300]	T	17.583	0	0	52.633	0	70.216
181	Column		C11[230*230]	T	15.388	0	0	48.736	0	64.124
182			C12[230*230]	T	15.388	0	0	0	83.242	98.63
183			C13[230*230]	T	18.939	0	39.191	0	0	58.13
184			C14[230*230]	T	18.939	0	32.504	0	0	51.443
185			C17[300*300]	T	29.814	19.017	0	0	0	48.831
186			C18[300*300]	T	29.814	17.488	0	0	0	47.282
187			C2[150*400]	T	39.171	0	0	167.962	0	207.133
188			C3[300*300]	T	87.913	0	0	0	412.742	500.655
189		Ground Floor	C4[300*300]	T	39.752	0	0	0	162.785	202.536
190			C5[300*300]	T	457.912	272.253	0	0	0	730.164
191			C6[300*300]	T	91.735	54.451	0	0	0	146.186
192			C7[300*300]	T	35.165	0	0	105.266	0	140.431

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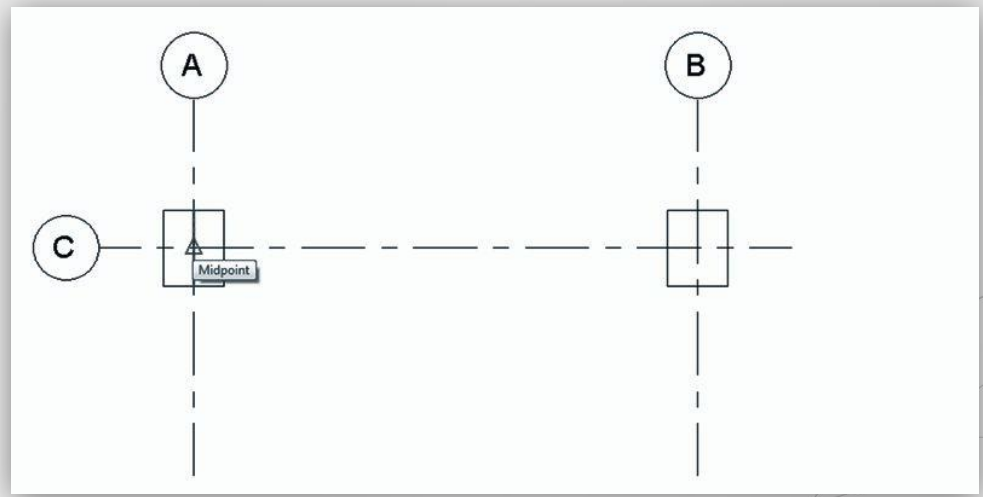
Parametric Relationships.



Detailed Drawings and Sections

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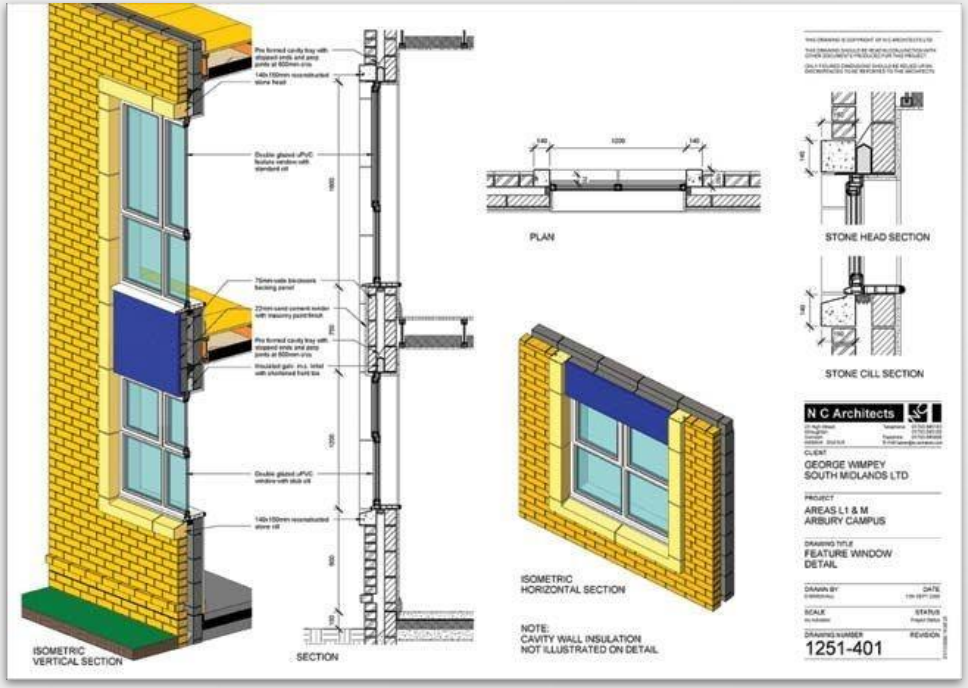
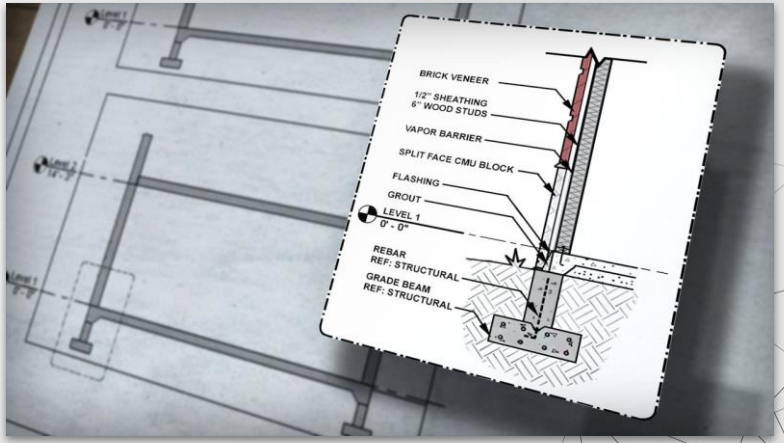
BIM based software's takes no time to produce a section from the plan view.





Material Quantity Take-off

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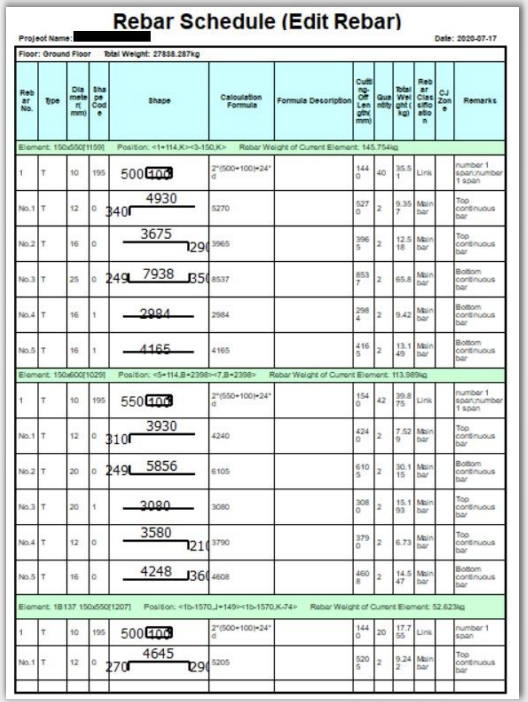
Material quantity take-off schedules are automatically extracted from the model and can be exported to excel spreadsheets.



Rebar Schedule (Edit Rebar)

Project Name: [redacted] Date: 2020-07-17

Floor: Ground Floor Total Weight: 27838.287kg

Rebar No.	Type	Diameter(mm)	Shape Code	Shape	Calculation Formula	Formula Description	Cutting Off Length(mm)	Quantity	Total Weight(kg)	Rebar Classification	CJ Zone	Remarks
Element: 150x550[1159] Position: <1+114,K><3-150,K> Rebar Weight of Current Element: 145.754kg												
1	T	10	195	500 400	2*(500+100)+24*d		1440	40	35.51	Link		number 1 span,number 1 span
No.1	T	12	0	340 4930	5270		5270	2	9.357	Main bar		Top continuous bar
No.2	T	16	0	3675 290	3965		3965	2	12.518	Main bar		Top continuous bar
No.3	T	25	0	249 7938 350	8537		8537	2	65.8	Main bar		Bottom continuous bar
No.4	T	16	1	2984	2984		2984	2	9.42	Main bar		Bottom continuous bar
No.5	T	16	1	4165	4165		4165	2	13.149	Main bar		Bottom continuous bar
Element: 150x600[1029] Position: <5+114,B+2398><7,B+2398> Rebar Weight of Current Element: 113.989kg												
1	T	10	195	550 400	2*(550+100)+24*d		1540	42	39.875	Link		number 1 span,number 1 span
No.1	T	12	0	310 3930	4240		4240	2	7.529	Main bar		Top continuous bar
No.2	T	20	0	249 5856	6105		6105	2	30.115	Main bar		Bottom continuous bar
No.3	T	20	1	3080	3080		3080	2	15.193	Main bar		Top continuous bar
No.4	T	12	0	3580 210	3790		3790	2	6.73	Main bar		Top continuous bar
No.5	T	16	0	4248 360	4608		4608	2	14.547	Main bar		Bottom continuous bar
Element: 1B137 150x550[1207] Position: <1b-1570,J+149><1b-1570,K-74> Rebar Weight of Current Element: 52.623kg												
1	T	10	195	500 400	2*(500+100)+24*d		1440	20	17.755	Link		number 1 span
No.1	T	12	0	270 4645 290	5205		5205	2	9.242	Main bar		Top continuous bar

Classification Condition					Quantity			
Floor	Concrete Grade	Entity Type	Name	Section Shape	Volume(m3)	Area of formwork(m2)	Number(pc)	Girth(m)
Foundation Floor	C25	Vertical	C5	Round	0.070	0.754	1	0.942
			C8	Round	0.071	0.801	1	0.942
			C1	Rectangular	0.090	0.693	1	1.300
			C10	Rectangular	0.023	0.325	1	1.300
			C11	Rectangular	0.023	0.325	1	1.300
			C12	Rectangular	0.024	0.400	1	1.000
			C13	Rectangular	0.024	0.400	1	1.000
			C14	L-a	0.086	1.198	1	1.800
			C15	Rectangular	0.050	0.715	1	1.300
			C17	Rectangular	0.030	0.430	1	1.300
			C18	Rectangular	0.044	0.600	1	1.500
			C19	Rectangular	0.049	0.780	1	1.500
			C2	Rectangular	0.067	0.908	1	1.500
			C20	Rectangular	0.044	0.655	1	1.300
			C21	Rectangular	0.052	0.798	1	1.300
			C22	Rectangular	0.044	0.600	1	1.500
			C23	Rectangular	0.044	0.705	1	1.300
			C24	Rectangular	0.036	0.615	1	1.000
			C25	Rectangular	0.060	0.894	1	1.300
			C26	Rectangular	0.036	0.520	1	1.300
			C27	Rectangular	0.041	0.550	1	1.500
			C28	Rectangular	0.120	1.776	1	2.400
			C3	Rectangular	0.056	0.910	1	1.300
			C31	Rectangular	0.289	3.638	1	4.500
			C4	Rectangular	0.036	0.520	1	1.300
			C6	Rectangular	0.053	0.951	1	1.300
			C7	Rectangular	0.073	1.185	1	1.500
			C9	Rectangular	0.028	0.375	1	1.500

Coordinated Drawings

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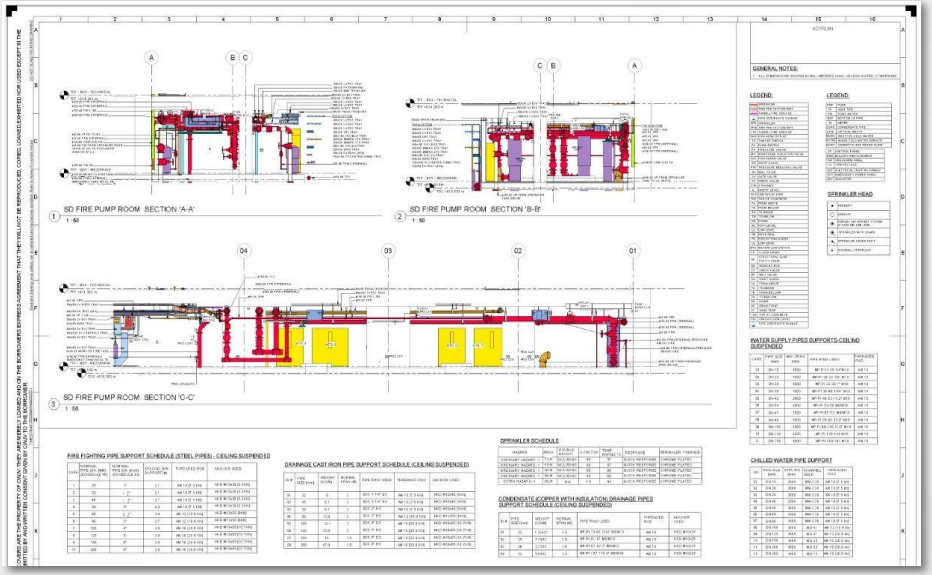
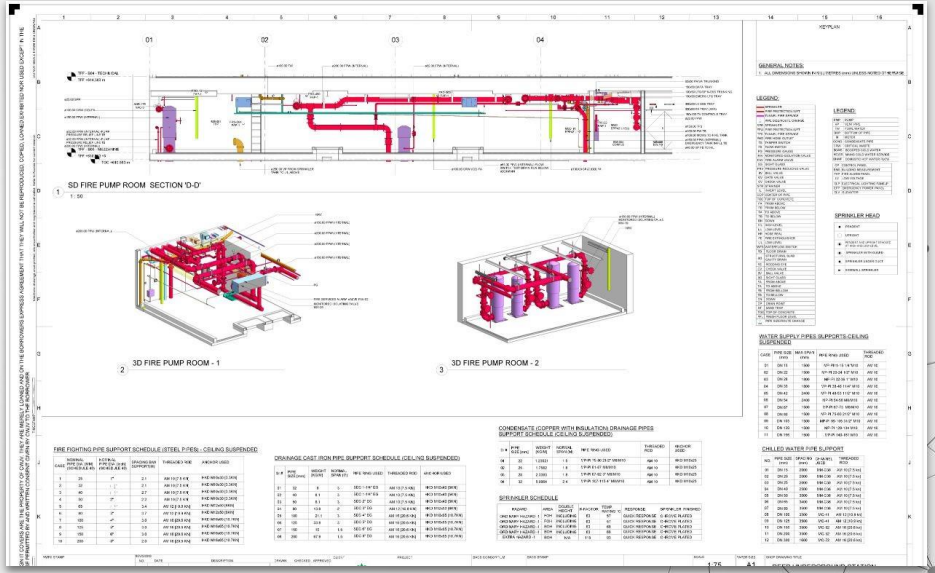
Facilitates the generation of 2D drawings of any part with any level of detail required.





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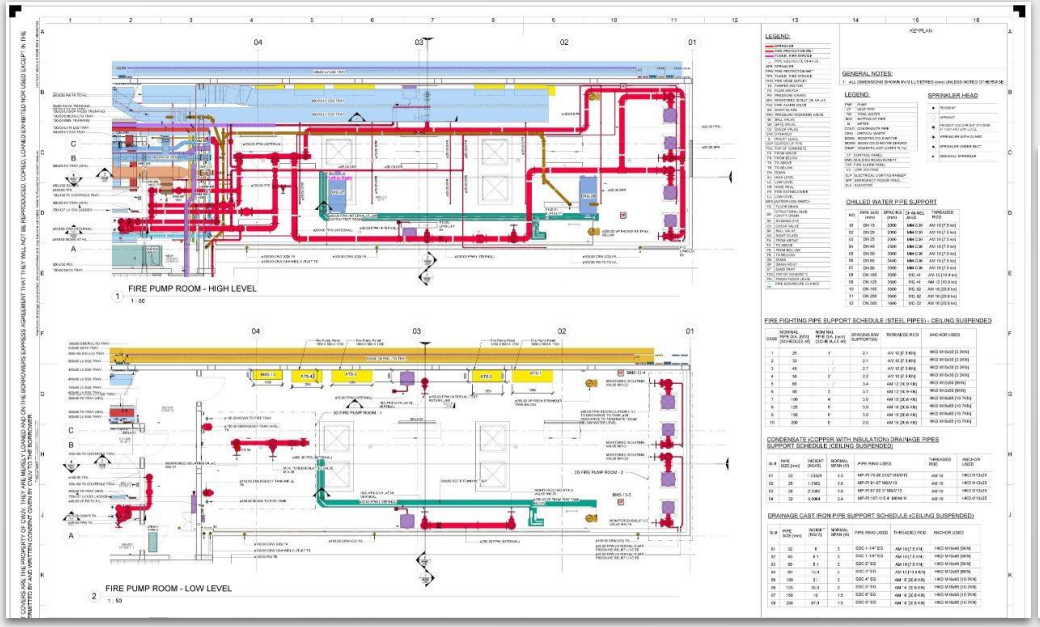
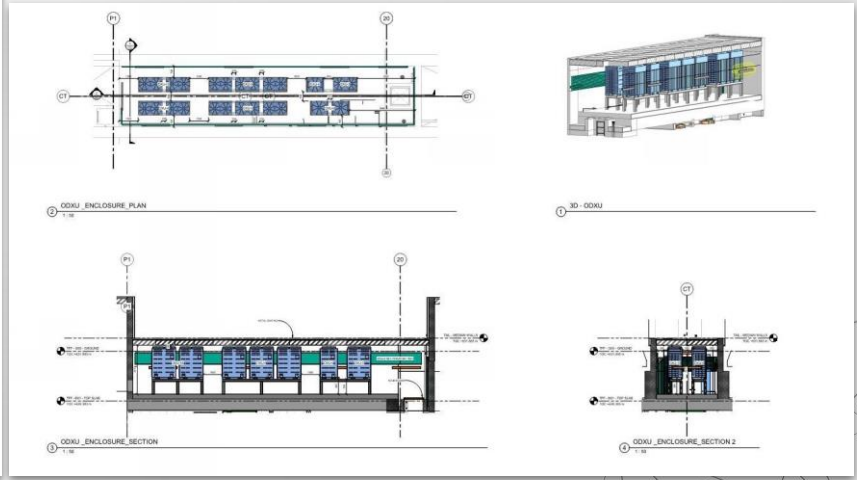
Coordinated Drawings





Coordinated Drawings

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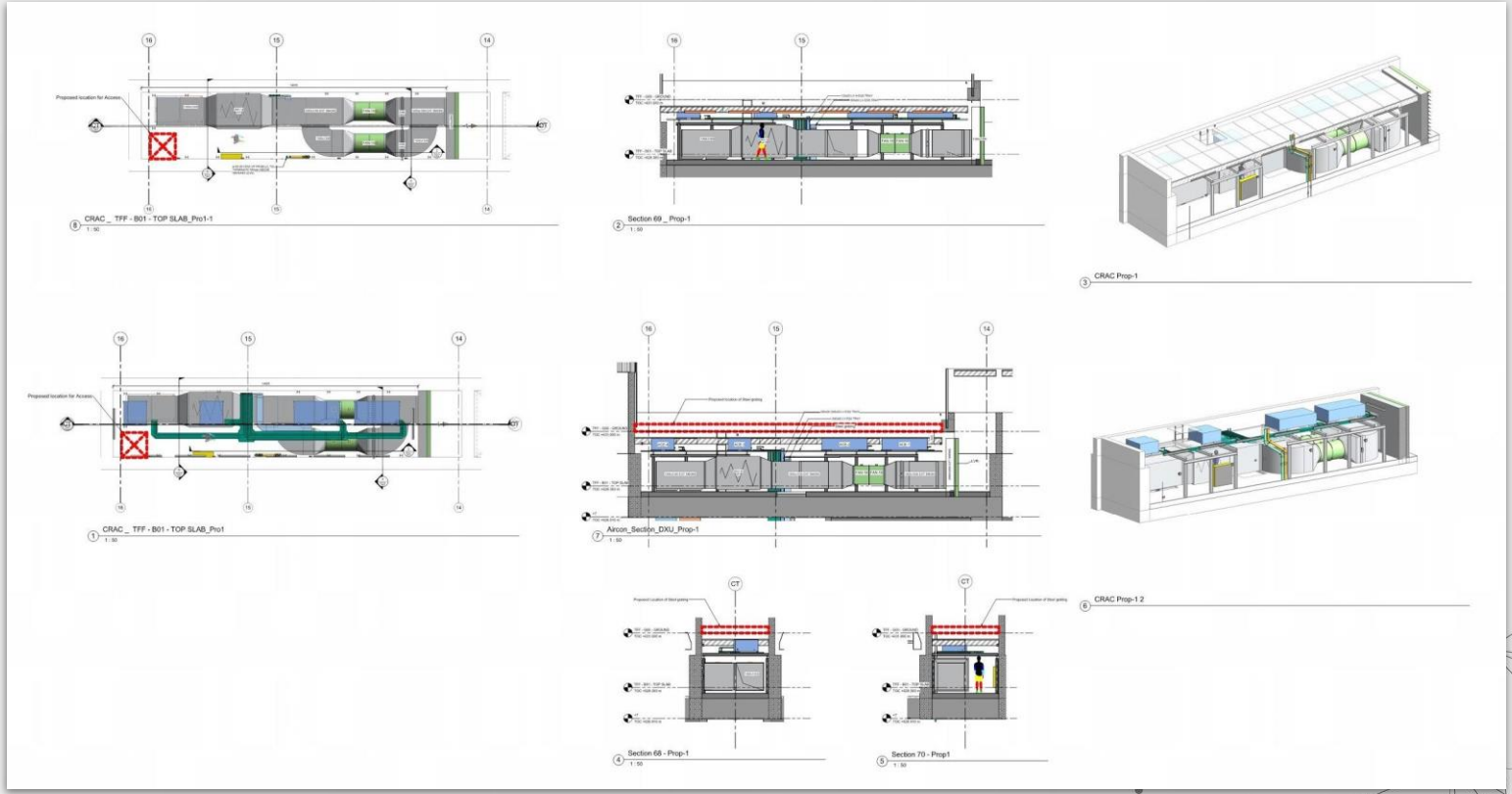

Chapter-02

04

BIM Maturity

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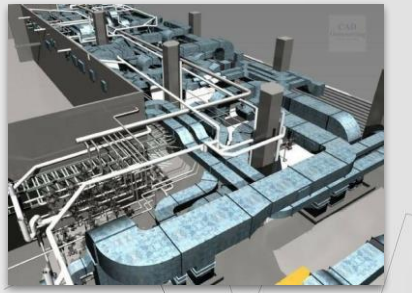
Evolution of Design Process

Hand Drafting

Computer Aided Drafting (CAD)



Building Information Modeling

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BIM Maturity

We have always had Building Information Modelled in some way or other.

The output from design teams have changed over the years from hand drawn plans and details to the use of computer aided design (CAD). CAD looked to replace drawing boards and improved drawing production.

CAD has more recently developed into 3D modelling design tools, improving the information output and also improving the ability to communicate, graphically the design to project stakeholder.

A Building Information Model is made up of **both graphical and non-graphical data.**
Objects contained in a model – a door being an object, a window, a ceiling and column etc. – can contain non graphical data such as specifications, dimensions and operational information. This graphical and non-graphical data can then be utilised by different project stakeholders.

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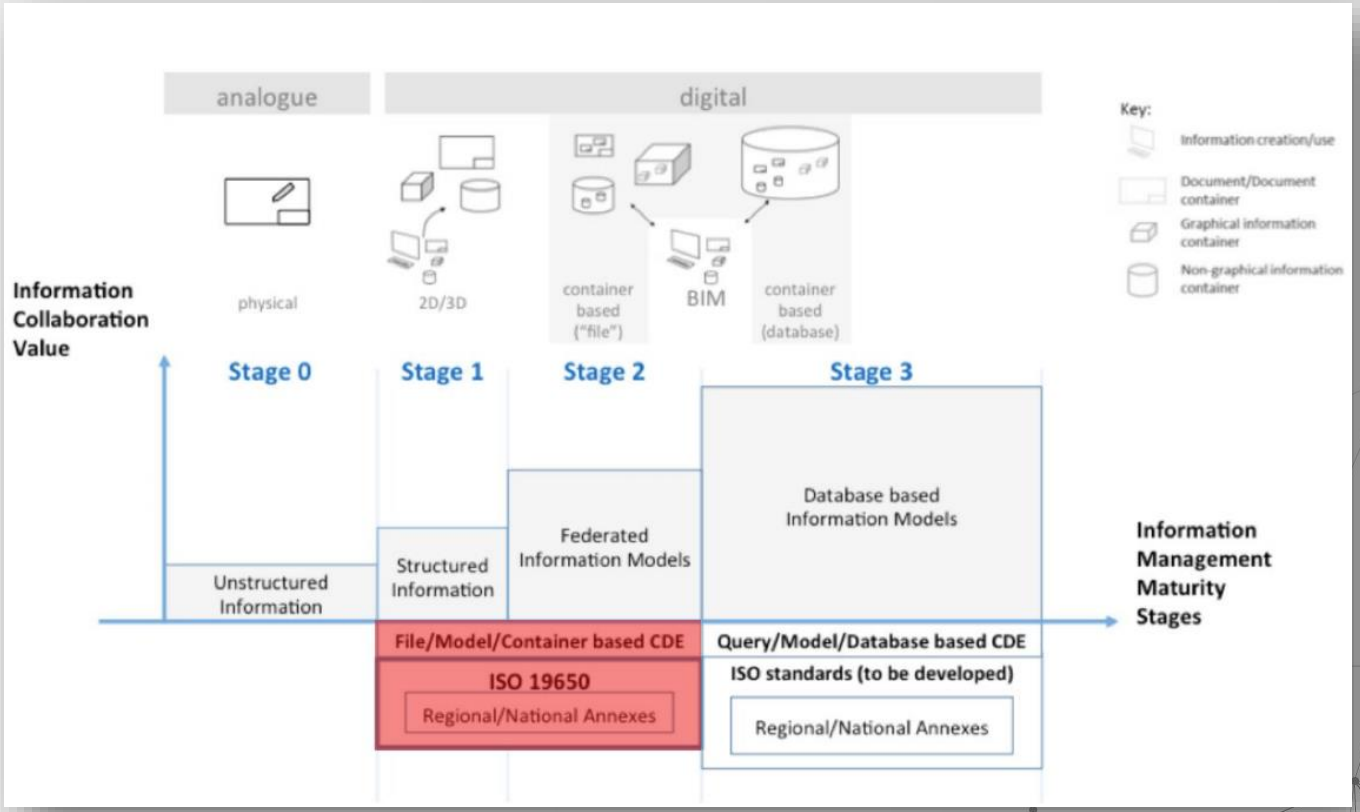
BIM Maturity



05

BIM Dimensions

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BIM Dimensions

BIM is more than a 3D visualisation

2D — **Documentation:**
Construction plans, any kind of drawings and graphic representations

3D — **BIM Three-dimensional Model**
Visualization of the project
Interdisciplinary coordination
Quantities take off
Workshop drawings

4D — **Planning**
Construction simulation
Logistics of the execution
Simulation of production processes

5D — **Costs control**
Estimating expenses / cash flow
Materials flow
Operating Costs

6D — **Sustainability**
Energy analysis
Climate impact assessment
LEED and RESET monitoring

7D — **Operation management**
As-Built BIM Model
Operation strategy
And maintenance
Repair or demolition plan

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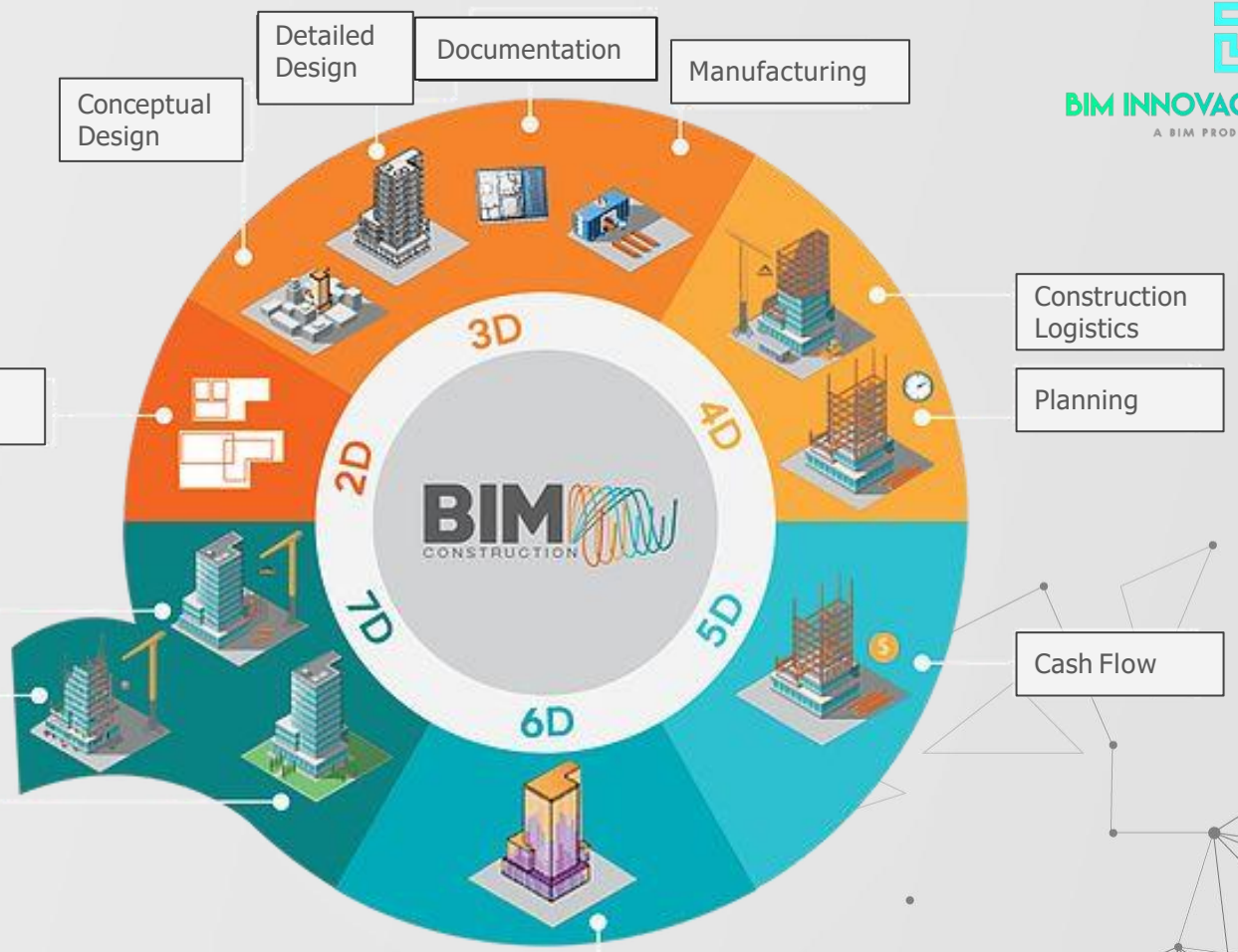

06

BIM Standards

BIM Standards

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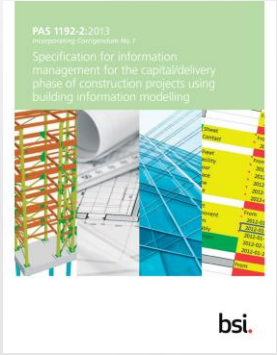
ISO 19650 (in Series from 1 to 5)

- Published British Standard in International Organization for Standardization (ISO)
- Defining the standards of information management including principles, delivery (construction) phase, operational phase, as well as information exchanging and security of information

PAS 1192 (in Series from 1 to 6)

- The former version of ISO 19650, commonly recognize as superseded document
- Consist of various fundamental principles on how information management work flow is established.
- Also include the indication of various Level of Information



BIM Standards

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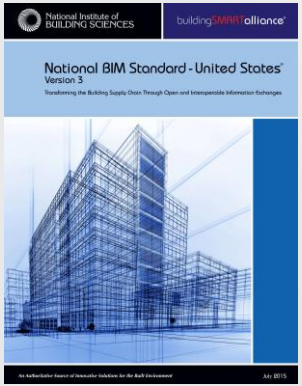
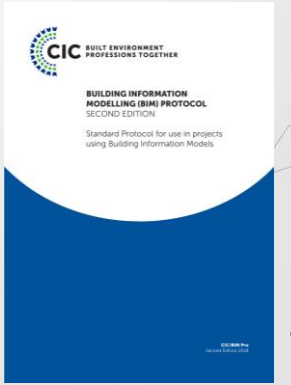
NBIMS-US V3

- United State National BIM Standards Version 3, an United State national standard
- Addressed various information management concerns including the referencing standards, Omni Class, Information Exchange Standards, as well as practical document samples



CIC BIM Protocol

- One of the British Guideline established by UK Construction Industry Council
- It defines various terminologies in use within BIM practices
- It also shown certain documentary samples to enable a smooth implementation of BIM by project team



BIM Standards

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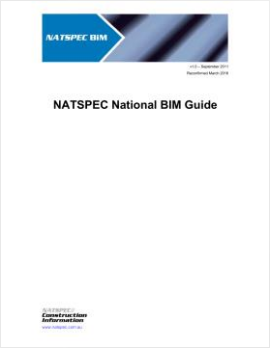
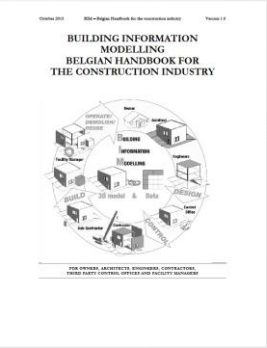
NATSPEC National BIM Guide

- An Australian national BIM guide
- Mainly driven by the definition of BIM workflow
- Indicating various terminology and technology in-use
- Presented as a role model on how BIM information exchange

Belgium BIM Handbook

- Handbook for Belgium construction industry on BIM adoption
- Contents are mainly conceptual and principles definition of BIM
- Determining various BIM uses in construction industry
- Defining contents required to be exchanged during various phases of construction





BIM Standards

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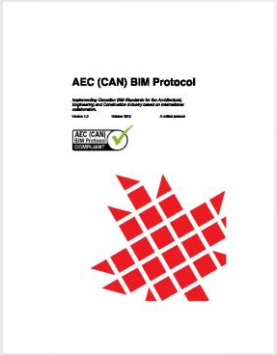
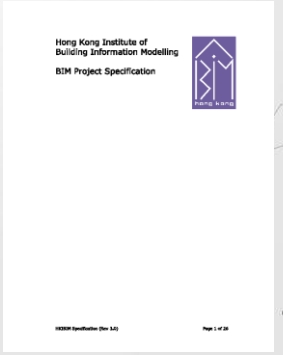
AEC (CAN) BIM Protocol

- A Canada national BIM Protocol
- Defining detail operations of BIM implementation
- Addressed various BIM information exchange concerns
- Detailed expression on file naming convention and detail drawing requirements



HKI BIM Project Specification

- BIM project specification by Hong Kong Institute of BIM
- Indicating various examples of BIM projects processes
- Detailed exploration on various BIM process concerns
- Determined hardware and software specifications
- Specifically determine Level of Developments



BIM Standards

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Malaysia BIM Guide

- A Malaysia national BIM guide
- Mainly defining conceptual and principles of BIM application
- Separated into 4 modules
- Fundamentally indicating various BIM conceptual & principles
- 4th Module is an example of BEP

Public Work Department BIM Guide

- A Malaysian government body internal BIM guide
- Indicating various BIM Uses
- Expressed different BIM processes
- Detail elaboration of each BIM Roles and responsibilities

BIM Standards

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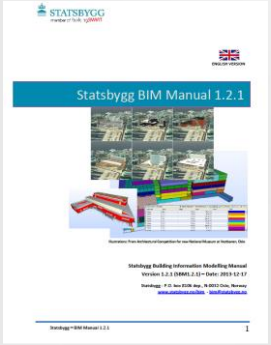
Statsbygg BIM Manual

- National BIM Manual for Norway
- Mainly modelling driven
- Indicating various BIM Uses as in various modelling techniques



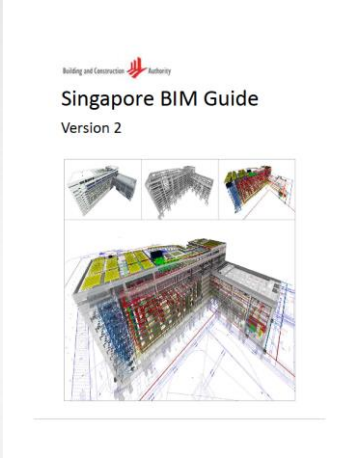
New Zealand BIM Handbook

- A New Zealand national BIM guide
- Mainly defining conceptual and principles of BIM application
- Consist a subsection indicating BIM process flow
- Expressed along the ultimate use of information, operational asset management

BIM Standards

Singapore BIM Guide

- A Singapore national BIM guide
- Indicated various modelling guide for the aid of collaborations
- Determined various deliverables for easier project application
- Explanation for BIM workflows



07

Level Of Development (LOD)

Level OfDevelopment

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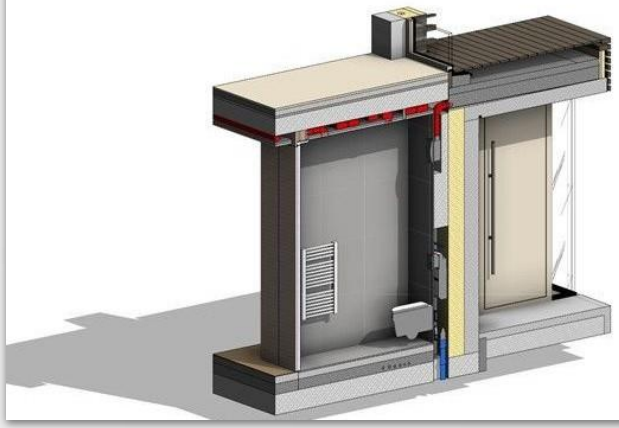
LOD

Level of Developement

LoD — Level of Detail

LOI — Level of Information



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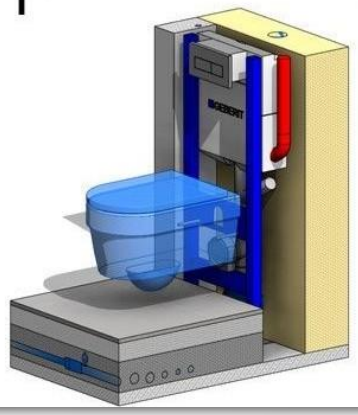

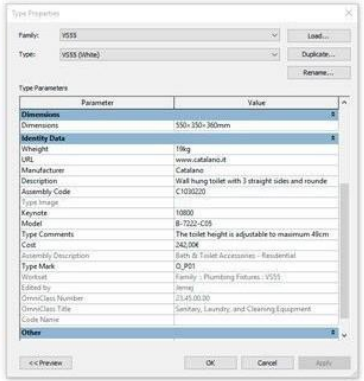

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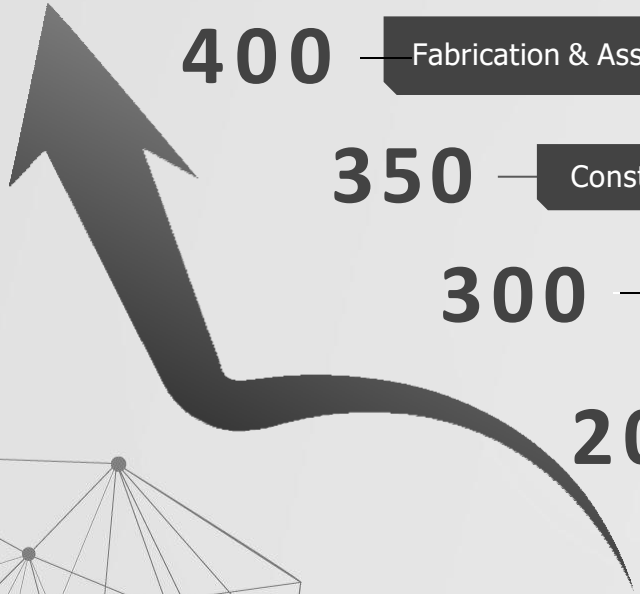
Level OfDeVELOPMENT



500 As-Built
Elements are modeled as constructed assemblies for Maintenance and operations. In addition to actual and accurate in size, shape, location, quantity, and orientation, non-geometric information is attached to modeled elements.

400 Fabrication & Assembly
Model elements are modeled as specific assemblies, with complete fabrication, assembly, and detailing information in addition to precise quantity, size, shape, location and orientation. Non- geometric information to the model elements can also be attached.

350 Construction Documentation
includes model detail and element that represent how building elements interface with various systems and other building elements with graphics and written definitions.

300 Detailed Design
Accurate modeling and shop drawings where elements are defined with specific assemblies, precise quantity, size, shape, location and orientation. Here too we can attach non- geometric information to the model elements.

200 Schematic Design
A general model where elements are modeled with approximate quantities, size, shape, location and orientation. We can also attach non- geometric information to the model elements.

100 Concept Design
A conceptual model where parameters like area, height, volume, location and orientation are defined.

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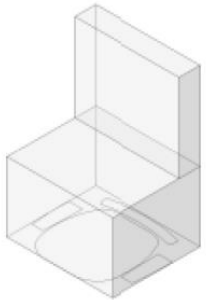
Level OfDetails

LOD 100	LOD 200	LOD 300	LOD 400	LOD 500
				
Concept (Presentation)	Design Development	Documentation	Construction	Facilities Management
DESCRIPTION: **Office Chair** Arms, Wheels WIDTH: DEPTH: HEIGHT: MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: **100**	DESCRIPTION: **Office Chair** Arms, Wheels WIDTH: **700** DEPTH: **450** HEIGHT: **1100** MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: **200**	DESCRIPTION: **Office Chair** **Arms, Wheels** WIDTH: **700** DEPTH: **450** HEIGHT: **1100** MANUFACTURER: Herman Miller, Inc. MODEL: Mirra LOD: **300**	DESCRIPTION: **Office Chair** **Arms, Wheels** WIDTH: **685** DEPTH: **430** HEIGHT: **1085** MANUFACTURER: **Herman Miller, Inc** MODEL: **Mirra** LOD: **400**	DESCRIPTION: **Office Chair** **Arms, Wheels** WIDTH: **685** DEPTH: **430** HEIGHT: **1085** MANUFACTURER: **Herman Miller, Inc** MODEL: **Mirra** PURCHASE DATE: **01/02/2013**

(Only data in **red** is useable)

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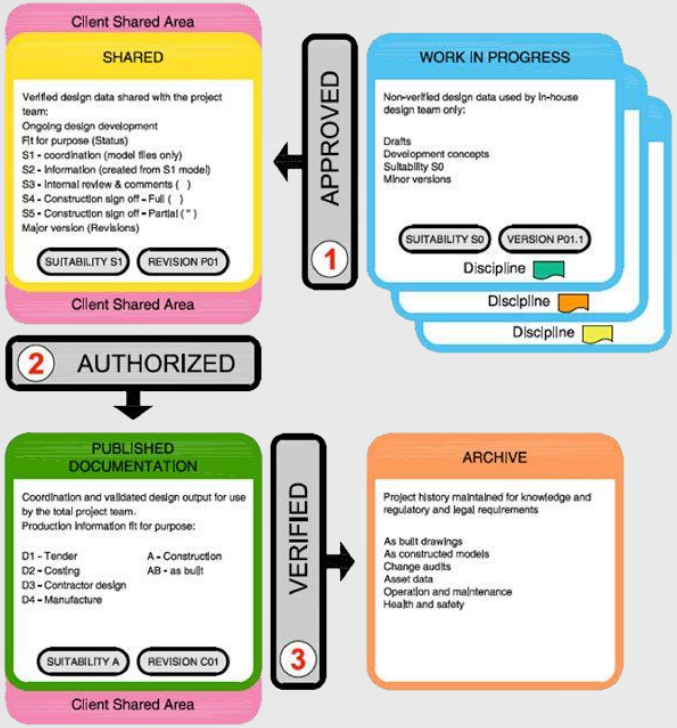
08

Common Data Environment (CDE)

Common Data Environment(CDE)

- The CDE is a means of providing a collaborative environment for sharing work and can be implemented in a number of ways. For the development of various forms of collaboration within organizations and across project teams



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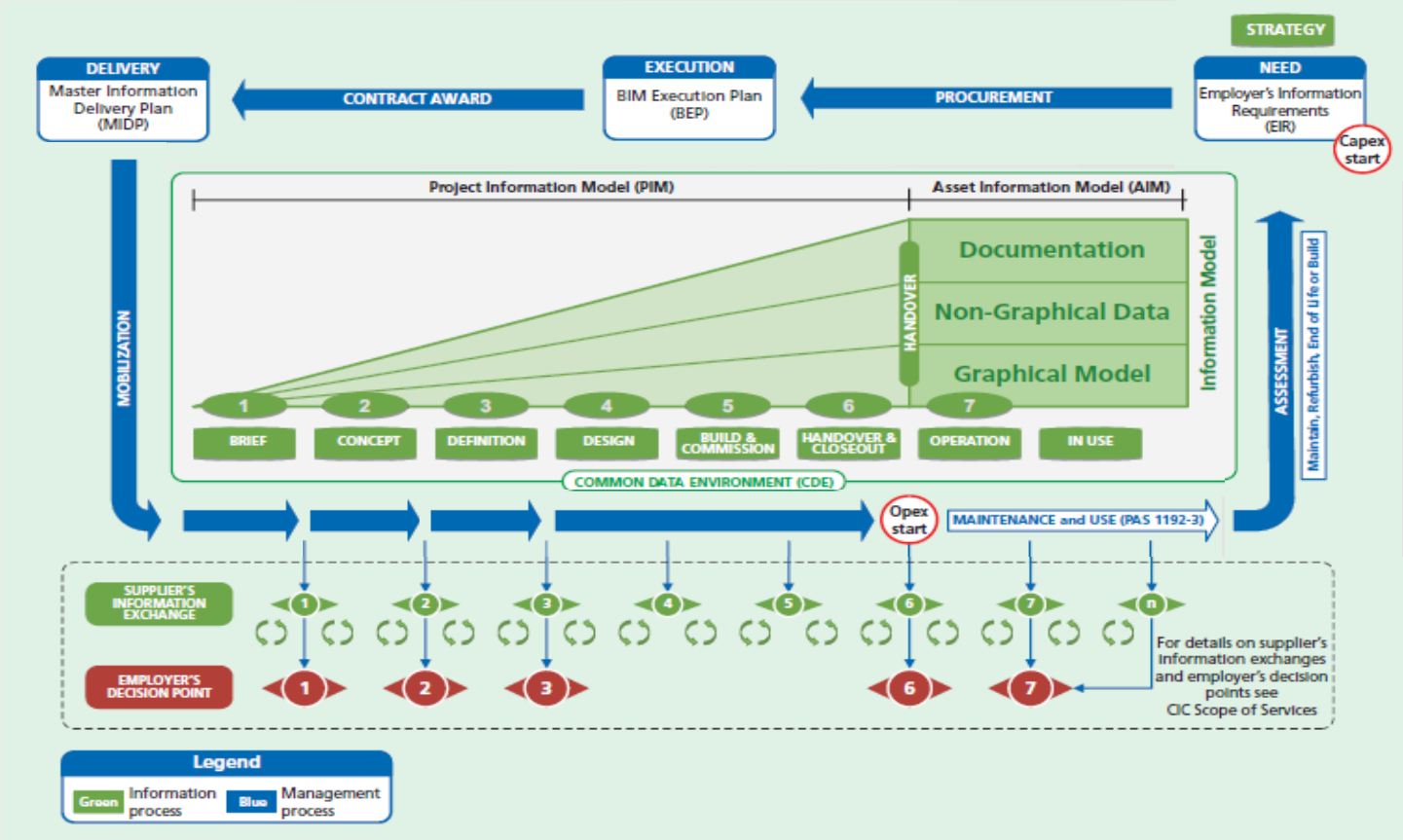
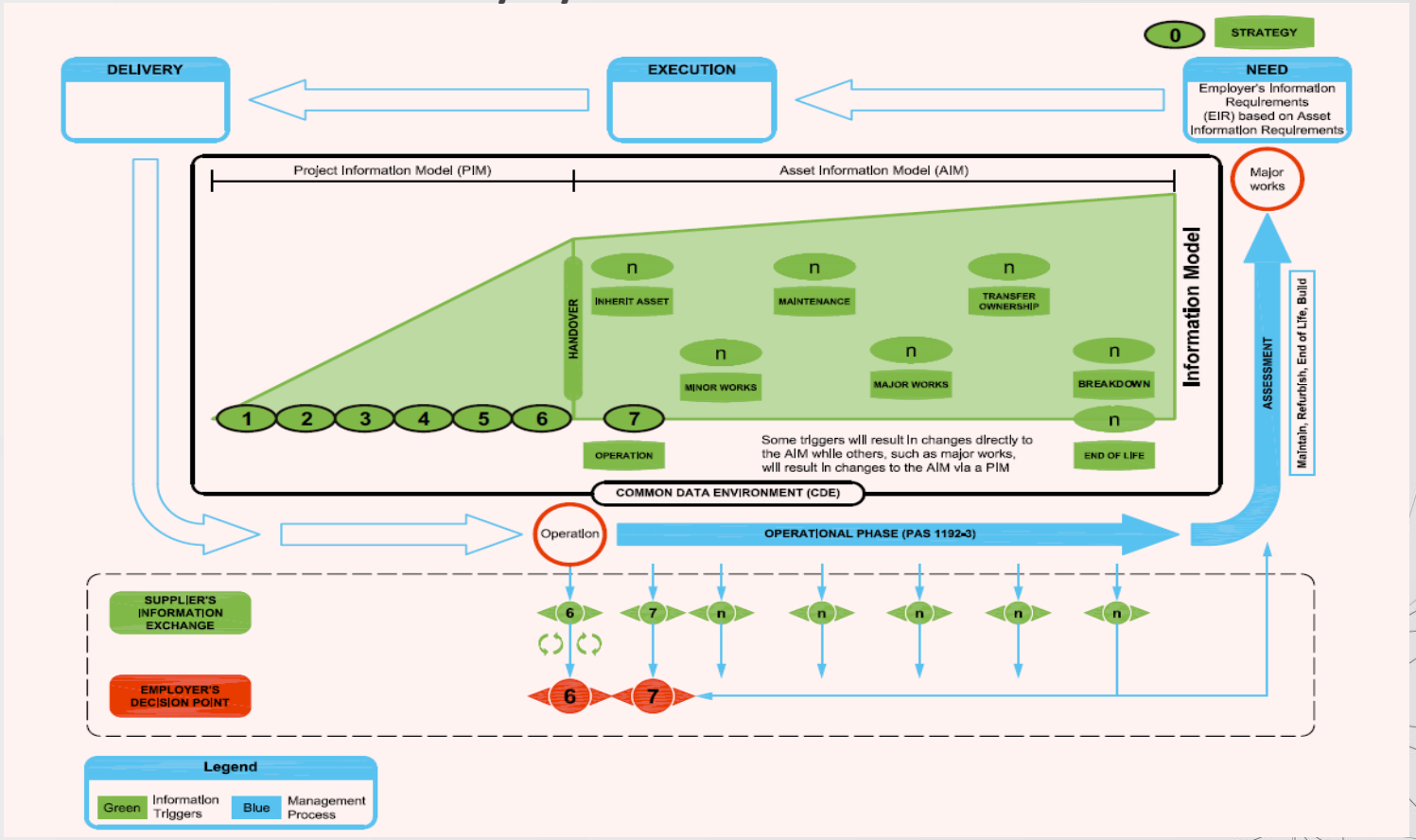
09

BIM Information/Documents Management.

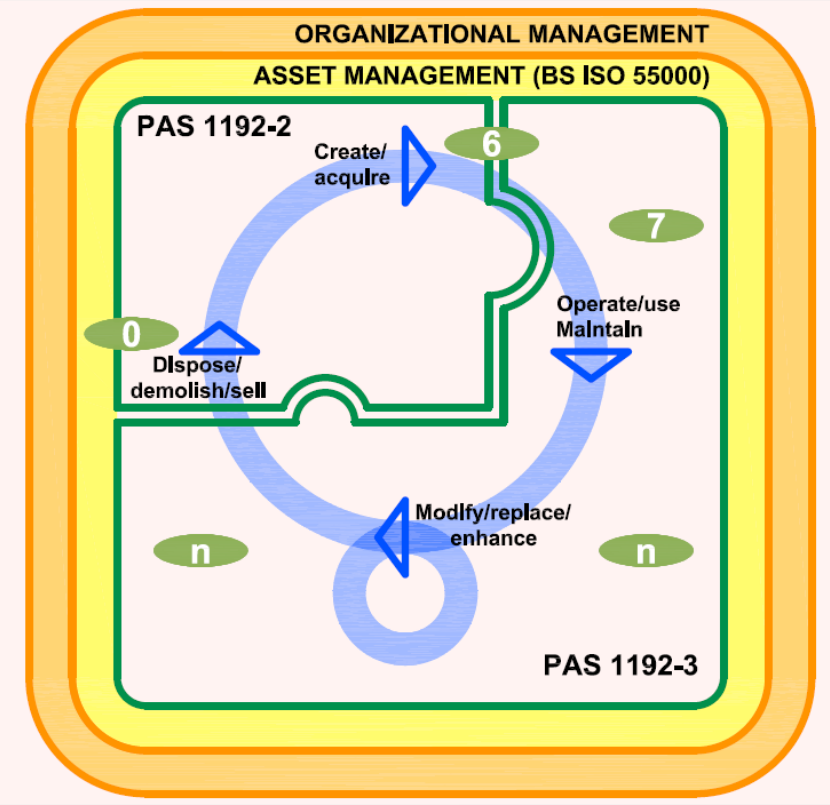
Information Delivery Cycle –PASS 1192-2



Information Delivery Cycle –PASS 1192-3



Relation Between PASS 1192-2 & 3



THANKS!

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