CONSTRUCTION INDUSTRY COUNCIL
建 造 業 議 會

BIM – Management Training

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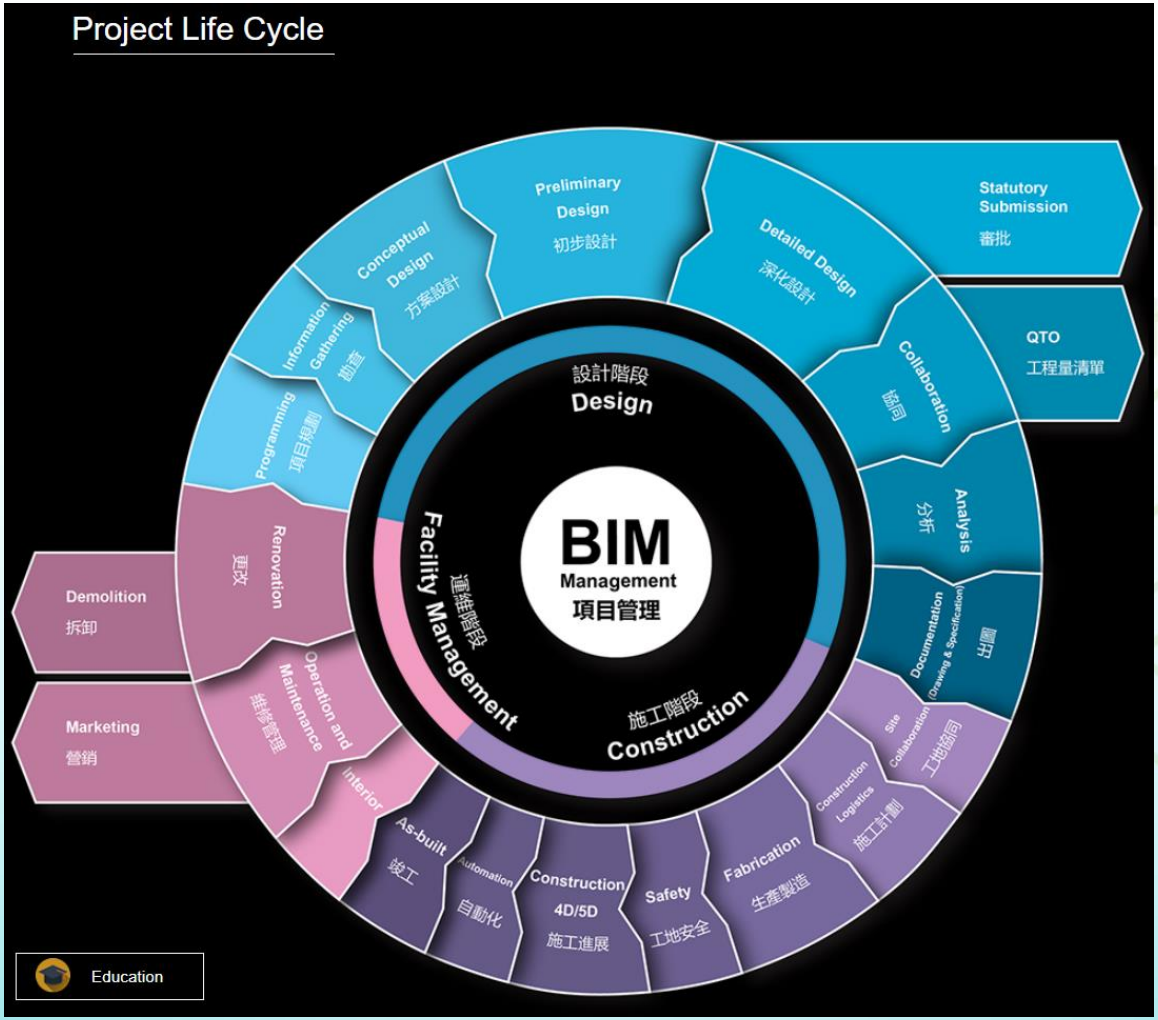
May 2018

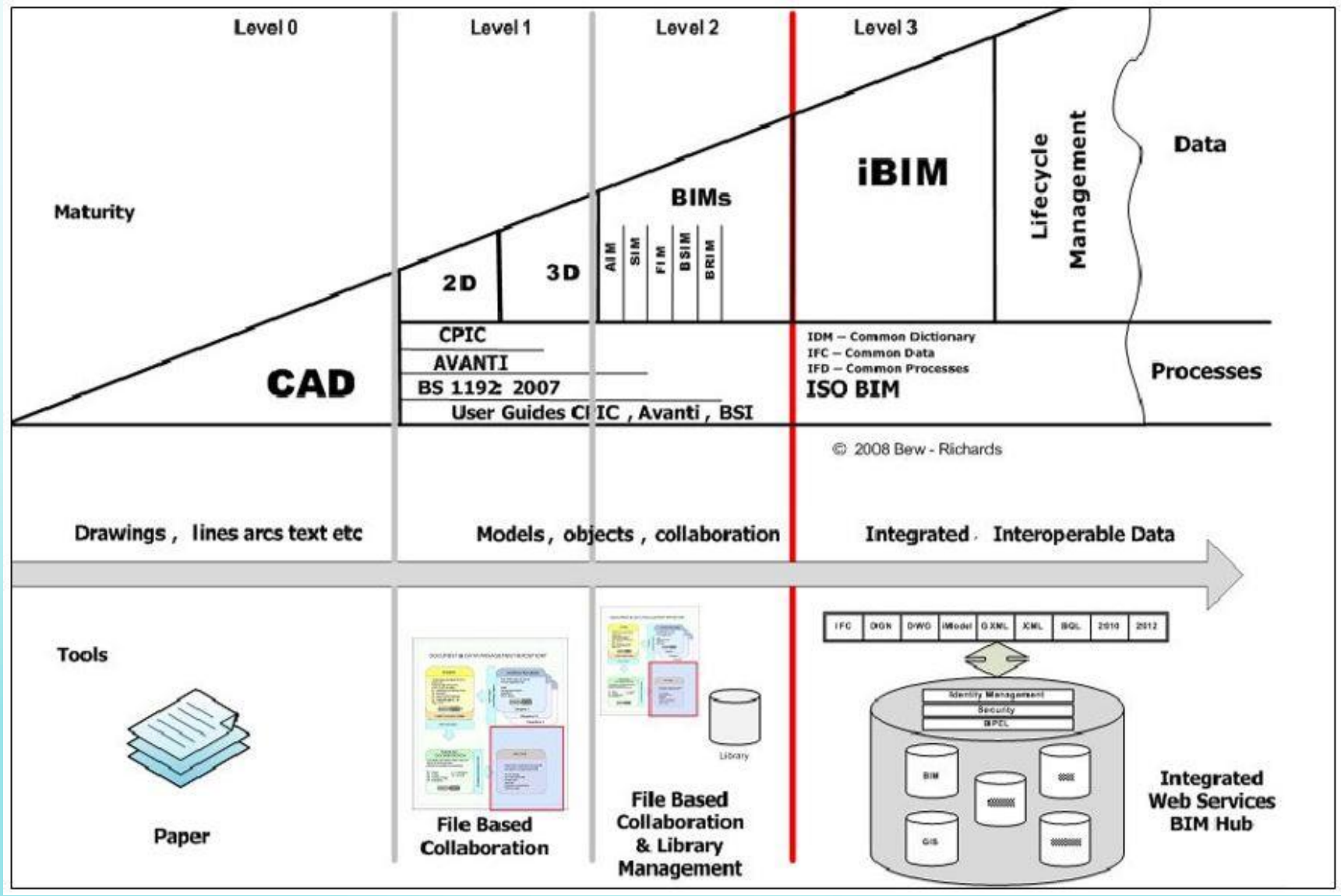
A. Introduction

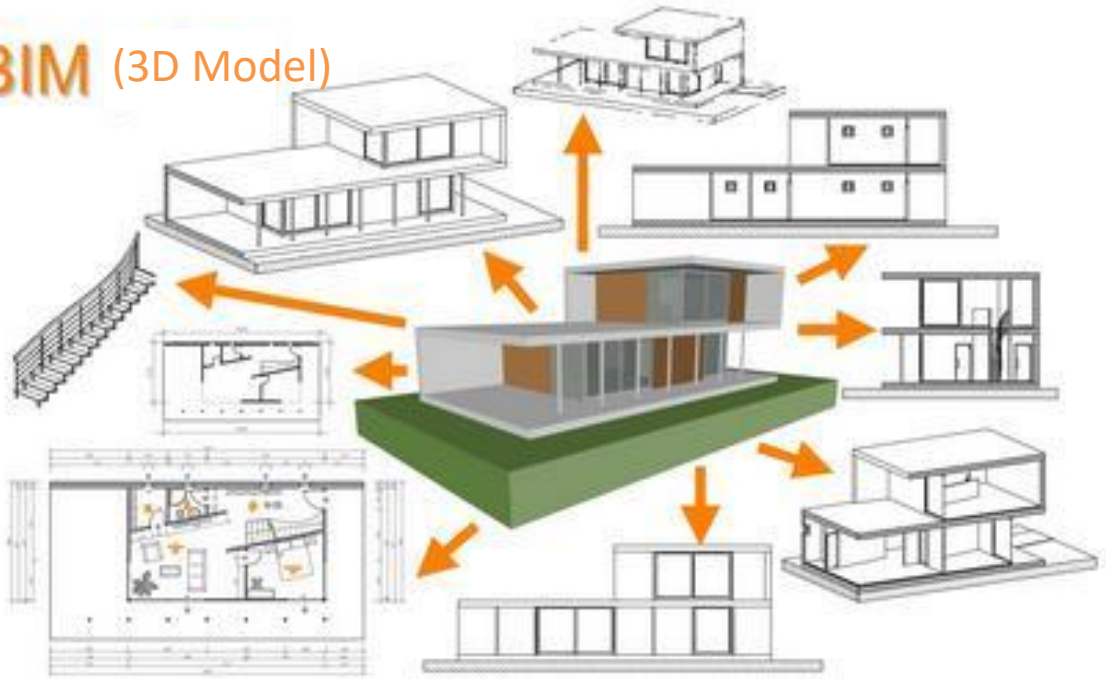
1. Correct Concept of BIM

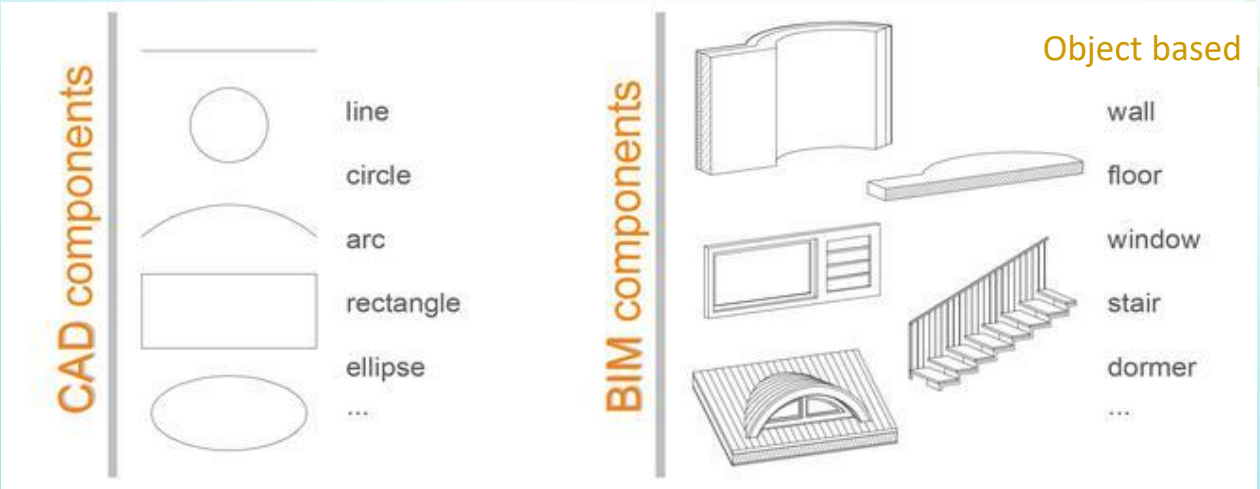


An Information Flow throughout Project Life Cycle

BIM Maturity







Parametric geometry
+ Attributes

http://www.cadtobim.com/what-is-bim.html

BIM Software Overview Experience

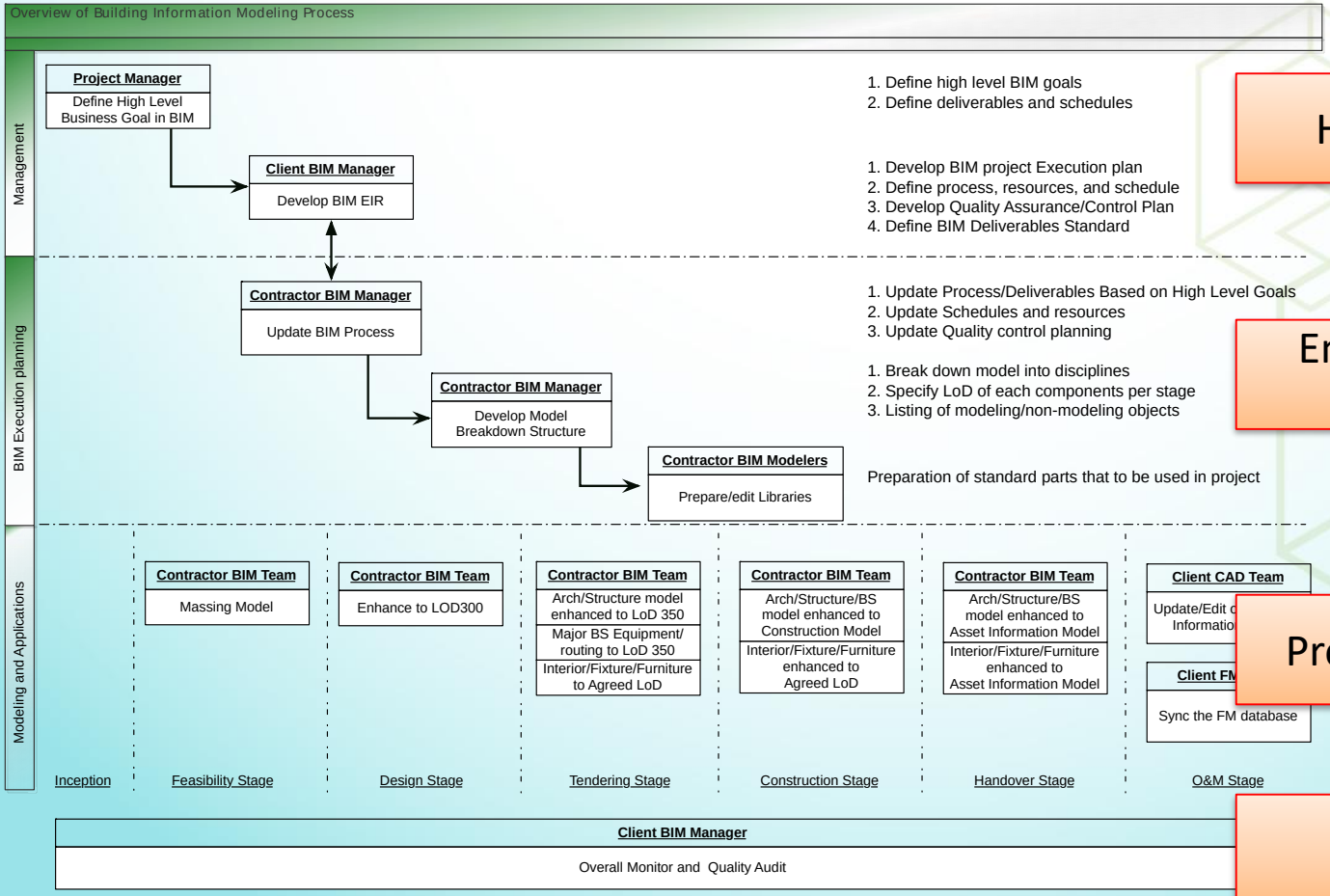
Autodesk Revit

AUTOCAD
CIVIL 3D

Aecosim Building Designer

Graphisoft ArchiCAD

BIM Execution Process



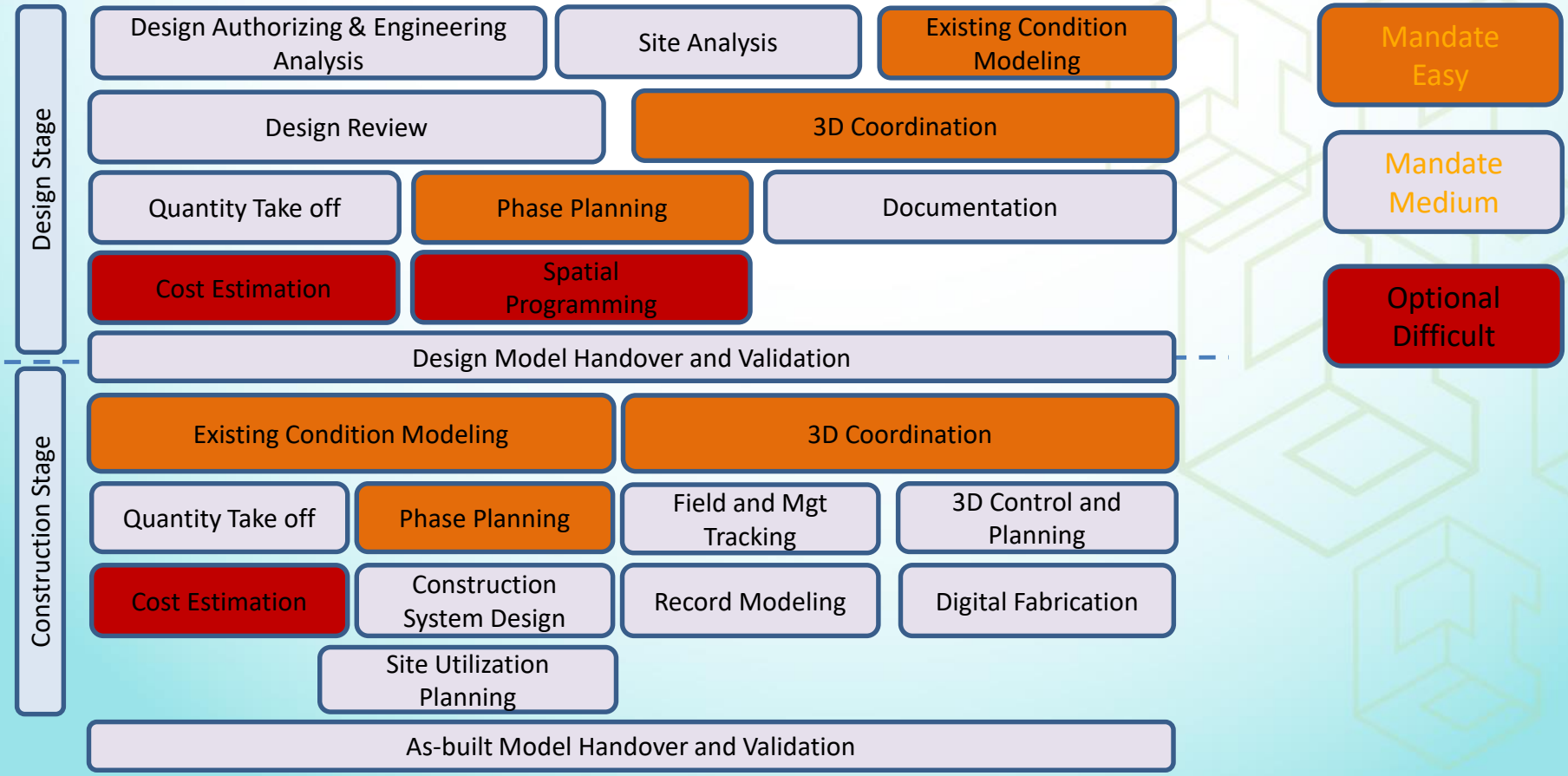
High Level BIM Goal

Employer Information Requirement

Process Re-engineering

Quality Audit

High level BIM Goals



2 Formulation of BIM strategy and standards

The Hong Kong Special Administrative Region of the People's Republic of China

The Chief Executive's 2017 Policy Address

繁體 | 简体 A A A Search

Policy Address | Speech | Policy Agenda | Highlights | Webcast | Press Releases | Videos | Other Publications | Archives | Contact Us | Sitemap

Policy Address

III. Diversified Economy

Construction and Related Professional Services Sectors

111. For the Hong Kong construction sector, the Belt and Road Initiative has brought visions while the Guangdong-Hong Kong-Macao Bay Area initiative has generated concrete opportunities and made it easier to achieve results.

112. The Mainland and Hong Kong signed an Agreement on Economic and Technical Co-operation under the Closer Economic Partnership Agreement (CEPA) on 28 June 2017, which expressly supports Hong Kong's participation in the development of pilot Free Trade Zones. The Government will capitalise on the new opportunities and continue to assist the construction and related professional services sectors in their business development in the Mainland. The Government will also deepen the co-operation with Qianhai, Hengqin and Nansha in accordance with the Agreement signed in June 2017. We will continue to discuss with the Mainland various issues such as mutual recognition of professional qualifications, rationalisation of the work of "professionals" and "practitioners", and promote the "Hong Kong management model" already adopted in Qianhai to other Free Trade Zones.

113. The construction industry has been facing the challenges of high construction costs and labour shortage in recent years. Hence, the Government is proactively promoting the adoption of technology and innovative construction methods to improve productivity and cost-effectiveness. For instance, the Government is assisting the industry in establishing large-scale and highly automated steel reinforcing bar prefabrication plants for the production of prefabricated steel reinforcement components for use in construction projects. We will also adopt Building Information Modelling technology in the design and construction of major government capital works projects that are scheduled to start in 2018, and promote the use of this technology in private construction projects. Besides, the new Construction Innovation and Technology Application Centre of the Construction Industry Council will be in operation by the end of this year to provide the latest information on local and overseas construction technologies and to support their adoption by small and medium enterprises.

香港特別行政區政府

The Government of the Hong Kong Special Administrative Region

政府總部
發展局
工務科

香港添馬添美道 2 號
政府總部西翼 18 樓

Works Branch
Development Bureau
Government Secretariat

18/F, West Wing,
Central Government Offices,
2 Tim Mei Avenue, Tamar,
Hong Kong

Ref : DEVB(W) 430/80/01
Group : 2, 5, 6

1 December 2017

Development Bureau
Technical Circular (Works) No. 7/2017

Adoption of Building Information Modelling for Capital Works Projects in Hong Kong

Scope

This Circular sets out the policy and requirements on the adoption of Building Information Modelling (BIM) technology.

2. This Circular applies to works either by in-house government staff, consultants or contractors.

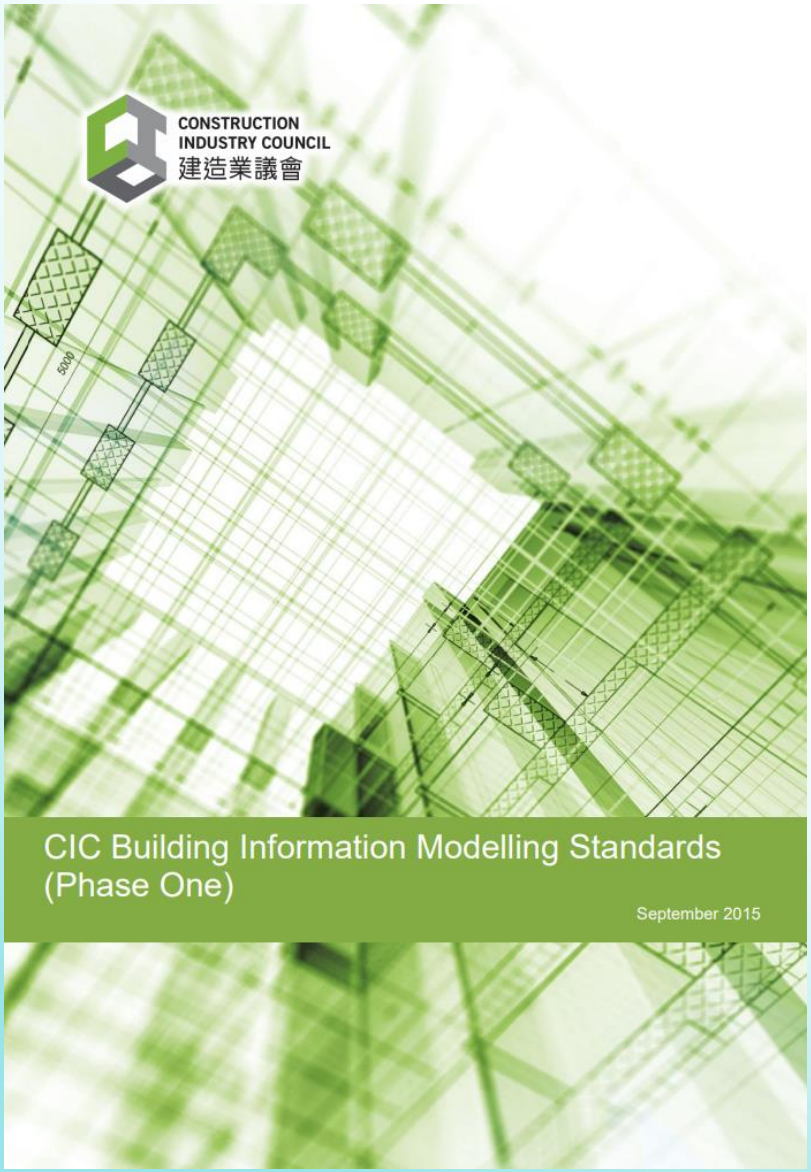
Effective Date

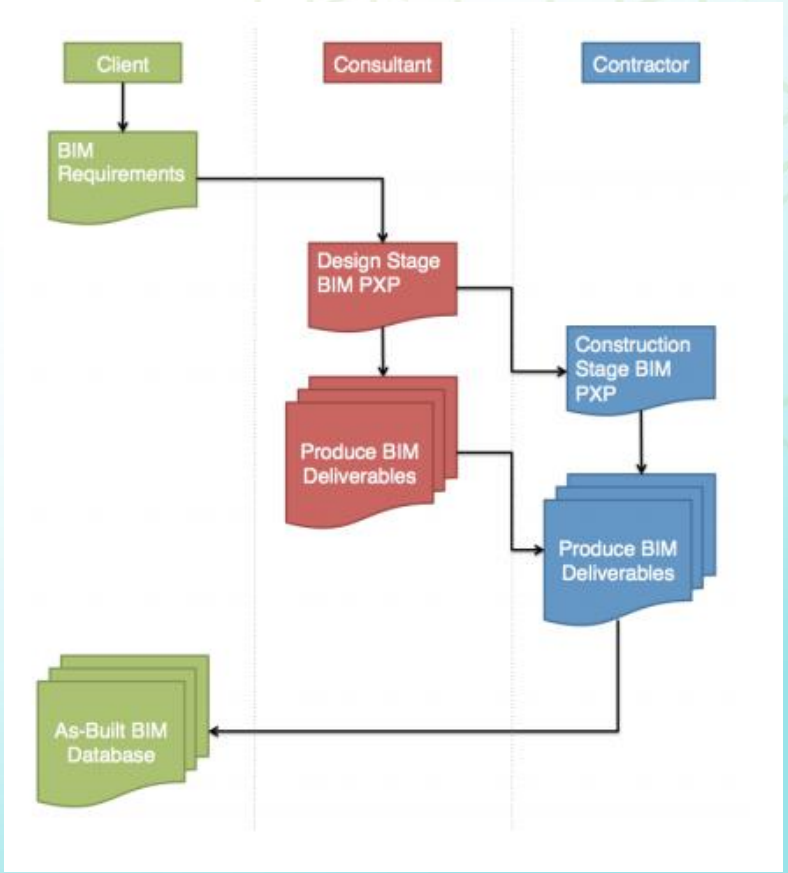
3. This Circular takes effect on **1 January 2018**.

Effect on Existing Circulars and Circular Memoranda

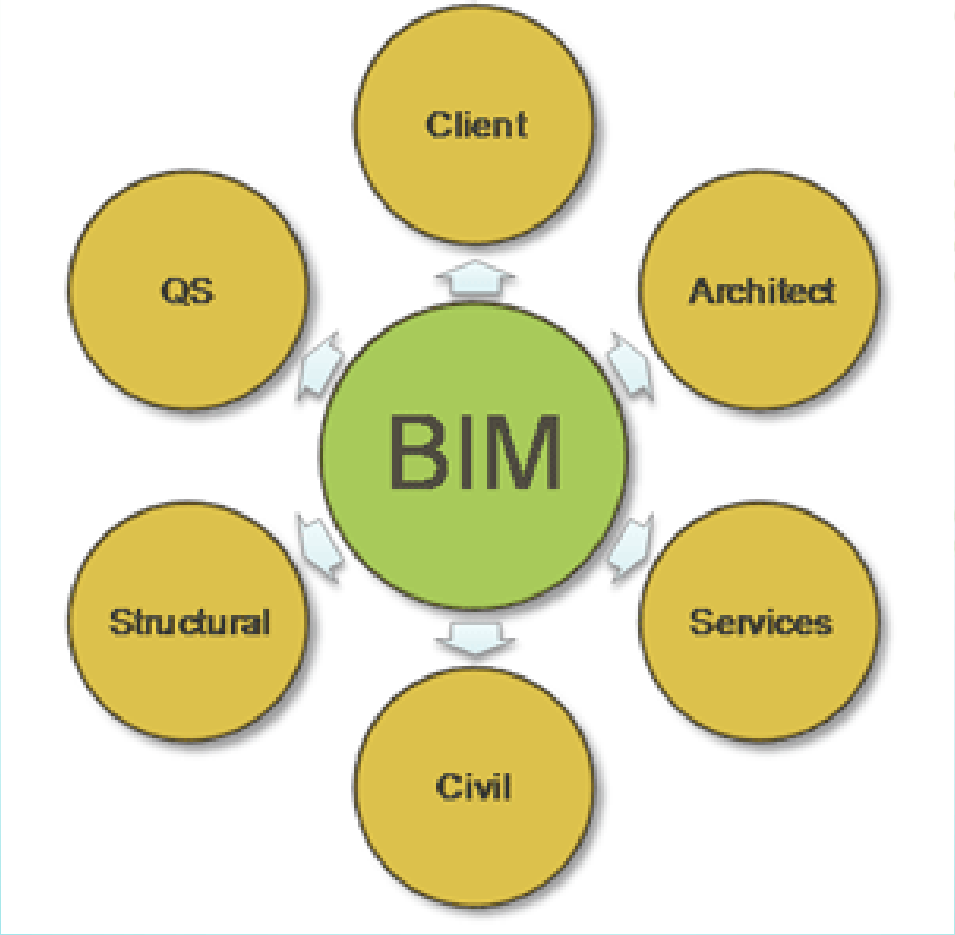
4. This Circular has no effect on existing circulars.

3 Introduction of CIC's BIM Standards





4 Basic concept, advantages and limitations of BIM design process



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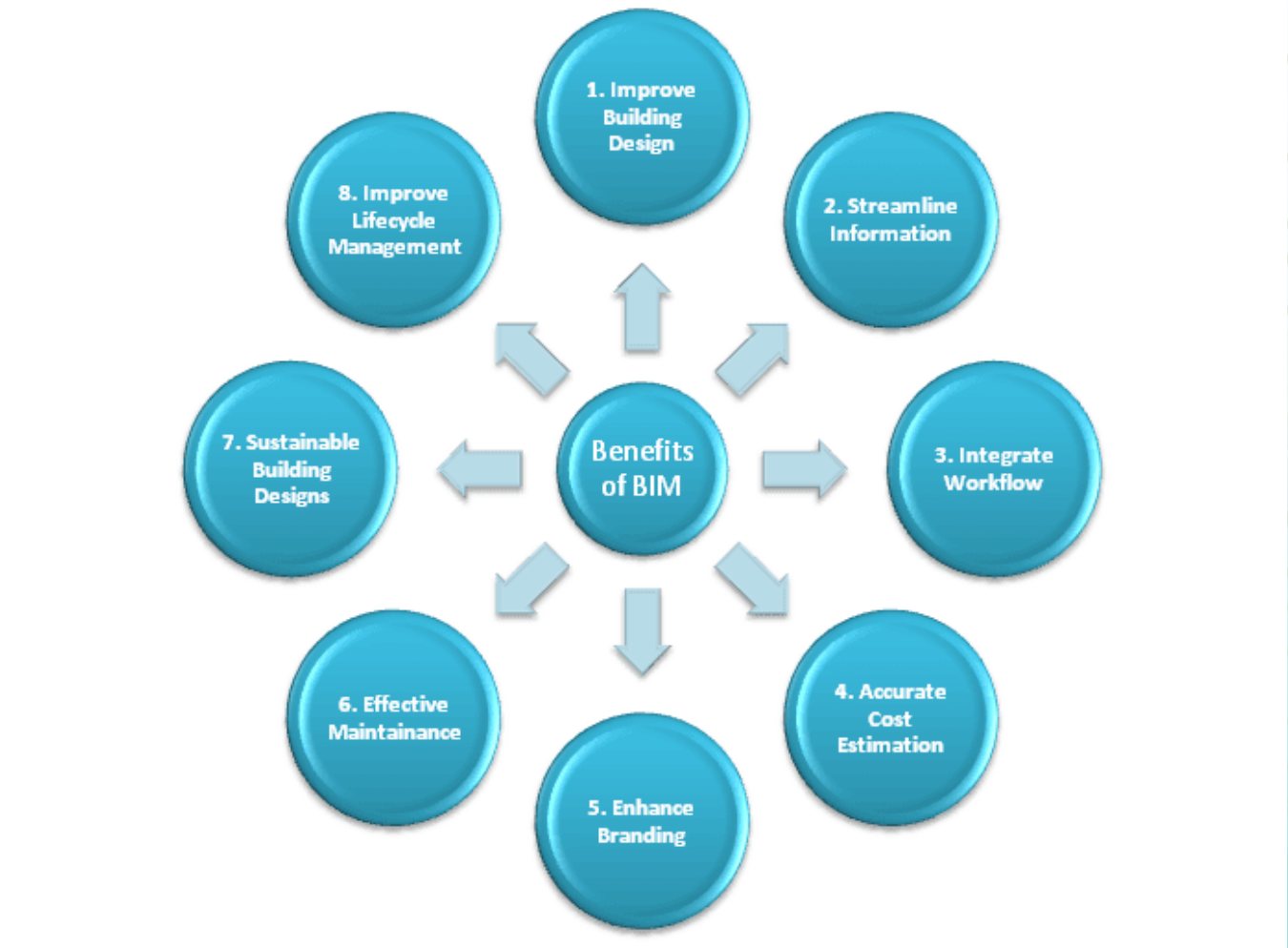


4 Basic concept, advantages and limitations of BIM design process

BIM ADVANTAGES

- 3D collaboration with all members of the team with automated detection of clashes. e.g. Is the service void designed by the architect sufficient for the M&E services.
- Visualization of projects to enable greater understanding of all members of the team. For example, it is far easier to schedule scaffolding requirements looking at a 3D model than in 2D.
- 4D visualization i.e. linking the 3D model to the programme to explore logistics.
- Faster to incorporate change into a Revit (3D) CAD layout as no need to update loads of individual drawings.
- 5D potential introducing costs into elements of model e.g electronic drawing take-off.
- Ability to incorporate additional information into model elements e.g maintenance and life span information for Facilities Management or sustainability information, etc

4 Basic concept, advantages and limitations of BIM design process

BIM DISADVANTAGES

- To be effective you need all major members of design team on significantly earlier than is often the case.
- BIM is more of a philosophy and not just a piece of software. Many people don't understand this. Construction is often slow to understand and embrace change.
- New protocols will be needed for managing information transfer and commenting, potentially new roles such as BIM Coordinators (much more than a document handler)
- Problems over information ownership and design responsibility within the model.

5 Definition and requirements of LOD (Level of Development)

3.1 LOD Definitions

LOD notations are comprised of numbers from LOD 100 to LOD 500 and are defined as follows:-

LOD 100	The Model Element may be graphically represented in the Model with a **symbol** or other generic representation. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements.
LOD 200	The Model Element is graphically represented within the Model as a **generic** system, object, or assembly with approximate quantities, size, shape, location, and orientation.
LOD 300	The Model Element is graphically represented within the Model as a **specific** system, object or assembly in terms of quantity, size, shape, location, and orientation.
LOD 350	The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, orientation, and **interfaces with other** building systems.
LOD 400	The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, **fabrication, assembly, and installation** information.
LOD 500	The Model Element is a **field verified representation** in terms of size, shape, location, quantity, and orientation.

For LOD 200 to 500, Non-graphic information and data may also be attached to the Model Elements.

3.1 LOD Definitions

Model Subdivision and LoD

Project Specific Sub-division: O-Chart & File Size

ID	Disciplinary Model	Initial Model	Design Model	Coordinated Model	As-built Model	Sub Models
ES	Existing Site Model	200	200	250	250	4
ER	Road Model	250	300	350	500	7
BR	Bridge Model	250	300	350	500	34
UP	Underpass Model	250	300	350	500	11
BD	Building Model	250	300	350	500	27

Progressively Developed during project;
May not developed to same LoD

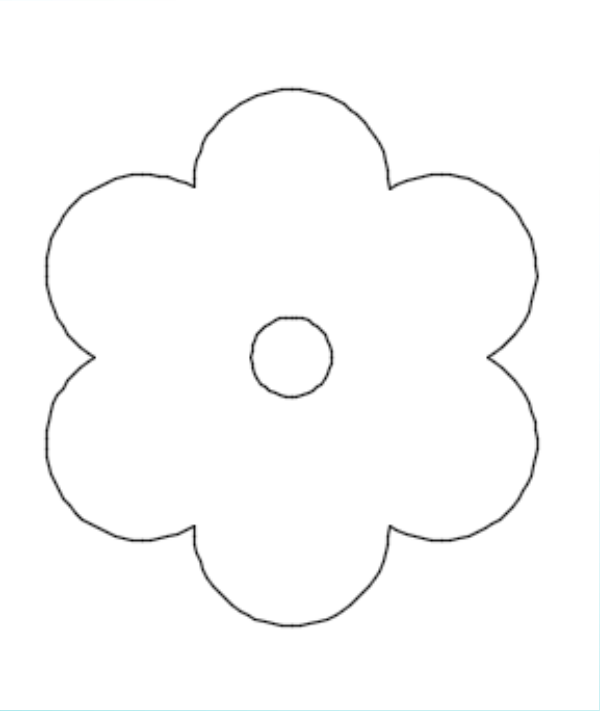
Further sub-division for operation and versioning

Geometric standard : Level of Development

LoD	Description
100	Graphically Represented as a **Symbol**
200	Graphically represented as a **Generic object**, with approximated size, shape, location, orientation
300	Graphically represented as a **Specific Object**, with accurate size, shape, location, and orientation Dimension can be directly measured from the model without referring to labels
400	Graphically represented as a specific object with **fabrication, assembly, construction joints, installation** information
500	Field verified representation with non-graphic attributes

LOD 100

LoD	Description
100	Tree as a **symbol**

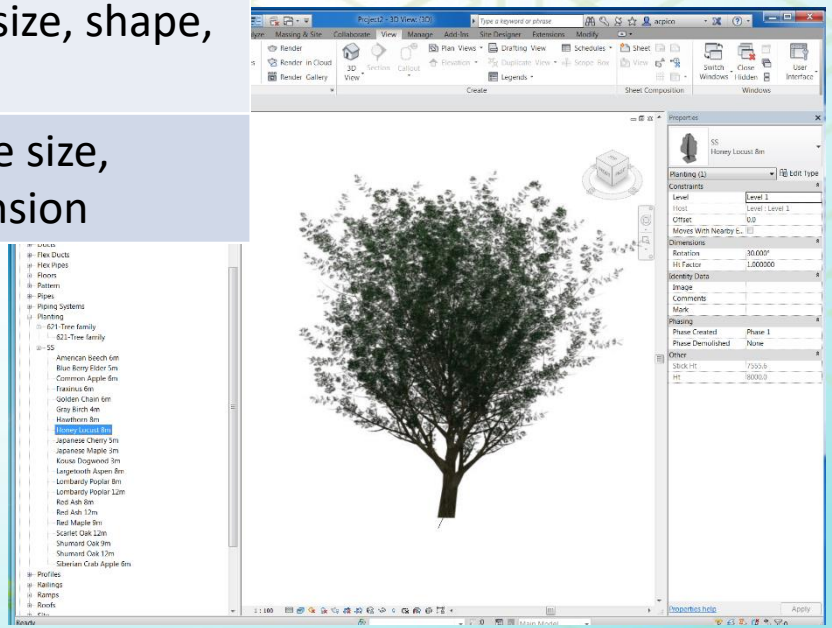


LOD 200

LoD	Description
100	Tree as a **symbol**
200	Tree as a **Generic**, with approximated size, shape, lo

LOD 299

LoD	Description
100	Tree as a **symbol**
200	Tree as a **Generic**, with approximated size, shape, location, orientation
300	Tree as a **Specific Object**, with accurate size, shape, location, orientation and dimension



Level of Development – Example Tree

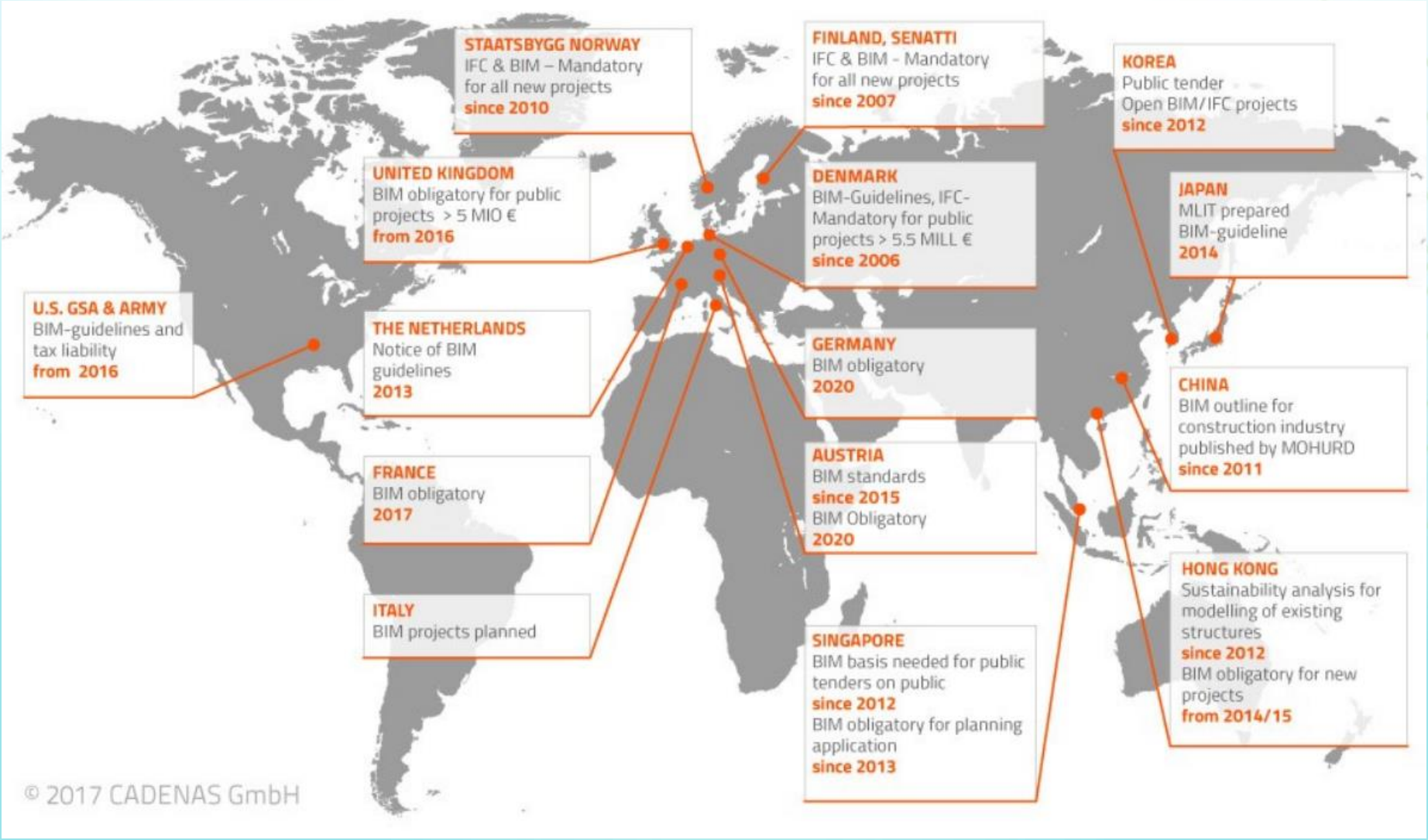
LoD	Description
100	Tree as a **symbol**
200	Tree as a **Generic**, with approximated size, shape, location, orientation
300	Tree as a **Specific Object**, with accurate size, shape, location, orientation and dimension
400	Tree as a **Specific Object**, with excavation limits/Installation requirements
500	Tree as a **Specific Object**, with name, type, plant date, etc

CIC Standard : Pavement

Pavement (Carriageway, Footpath, Cycle Track)

LOD	Description	Data	Example Image
100	Approximate alignment, width and spot levels of the paving surfaces		
200	Element modelling to include approximate 3D alignment, shape and width of pavement		
300	Element modelling to include: • Accurate size and geometry of every layer of paving components (frication course, wearing course, base-course, road-base, sub-base, etc.) that varies continuously along the road alignment • Accurate super-elevation and longitudinal fall of the pavement components Required non-graphic information associated with model elements includes: • Polygon Feature Type * • Surface Material Type * • Paver Type * • Headroom requirement (* to match HyD GIS requirement)		

6 Recent development of BIM in various countries and the prevailing standards and requirements



7 Worldwide organizations and standards promoting BIM (CIC, IFC, COBie, etc.)

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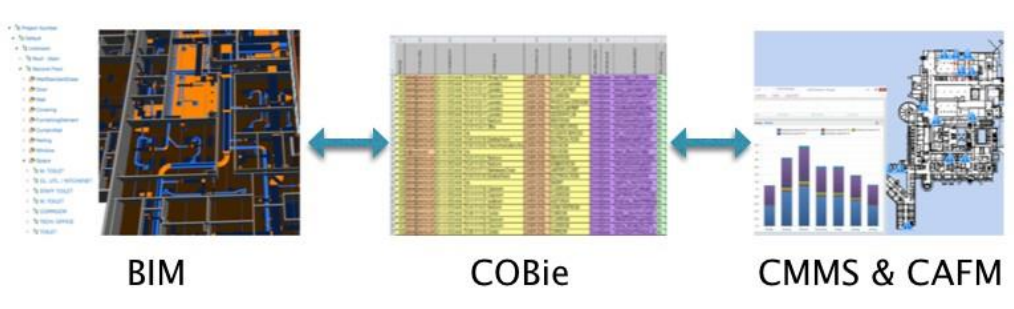
buildingSMART
International home of openBIM



UDC

中华人民共和国国家标准

P GB/T ××××—201×

建筑工程信息模型应用统一标准

Unified standard for building information model application

（征求意见稿）

201×—××—×× 发布 201×—××—×× 实施

中华人民共和国住房和城乡建设部
中华人民共和国国家质量监督检验检疫总局 联 合 发 布

8 Identification of the uses of BIM

- Design authoring
- Design coordination
- Estimating and cost management
- 4D BIM for construction management
- 5D BIM i.e. 3D + time + cost - Environmental and engineering analysis
- Visualization
- Model federation and validation
- Site supervision and safety management

	BIM Use	Investigation, Feasibility and Planning	Design	Construction
1	Design Authoring	O	M	M
2	Design Reviews	O	M	M
3	Existing Conditions Modelling	O	O	M
4	Site Analysis	O	M	
5	3D Coordination		M	M
6	Cost Estimation	O	O	O
7	Engineering Analysis		O	O
8	Facility Energy Analysis		O	O
9	Sustainability Evaluation	O	O	O
10	Space Programming	O	O	
11	Phase Planning (4D Modelling)		O	M
12	Digital Fabrication		O	O
13	Site Utilization Planning			O
14	3D Control and Planning			O
15	As-Built Modelling			M
16	Project Systems Analysis			O
17	Maintenance Scheduling			O
18	Space Management and Tracking			O
19	Asset Management			O
20	Drawing Generation (Drawing Production)		M	M

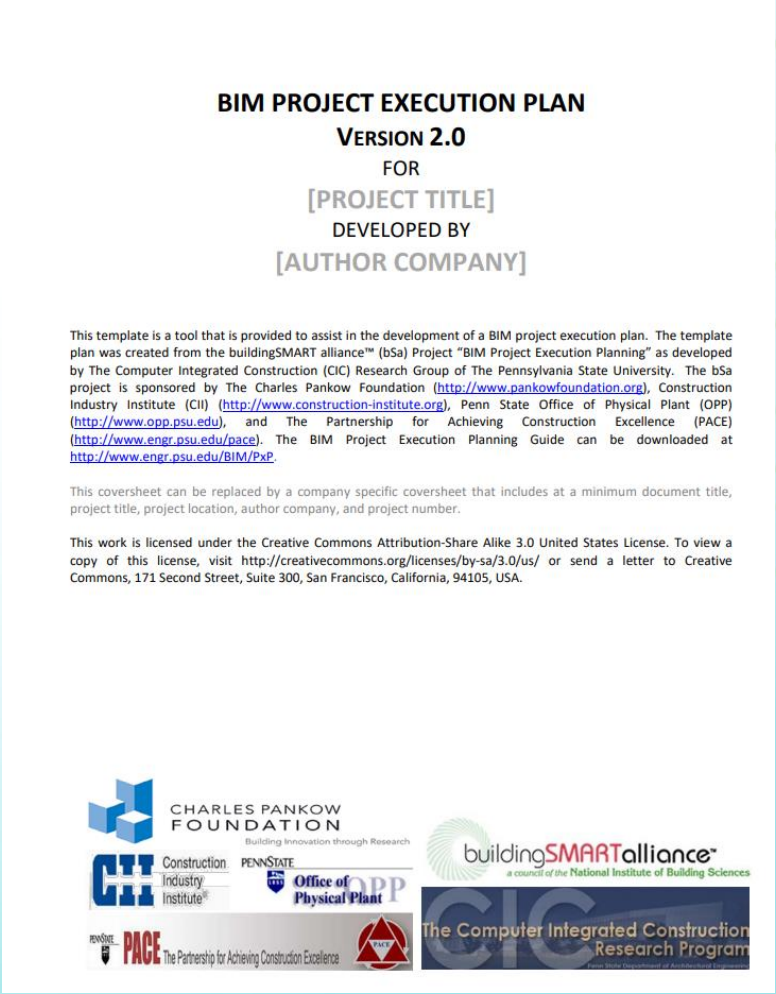
Legend:

M – Mandatory BIM Use for the mentioned stage, including that carried forward from previous stage.

O – Optional BIM Use

B. BIM in the Design Development Stage

1. Preparation and development of the BIM Project Execution Plan and compliant check of the BIM Project Execution Plan



BIM PROJECT EXECUTION PLAN
VERSION 2.0
FOR
[PROJECT TITLE]
DEVELOPED BY
[AUTHOR COMPANY]

This template is a tool that is provided to assist in the development of a BIM project execution plan. The template plan was created from the buildingSMART alliance™ (bSa) Project "BIM Project Execution Planning" as developed by The Computer Integrated Construction (CIC) Research Group of The Pennsylvania State University. The bSa project is sponsored by The Charles Pankow Foundation (http://www.pankowfoundation.org), Construction Industry Institute (CII) (http://www.construction-institute.org), Penn State Office of Physical Plant (OPP) (http://www.opp.psu.edu), and The Partnership for Achieving Construction Excellence (PACE) (http://www.engr.psu.edu/pace). The BIM Project Execution Planning Guide can be downloaded at http://www.engr.psu.edu/BIM/PxP.

This coversheet can be replaced by a company specific coversheet that includes at a minimum document title, project title, project location, author company, and project number.

CHARLES PANKOW FOUNDATION
Building Innovation through Research
Construction Industry Institute
PENNSTATE Office of Physical Plant
buildingSMARTalliance a council of the National Institute of Building Sciences
PACE The Partnership for Achieving Construction Excellence
The Computer Integrated Construction Research Program

1. Preparation and development of the BIM Project Execution Plan and compliant check of the BIM Project Execution Plan

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING		DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS		DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
			3D COORDINATION		3D COORDINATION		ASSET MANAGEMENT
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
			ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
			MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
			SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

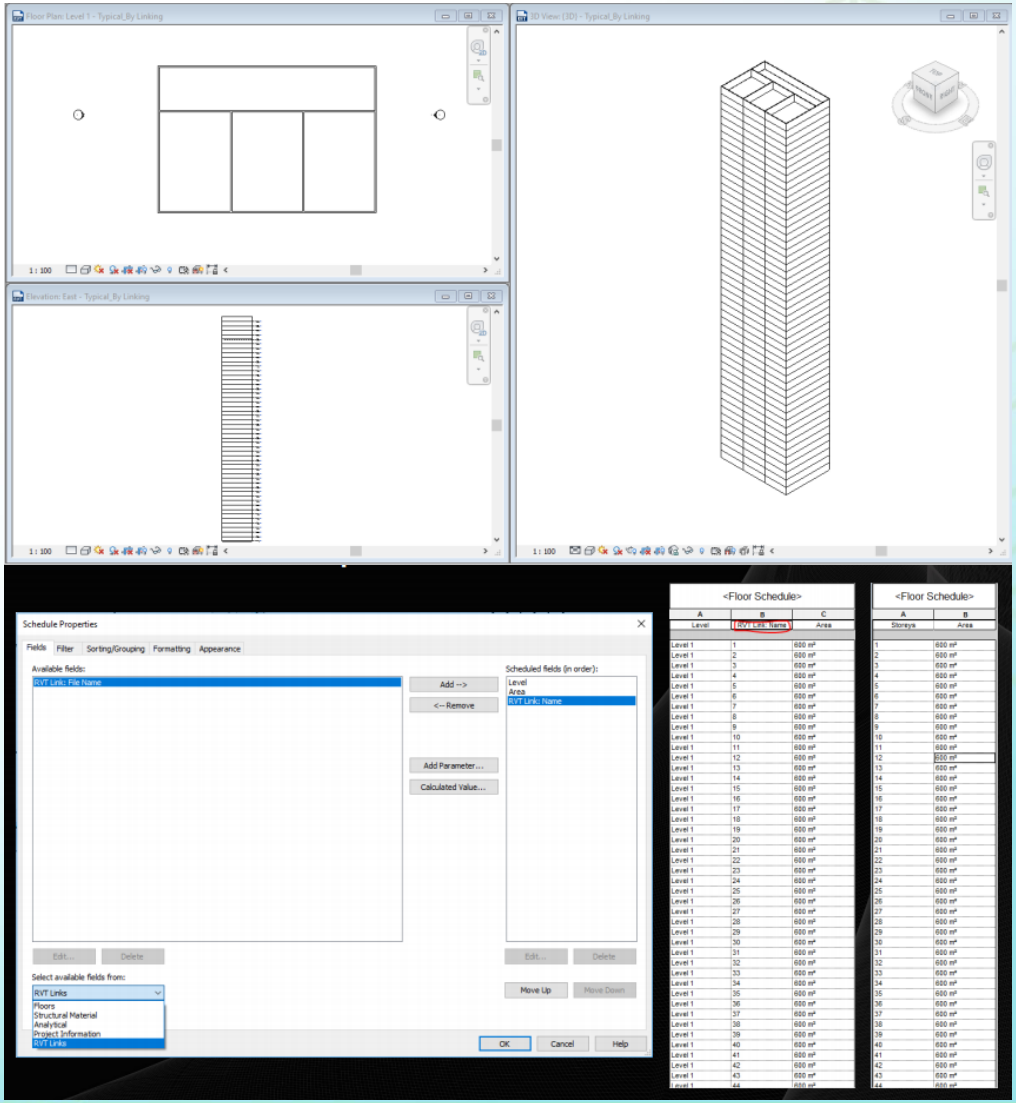
1. Compliant check of the PxP

QUALITY CONTROL CHECKS:

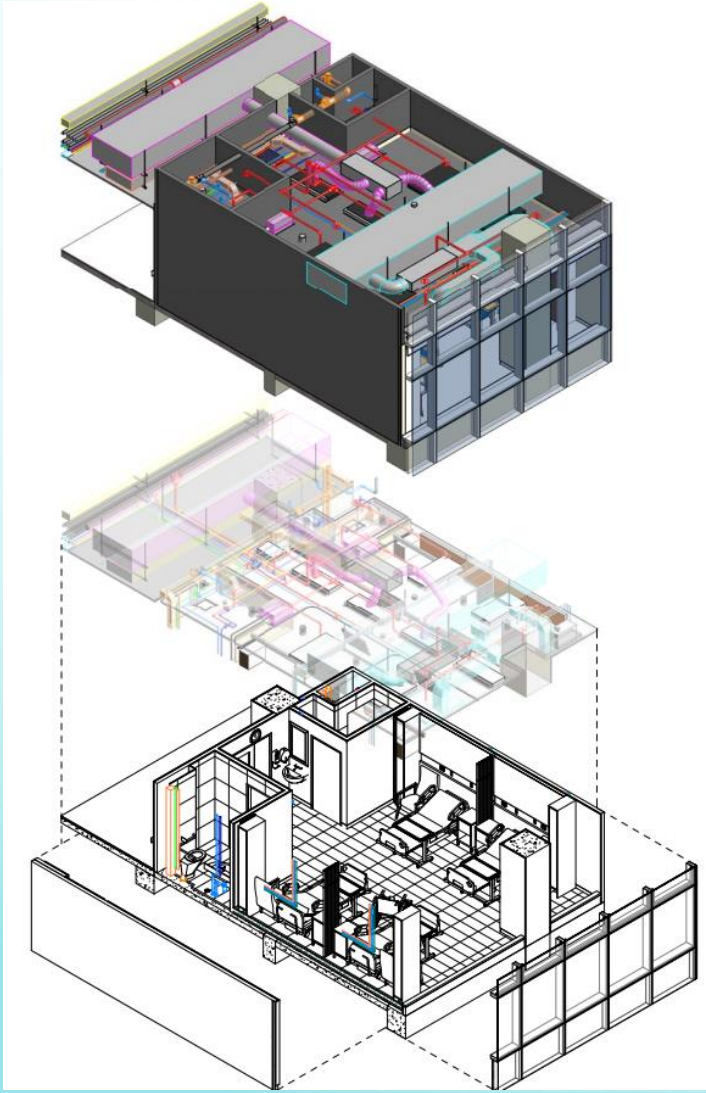
The following checks should be performed to assure quality.

CHECKS	DEFINITION	RESPONSIBLE PARTY	SOFTWARE PROGRAM(S)	FREQUENCY
VISUAL CHECK	Ensure there are no unintended model components and the design intent has been followed			
INTERFERENCE CHECK	Detect problems in the model where two building components are clashing including soft and hard			
STANDARDS CHECK	Ensure that the BIM and AEC CADD Standard have been followed (fonts, dimensions, line styles, levels/layers, etc)			
MODEL INTEGRITY CHECKS	Describe the QC validation process used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements and the reporting process on non-compliant elements and corrective action plans			

2 Development of conceptual design, mass modelling, area scheduling, outline cost plan



3 Design modulization and optimization in BIM



Wall Schedule

TYPE	AREA	Volume	Cost
ACID_Curtain wall 100x300Mu	302.785 m²		
Aluminium-50mm	3.854 m²		
Anti-Bacteria Ceramic Tile 300mm x 600mm x5mm	34.022 m²		
Anti-Mould Acrylic Emulsion Paint - 2mm	163.150 m²		
Ceiling - 55mm	2.551 m²		
Chengdu-Interior-75 mm	4.259 m²		
Generic - 100 mm	335.453 m²		
Interior - 79mm Partition (1-hr)	3.340 m²		
Moisture Sealer	1.963 m²	0.00 m³	
Vinyl sheet Skirting - 1mm	0.532 m²	0.00 m³	
Vinyl sheet Skirting - 25 mm	11.899 m²		
Washable & anti-mould acrylic emulsion paint - 1mm	60.879 m²		
Grand total: 117	924.684 m²		

Chair Schedule

Type	Type Mark	Count	Cost
BAS	F2503	3	

Table Schedule

Type	Type Mark	Count	Cost
Thermoform Top - Rectangular	F2502	4	

Bed Schedule

Type	Type Mark	Count	Cost
BED0269	S3101	4	

TV Schedule

Type	Type Mark	Count	Cost
TV_CEILING	F2501	4	

Curtain Schedule

Type	Type Mark	Count	Cost
	Curtain	4	

Air Terminal Schedule

Type	Type Mark	Count	Cost
400 x 250		1	
400 x 400		2	
600 x 100		2	
700 x 250		4	
1200 x 100		8	
Exhaust Air Grille		2	
Return Air Grille		5	
Supply Air Grille		2	
Transfer Grille		4	

Cabinet Schedule

Type	Type Mark	Count	Cost
Standard	F2506	4	1100.00

Shower Cubicle Schedule

Type	Type Mark	Count	Cost
PF-SH4	SHOWER	1	

Water Closet Schedule

Type	Type Mark	Count	Cost
WCA-01	F2504	1	

Water Basin Schedule

Type	Type Mark	Count	Cost
BAS	F2503	3	

Sprinkler Schedule

Type	Type Mark	Count	Cost
Exposed Sprinkler Head		13	

Door Schedule

Family	Mark	Type	Door Rating	Count	Cost
Flush_UneqDbl	118	Type A3_1400mm x 2100mm	-	1	
Flush_Single1	119	Type A1_900mm X 2100mm	-	1	
Flush_Single1	120	Type A1_900mm X 2100mm	-	1	

Ceiling Schedule

Type	Area	Volume	Cost
600 x 600mm Grid	35.372 m²	1.84 m³	
600 x 1200 - Ceiling Tile	52.486 m²	2.89 m³	
600 x 1200 - Ceiling Tile	1.456 m²	0.08 m³	
600 x 600mm Grid	2.316 m²	0.12 m³	
600 x 600mm Grid	3.772 m²	0.20 m³	
600 x 1200 - Ceiling Tile	13.938 m²	0.77 m³	

Floor Schedule

Type	Area	Volume	Cost
Waterproofed & Non-Slip Homogenous Porcelain Tile - 300x600x8mm	1.667 m²	0.08 m³	
Non Slip, Resilient & Hardwearing vinyl sheet - 3mm	41.642 m²	2.08 m³	
Non Slip, Resilient & Hardwearing vinyl sheet - 3mm	14.000 m²	0.70 m³	
Waterproofed & Non-Slip Homogenous Porcelain Tile - 300x600x8mm	3.786 m²	0.19 m³	
Non Slip, Resilient & Hardwearing vinyl sheet (For Ward) - 3mm	54.046 m²	2.70 m³	
Aluminium-50mm	0.206 m²	0.01 m³	
Aluminium-50mm	0.522 m²	0.03 m³	
Aluminium-50mm	0.388 m²	0.02 m³	
Aluminium-50mm	0.616 m²	0.03 m³	
Aluminium-50mm	0.206 m²	0.01 m³	
Non Slip, Resilient & Hardwearing vinyl sheet - 3mm	42.471 m²	2.12 m³	
Non Slip, Resilient & Hardwearing vinyl sheet (For Ward) - 3mm	54.046 m²	2.70 m³	

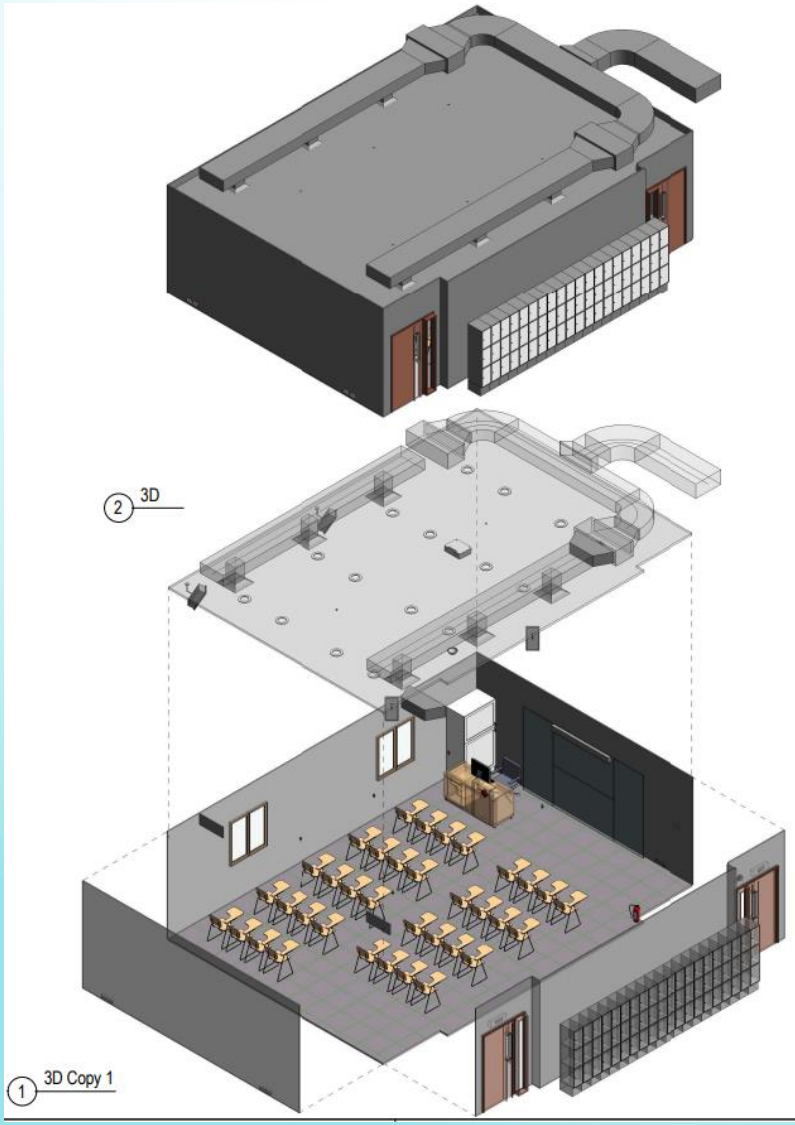
Curtain Panel Schedule

TYPE	Type Mark	Count	AREA
CTP-CWP-ACD-Double_Glazing			
CTP-CWP-ACD-Double_Glazing		1	2.267 m²
CTP-CWP-ACD-Double_Glazing		1	2.267 m²
CTP-CWP-ACD-Double_Glazing		1	2.267 m²
CTP-CWP-ACD-Double_Glazing		1	2.267 m²
CTP-CWP-ACD-Double_Glazing		1	2.267 m²
CTP-CWP-ACD-Single_Glazing_with_Aluminium_Back_Panel			
CTP-CWP-ACD-Single_Glazing_with_Aluminium_Back_Panel		1	2.267 m²
CTP-CWP-ACD-Single_Glazing_with_Aluminium_Back_Panel		1	2.267 m²
CTP-CWP-ACD-Single_Glazing_with_Aluminium_Back_Panel		1	2.267 m²
CTP-CWP-ACD-Single_Glazing_with_Aluminium_Back_Panel		1	2.267 m²
CTP-CWP-ACD-Single_Glazing_with_Aluminium_Back_Panel		1	2.267 m²
CTP-CWP-ACD-Window			
CTP-CWP-ACD-Window		1	1.133 m²
CTP-CWP-ACD-Window		1	1.133 m²
CTP-CWP-ACD-Window		1	1.133 m²
CTP-CWP-ACD-Window		1	1.133 m²
CTP-CWP-ACD-Window		1	1.133 m²

Lighting Fixture Schedule

FAMILY	TYPE	MARK	Count
M_Downlight - Recessed Can			
M_Downlight - Recessed Can	152mm Incandescent - 120V		10
PB_LTG_INT_Fluorescent_Non-Hosted			
PB_LTG_INT_Fluorescent_Non-Hosted	230V 1 x 40W LED		15
T5 Fluorescent			
T5 Fluorescent			9

3 Design modulization and optimization in BIM



Wall Schedule

Type	Area	Volume	Cost	Total Cost
25mm Cement Sand Rendering + Paint Finish	20.963 m²	0.524 m³	HK$1000.00	HK$524.06
25mm Cement Sand Rendering + Paint Finish	27.041 m²	0.676 m³	HK$1000.00	HK$676.02
25mm Cement Sand Rendering + Paint Finish	20.888 m²	0.522 m³	HK$1000.00	HK$522.19
25mm Cement Sand Rendering + Paint Finish	0.810 m²	0.020 m³	HK$1000.00	HK$20.26
25mm Cement Sand Rendering + Paint Finish	0.810 m²	0.020 m³	HK$1000.00	HK$20.26
25mm Cement Sand Rendering + Paint Finish	18.900 m²	0.473 m³	HK$1000.00	HK$472.50
25mm Cement Sand Rendering + Paint Finish	2.670 m²	0.067 m³	HK$1000.00	HK$66.75
25mm Cement Sand Rendering + Paint Finish	2.670 m²	0.067 m³	HK$1000.00	HK$66.75
Grand total: 8	94.752 m²	2.369 m³		HK$2368.79

Ceiling Schedule

Type	Area	Volume	Cost
600 x 1200mm Grid	70.572 m²	3.670 m³	

Floor Schedule

Type	Area	Volume	Cost
ACD_carpet tile on screed 50mm	70.572 m²	3.529 m³	

Chair Schedule

Type	Type Mark	Count	Cost
	Chair	37	

Table Schedule

Type	Type Mark	Count	Cost
700 x 1600mm	Table	1	

Computer Schedule

Type	Type Mark	Count	Cost
iMac_20quot_Intel_Computer_4508	Computer	1	

Cabinet Schedule

Type	Type Mark	Count	Cost
1000mm	Cabinet	1	

Locker Schedule

Type	Type Mark	Count	Cost
Locker x3 Row	Locker	5	

Screen Schedule

Type	Type Mark	Count	Cost
OFC_SCR_ACD_Projection screen	Screen	1	

Glass Board Schedule

Type	Type Mark	Count	Cost
688	Glass Board	1	

Window Schedule

Type	Type Mark	Count	Cost
0610 x 1220mm	Window	4	

Projector Schedule

Type	Type Mark	Count	Cost
OFC_VPR_ACD_Video_projector	Projector	1	

Alarm Bell Schedule

Type	Type Mark	Count	Cost
FS-FAD-ACD-Alarm Bell	Alarm Bell	1	
Grand total: 1			

Fire Extinguisher Schedule

Type	Type Mark	Count	Cost
FS-FAD-ACD-FE	Fire Extinguisher	1	

Camera Schedule

Type	Type Mark	Count	Cost
020_000deg	Camera	1	
Grand total: 1			

Telephone Point Schedule

Type	Type Mark	Count	Cost
Wall Based	Telephone Point	2	
Grand total: 2			

Exit Light Schedule

Type	Type Mark	Count	Cost
020_Symbol_Vis_000deg	Exit Light	2	
Grand total: 2			

Flashing Light Schedule

Type	Type Mark	Count	Cost
FS-LIF-MTR-Flashing LGT	Flashing Light	1	
Grand total: 1			

Smoke Detector Schedule

Type	Type Mark	Count	Cost
100_000deg	Smoke Detector	2	
Grand total: 2			

Break Glass Unit Schedule

Type	Type Mark	Count	Cost
FS-FAD-ACD-Break Glass Unit	Break Glass Unit	1	
Grand total: 1			

Electrical Socket Schedule

Type	Type Mark	Count	Cost
ELE-ELF-ACD-13A SW Twin Socket Outlet+SW Button	Electrical Socket	8	
Grand total: 8			

Sprinkler Schedule

Type	Type Mark	Count	Cost
SPR-MTR-SPR. Head-Under Ceiling Soffit	Sprinkler	6	
Grand total: 6			

Speaker Schedule

Type	Type Mark	Count	Cost
Ceiling Mount 300 x 300 mm	Speaker	4	
Grand total: 4			

Internet Socket Schedule

Type	Type Mark	Count	Cost
ELE-ELF-ACD-Internet Socket	Internet Socket	2	
Grand total: 2			

Door Schedule

Family	Mark	Type	FRP Door Tag	Count	Cost
DOR-SGL-ACD-Wood-w_Glazing	B	1300 x 2100mm		1	
DOR-SGL-ACD-Wood-w_Glazing	22	1300 x 2100mm		1	

Lighting Fixture Schedule

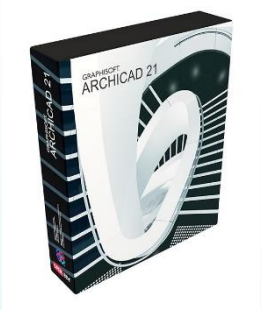
Type	Illuminance	Type Mark	Count	Co
ELE-LTF-ACD-1x26W Single Phase Recess Mounted Downlight	132 lx	Light	16	
Grand total: 16				

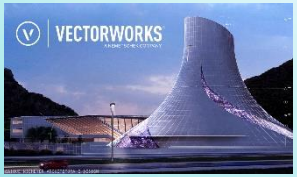
Light Switch Schedule

Type	Type Mark	Count
ELE-LTD-ACD-10A 1-WAY LGT SW.	Light Switch	2
Grand total: 2		

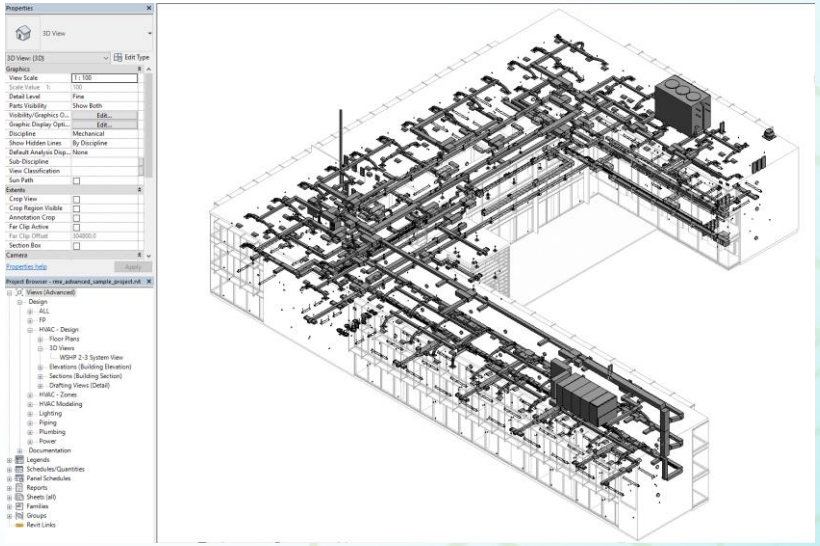
4 Demonstration on model authoring and cost tools

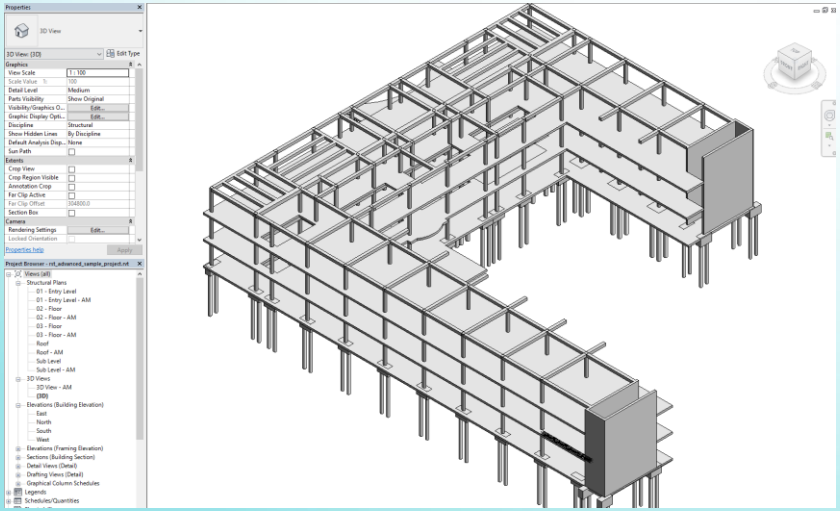
– Autodesk Revit, Civil 3D
– Gaphisoft ArchiCAD
– Tekla Structures
– Bentley Architecture / Aecosim Building Designer
– Nemetschek Vectorks
– Gehry Technologies - Digital Project Designer
- Cost X



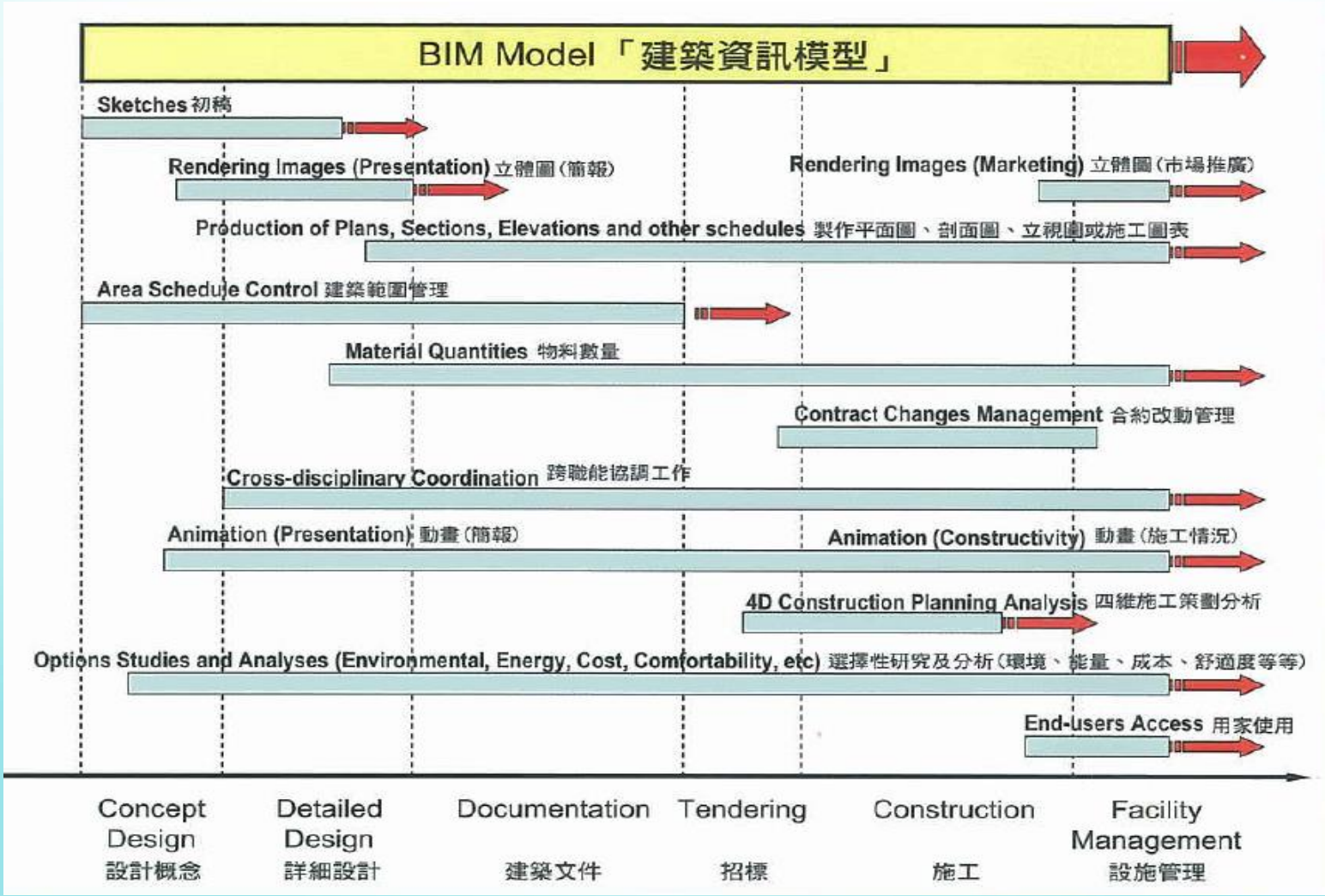


5 Commencement of design model authoring (Architecture, Structure, MEP, Landscape);

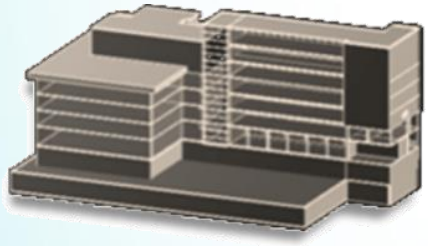




6 Introduction of the advantages of making early decisions in the design process



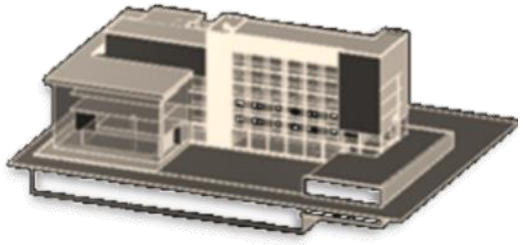
BIM Enables Sustainable Design



Conceptual Design

Use early-stage massing models

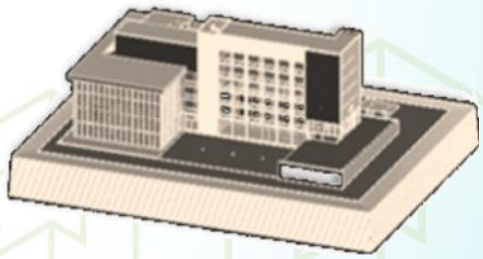
- Optimal location
- Building form
- Orientation of building design



Design Development

Conduct whole building energy, water & carbon analysis

- Benchmark energy use
- Recommend potential savings
- Study alternatives



Design Validation

Make detailed design

- Adjust rooms and zones
- Size and shape individual openings
- Design custom shading devices
- Choose optimal materials

Structural Engineering – Design

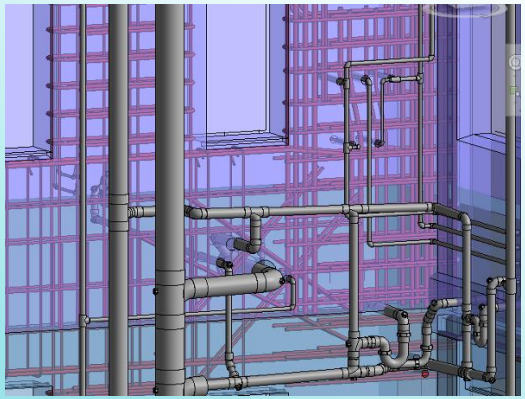
BIM Structural Model

Drawing Production

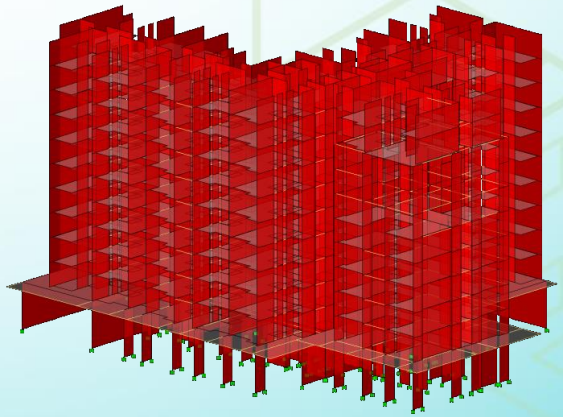
Framing Plan

Collaboration

Software Interface



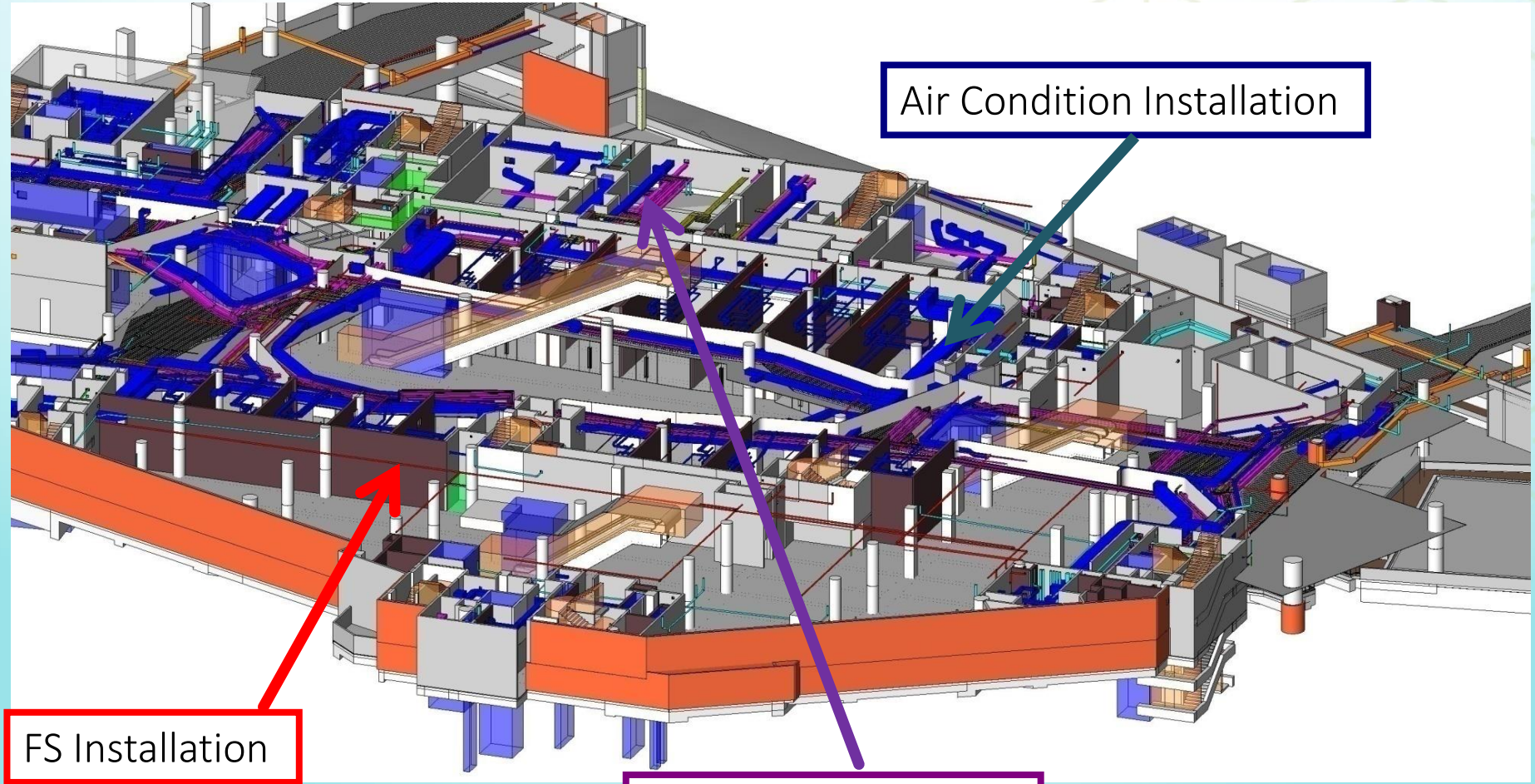
Clash Detection



Analytical / Design Model – ETABS / ORION

Source: Hong Kong Housing Authority

Building Services Installation



Source: Hong Kong Housing Authority

Building Models for Virtual Design & Construction

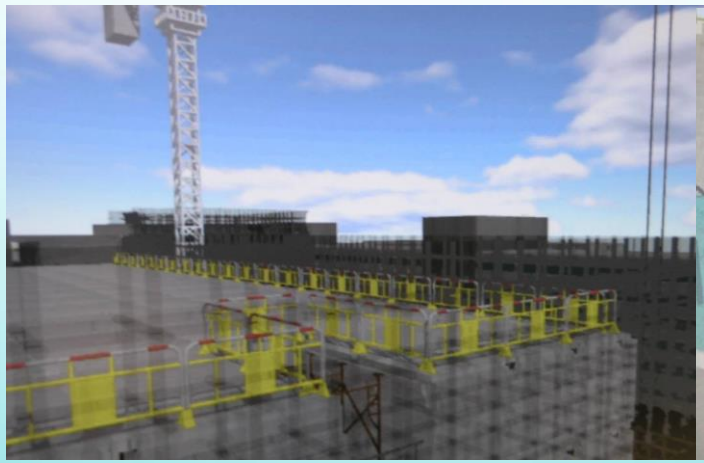
Performance validation & check buildability

BIM Enabling Safety 地盤工業安全

In Construction Site Process

Design for safety

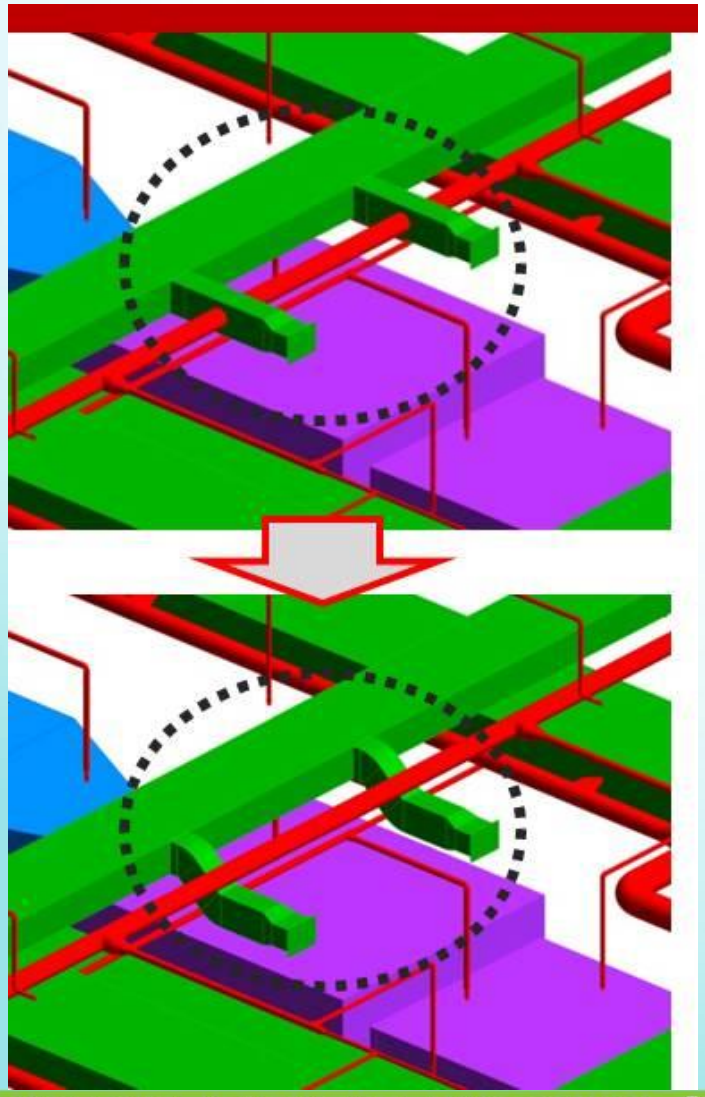
- Construction and operation planning
- Relationship between working time & space
- Validation of construction sequence
- Anticipate the interaction between workers & machineries
- Evaluation of safety from workers viewpoint
- Concern from the public



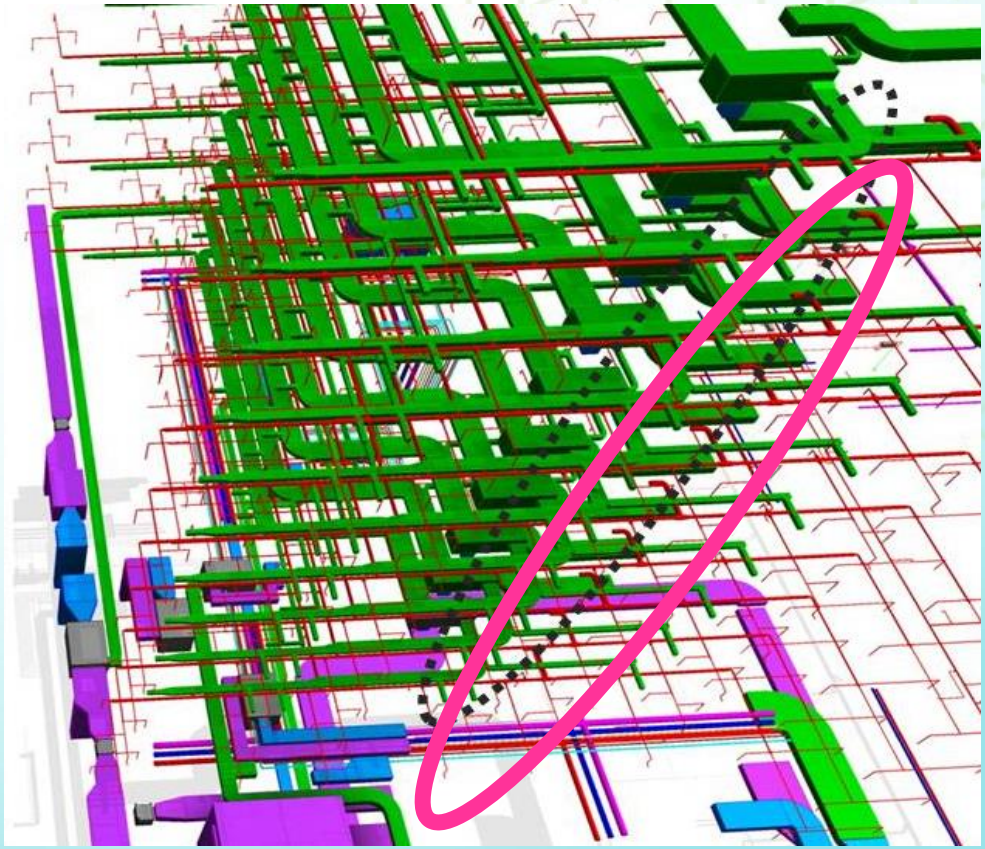
Source: Hong Kong Housing Authority

Clash Detection

Building Services, False ceiling, Structural Elements



- Check clashes before build
- Minimize number of variations & avoid delay



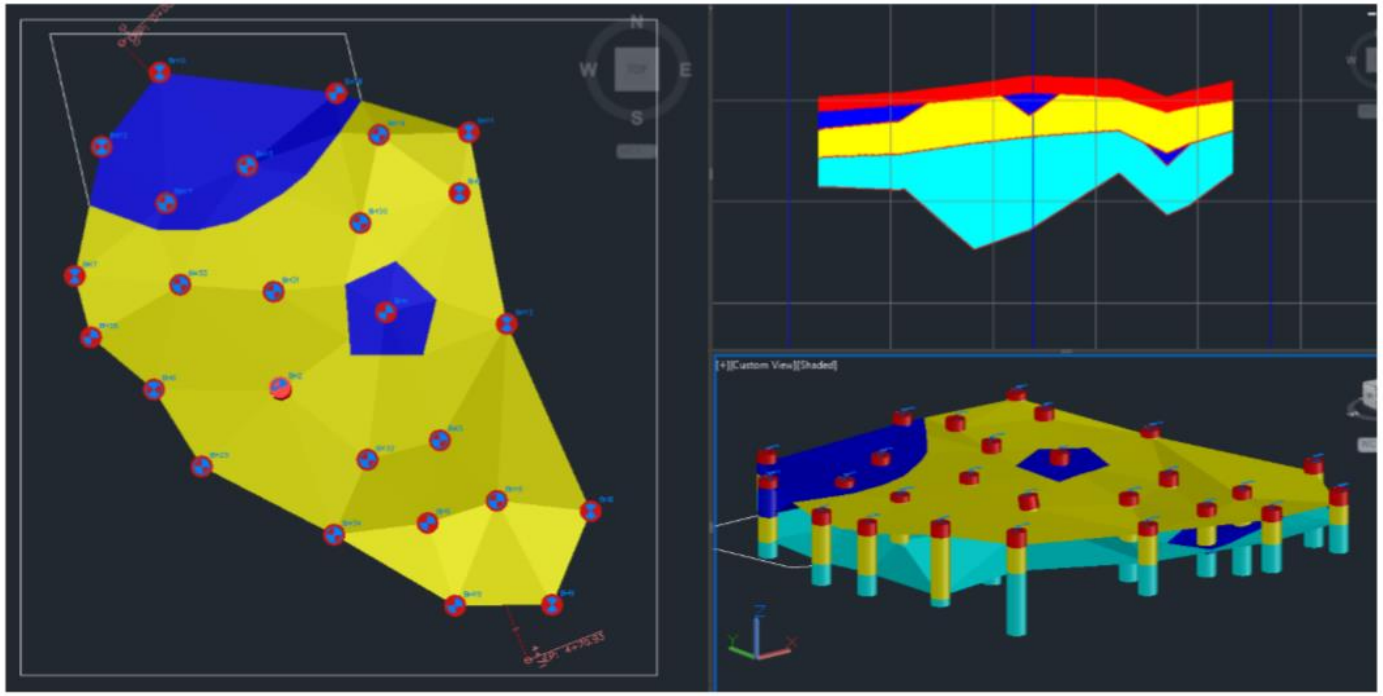
Source: http://www.designbimstudio.com

Model Geology in 3D Environment

Integrate geotechnical data into construction process

Learn how to create a geotechnical project and import data

The aim of this class is to take hole data stored in the CSV files, import them and model the resulting information.

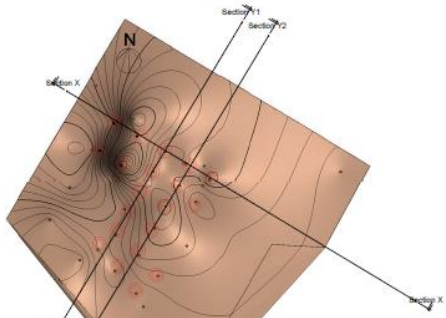


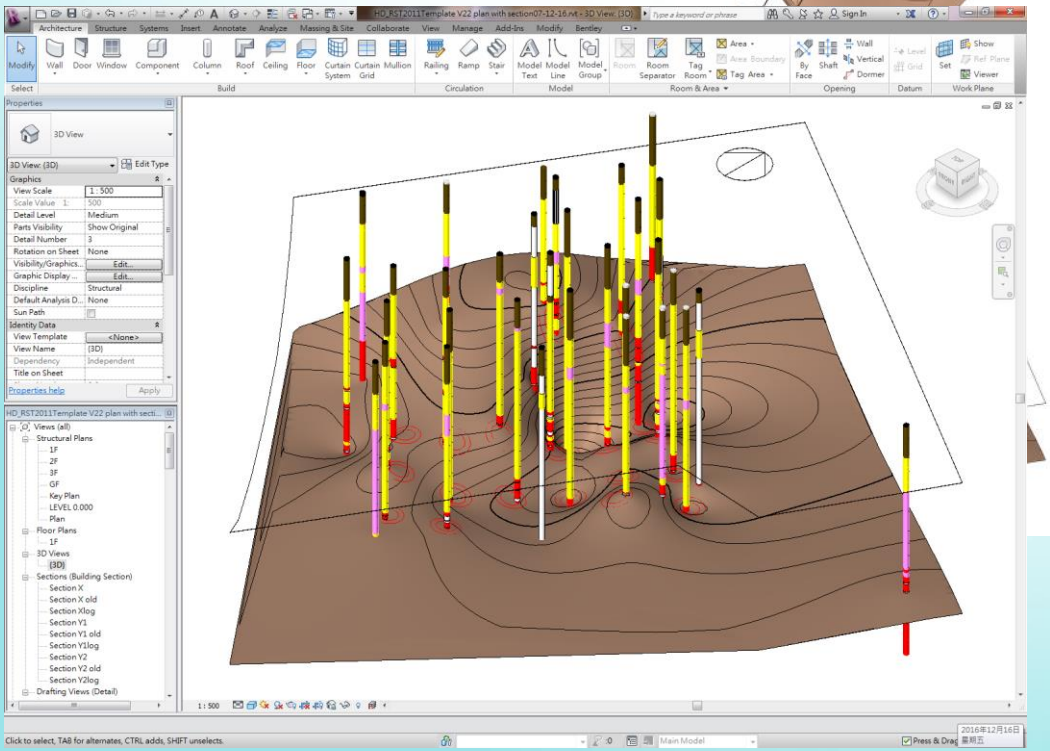
THE MODELED GEOLOGY

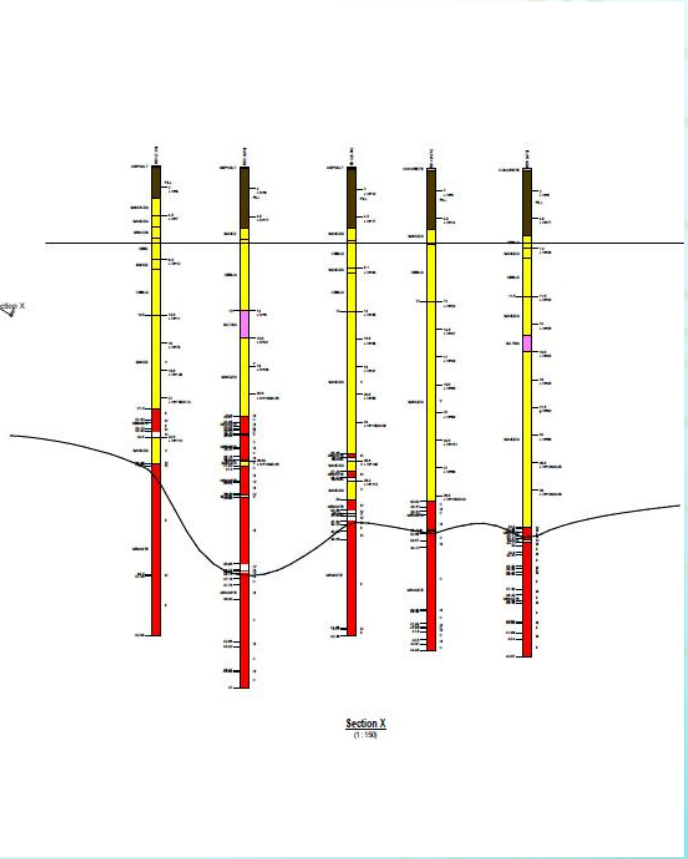
The Autodesk Geotechnical Module for AutoCAD Civil 3D 2016 was a total rewrite with new concepts and workflows. The 2016 version saw the introduction of Projects to store geotechnical data, the project data can then be quickly accessed in any drawing.

Source: AU2015 Gary Morin, Keynetix Ltd.

Geotechnical Investigation



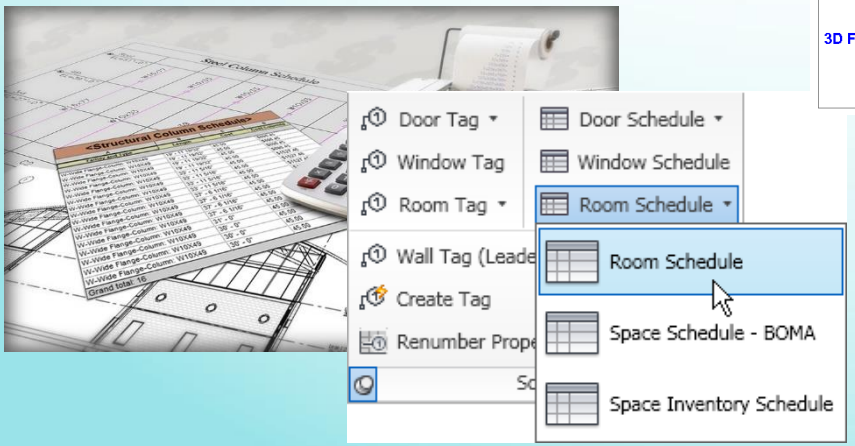




Calculation with BIM

The BIM concept supports a wide range of calculation and estimating activities:

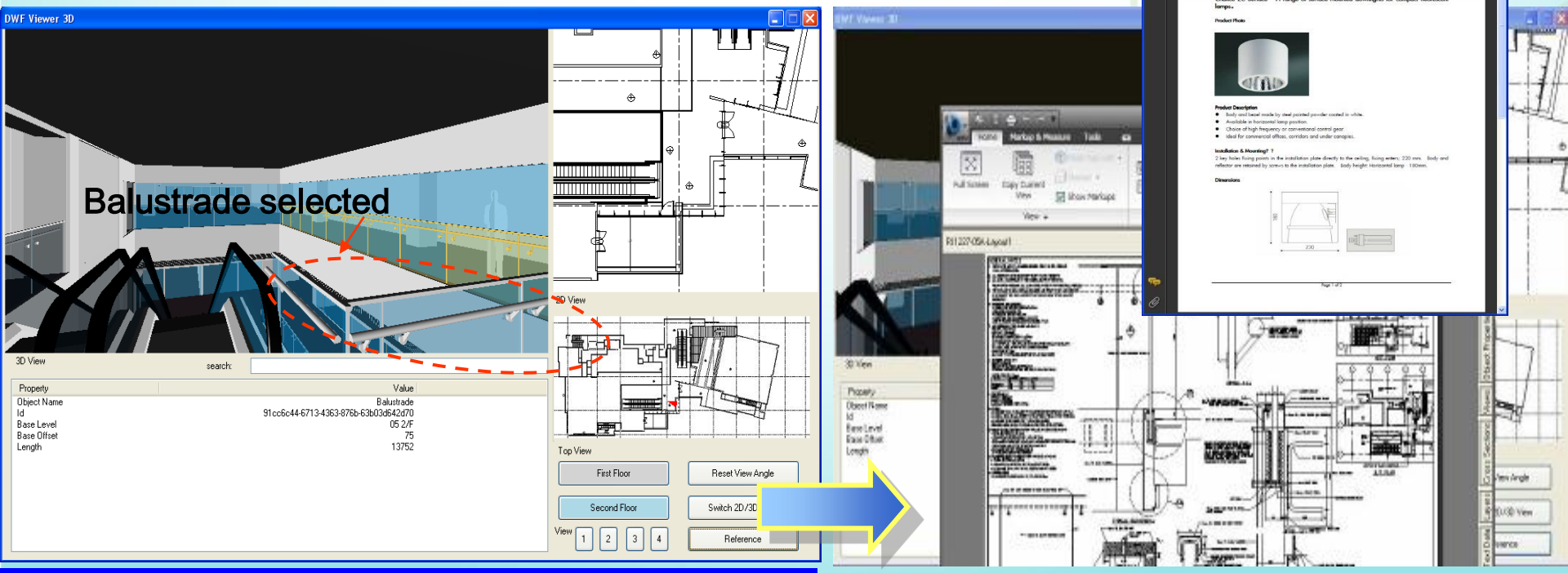
- Quantity take-offs
- Door-window schedules
- Room Inventories
- Cost estimations



Window List			
Window Name	W Multiside Fix 13	W Triple Sash 13	W1 Casement 13
Quantity	1	1	1
From Room Number			
W x H Size	1,000x0,951	1,500x1,500	0,900x1,500
Orientation	R	L	L
Window sill height	0,900	0,900	0,900
Window head height	1,851	2,400	2,400
2D Symbol	1,000	1,500	0,900
3D Front View	1,000 / 0,951	1,500 / 1,500	0,900 / 1,500

Facility Management 設施管理

- As-built BIM model
- Linking Information to BIM model e.g. detailed shop drawings linked to balustrade in 3D view

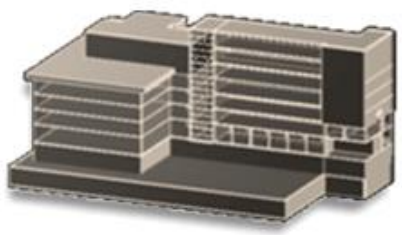


Basic Information e.g. height, type of glass

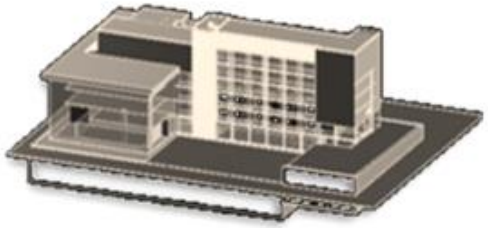
Detailed Drawings

7 Distinguish between “design model” and “analytical model”

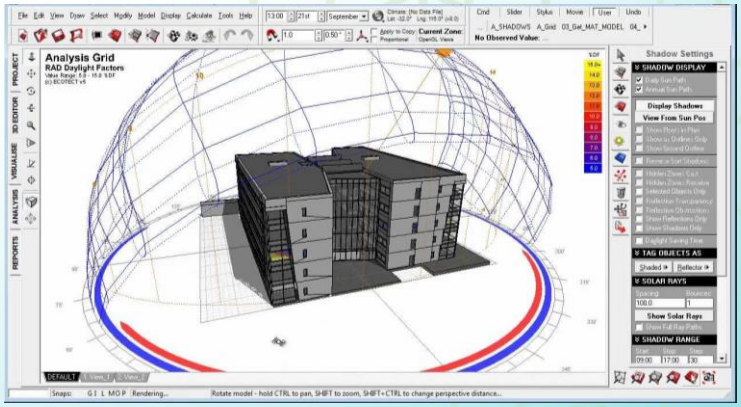
	Design Model	Analytical Model
Objectives	Continuous Design Development	Typically snap shot for analysis
Details	Fine Details as per deliverables	Supplied and isolated model to yield a particular result.
Deliverables	Professional Output such as statutory and contractual Documents	Analysis Report



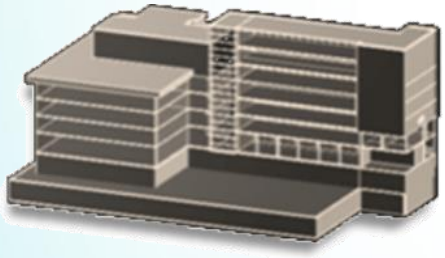
Conceptual Design



Design Development



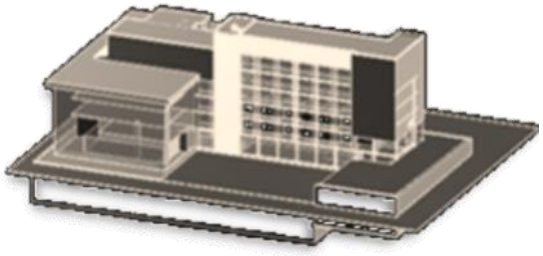
BIM Enables Sustainable Design



Conceptual Design

Use early-stage massing models

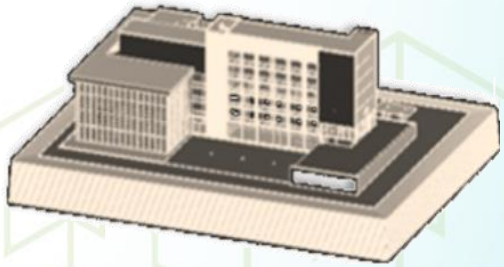
- Optimal location
- Building form
- Orientation of building design



Design Development

Conduct whole building energy, water & carbon analysis

- Benchmark energy use
- Recommend potential savings
- Study alternatives

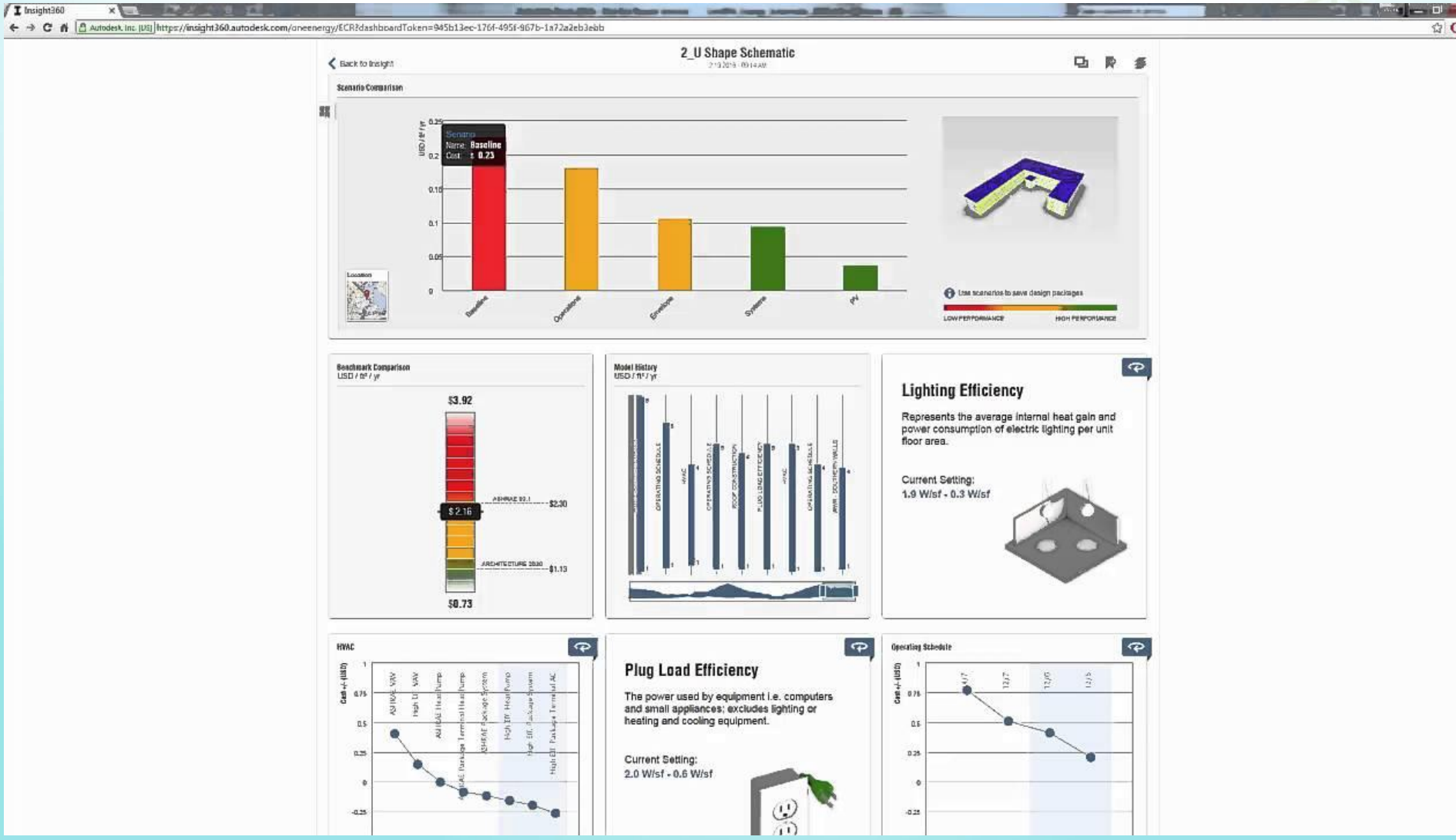


Design Validation

Make detailed design

- Adjust rooms and zones
- Size and shape individual openings
- Design custom shading devices
- Choose optimal materials

8 Information needed for effective analysis of the conceptual BIM model



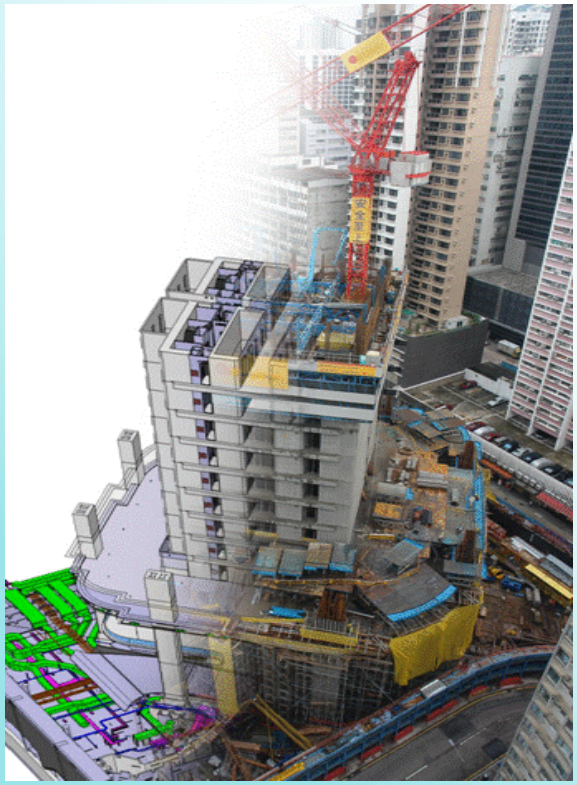
9 Overview of conceptual analytical tools

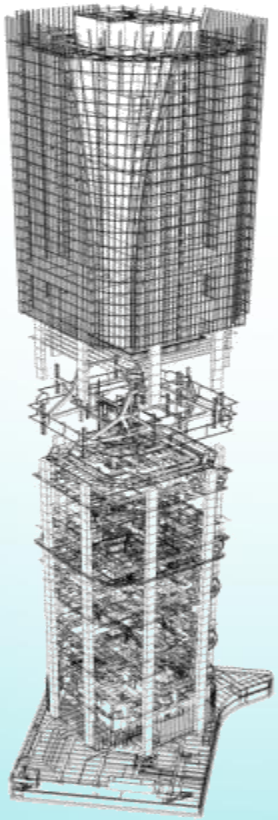
Site context and massing study,
sun shading study,
daylight analysis,
airflow & ventilation study,
visual impact & view corridor study,
wind tunnel simulation,
structural analysis etc.

BIM Adoption – Private Project

HIGH RISE BUILDING PROJECT

Name of Building: One Island East
Client: Swire Properties
Main Contractor: Gammon Construction
Completion: 2008
Description: 1.5 million sq. ft. 70-storey Hong Kong office building.





Andrew Baldwin, David Bordoli (2014). A Handbook for Construction Planning and Scheduling, John Wiley & Sons, Ltd.

BIM Adoption – Public Project

HONG KONG HOUSING AUTHORITY PROJECT

Autodesk Far East Ltd. (2010), Autodesk BIM Award 2010, Hong Kong, Macau and Taiwan

BIM Adoption

HONG KONG HOUSING AUTHORITY PROJECT

Autodesk Far East Ltd. (2010), Autodesk BIM Award 2010, Hong Kong, Macau and Taiwan

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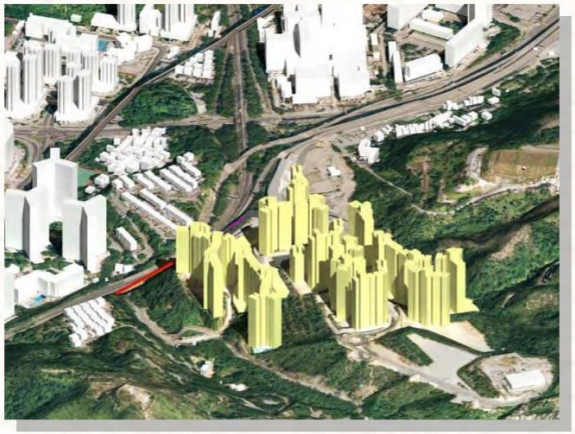
BIM Adoption

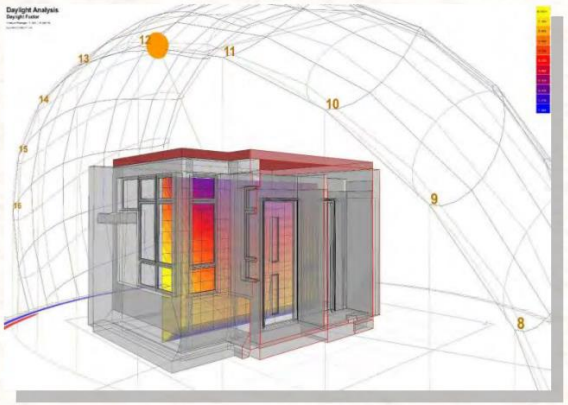
HOUSING AUTHORITY PROJECT

BIM Technology in HA – Current Applications

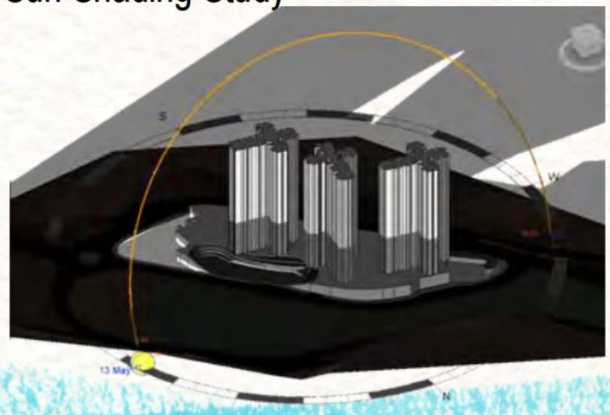
Visual Assessment



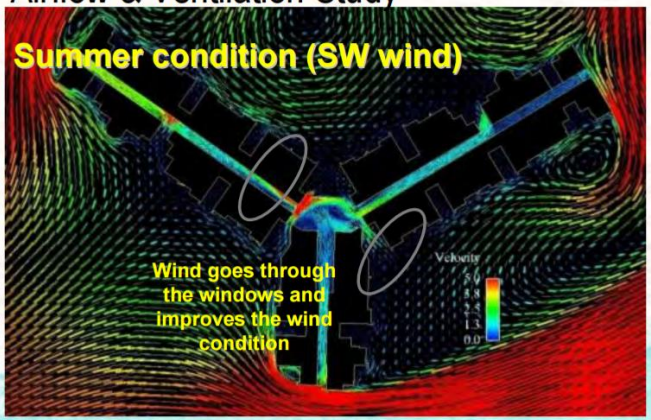
Daylight Analysis



Sun Shading Study



Airflow & Ventilation Study



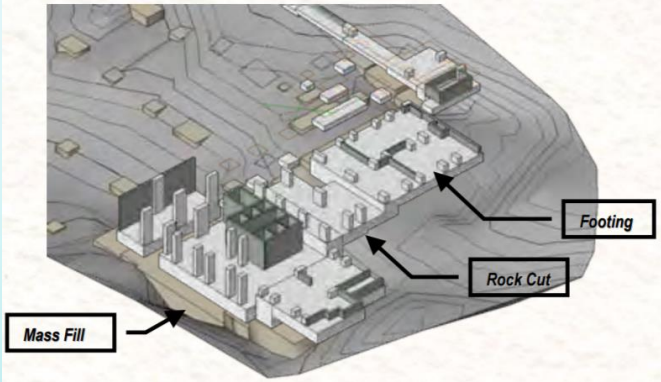
Ada Fung (2013). Application of BIM and RFID Application of BIM and RFID in Public Housing Projects in Public Housing Projects, CICID 10th Anniversary Conference

BIM Adoption

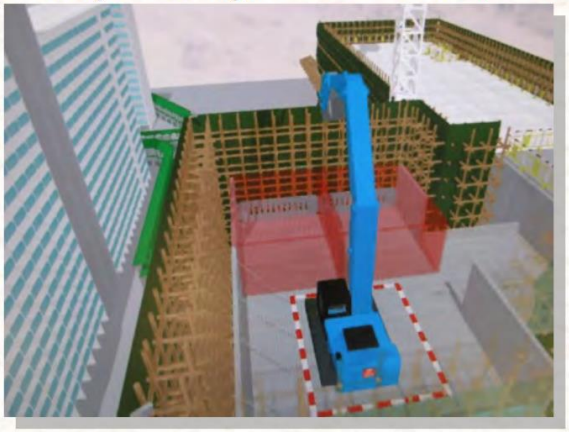
HOUSING AUTHORITY PROJECT

BIM Technology in HA – Current Applications

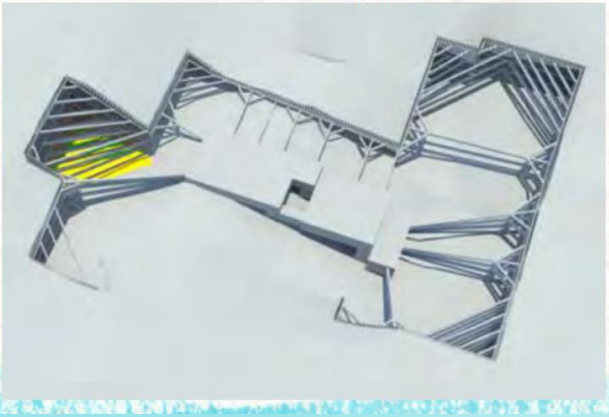
Optimization of Foundation Design



Site Safety Planning for Construction, Demoliti



Excavation and Lateral Support Simulation



Demolition Simulation

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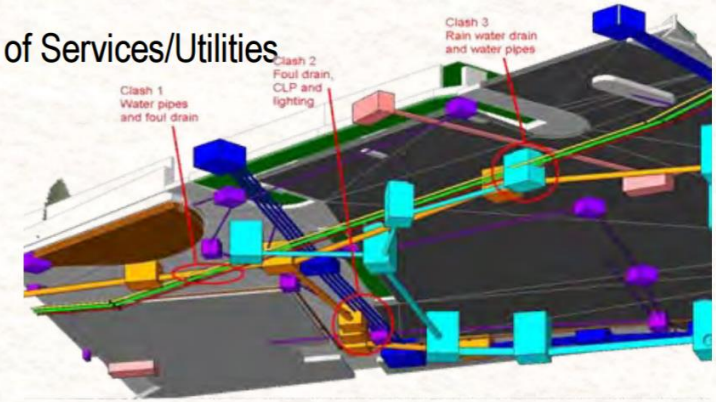
BIM Adoption

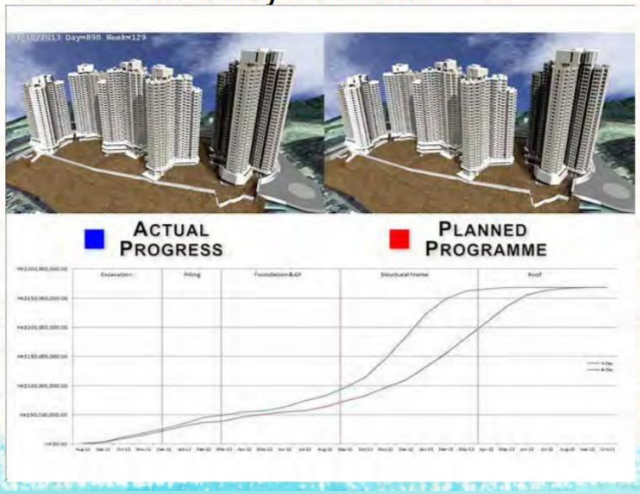
HOUSING AUTHORITY PROJECT

BIM Technology in HA – Current Applications

Co-ordinations of Services/Utilities Design



5D Model to Study Cash Flow



6-Day Typical Floor Construction Cycle

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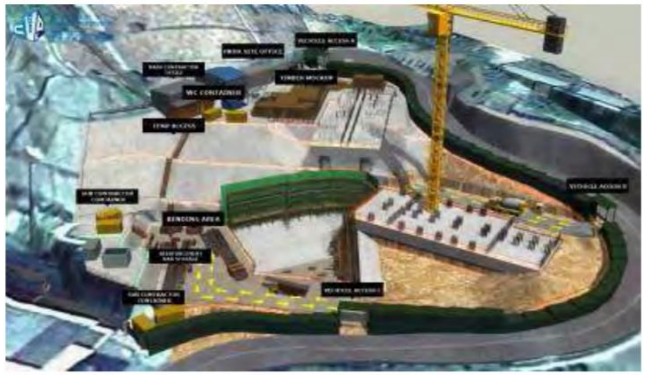
BIM Adoption

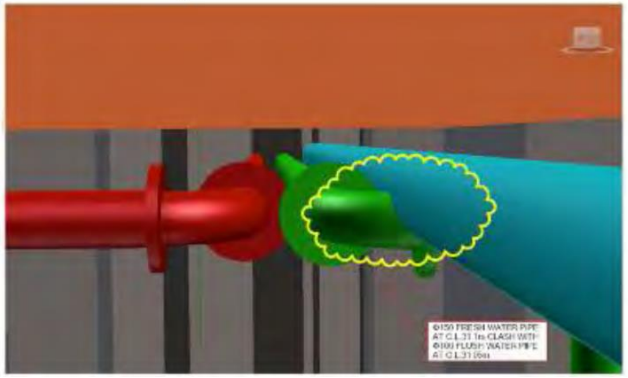
HOUSING AUTHORITY PROJECT

Contractor's Applications

Site Layout Planning

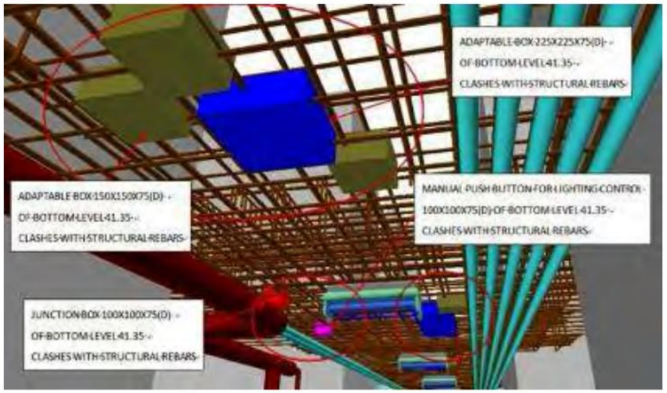


Clashes Study



Virtual Rehearsal : Six-day Cycle for Typical Floor

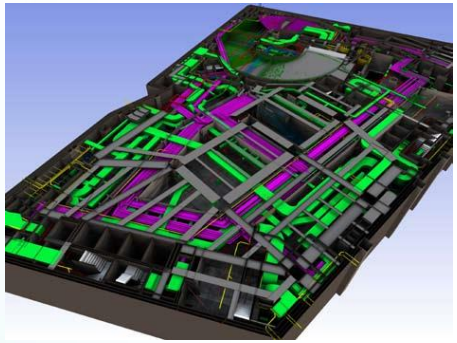
Rebars Fixing & Services Installation Collaboration

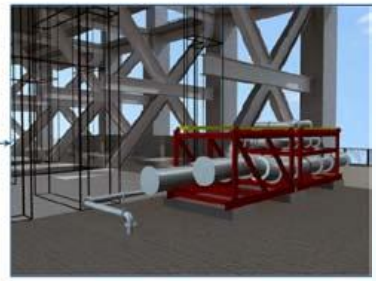


Ada Fung (2013). Application of BIM and RFID Application of BIM and RFID in Public Housing Projects in Public Housing Projects, CICID 10th Anniversary Conference

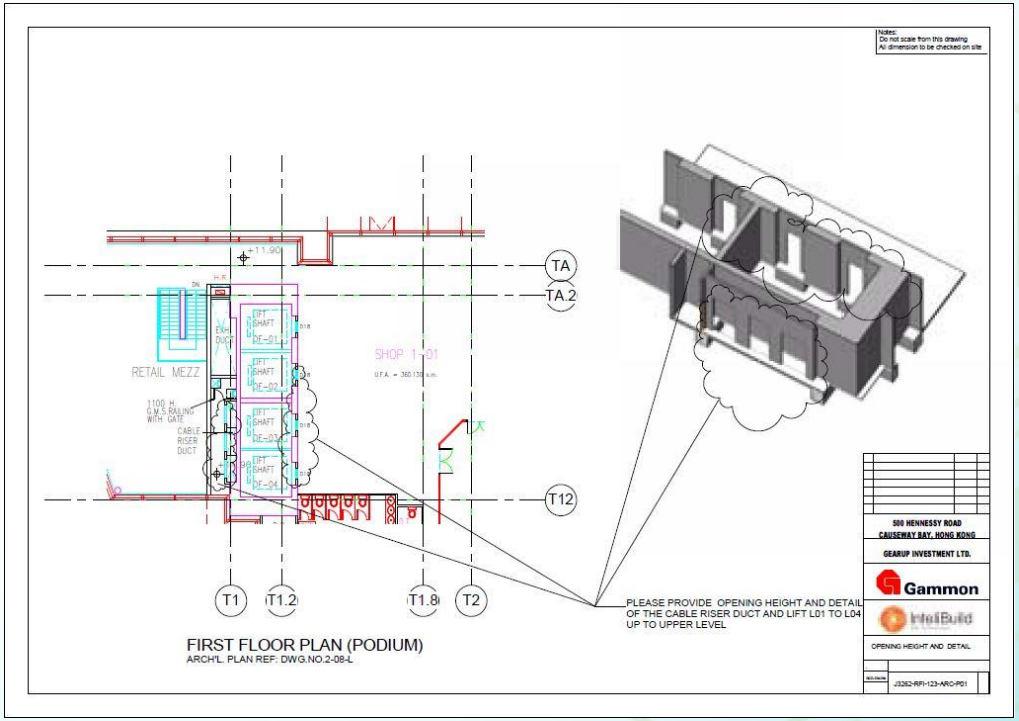
BIM Adoption – Commercial Office

Redevelopment of Hennessy Centre

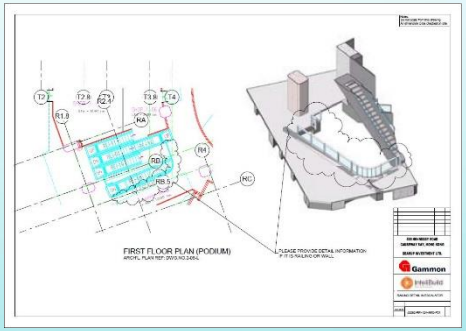




Pipe Module Installation



Pipe Rack Units

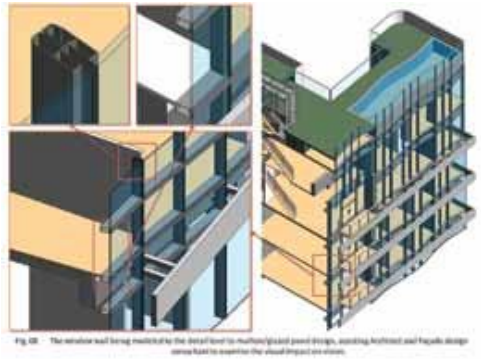


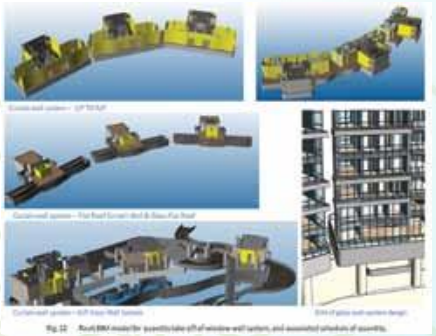
Company: Gammon Construction Limited
Project: Redevelopment of Hennessy Centre
Location: Causeway Bay, Hong Kong
Type: Commercial
Scheduled Time of Completion: 2012

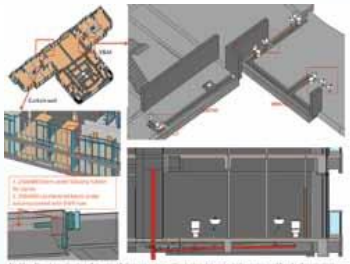
Autodesk Far East Ltd. (200), Autodesk BIM Award 2010, Hong Kong, Macau and Taiwan

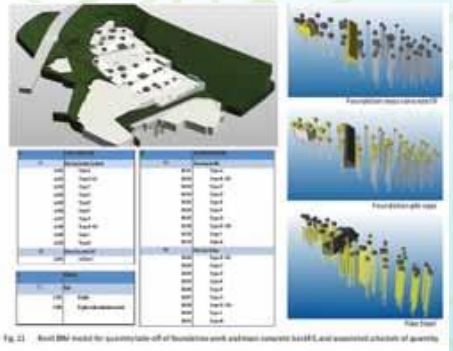
BIM Adoption – Private Residential Project

The University Heights Redevelopment









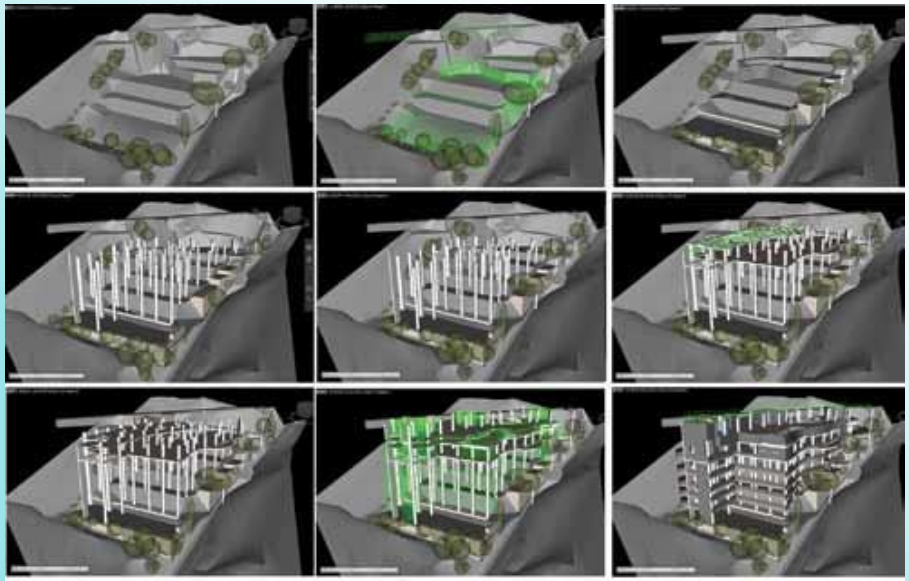


Fig. 05 Captured views of Navisworks 4D simulation to visualize the construction process of site formation work and basement structure.

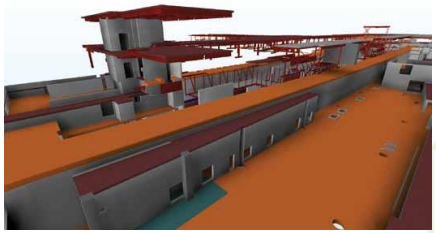
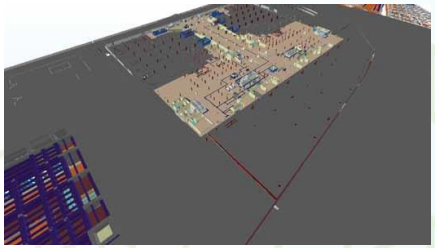
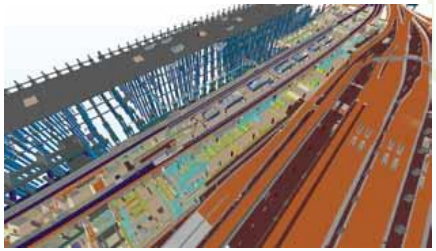
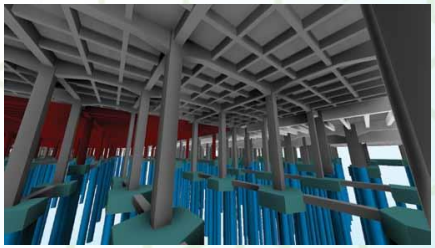
Company: Chinachem Group
Project: The University Heights Redevelopment
Location: No.42-44, Kotewall Road, Mid-levels West, Hong Kong
Type: Luxury High-end Residential Development
Scheduled Time of Completion: 2017

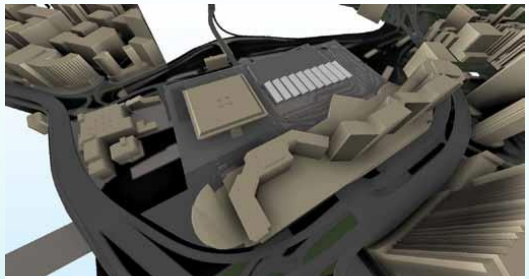
BIM Partners:
• Andrew Lee King Fun & Associates Architects Limited
• Far East Consulting Engineers Limited • CM Wong & Associates Limited • Rider Levett Bucknall Limited • Atkins China Limited
• Vircon Limited

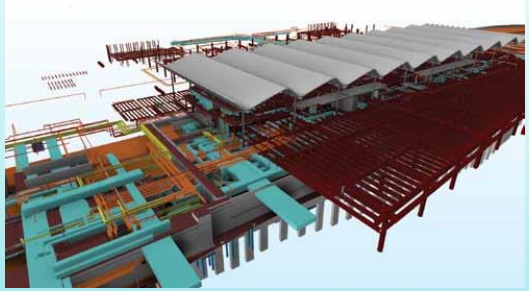
Autodesk Far East Ltd. (2013). Autodesk BIM Award 2013, Hong Kong, Macau and Taiwan

BIM Adoption – Metro Station

Hung Hom Station & Approach Tunnels





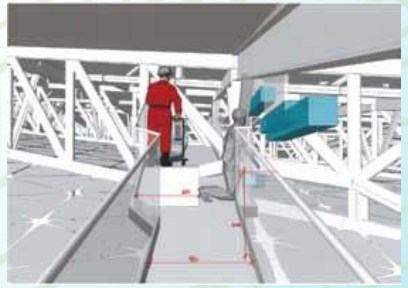
Company: MTR Corporation Limited
Project: Hung Hom Station & Approach Tunnels
Location: Hung Hom, Hong Kong
Type: Civil Infrastructure
Scheduled Time of Completion: 2018

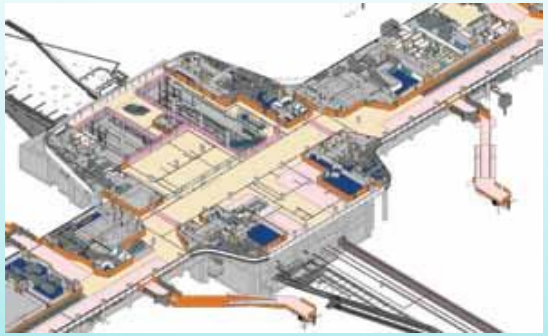
BIM Partners:
- Aedas Limited • Parsons Brinckerhoff
- Atkins • Sweett Limited • InteliBuild
- Leighton Contractor (Asia) Limited
- Gammon Kaden Joint Venture

Autodesk Far East Ltd. (2013). Autodesk BIM Award 2013, Hong Kong, Macau and Taiwan

BIM Adoption – Airport

Airport Terminal: Midfield Development Design Consultancy Services





Company: Mott MacDonald and Arup
Project: Midfield Development Design Consultancy Services
Location: Hong Kong International Airport
Type: Infrastructure
Scheduled Time of Completion: Q3, 2015

BIM Partners:
• Airport Authority Hong Kong • Aedas Limited • OTC Limited • Atkins China Limited • Bo Steiber Lighting Design

Autodesk Far East Ltd. (2009). Autodesk BIM Award 2009, Hong Kong, Macau and Taiwan

BIM Adoption – Design and Build

Renovation of 1/F Main Block APB Centre Architectural Services Department

- Use of BIM for renovation project

PLATINUM
鉑金級 BI 室內建築 V1.0 2015
HKGBC
BEAM Plus
綠建環評

Total Score: 89.0

BEAM Plus Interiors V1.0 Platinum

Completion Year: 2015
IFA: 794sqm

Owner: Architectural Services Department
Architect: Llewelyn-Davies HK Ltd.
M&E: Wong & Ouyang (BS) Ltd.
Sustainable Design: Ove Arup
BIM Consultant: Vircon Ltd.

From Hong Kong Green Building Council (2016)

BIM Adoption – Full BIM

Xiqu Centre

Image courtesy of BTA & RLP Company Ltd.

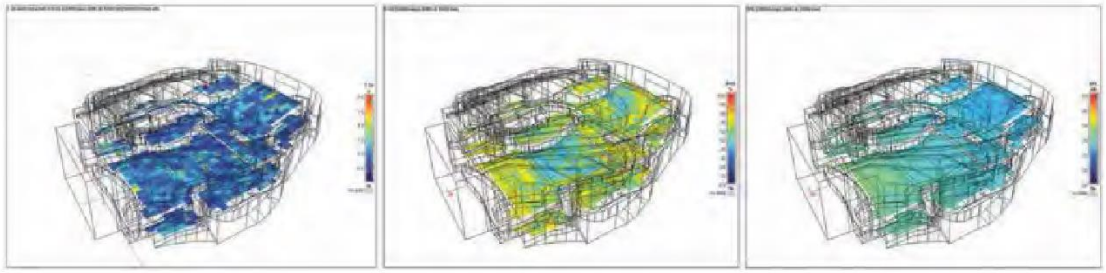
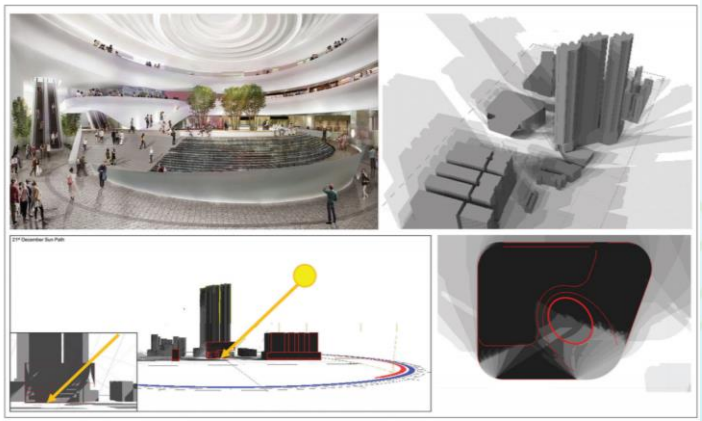


Image courtesy of BTA & RLP Company Ltd.



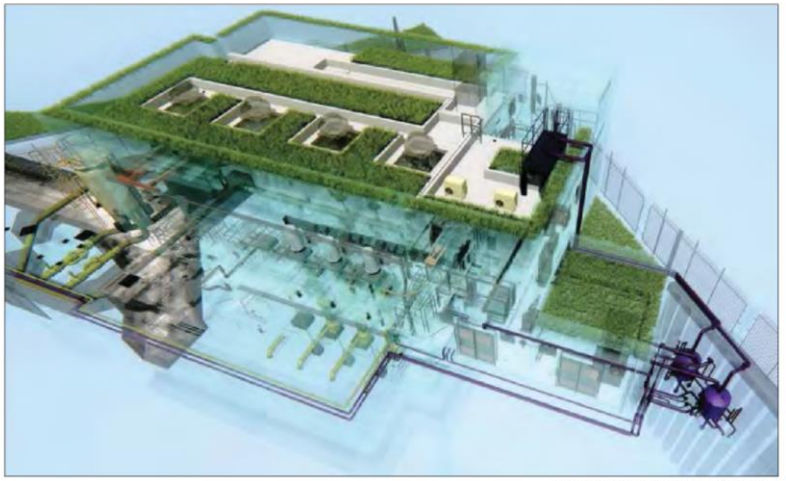
Company: BTA & RLP Company Limited
Project: Xiqu Centre
Location: West Kowloon Cultural District, Hong Kong
Type: Theatre and Retail
Scheduled Time of Completion: 2017

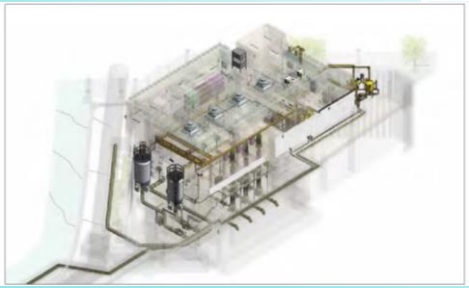
BIM Partners:

- West Kowloon Cultural District Authority
- Buro Happold International
- Rider Levett Bucknall
- Atkins China Ltd.
- Front Inc.
- Hip Hing Construction Co. Ltd.
- Kingsfield Engineering Ltd.

BIM Adoption – Asset Management

Study on the Trial Use of Building Information Modelling (BIM) for Asset Management





Company: Water Supplies Department, HKSAR Government
Project: Study on the Trial Use of Building Information Modelling (BIM) for Asset Management
Location: Tai Po and Telegraph Bay Salt Water Pumping Stations
Type: Waterworks
Scheduled Time of Completion: 2015

BIM Partners:

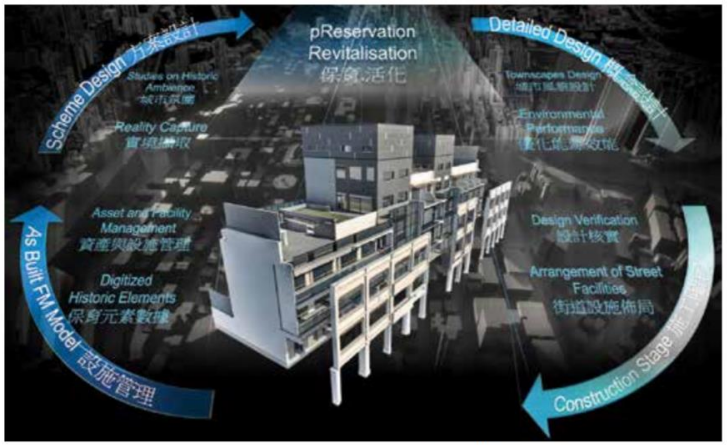
- Summit Technology (HK) Ltd • Sino-iTech Holdings Co Ltd.

Autodesk Far East Ltd. (2015). Autodesk BIM Award 2015, Hong Kong, Macau and Taiwan

BIM Adoption –Revitalization Project

Revitalization of Shophouses at 600-626 Shanghai Street, Mong Kok

Enabling a more efficient building life cycle through the use of Building Information Modelling
Image courtesy of Urban Renewal Authority



To adopt the use of BIM in the building life cycle: Design, Build and Operate
Image courtesy of Urban Renewal Authority

Enhanced Design Communication, Closer Collaboration and quality of the buildings

3D digital representation of building data
Image courtesy of Urban Renewal Authority

Interface of the entrance, covered cloister, finishes of old and new façade can be evaluated easily
Image courtesy of Urban Renewal Authority

Company: Urban Renewal Authority
Project: Revitalization of Shophouses at 600-626 Shanghai Street, Mong Kok
Location: Mong Kok, Hong Kong
Type: Revitalization and Preservation
Scheduled Time of Completion: 2018/2019

BIM Partners:

- Chau Lam Architects & Associates Architects & Engineers (HK) Limited
- Ben Tse & Associates Limited • Far East Consulting Engineers Limited
- China Point Consultants Limited • Beria Consultants Limited
- Team 73 HK Limited • Wan Chung Construction Company Limited
- Vircon Limited

Autodesk Far East Ltd. (2017). Autodesk BIM Award 2017, Hong Kong, Macau and Taiwan

BIM Adoption - Landscape

The Use of BIM for Landscape Design – Landscape Information Modelling

Image courtesy of Architectural Services Department, HKSAR Government

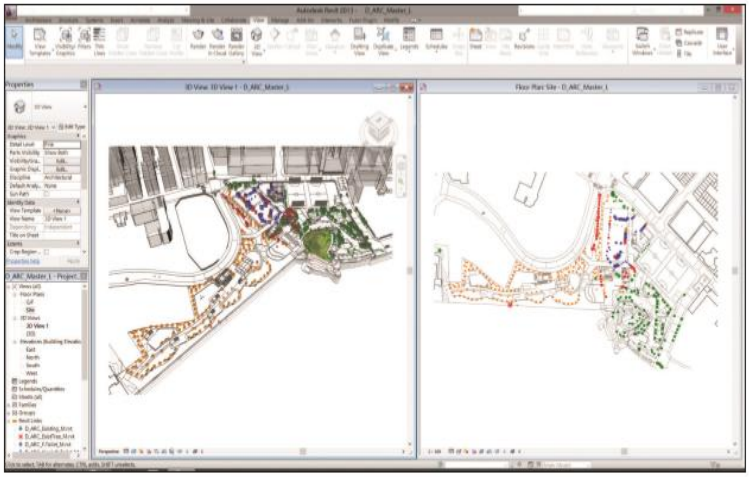


Image courtesy of Architectural Services Department, HKSAR Government

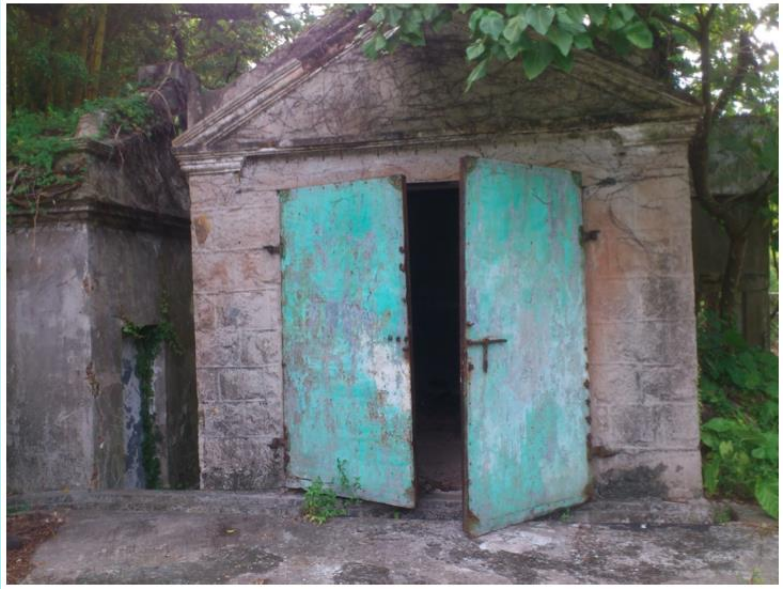
Company: Architectural Services Department, HKSAR Government
Project: The Use of BIM for Landscape Design – Landscape Information Modelling
Location: Victoria Park, Causeway Bay; Parks in To Kwa Wan & Kwun Tong
Type: Landscape Design and Construction
Scheduled Time of Completion: 2015-2018

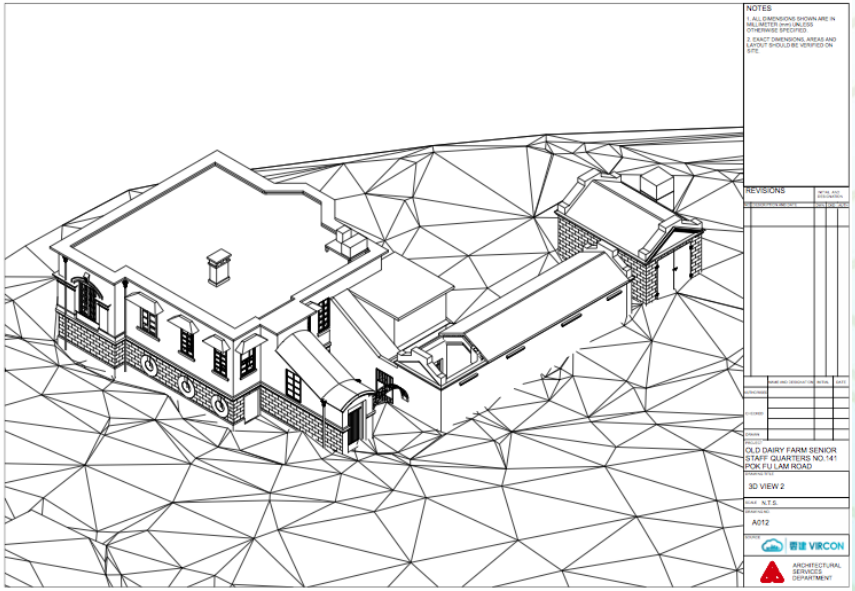
BIM Partners:
• Vircon Ltd. • Kalloc Studios Asia Ltd.

BIM Adoption - Heritage

HERITAGE

- Use of BIM for Heritage Record and Further Design





Year Built: 1887
Grading: Grade 1
Selected Applicant: Caritas-Hong Kong
Project Title: The Pokfulam Farm Project
Content: The project will present the history of the Old Dairy Farm and introduce the culture of Pokfulam village and the surrounding area through exhibitions, guided tours and workshops

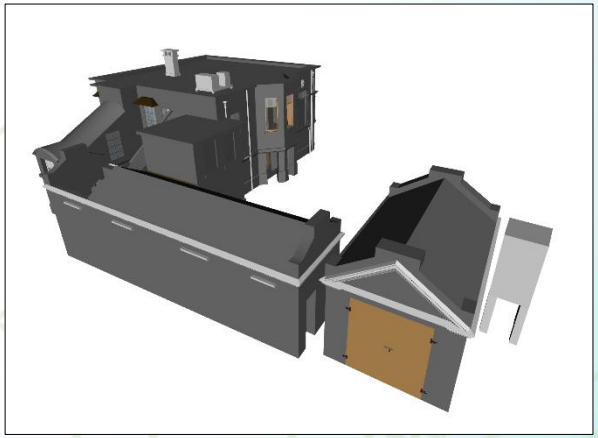
Conserve and Revitalise Hong Kong Heritage Department (2013), Revitalising Historic Buildings Through Partnership Scheme, Resource Kit

BIM Adoption - Heritage

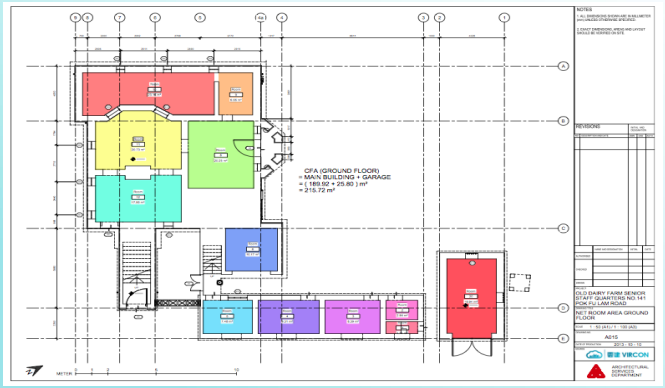
TERRESTRIAL LASER SCANNING AND BIM

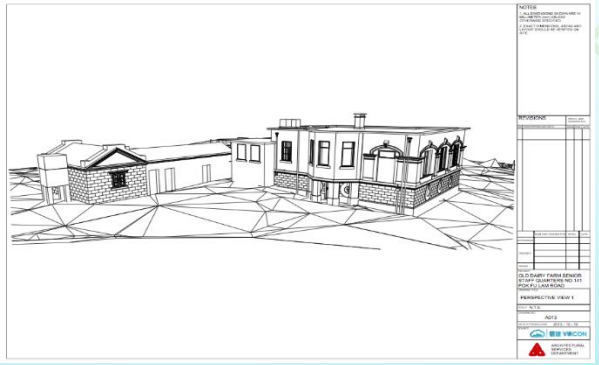
3D Scanning

Point Cloud Data



BIM Model



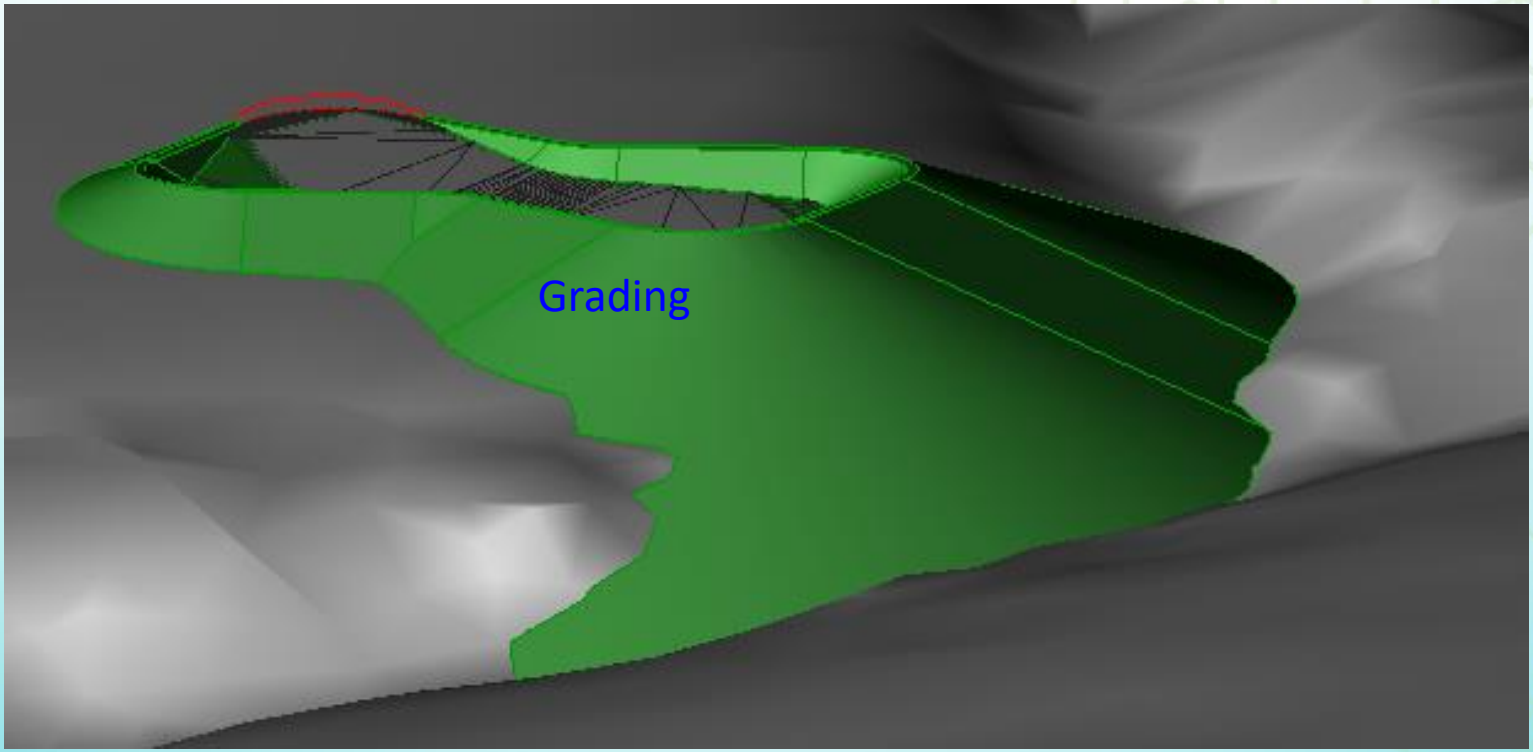


Room Schedule	
Name	Area
Room 01	10.37 m²
Room 02	6.65 m²
Room 03	24.67 m²
Room 04	24.61 m²
Room 05	4.53 m²
Room 06	21.89 m²
Room 07	24.25 m²
Room 08	23.20 m²
Room 09	10.55 m²
Room 10	7.48 m²
Room 11	25.21 m²
Room 12	24.35 m²
Room 13	21.31 m²
Room 14	9.55 m²
Room 15	4.30 m²
Room 16	9.73 m²
Room 17	7.48 m²
Room 18	1.84 m²

Drawing Production and Quantity Take-off

Create Parametric Road Model

Surface/DTM Model

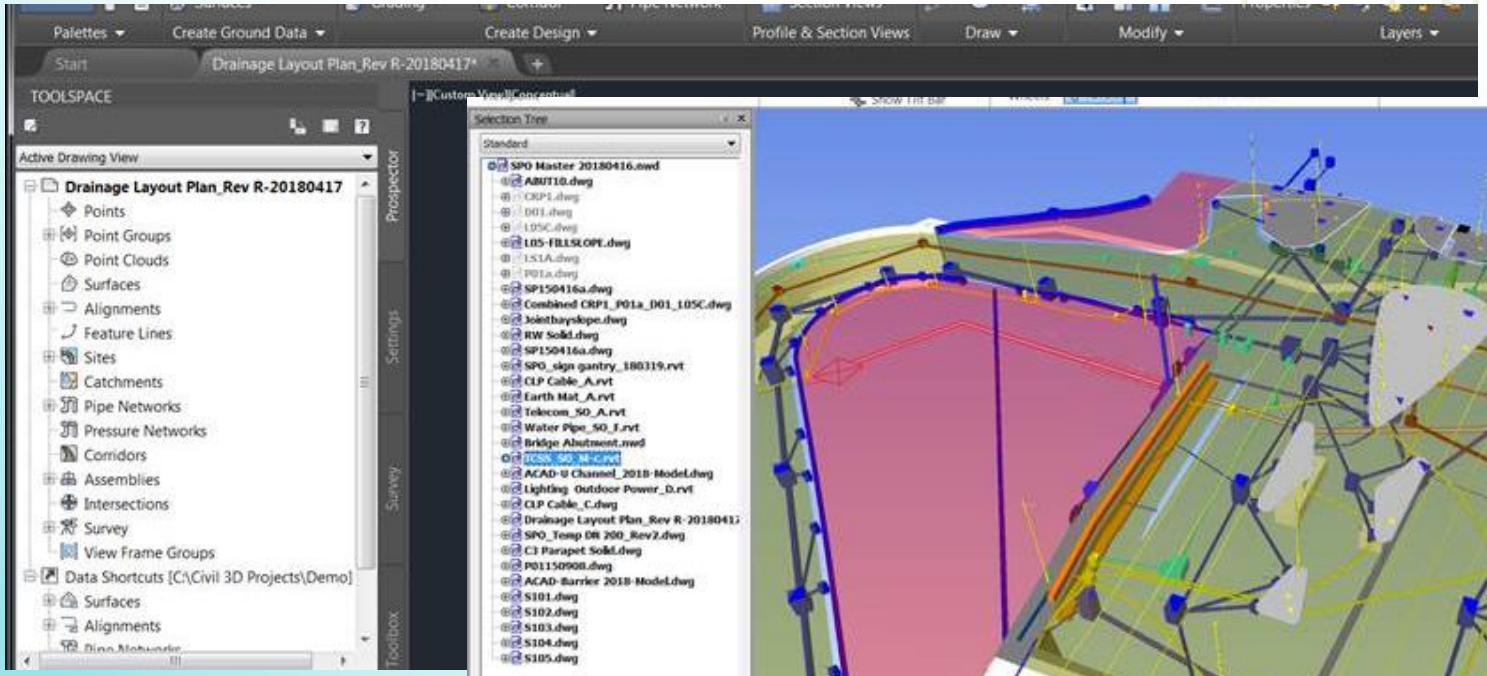


Modelling Methodology : Site Formation

Modelling Methodology : Site Model

ID	Terminology	Autodesk Civil 3D	Format	Bentley Open Road	Format	Exchange Format
1	Site formation/Slope	Grading	DWG/XML	3D Slope	DGN/DTM	XML
2	Existing Terrain	Surface	DWG/XML	Terrain	DGN/DTM	XML
3	Building Foot print	Feature Line	DWG	Geometry Tool	DGN	XML
3	Strata/ Sub-surface	Surface	DWG/XML	Terrain	DGN/DTM	XML
4	Bore hole	(Geotechnical Extension)	DWG	(GINT)	DGN	AGS/XML

Modelling Methodology : Utilities Model

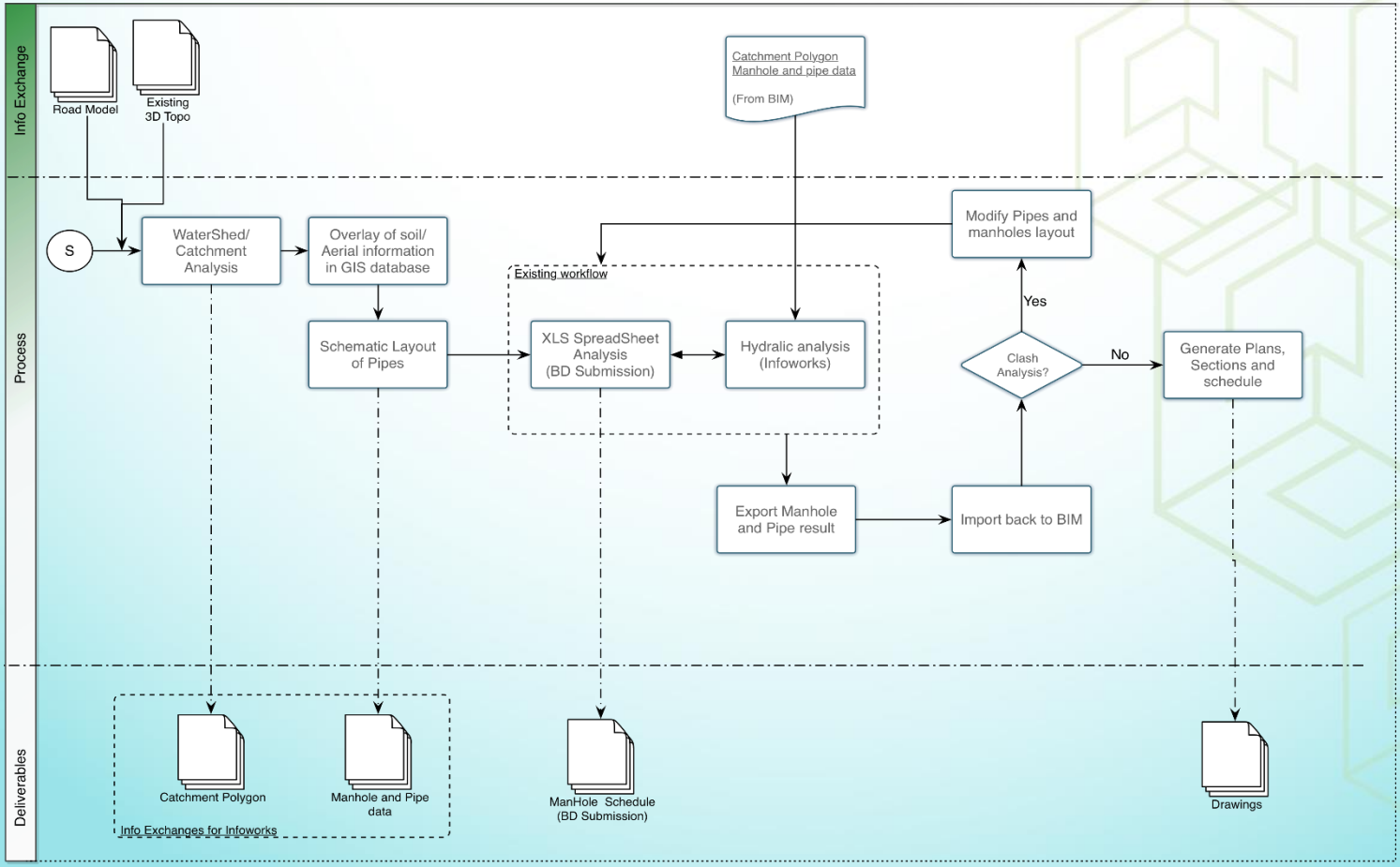


Modelling Methodology : Underground Utilities

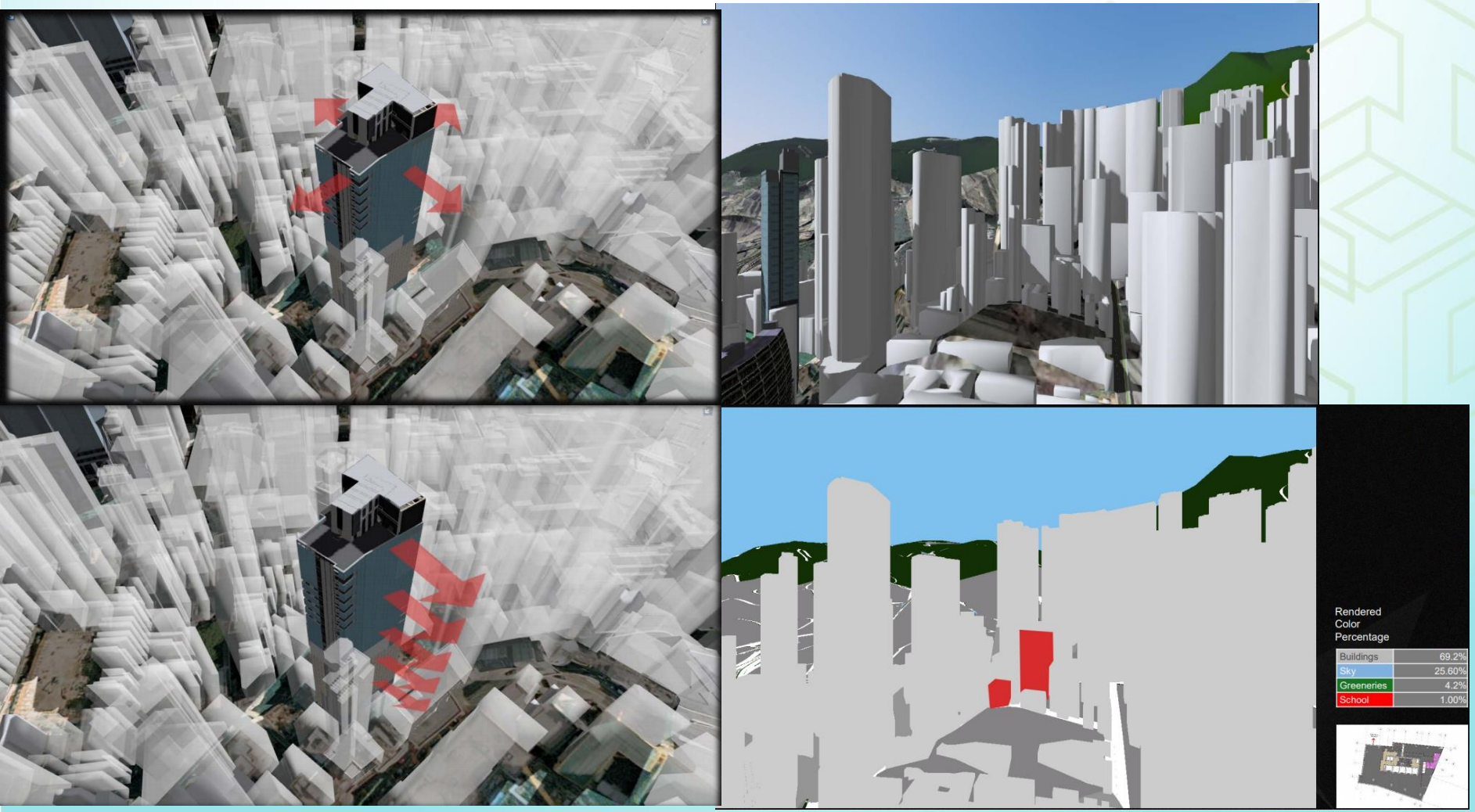
ID	Terminology	Autodesk	Format	Bentley	Format	Exchange Format
1	Storm Drain/PVC/DI Pipes	C3D: Pipe Network	DWG	SSU: Pipes	DGN	XML
2	Pressure Pipe	C3D: Pressure pipe	DWG	SSU: Pipes	DGN	XML
3	Manholes	C3D: Structures	DWG	SSU: Cells	DGN	N/A
4	Valve, Bend, Fittings	C3D: Fittings	DWG	SSU: Cells	DGN	N/A

- Utilities could be modelled in C3D/SSU or Revit/AECOSim
- Key Consideration
  - Interfaces with Terrain
  - Storm drainage analysis

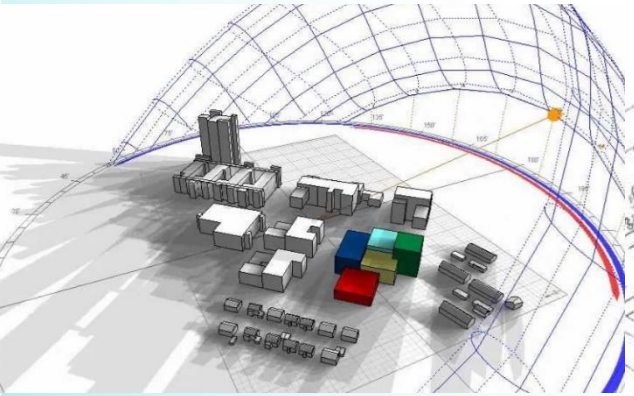
Storm Drain Analysis

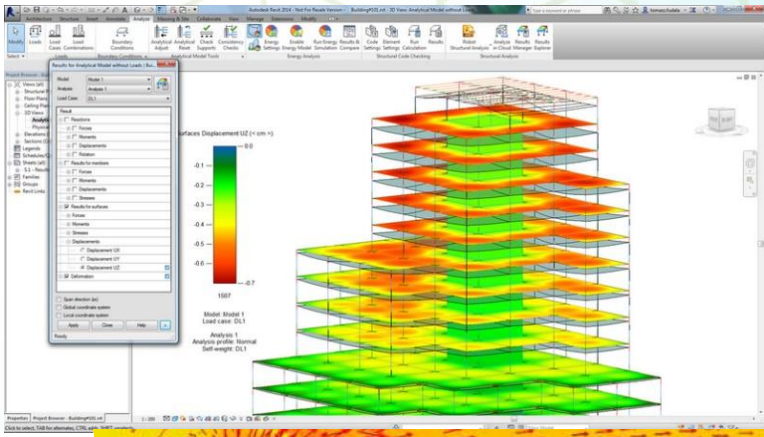


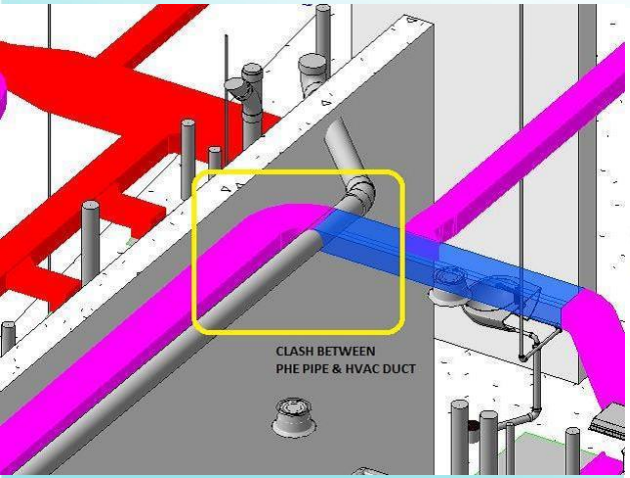
10 Constraints of conceptual analytical tools and decisions made on their basis

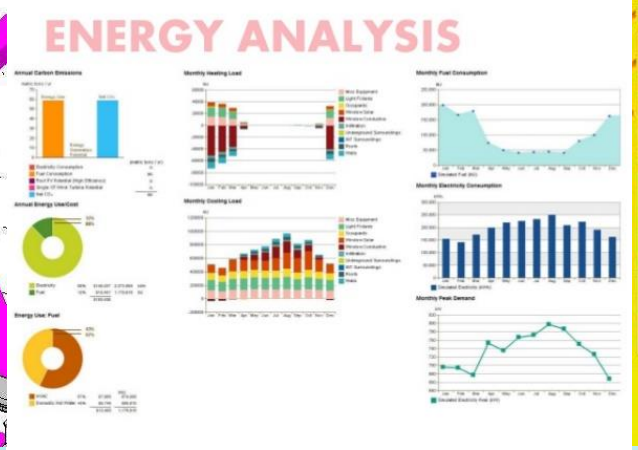


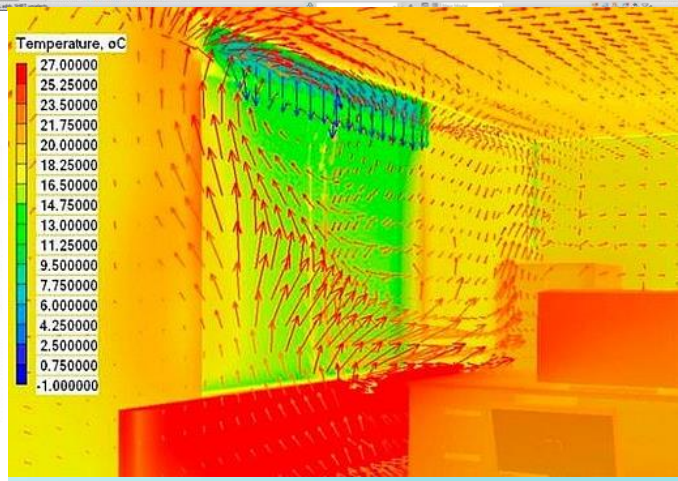
11 Applying selected analytical tools to a validated model











12 Understanding the results of analyses and drawing conclusions for the project

C. BIM Model As A Project Database

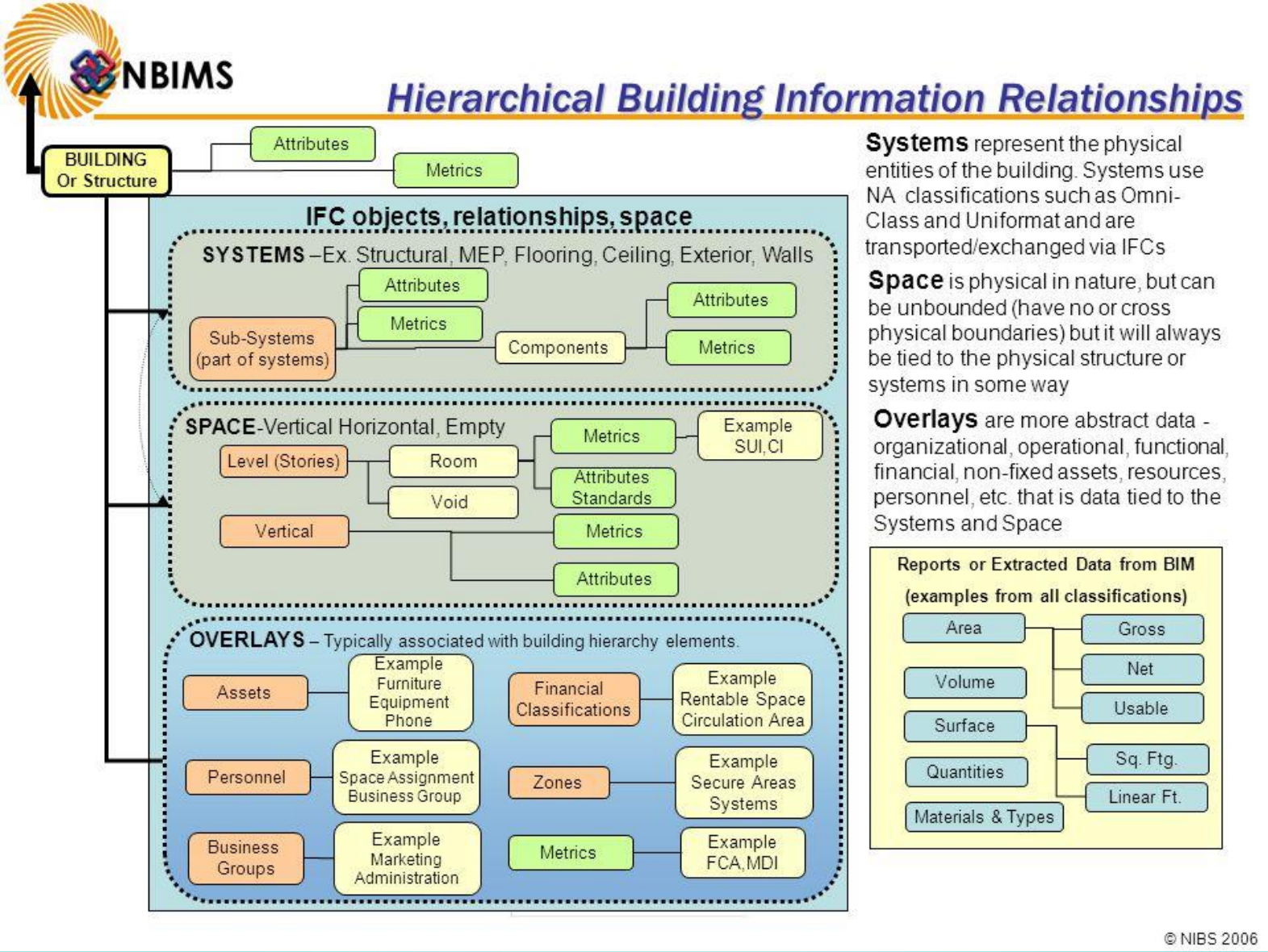
1 Basic application of BIM model as a/an database/ objective database

- 3D - 三維資訊模型 – 3D Model
- 4D - 建設規劃 – Scheduling
- 5D - 工料測量 – Quantity Surveying
- 6D - 可持續性分析 - Sustainability
- 7D - 設施管理應用 – Facility Management

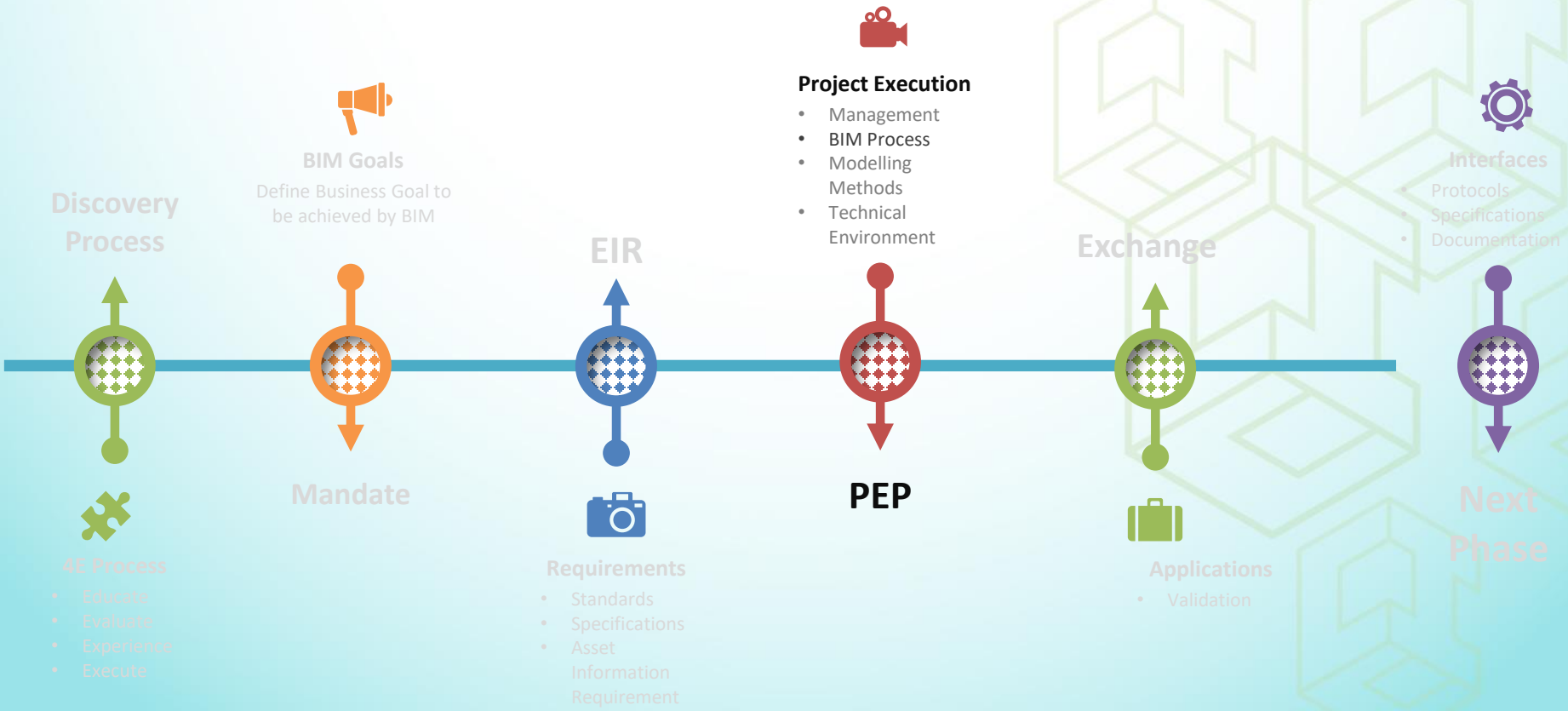
……

Addition of Information in BIM!

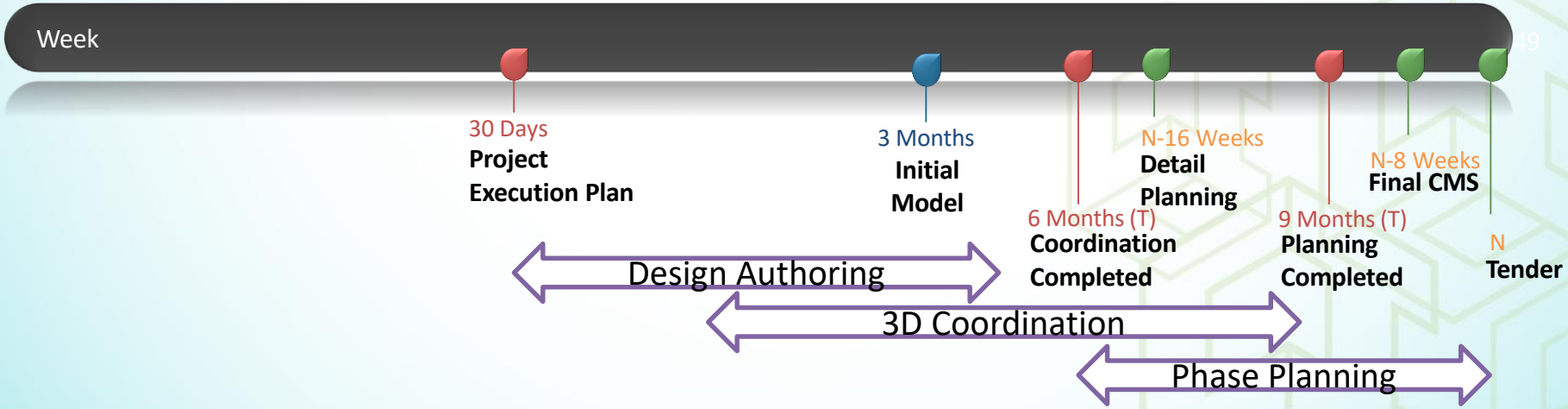
2 Hierarchy and organization of a project database



3 Project management at different stages (from design to asset/facility management)



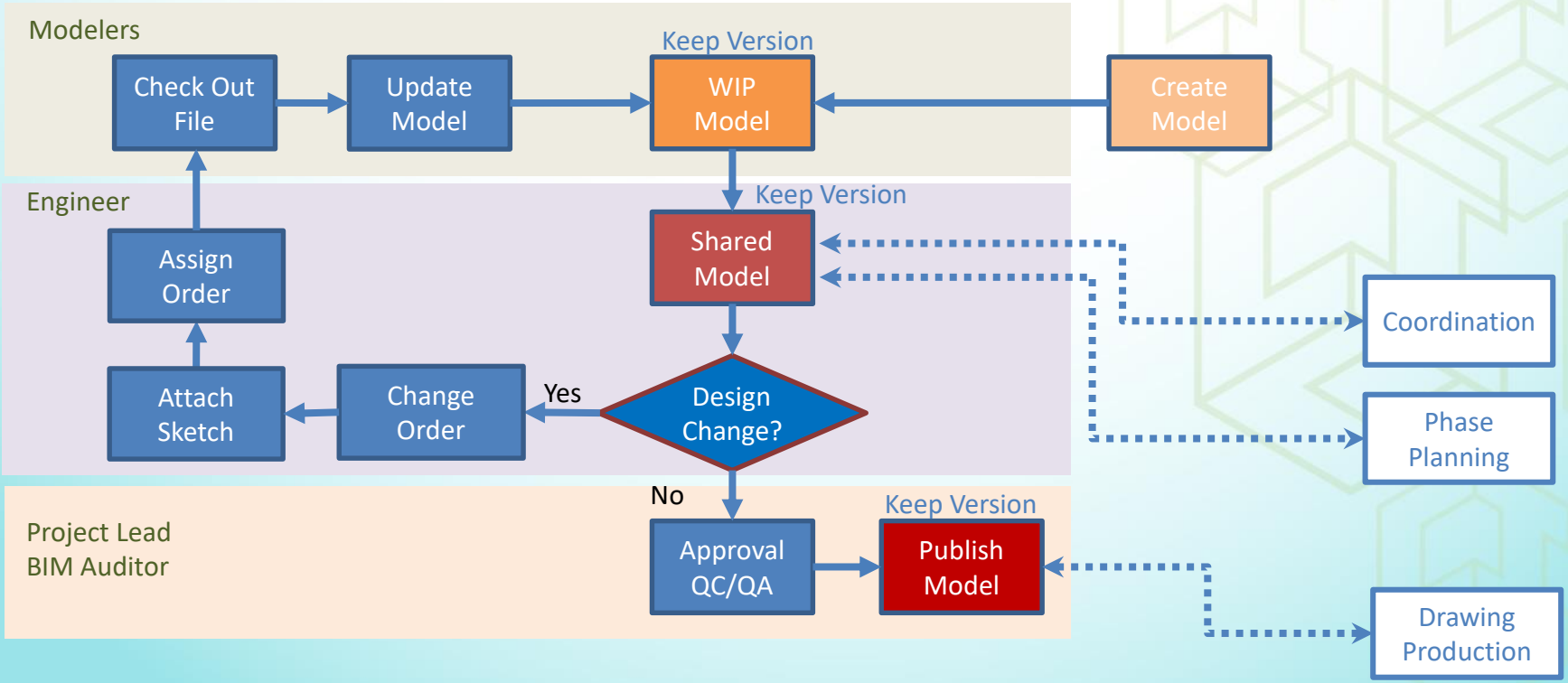
Challenges managing Process and Deliverables (Design Phase)



ID	Disciplinary Model	Conceptual Model	Design, Analytical, Visualization Model	Coordinated & Planning Model	Tender Model
ES	Existing Site Model	100	200 - 250	250	250
ER	Road Model	200	200 -300	300 - 350	300 ~ 350
BR	Bridge Model	100	200 - 300	300 - 350	300 ~ 350
UP	Underpass Model	100	200 - 300	300 - 350	300 ~ 350
BD	Building Model	200	200 ~ 300	200 - 300	300 ~ 350

Parallel Iterative Process

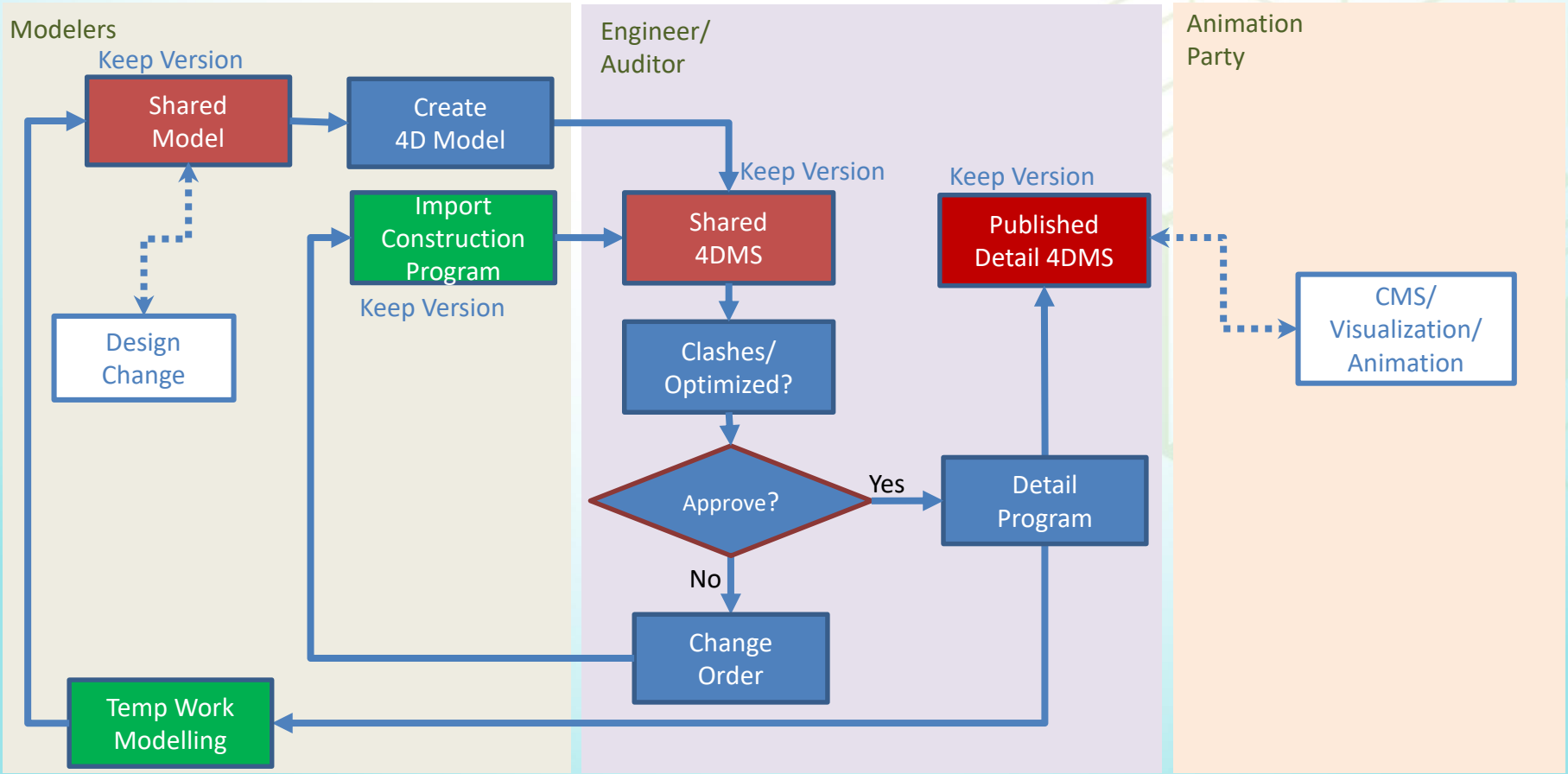
Design/Changes/Deliverables Management



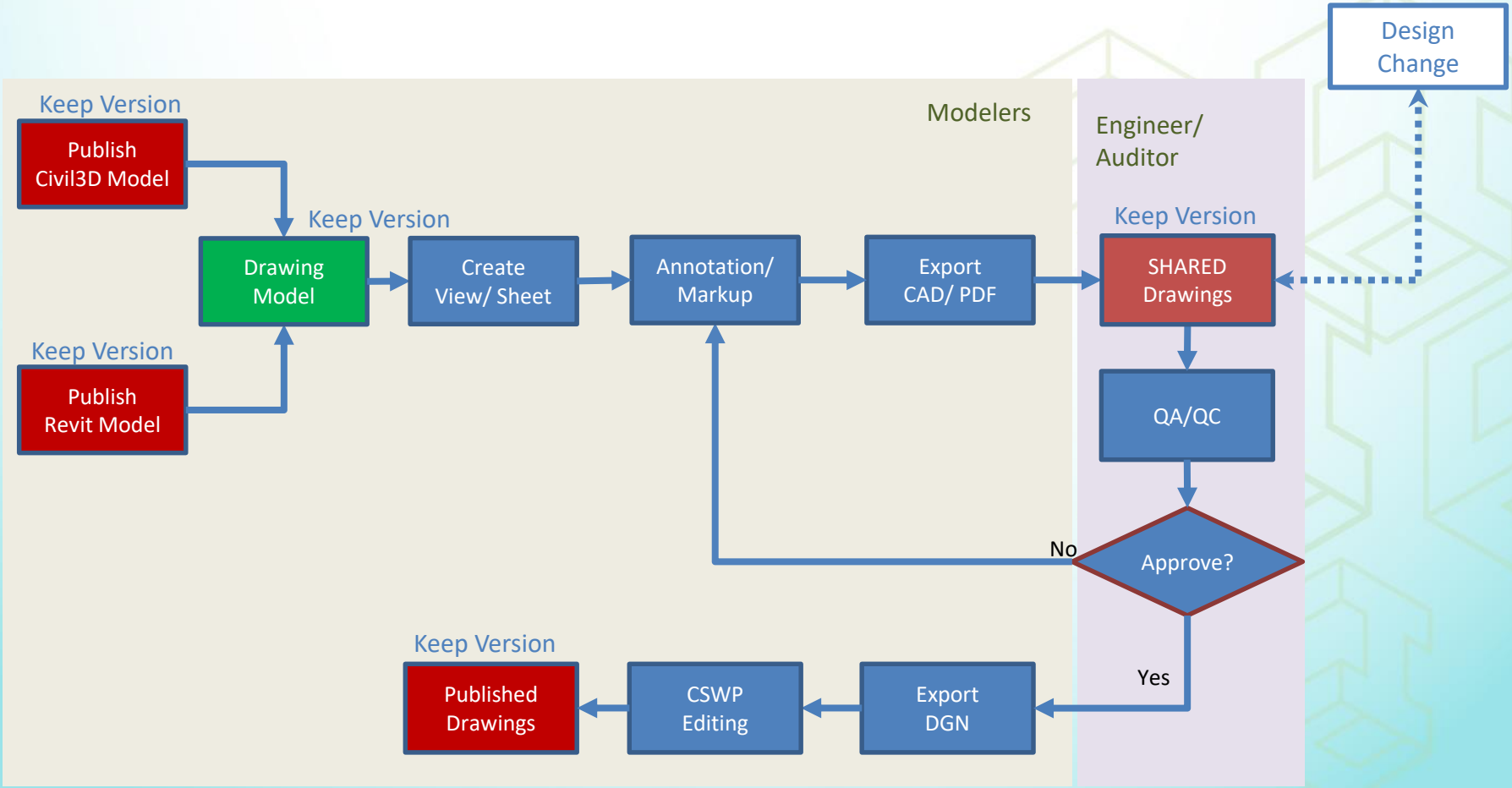
Folder structure, Control Spreadsheets, & Naming Convention

Coordination History Tracking			ES-STM	ES-TOP	SF-SLP-A	ER-S01	ER-S02	ER-STM	UU-WM01	BR-SEG
TQ/ Issue	Change Order/Description	Sketch/drawing/Incoming Files								
1	Initial Survey out of date	Initial_Survey.dwg	WIP-200	WIP-200						
2	…	…								
	Latest Released		COR-200	COR-200	CMS-100	CMS-100	CMS-100	CMS-100	CMS-100	CMS-100

Phase Planning Management



Drawing Production Process



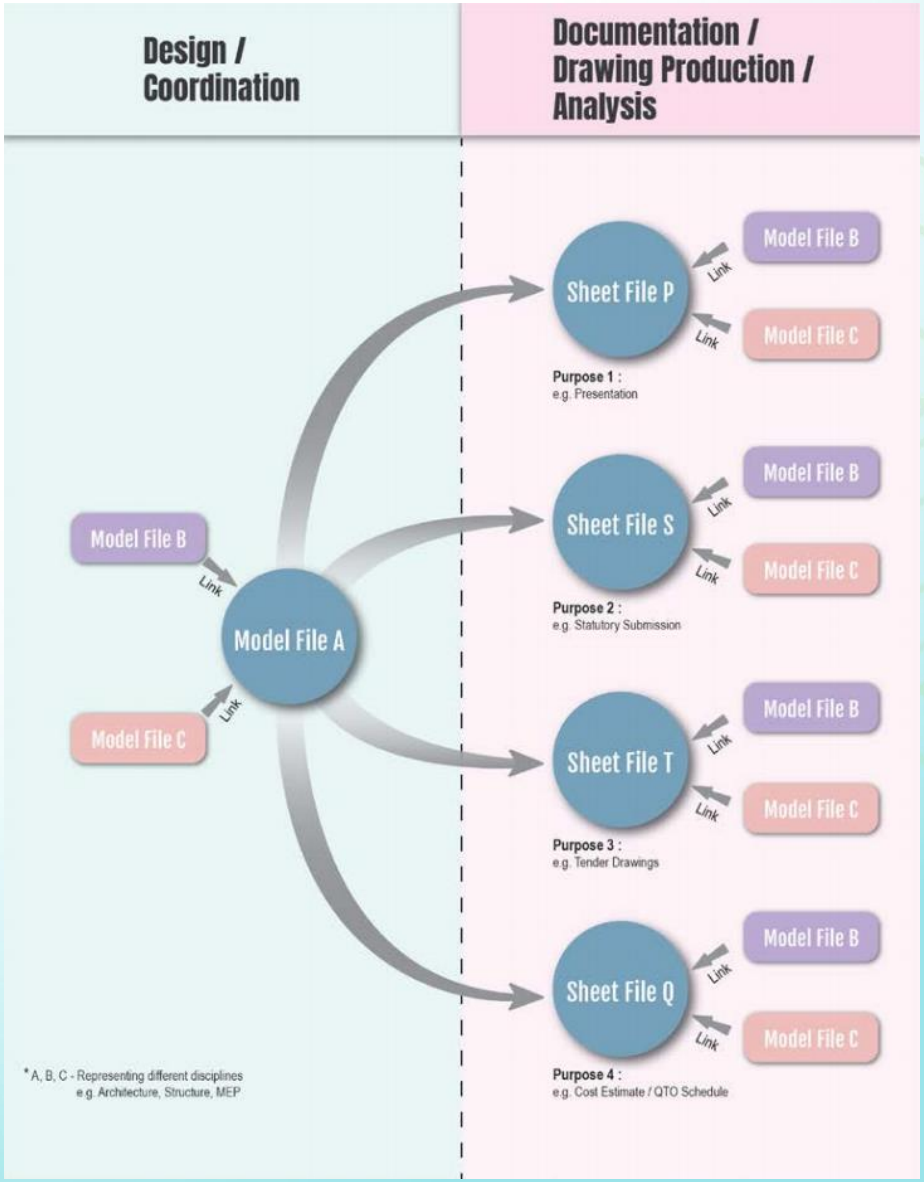
Generation of Documentation

- General Concept
  - Link Models > Generate Views > Generate Sheets
  - EXPORT to CAD (civil) /PDF / Light Format
- Extracted from Model
  - Layout
  - General arrangement
  - Sections
- Hybrid CAD/BIM
  - Standard drawings
  - Detail drawings (or in BIM)
- CAD Standard compliance is a BIG Issue

BIM Documentation

Model Files vs Drawing Files

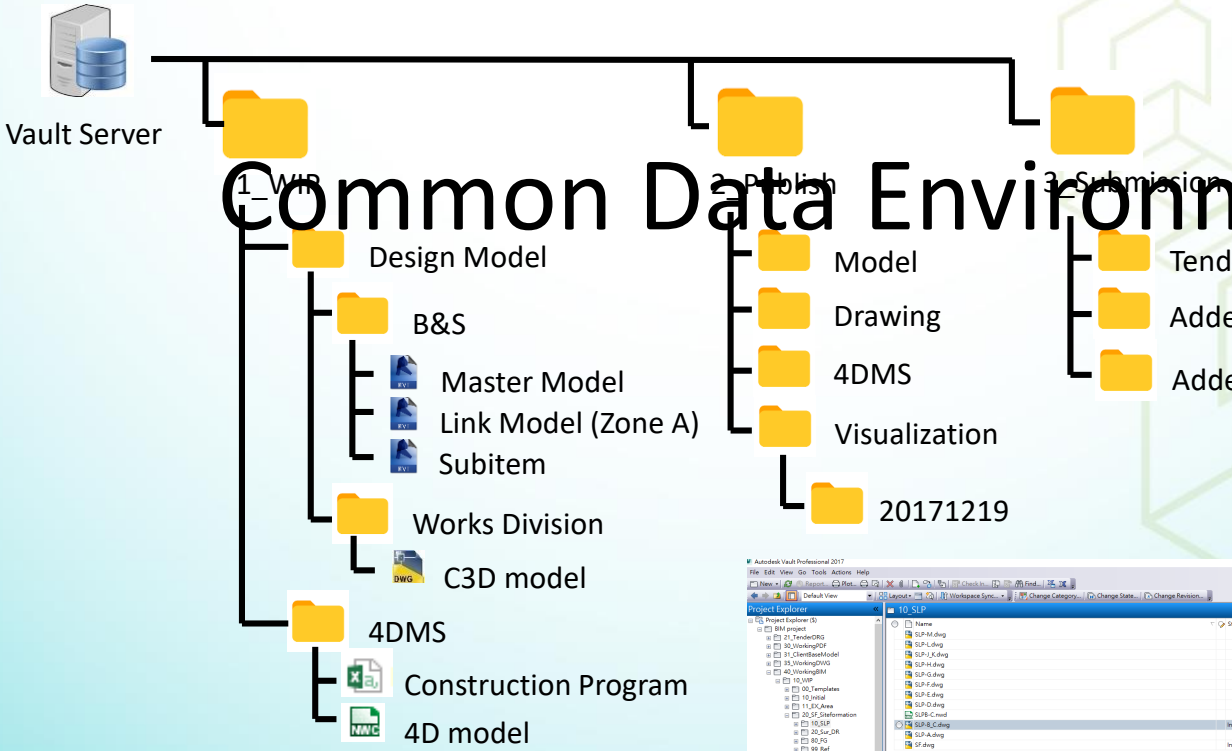
Drawing / Model Register

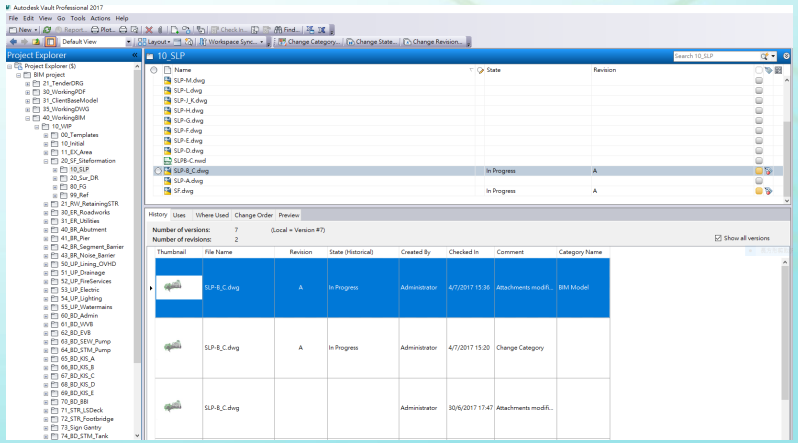


Documentation Control Spreadsheet

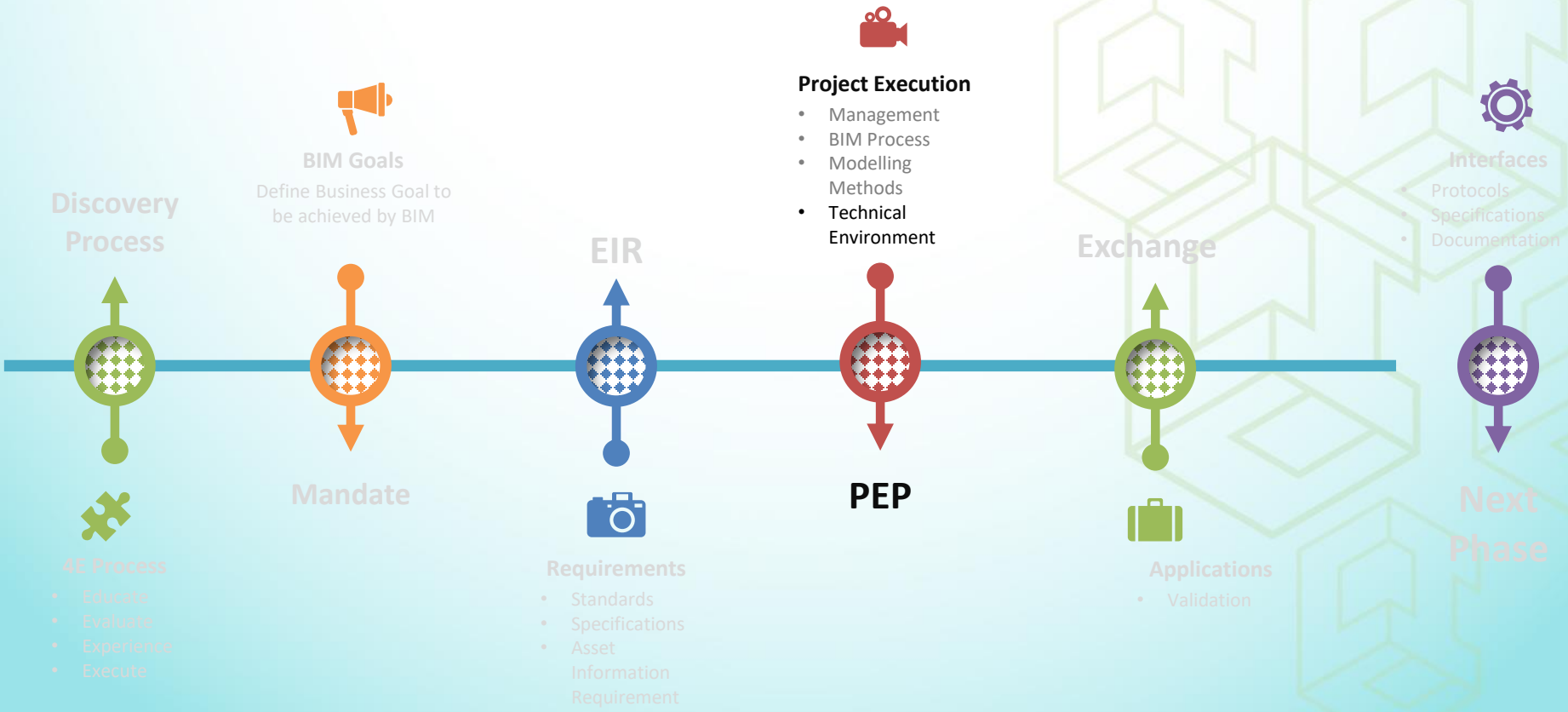
Drawing Version Tracking				Modelfiles.rvt	Modelfiles.rvt	Modelfiles.rvt	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg
Discipline	Drawing title	File Name	Revision/Date								
BS	Drawings files	Drawingfiles.pdf				*		*		*	
…	…	…		*	*			*	*		*

Common Data Environment





Project Execution – Technical Environment



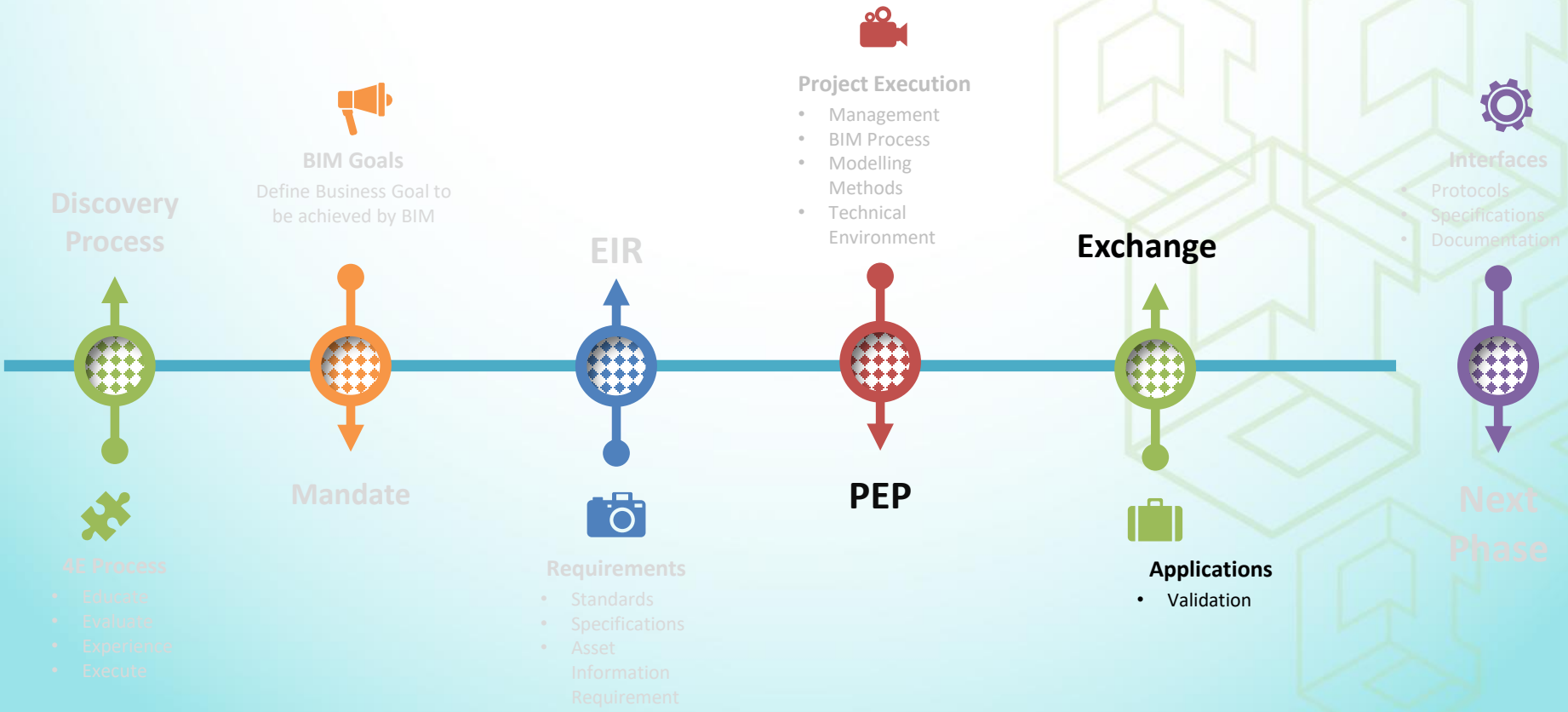
Format and Software

	C3D	RVT	ORD	ABD	Open Format	Shared Format	Related Tools
Alignment-based Road Model	Y		Y		IFC	XML	
Topography-related Site formation Model	Y		Y			XML	
Strata Models (Plugins)	GEO		GINT			XML	HolebaseSI
Utilities Model	Y	Y	SSU	Y	IFC	XML	
Bridge Segment Model	Y		OBD		IFC		
Bridge Substructure/Superstructure		G		G	IFC		
Tunnel Model	Y				IFC		Sub Assem composer
Retaining Wall Model	Y	G	Y	G	IFC		
4DMS						MP4	NWD/ Sychro
Drawings/Site Sketches	*	*	*	*	DXF	PDF	
3DVR						EXE	3DS/LRT
Asset Information (COBie)		Y		Y		COBIE	

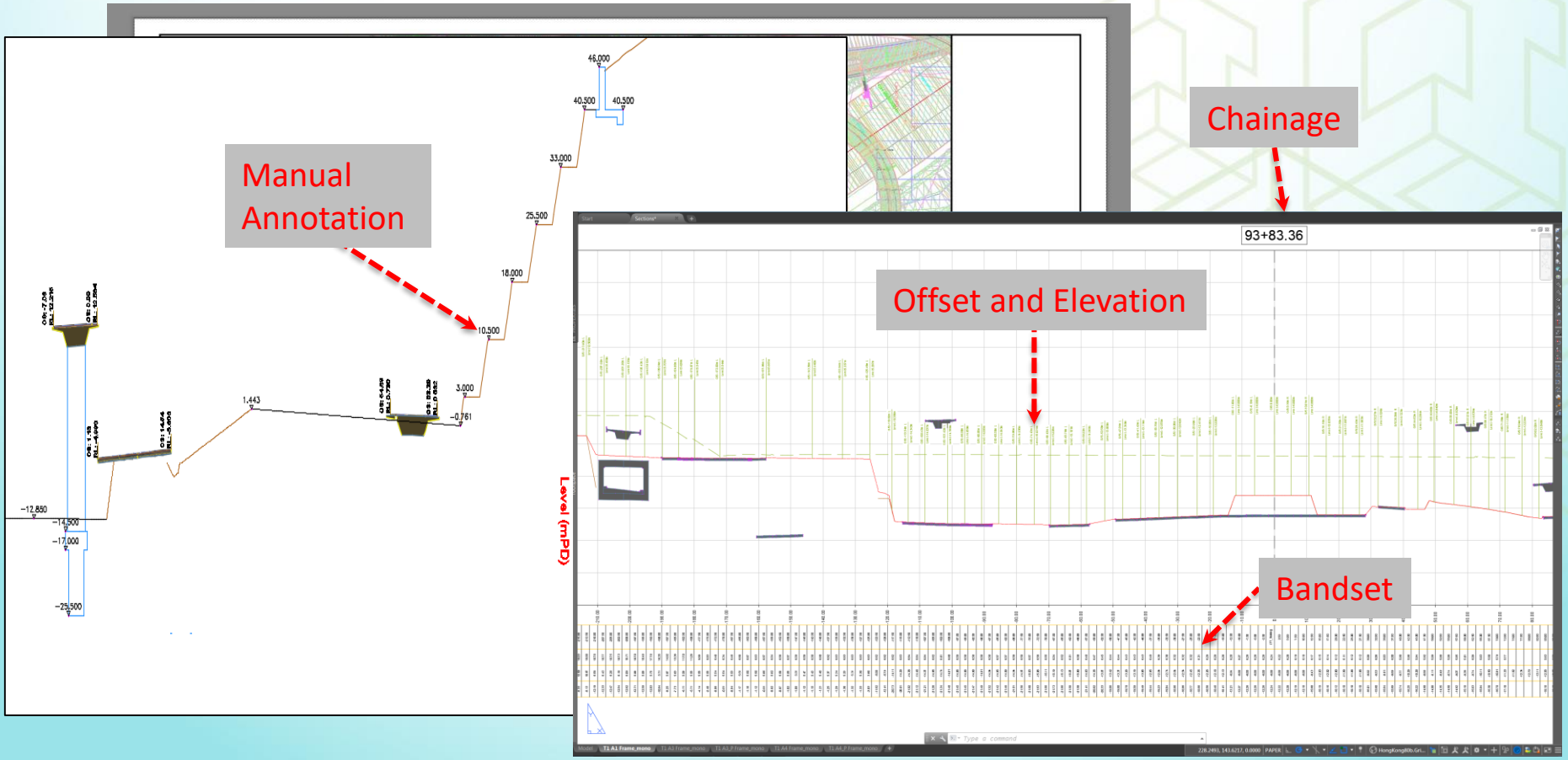
- IFC 4.0
  - Latest Version support ALG
  - XML-based Text file
- COBie
  - BIM/FM Standard
  - PAS 1192-4
  - XLS file 13 tables
- XML
  - Terrain and alignments
  - XML-base Text files

Y - Default Function
G– Generic Solid
GEO – Geotechnical Module
GINT – GINT Module
SSU: SubSurface Utilities
OBD: OpenBridge Designer
3DS: 3Ds Max
LDT: LumenRT

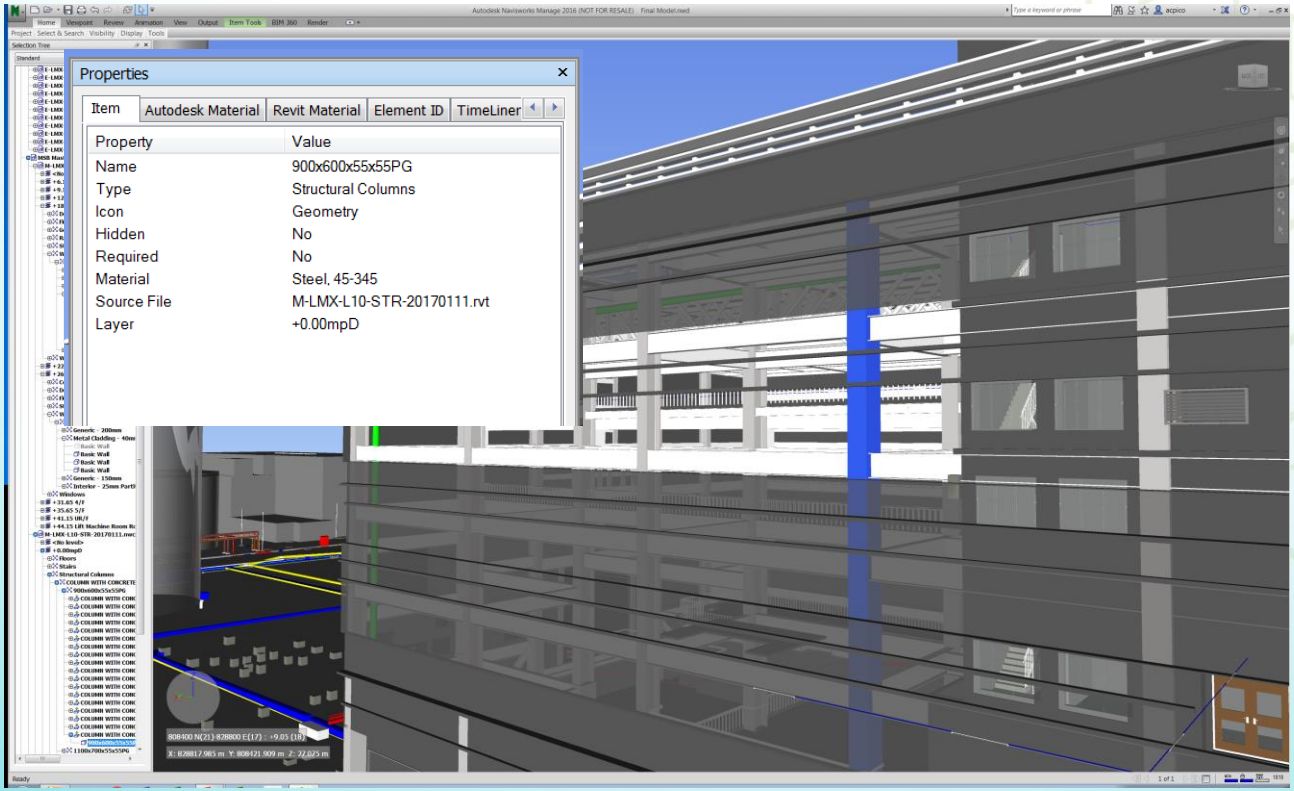
Project Execution – Exchange for BIM Application



Section and Annotation

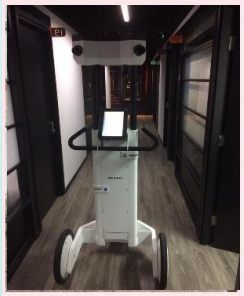


Information Accuracy



Scanning and Verification

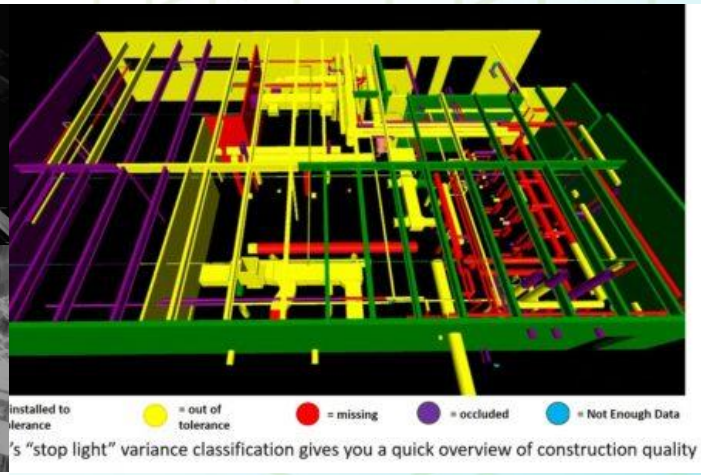
Mobile Scanner



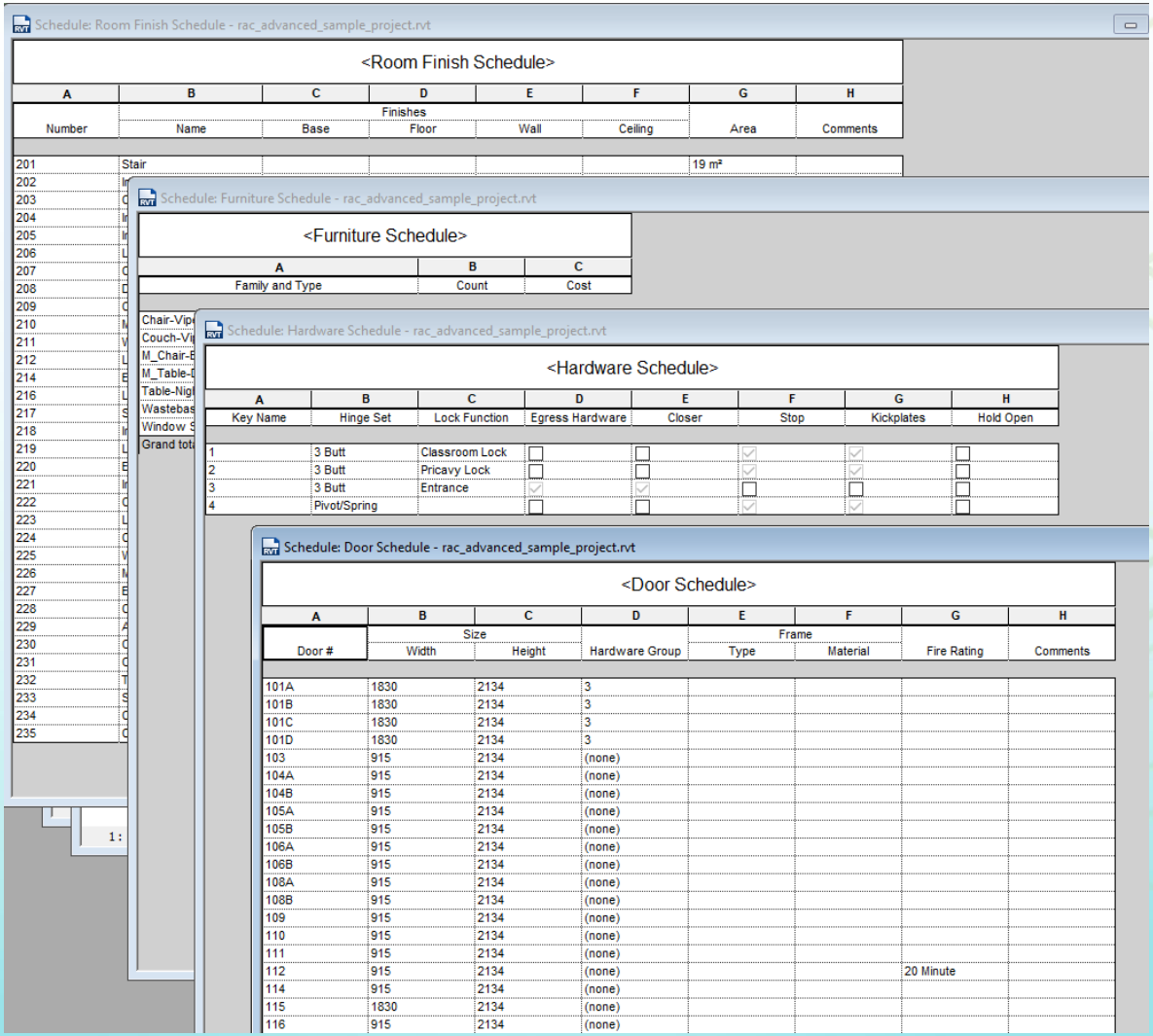
UAV Devices

Point Cloud

Verification



4 Digital information/documents obtaining from a BIM model



Schedule: Room Finish Schedule - rac_advanced_sample_project.rvt

<Room Finish Schedule>

A	B	C	D	E	F	G	H
Number	Name	Finishes				Area	Comments
		Base	Floor	Wall	Ceiling		
201	Stair					19 m²	

Schedule: Furniture Schedule - rac_advanced_sample_project.rvt

<Furniture Schedule>

A	B	C
Family and Type	Count	Cost

Schedule: Hardware Schedule - rac_advanced_sample_project.rvt

<Hardware Schedule>

A	B	C	D	E	F	G	H
Key Name	Hinge Set	Lock Function	Egress Hardware	Closer	Stop	Kickplates	Hold Open
1	3 Butt	Classroom Lock	☐	☐	☑	☑	☐
2	3 Butt	Pricavy Lock	☐	☐	☑	☑	☐
3	3 Butt	Entrance	☑	☑	☐	☐	☐
4	Pivot/Spring		☐	☐	☑	☑	☐

Schedule: Door Schedule - rac_advanced_sample_project.rvt

<Door Schedule>

A	B	C	D	E	F	G	H
Door #	Size		Hardware Group	Frame		Fire Rating	Comments
	Width	Height		Type	Material		
101A	1830	2134	3				
101B	1830	2134	3				
101C	1830	2134	3				
101D	1830	2134	3				
103	915	2134	(none)				
104A	915	2134	(none)				
104B	915	2134	(none)				
105A	915	2134	(none)				
105B	915	2134	(none)				
106A	915	2134	(none)				
106B	915	2134	(none)				
108A	915	2134	(none)				
108B	915	2134	(none)				
109	915	2134	(none)				
110	915	2134	(none)				
111	915	2134	(none)				
112	915	2134	(none)			20 Minute	
114	915	2134	(none)				
115	1830	2134	(none)				
116	915	2134	(none)				

5 Interchange/inter-linkage of data between BIM database and other applications

	A	B	C
1	Title	COBie	
2	Version	2	
3	Release	4	
4	Status	IFC2x3	
5	Region	en-UK	
6	Purpose		This COBie spreadsheet is an example file that comes with the COBie Extension 1.0
7	Outline		Individual worksheets are organized by project phase as shown below
8			
9	All Phases	Sheet	Contents
10		Contact	People and Companies
11			
12	Early Design Worksheets	Sheet	Contents
13		Facility	Project, Site, and Facility
14		Floor	Vertical levels and exterior areas
15		Space	Spaces
16		Zone	Sets of spaces sharing a specific attribute
17		Type	Types of equipment, products, and materials
18			
19	Detailed Design Worksheets	Sheet	Contents
20		Component	Individually named or schedule items
21		System	Sets of components providing a service
22		Assembly	Constituents for Types, Components and others
23		Connection	Logical connections between components

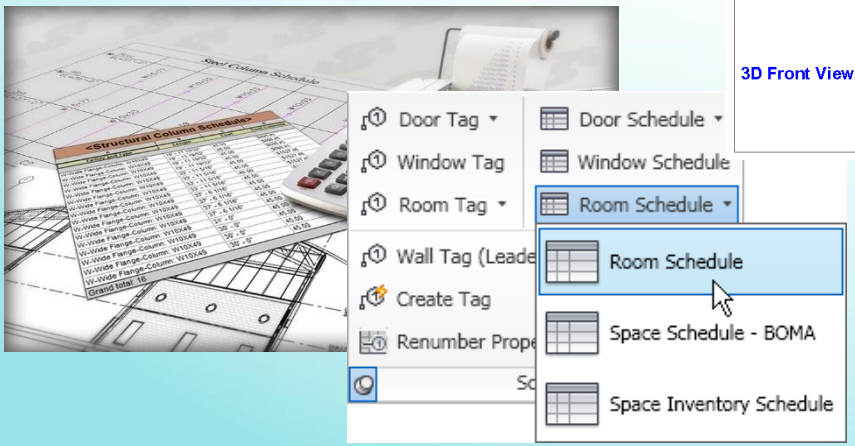
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Name	CreatedBy	CreatedOn	TypeName	Space	Description	ExtSystem	ExtObject	ExtIdentifier	SerialNumber	InstallationDate	WarrantyStartDate	TagNumber	BarCode	AssetIdentifier	Area	Length
22	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
23	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
24	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
25	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
26	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
27	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
28	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	2bf19293-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
29	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	44772ab3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	e895d30d	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
31	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	e895d30d	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
32	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	d6d1a613	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
33	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	b1d85879	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
34	Lighting D	dave@aut	2016-03-1	Lighting D	n/a	n/a	Autodesk	Lighting D	b1d85879	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
35	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	badde294	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
36	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	badde294	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
37	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	29d80c5d	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
38	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	29d80c5d	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
39	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	49433253	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
40	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	49433253	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
41	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	49433253	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
42	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	49433253	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
43	Lighting F	dave@aut	2016-03-1	Lighting F	Spaces_2	n/a	Autodesk	Lighting F	49433253	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Instruction | Contact | Facility | Floor | Space | Zone | Type | Component | System | Assembly | Connection | Spare | Re ...

6 Schedules of components and quantity takeoffs

The BIM concept supports a wide range of calculation and estimating activities:

- Quantity take-offs
- Door-window schedules
- Room Inventories
- Cost estimations

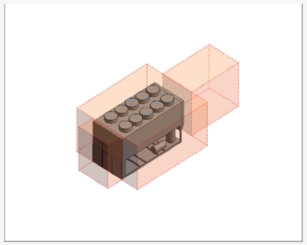


Window List			
Window Name	W Multiside Fix 13	W Triple Sash 13	W1 Casement 13
Quantity	1	1	1
From Room Number			
W x H Size	1,000x0,951	1,500x1,500	0,900x1,500
Orientation	R	L	L
Window sill height	0,900	0,900	0,900
Window head height	1,851	2,400	2,400
2D Symbol	1,000	1,500	0,900
3D Front View	1,000 / 0,951	1,500 / 1,500	0,900 / 1,500

7 Processing information generated from BIM system in external applications

BIM (Revit)

Construction Phase



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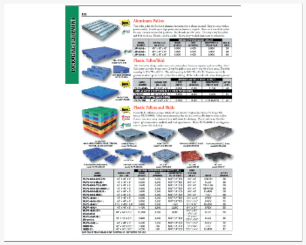
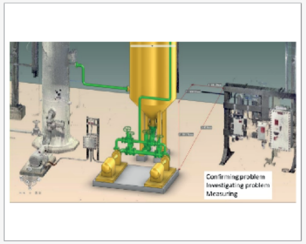
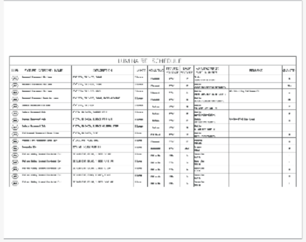


LOD 500 Model



1. Overall dimension
2. Shape
3. Connector
4. Do not ouer model, FIM

Trade Catalogue



1. Extensire Input
2. What information goes of what field? Same Name? Who Input?

+ ID

CoBie

FM (Maximo)

Inventory List

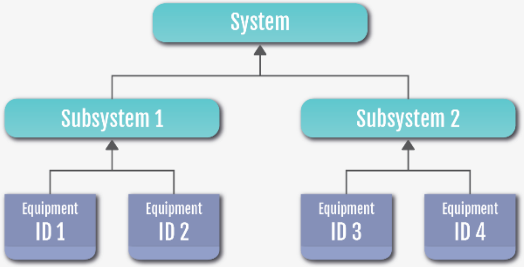
EQUIPMENT INVENTORY LIST

PHYSICAL CONDITION

Asset or serial number	Item description (make and model)	Location	condition	Vendor	Years of service left	Initial value	Down payment	Date purchased or leased	Loan term in years	Loan rate
123	Make Model	Main branch	Good	local	5	$30,000.00	$5,000.00	1/15/2010	4	10.00%
456	Make Model	Main branch	Excellent	local	3	$5,000.00	$5,000.00	5/1/2013		
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%
123	Make Model	Main branch	Good	local	5	$30,000.00	$5,000.00	1/15/2010	4	10.00%
456	Make Model	Main branch	Excellent	local	3	$5,000.00	$5,000.00	5/1/2013		
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%
123	Make Model	Main branch	Good	local	5	$30,000.00	$5,000.00	1/15/2010	4	10.00%
456	Make Model	Main branch	Excellent	local	3	$5,000.00	$5,000.00	5/1/2013		
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%
123	Make Model	Main branch	Good	local	5	$30,000.00	$5,000.00	1/15/2010	4	10.00%
456	Make Model	Main branch	Excellent	local	3	$5,000.00	$5,000.00	5/1/2013		
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%
123	Make Model	Main branch	Good	local	5	$30,000.00	$5,000.00	1/15/2010	4	10.00%
456	Make Model	Main branch	Excellent	local	3	$5,000.00	$5,000.00	5/1/2013		
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%
123	Make Model	Main branch	Good	local	5	$30,000.00	$5,000.00	1/15/2010	4	10.00%
456	Make Model	Main branch	Excellent	local	3	$5,000.00	$5,000.00	5/1/2013		
789	Make Model	East coast	Fair	local	6	$50,000.00	$20,000.00	8/20/2007	5	5.00%

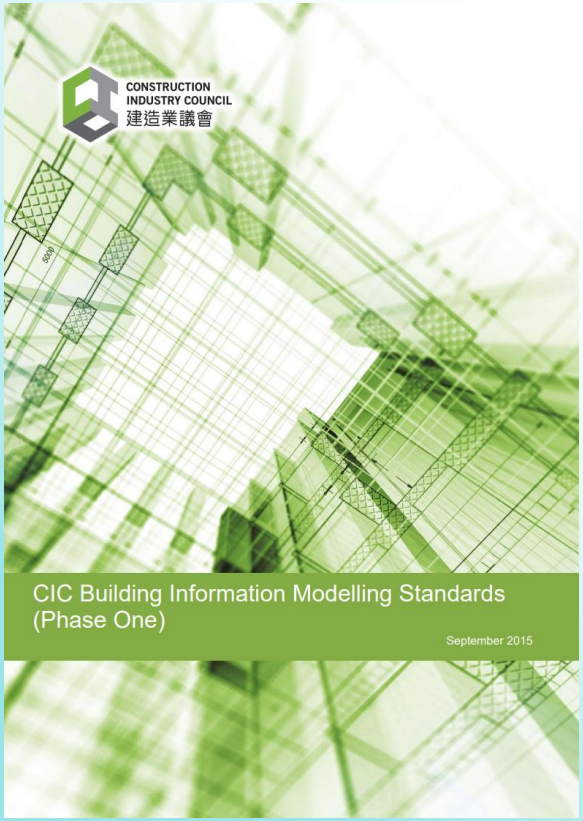
+

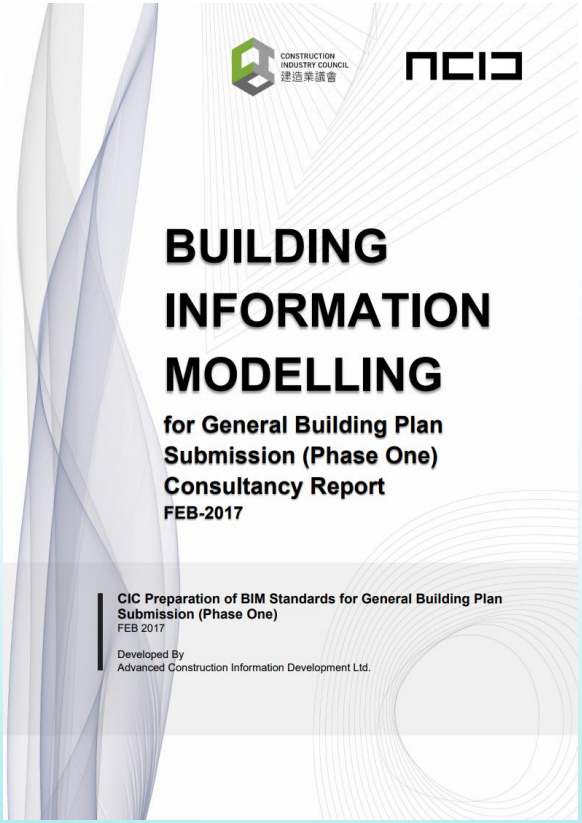
System Hierarchy

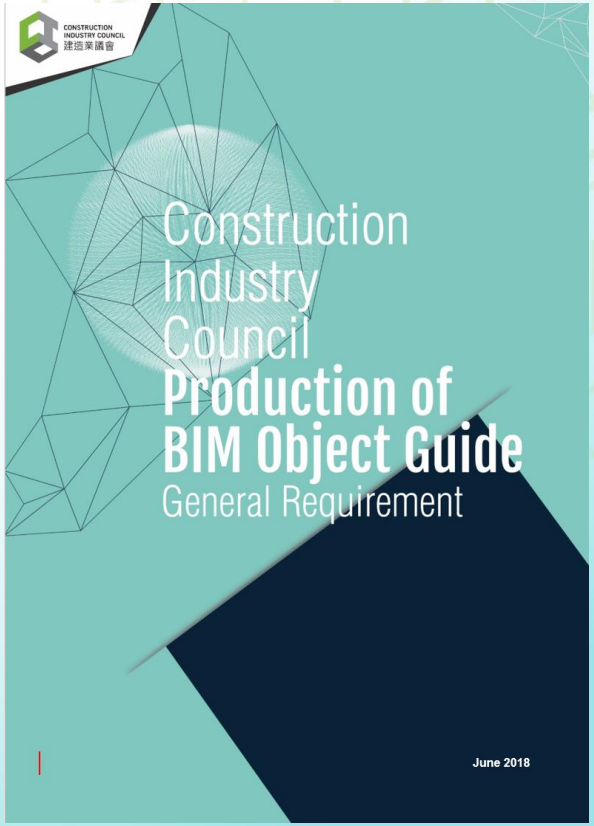


D. Standards and Practice for Projects Implementation of BIM Technology

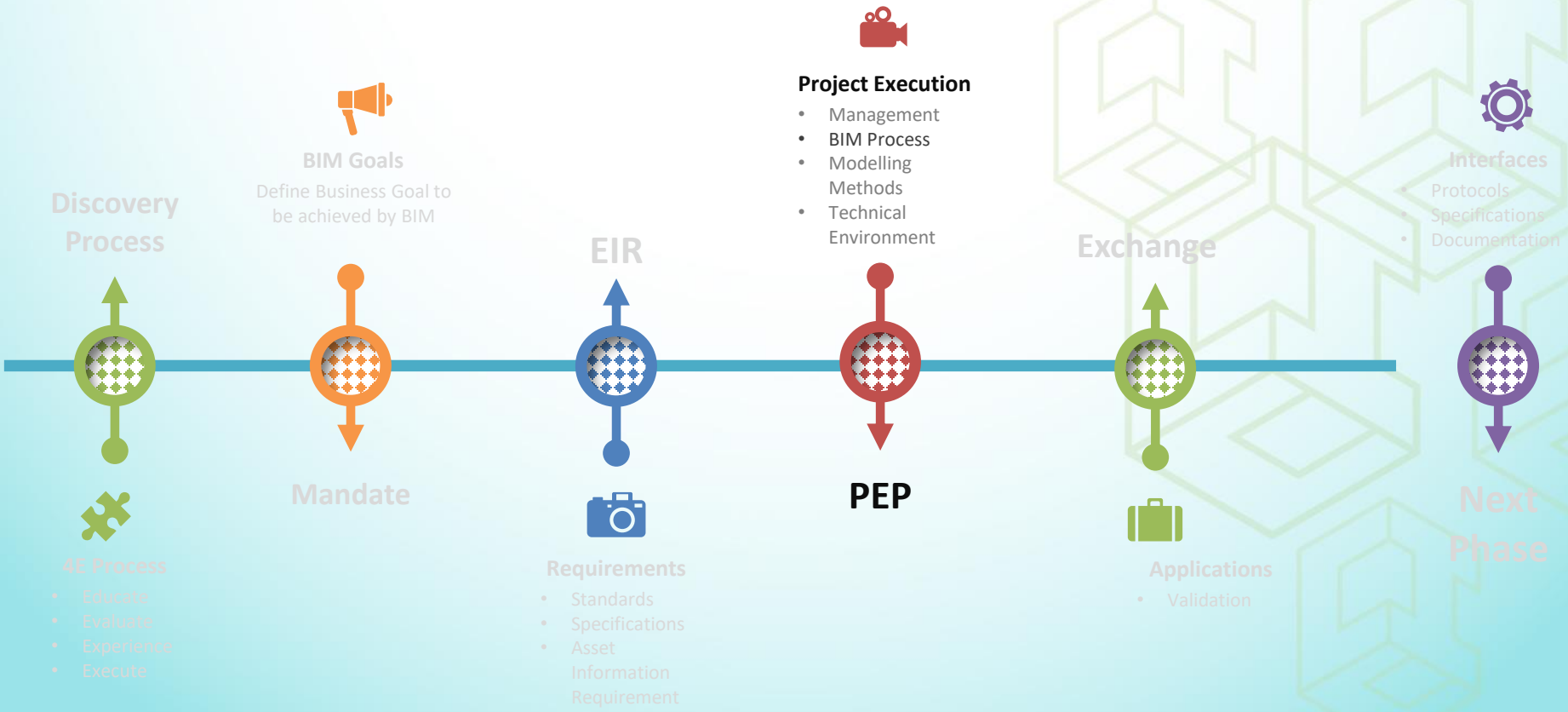
1 Introduction of all of the CIC's BIM Standards and its publications



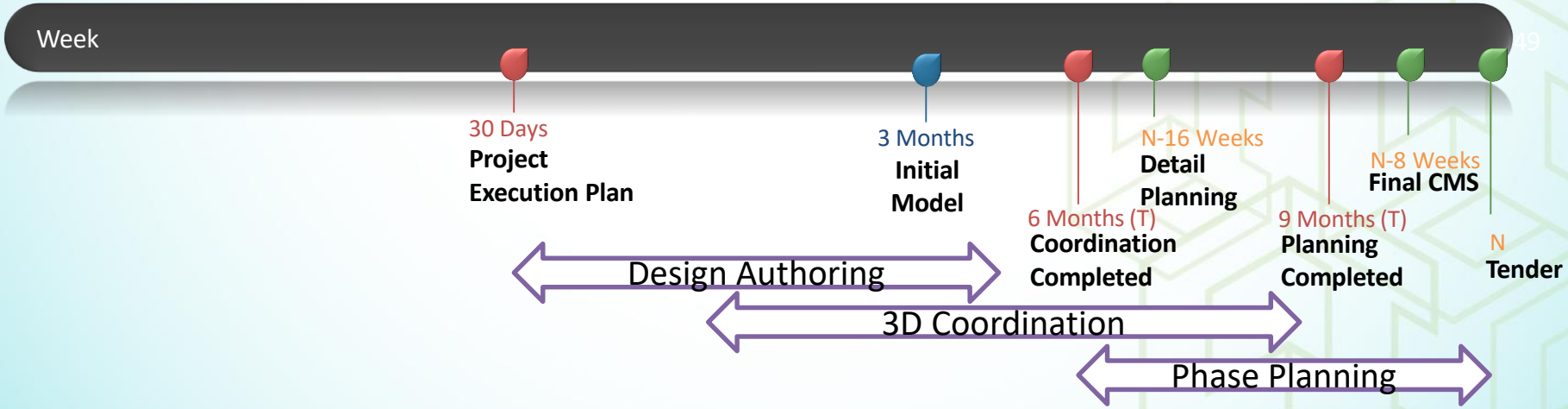




2 Project Execution Plan and procedures for project BIM workflow



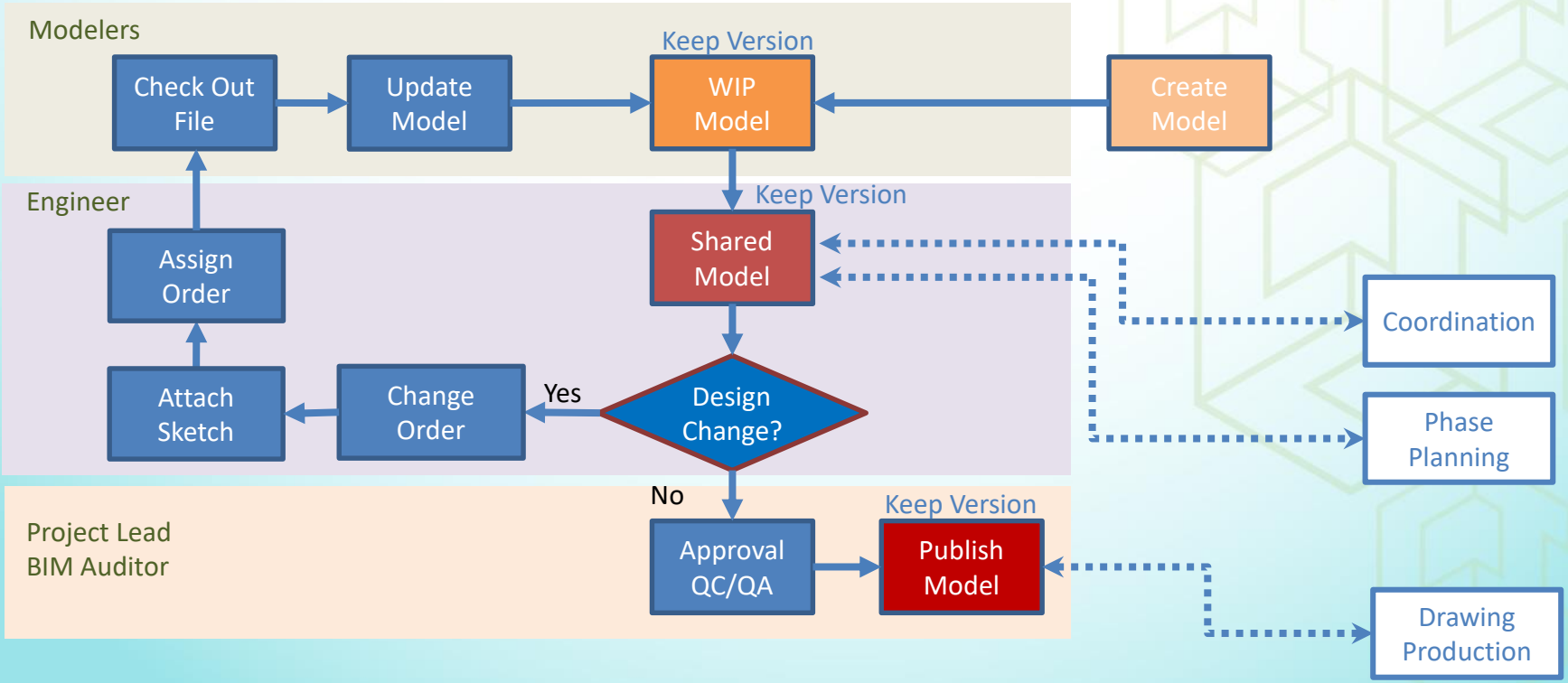
Challenges managing Process and Deliverables (Design Phase)



ID	Disciplinary Model	Conceptual Model	Design, Analytical, Visualization Model	Coordinated & Planning Model	Tender Model
ES	Existing Site Model	100	200 - 250	250	250
ER	Road Model	200	200 -300	300 - 350	300 ~ 350
BR	Bridge Model	100	200 - 300	300 - 350	300 ~ 350
UP	Underpass Model	100	200 - 300	300 - 350	300 ~ 350
BD	Building Model	200	200 ~ 300	200 - 300	300 ~ 350

Parallel Iterative Process

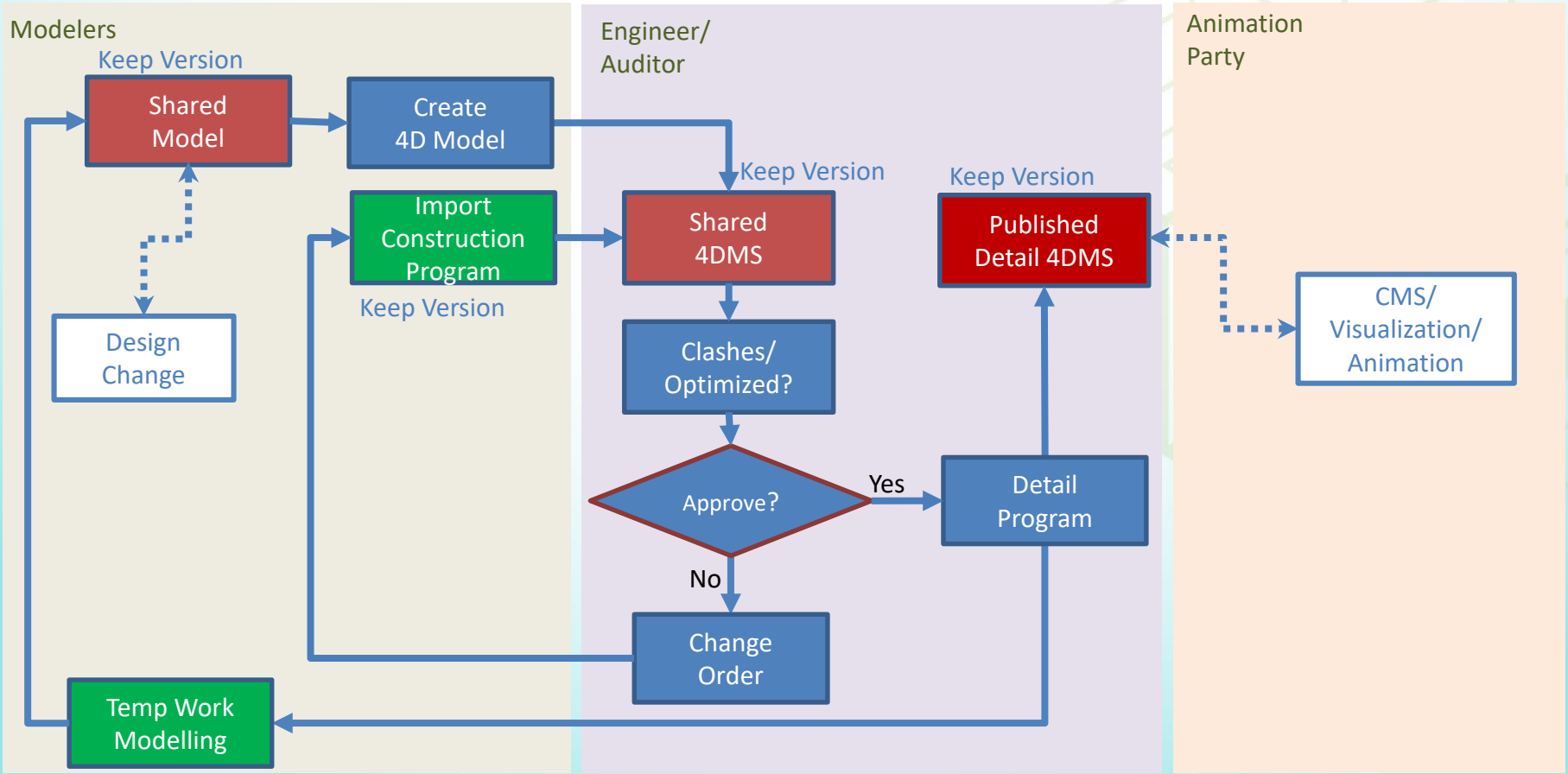
Design/Changes/Deliverables Management



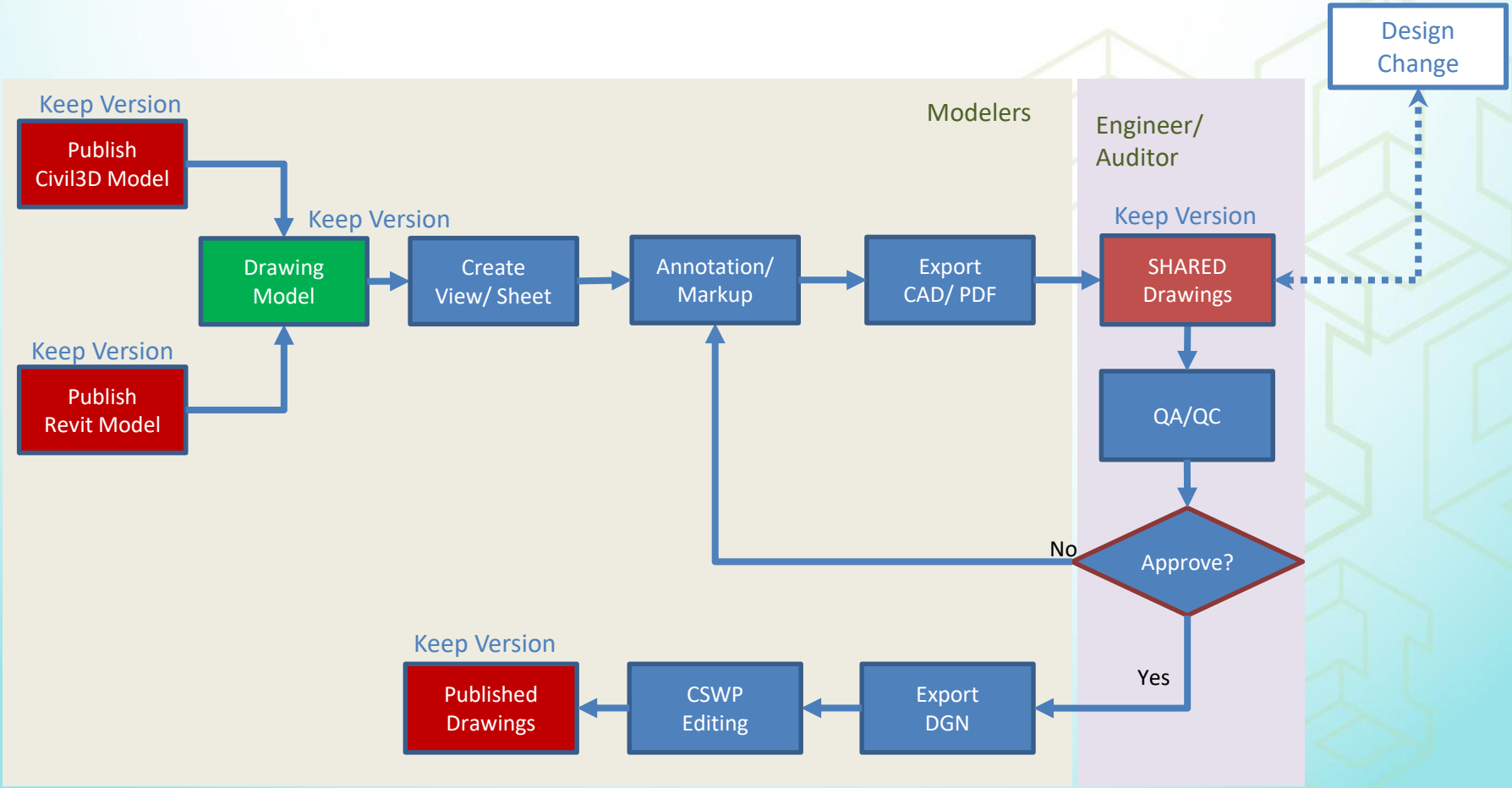
Folder structure, Control Spreadsheets, & Naming Convention

Coordination History Tracking			ES-STM	ES-TOP	SF-SLP-A	ER-S01	ER-S02	ER-STM	UU-WM01	BR-SEG
TQ/ Issue	Change Order/Description	Sketch/drawing/Incoming Files								
1	Initial Survey out of date	Initial_Survey.dwg	WIP-200	WIP-200						
2	…	…								
	Latest Released		COR-200	COR-200	CMS-100	CMS-100	CMS-100	CMS-100	CMS-100	CMS-100

Phase Planning Management

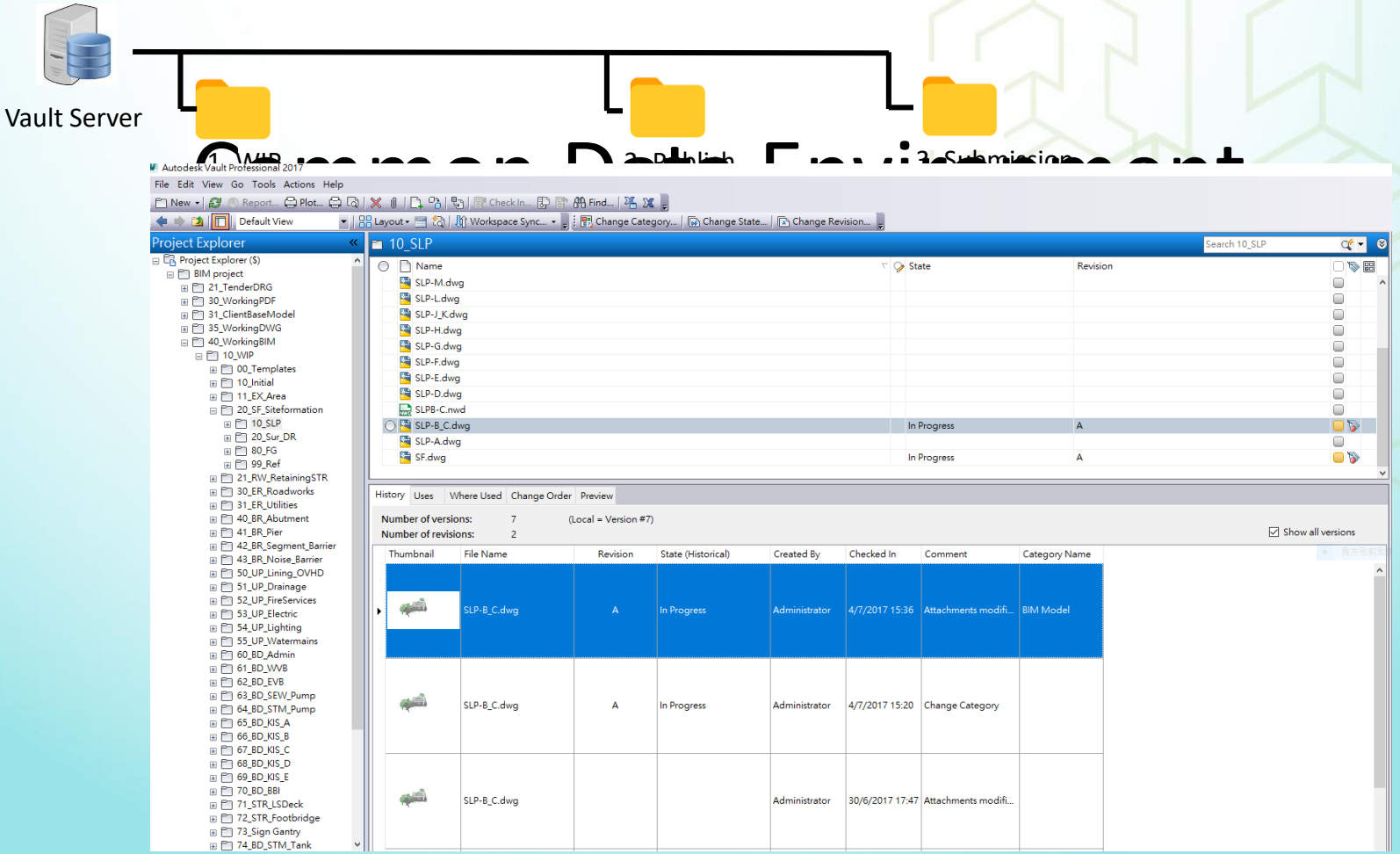


Drawing Production Process

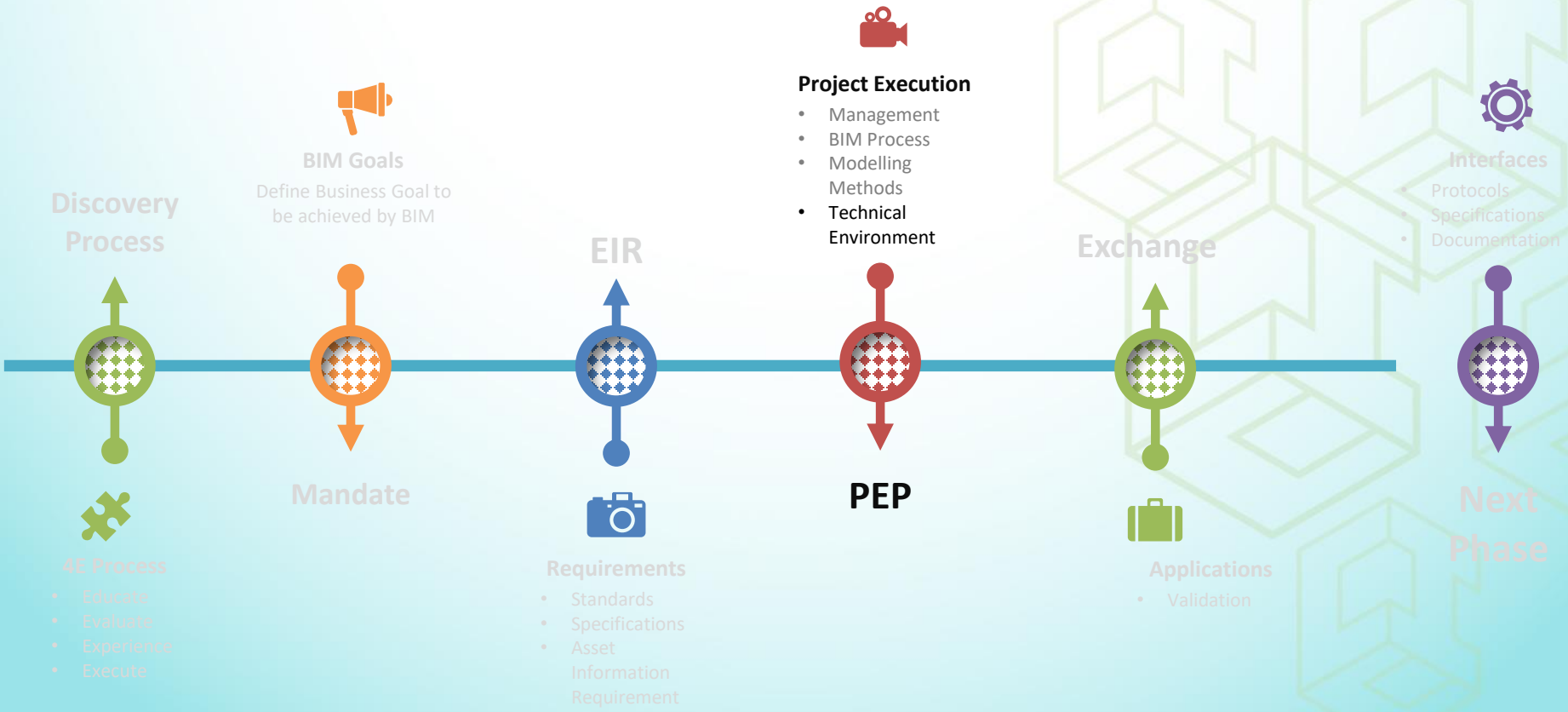


Documentation Control Spreadsheet

Drawing Version Tracking				Modelfiles.rvt	Modelfiles.rvt	Modelfiles.rvt	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg
Discipline	Drawing title	File Name	Revision/Date								
BS	Drawings files	Drawingfiles.pdf				*		*		*	
…	…	…		*	*			*	*		*


Vault Server
Autodesk Vault Professional 2017
File Edit View Go Tools Actions Help
Project Explorer
10_SLP
Name
State
Revision
SLP-M.dwg
SLP-L.dwg
SLP-J_K.dwg
SLP-H.dwg
SLP-G.dwg
SLP-F.dwg
SLP-E.dwg
SLP-D.dwg
SLPB-C.nwd
SLP-B_C.dwg
In Progress
A
SLP-A.dwg
SF.dwg
In Progress
A
History
Uses
Where Used
Change Order
Preview
Number of versions: 7
(Local = Version #7)
Number of revisions: 2
Show all versions
Thumbnail
File Name
Revision
State (Historical)
Created By
Checked In
Comment
Category Name
SLP-B_C.dwg
A
In Progress
Administrator
4/7/2017 15:36
Attachments modifi...
BIM Model
SLP-B_C.dwg
A
In Progress
Administrator
4/7/2017 15:20
Change Category
SLP-B_C.dwg
Administrator
30/6/2017 17:47
Attachments modifi...

Project Execution – Technical Environment



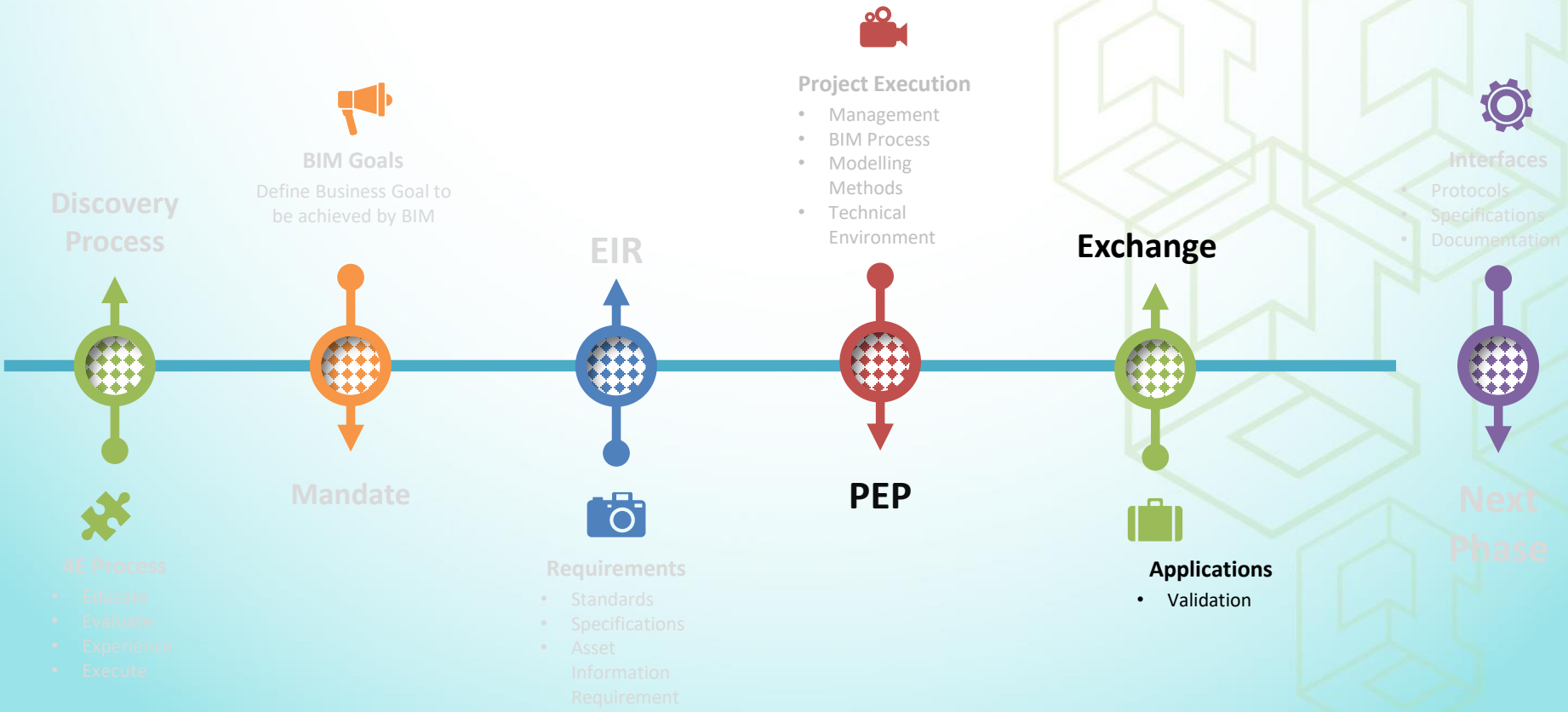
Format and Software

	C3D	RVT	ORD	ABD	Open Format	Shared Format	Related Tools
Alignment-based Road Model	Y		Y		IFC	XML	
Topography-related Site formation Model	Y		Y			XML	
Strata Models (Plugins)	GEO		GINT			XML	HolebaseSI
Utilities Model	Y	Y	SSU	Y	IFC	XML	
Bridge Segment Model	Y		OBD		IFC		
Bridge Substructure/Superstructure		G		G	IFC		
Tunnel Model	Y				IFC		Sub Assem composer
Retaining Wall Model	Y	G	Y	G	IFC		
4DMS						MP4	NWD/ Sychro
Drawings/Site Sketches	*	*	*	*	DXF	PDF	
3DVR						EXE	3DS/LRT
Asset Information (COBie)		Y		Y		COBIE	

- IFC 4.0
  - Latest Version support ALG
  - XML-based Text file
- COBie
  - BIM/FM Standard
  - PAS 1192-4
  - XLS file 13 tables
- XML
  - Terrain and alignments
  - XML-base Text files

Y - Default Function
G– Generic Solid
GEO – Geotechnical Module
GINT – GINT Module
SSU: SubSurface Utilities
OBD: OpenBridge Designer
3DS: 3Ds Max
LDT: LumenRT

Project Execution – Exchange for BIM Application



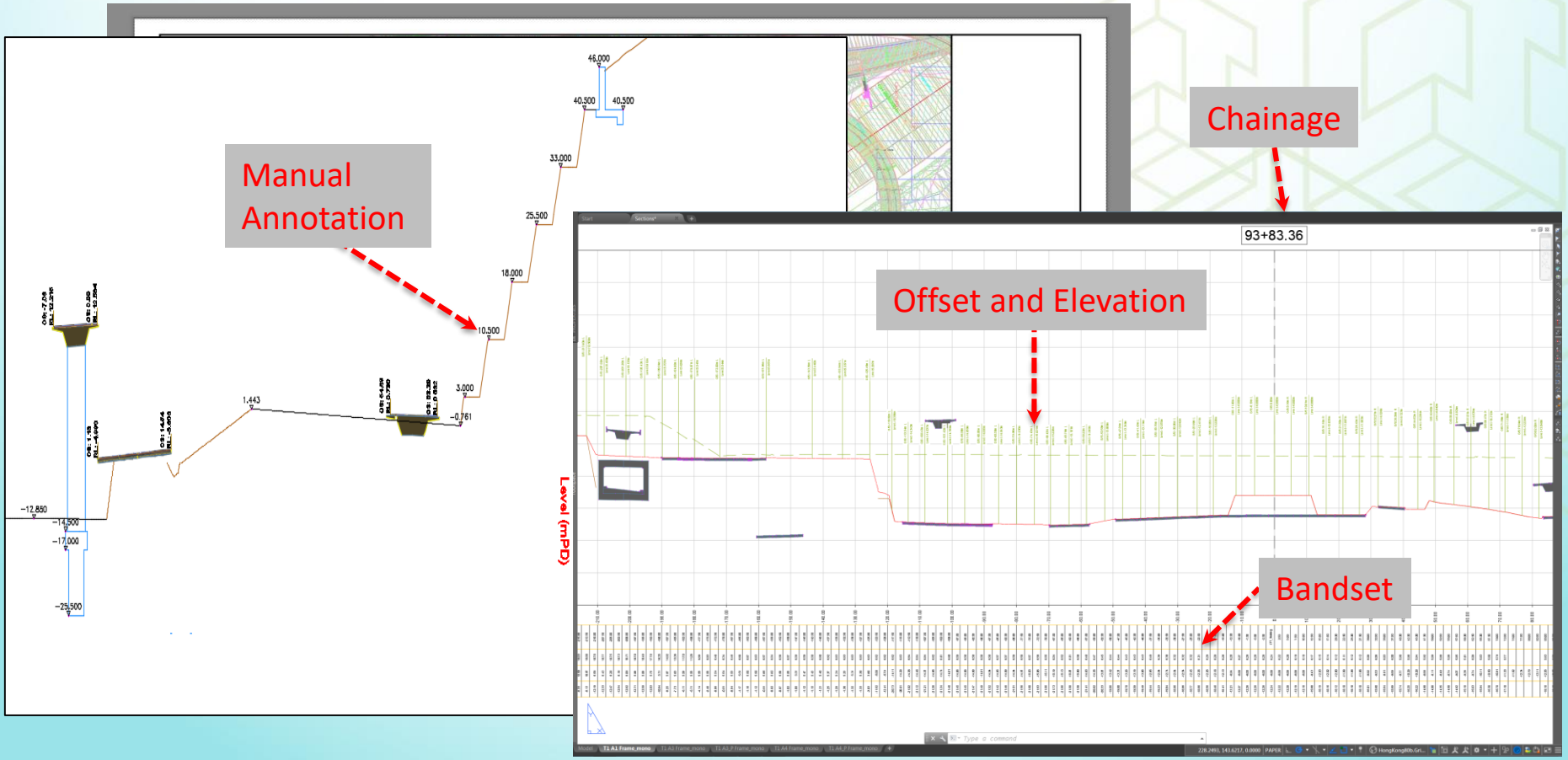
QA/QC Process

- Design Standard
  - TPDM
- Modelling Standard
  - Type and Category
- Geometry Accuracy
  - Location, Size, dimension
- Information Completeness

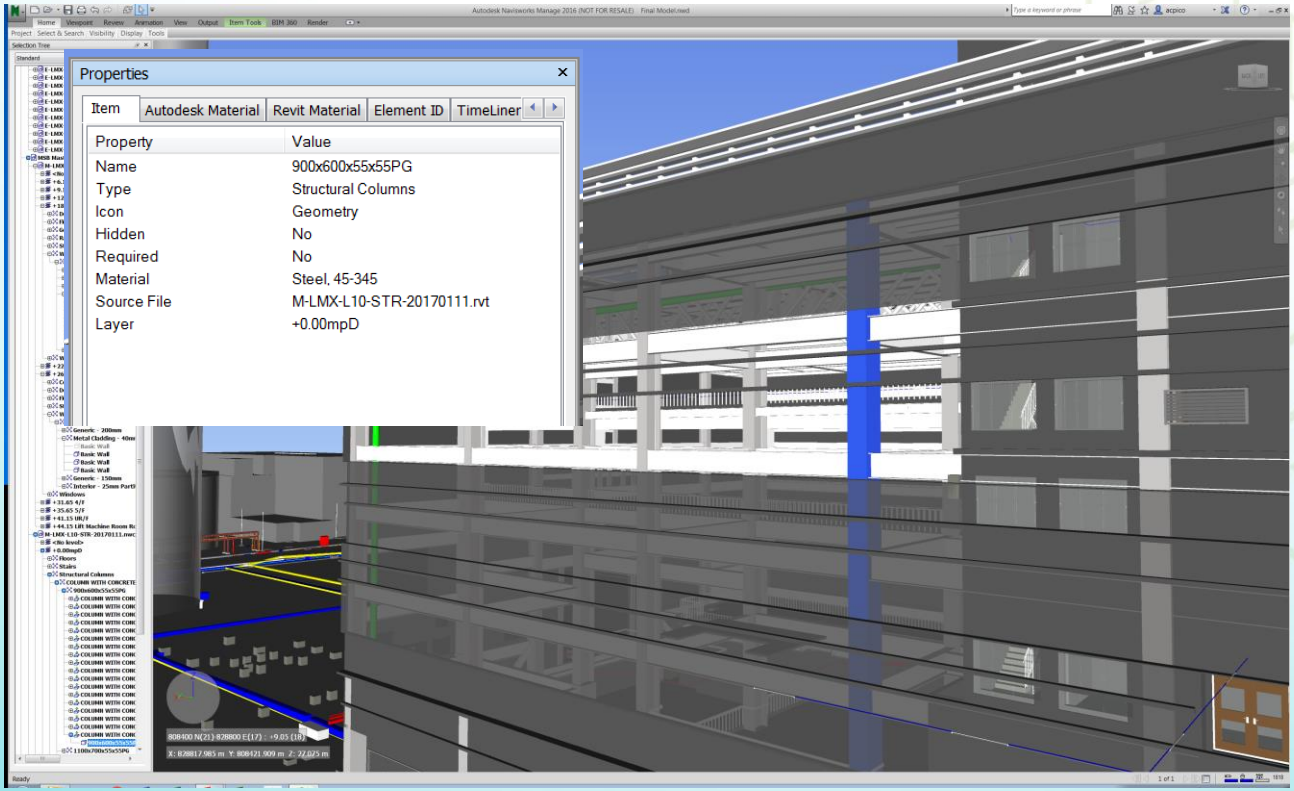
BIM Quality check/Quality report

	Visual Inspection	Software Aided	Others
Design Standard	N/A	Design Constraints	Revision Mgt
Modelling Standard	Yes	N/A	Random Checks
CAD Standard	Yes	N/A	Version Mgt
Interference check	Yes	Clash Detection	Revision Mgt
Geometry Accuracy	Overlaid	Sections and Annotation	Point Cloud Overlaid
Information Completeness	Yes	Schedules	Onsite Inspection

Section and Annotation

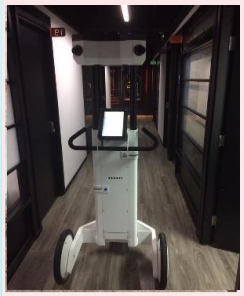


Information Accuracy



Scanning and Verification

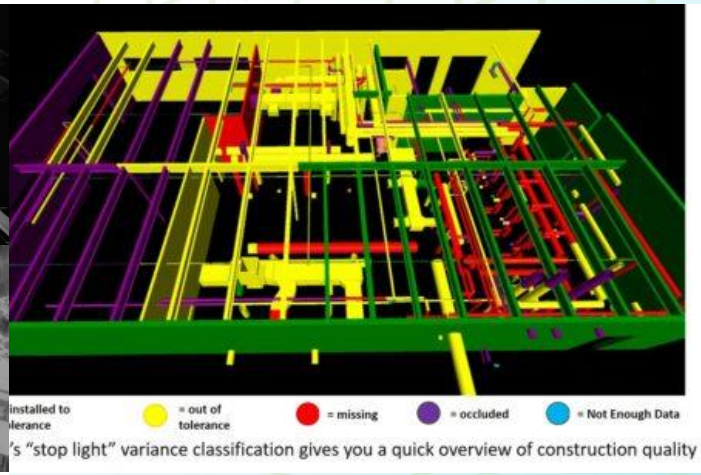
Mobile Scanner



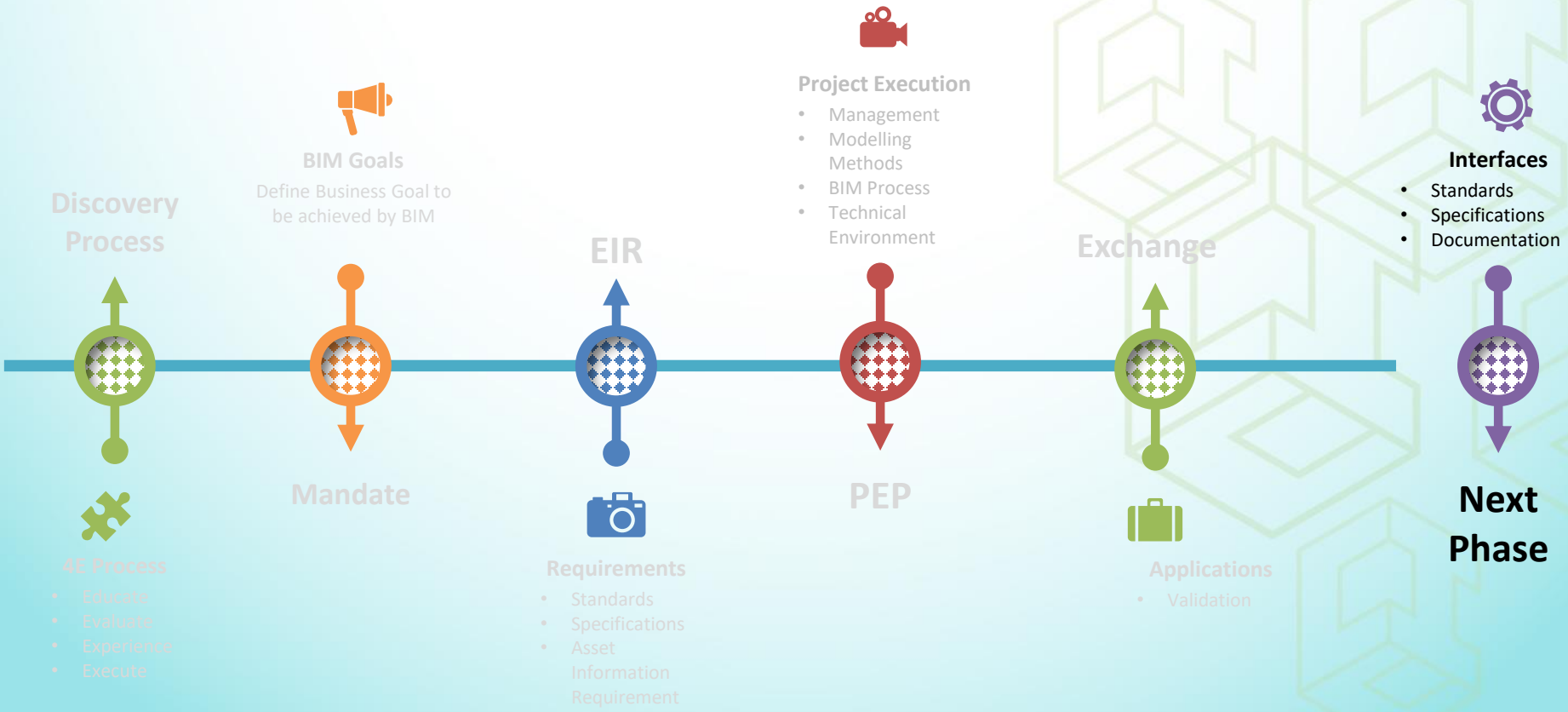
UAV Devices

Point Cloud

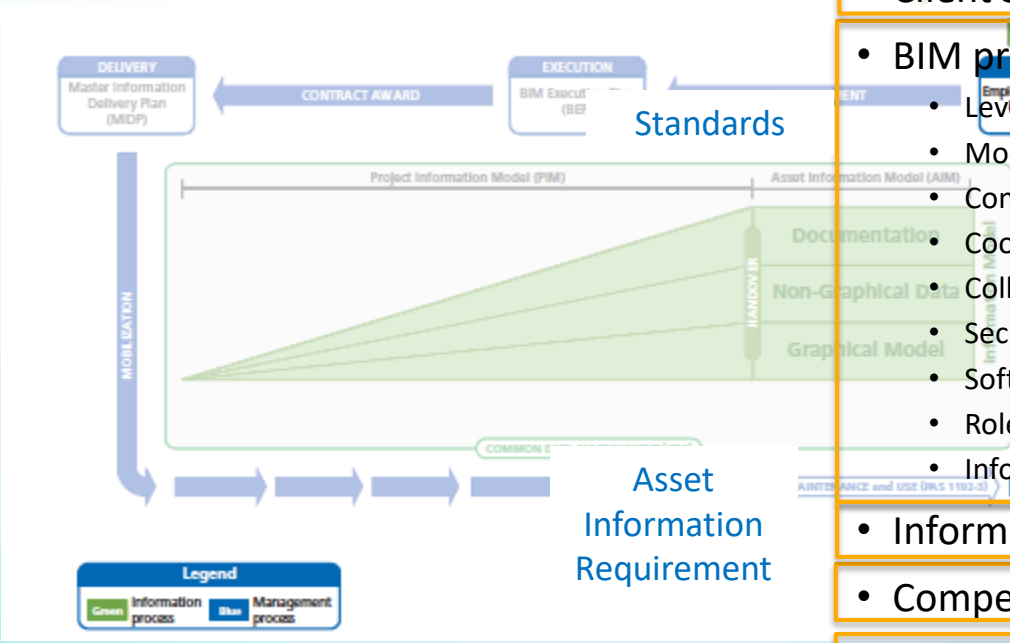
Verification



Interface to next phase – EIR, PEP, MIDP



Employer Information Requirement



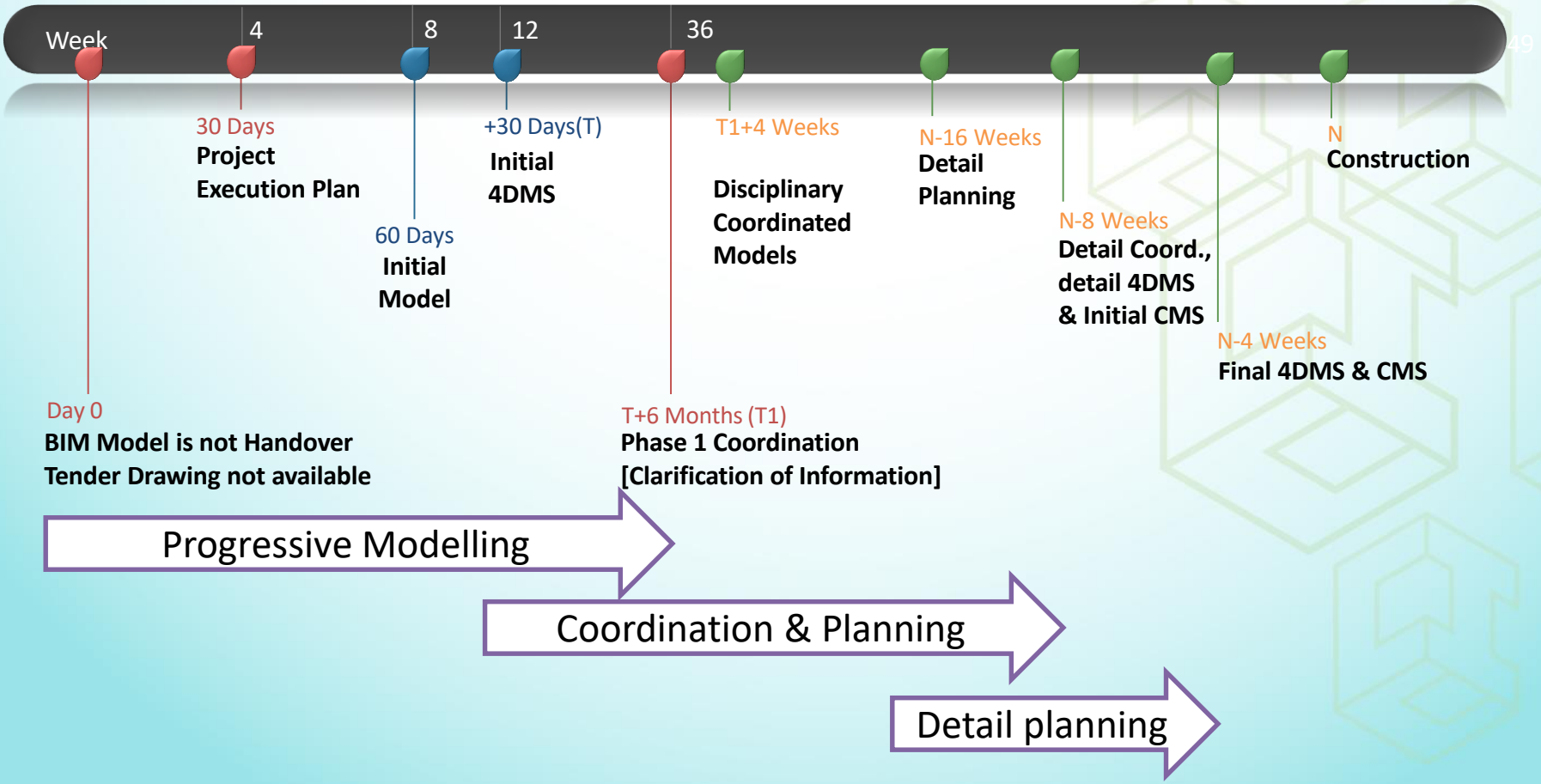
Project Spec

Standards

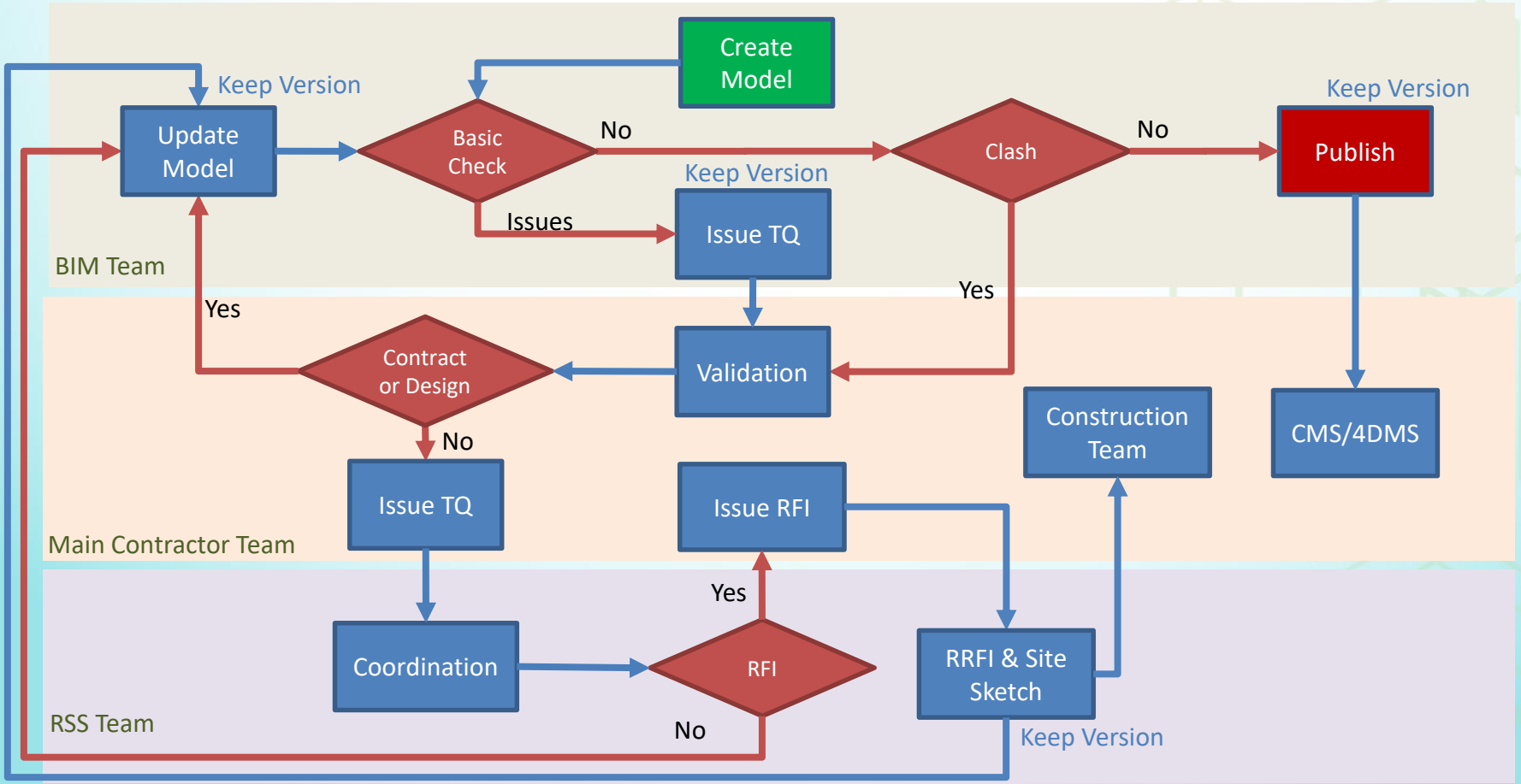
Asset Information Requirement

- Client Strategic purpose
- BIM process and Protocol standards
  - Level of detail requirement
  - Model management standard
  - Constraints List
  - Coordination process description
  - Collaboration process description
  - Security/Integrity requirement
  - Software requirement
  - Role and responsibility matrix
  - Information Exchange requirement
- Information requirement
- Competence requirement
- Assessment criteria and detail

Challenges Process and Deliverables in Construction Phase



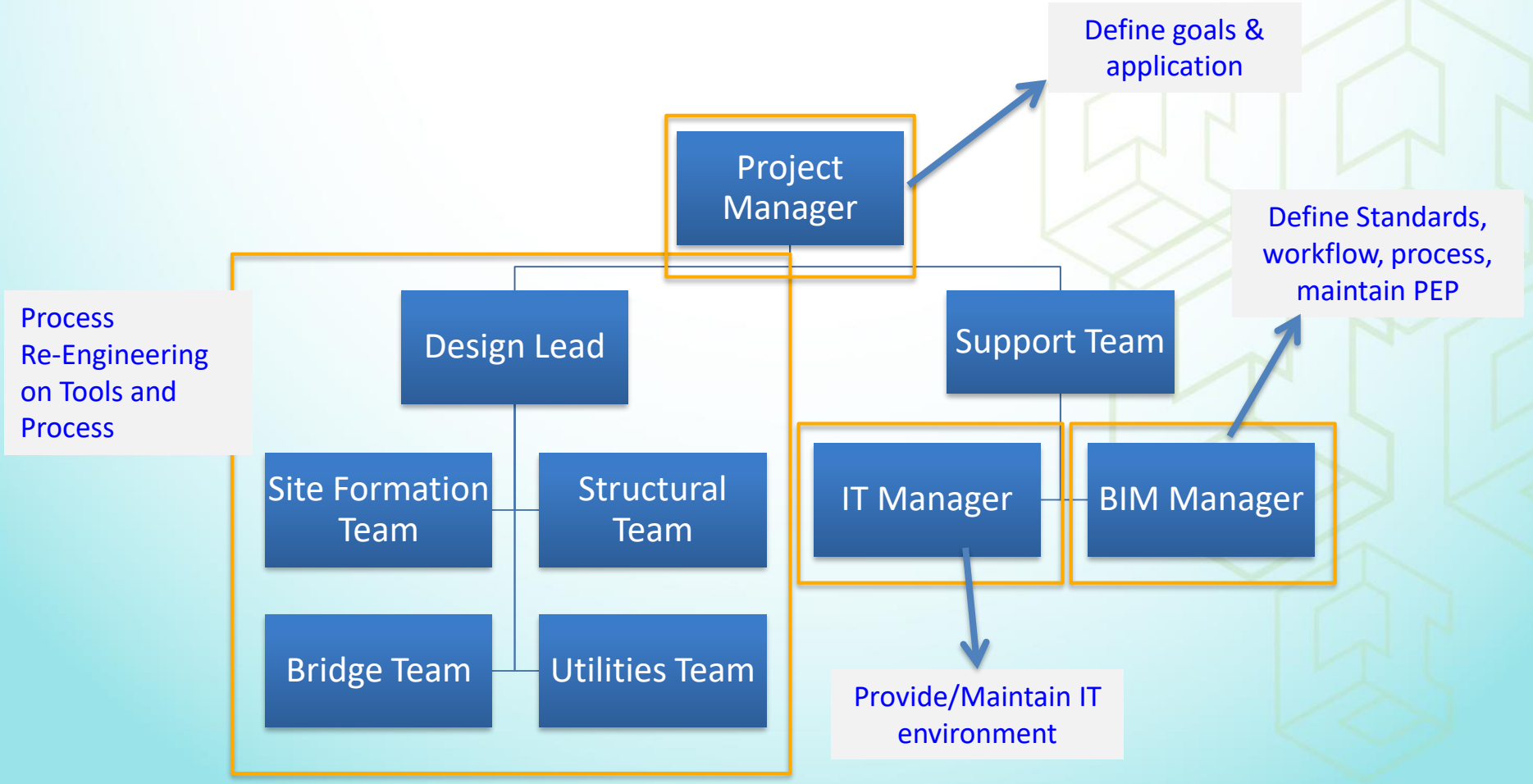
Coordination Process in Construction Stage



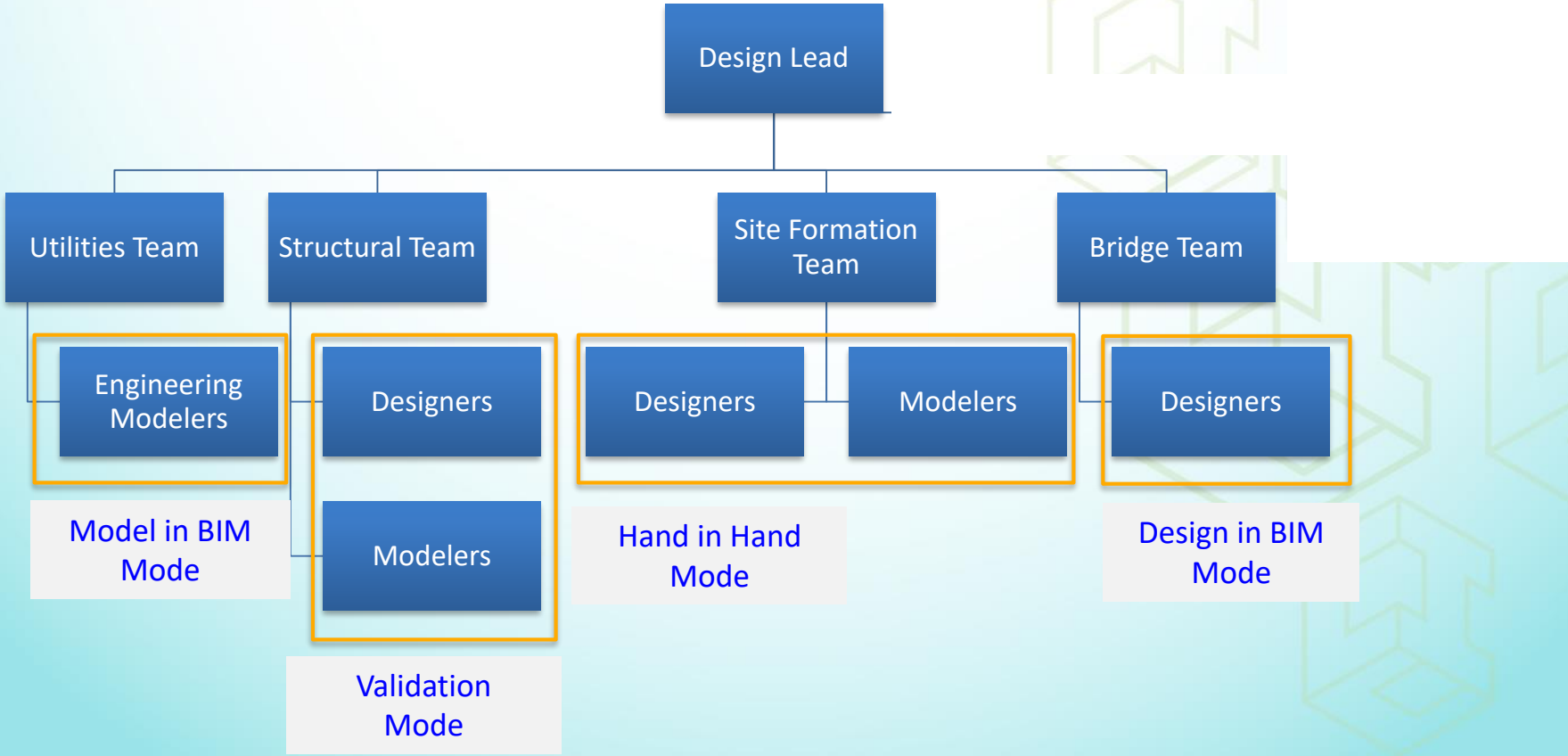
3 Object and file naming standards and data security and storage system

Coordination History Tracking			ES-STM	ES-TOP	SF-SLP-A	ER-S01	ER-S02	ER-STM	UU-WM01	BR-SEG
TQ/ Issue	Change Order/Description	Sketch/drawing/Incoming Files								
1	Initial Survey out of date	Initial_Survey.dwg	WIP-200	WIP-200						
2	…	…								
	Latest Released		COR-200	COR-200	CMS-100	CMS-100	CMS-100	CMS-100	CMS-100	CMS-100

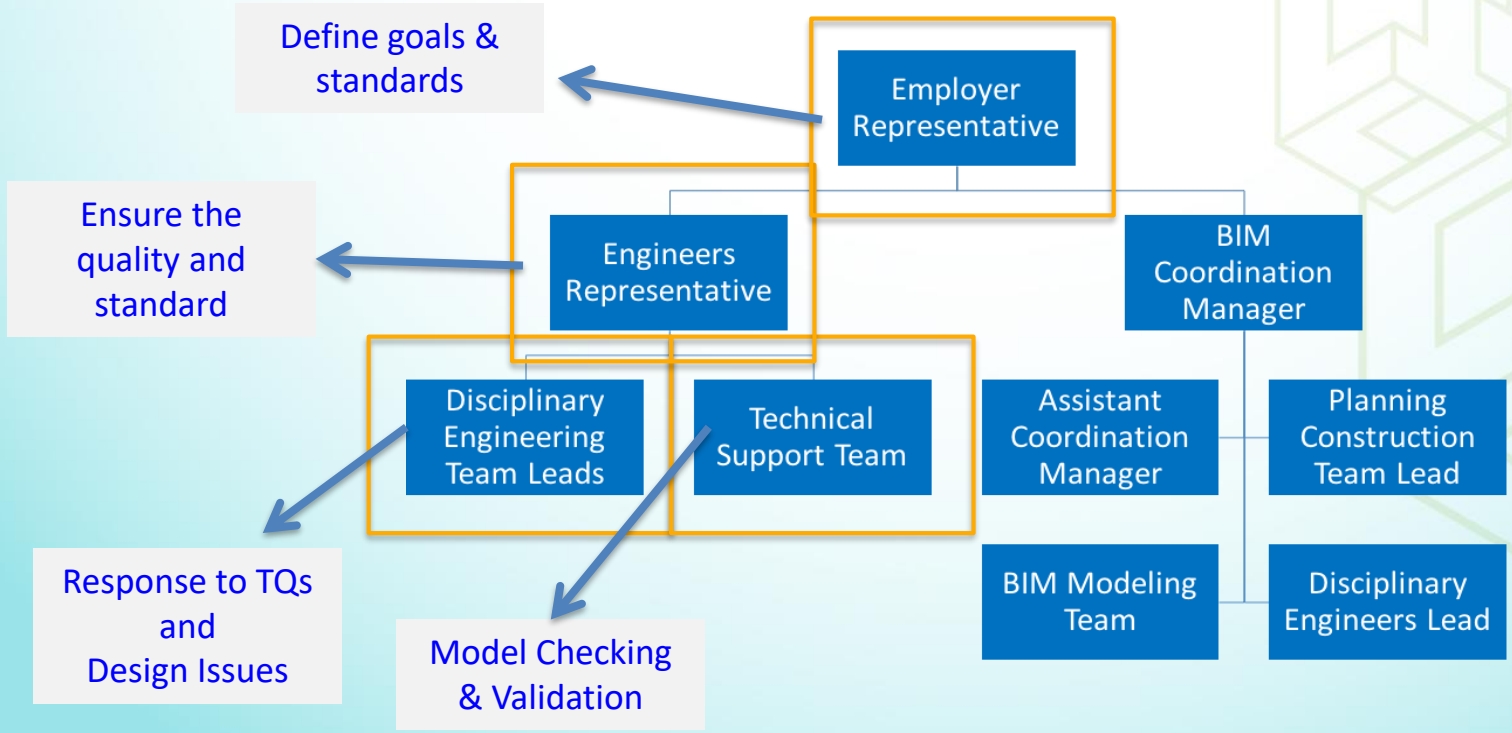
4 Line of communication in a Project Team



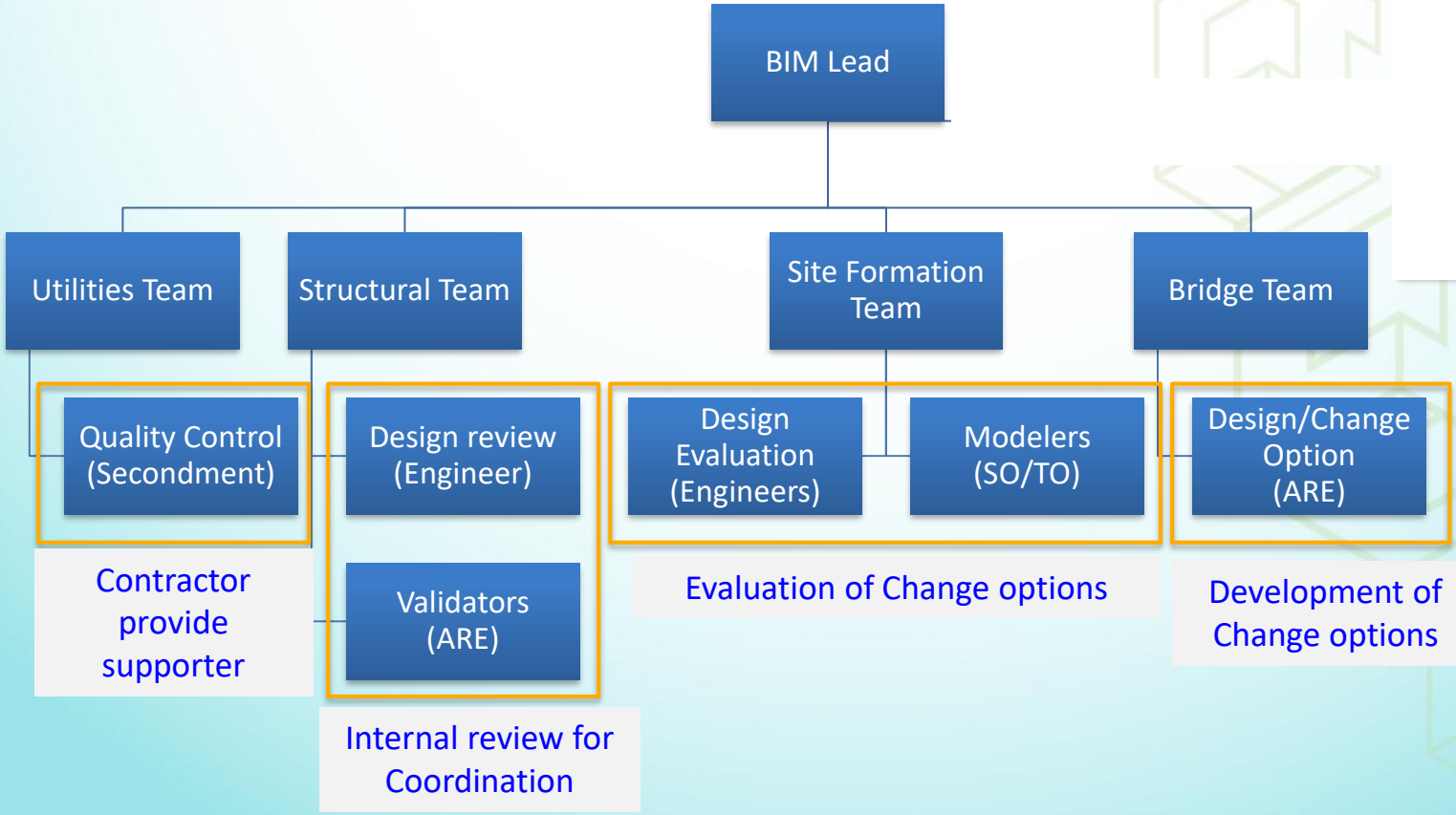
Mode of Process Re-engineering



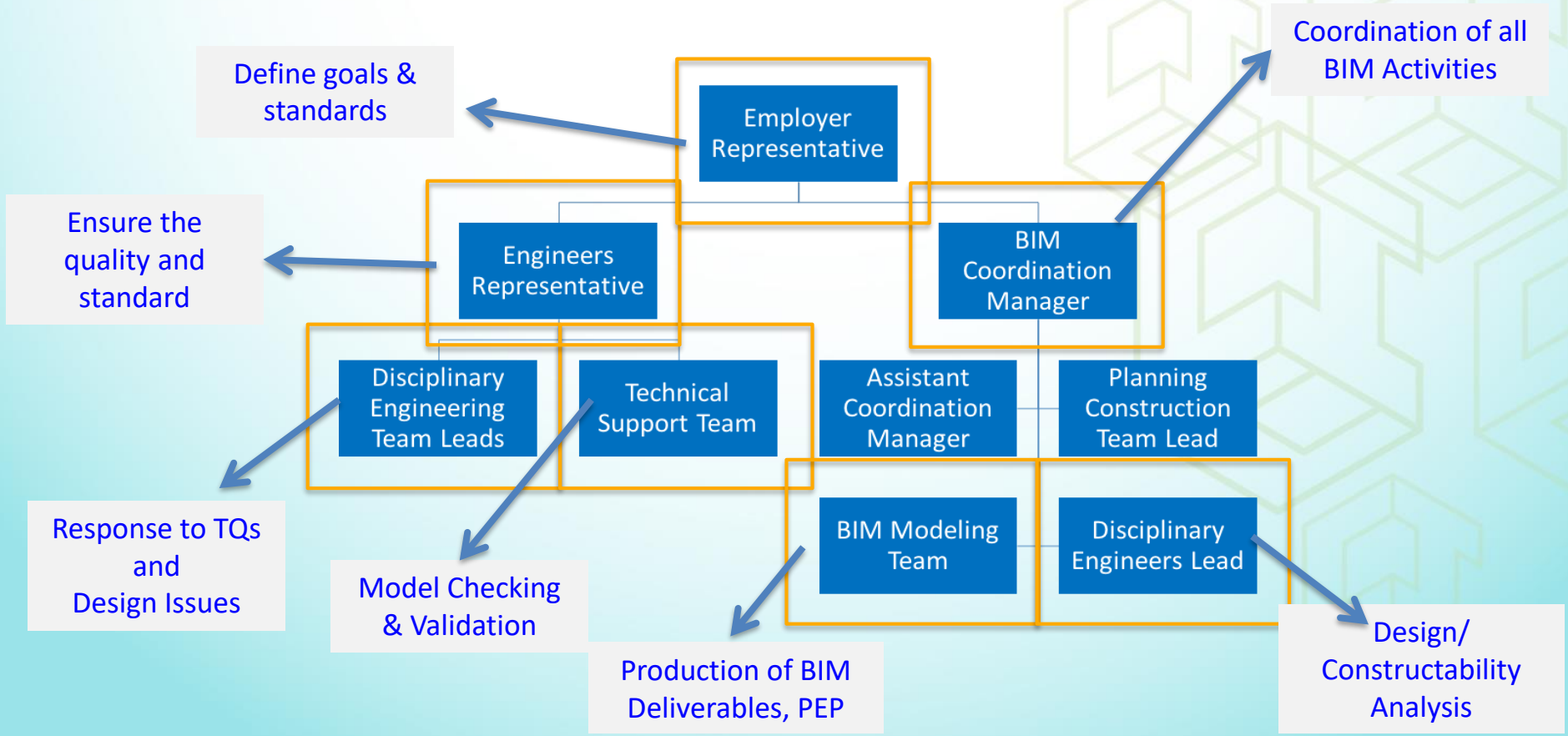
O-Chart, Role and Responsibility (Construction Phase)



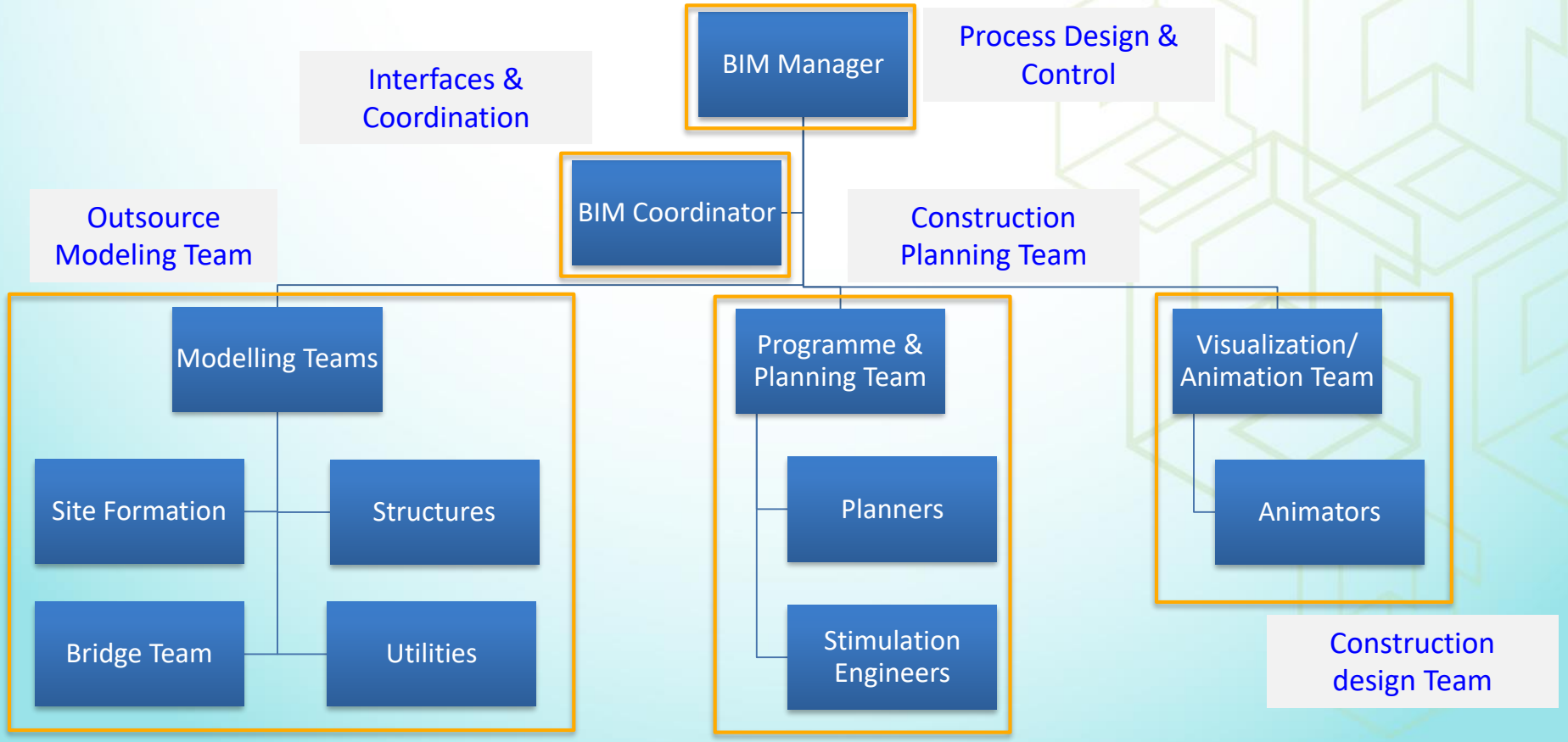
Modes of Re-Engineering (RSS)



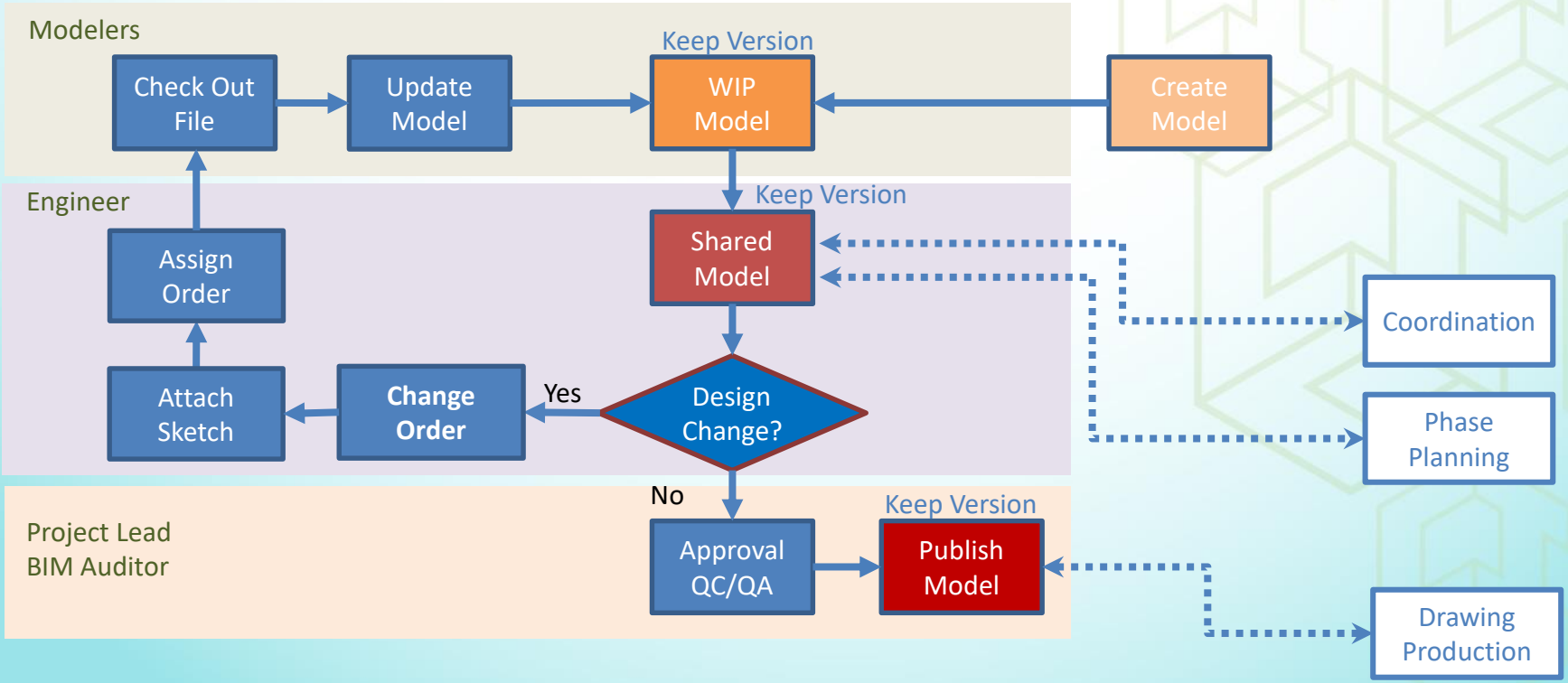
O-Chart, Role and Responsibility (Construction Phase)



Contractor BIM Team



5 Communicating design requests and changes based on standardized protocols



6 Contractual issue/ liability of BIM Projects

Development Bureau Technical Circular Requirements and Deliverables

Process

Deliverable

	BIM Use	Investigation, Feasibility and Planning	Design	Construction
1	Design Authoring	O	M	M
2	Design Reviews	O	M	M
3	Existing Conditions Modelling	O	O	M
4	Site Analysis	O	M	
5	3D Coordination		M	M
6	Cost Estimation	O	O	O
7	Engineering Analysis		O	O
8	Facility Energy Analysis		O	O
9	Sustainability Evaluation	O	O	O
10	Space Programming	O	O	
11	Phase Planning (4D Modelling)		O	M
12	Digital Fabrication		O	O
13	Site Utilization Planning			O
14	3D Control and Planning			O
15	As-Built Modelling			M
16	Project Systems Analysis			O
17	Maintenance Scheduling			O
18	Space Management and Tracking			O
19	Asset Management			O
20	Drawing Generation (Drawing Production)		M	M

Legend:

M – Mandatory BIM Use for the mentioned stage, including that carried forward from previous stage.

O – Optional BIM Use

Design Presentation

Architectural Design
Structural Design
MEP Design
Landscape Design
Civil Design ……..

Statutory Submission - Legal

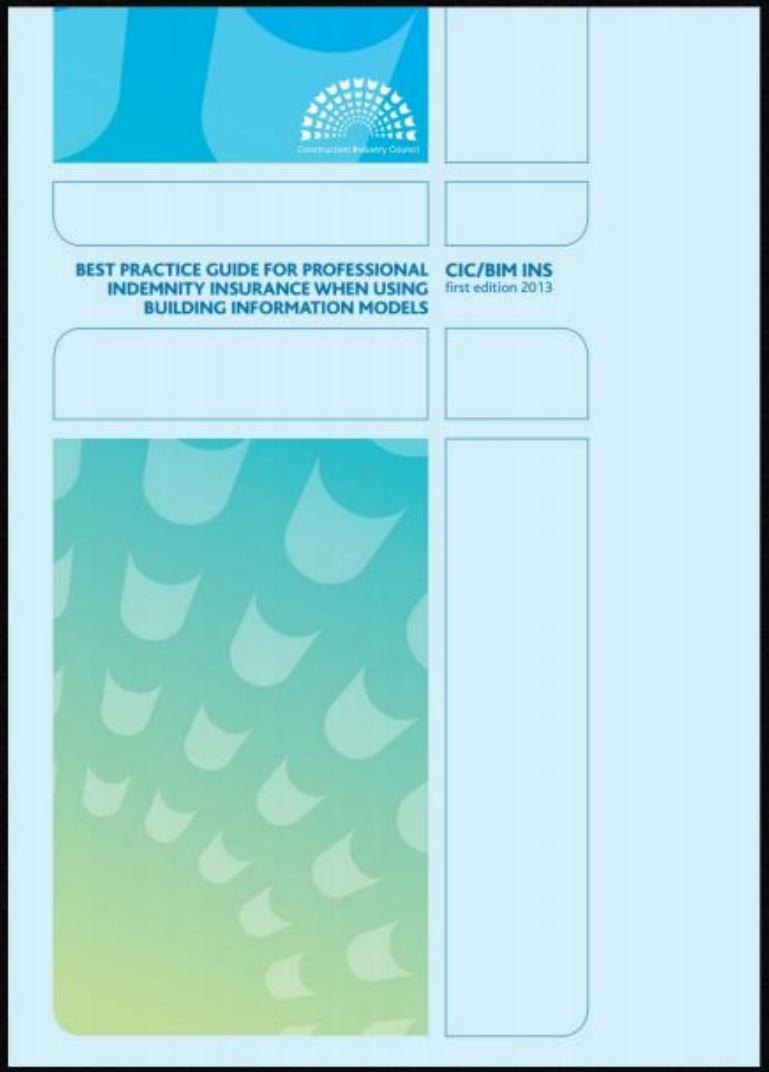
General Building Plan,
Curtain Wall submission,
Demolition Plan, Site Formation Plan, Structural Submission,
Drainage Submission, Utility Submission, ……..

Construction - Contractual

Tender Drawing, Construction Drawing,
Shop Drawings,
Combined Services Drawings,
Combined Builder's Work Drawings,
As – built drawings…….

6 Contractual issue/ liability of BIM Projects

BIM Professional Indemnity



1. Executive Summary

This Best Practice Guide has been produced by Griffiths & Armour on behalf of CIC in support of the work of the BIM Task Group. The guide is directly addressed to the needs of insured parties – particularly consultants engaged in the production of definition information using Building Information Models.

The aim of this best practice guide is to support the construction industry's take up of Level 2 Building Information Modelling, by summarising the key areas of risk which Professional Indemnity ('PI') insurers associate with level 2 BIM and what you can do about those risks as a prudent insured.

We are therefore looking to inform you, the insured, of what you might be required to do in order to ensure that your PI insurance arrangements are in order.

The foundation of this document is a series of consultations held by Griffiths & Armour with the majority of the PI insurance market, including several Lloyd's syndicates and the main insurers in the company market. A major and necessary part of the consultation process was the education of insurers as to what the introduction of level 2 BIM involves, what technology is required to support it and what the "outputs" of such a design process might involve.

The overarching response to the consultation from insurers has been that there are no issues with level 2 BIM which are sufficiently serious as to require coverage restrictions for consultants which use it, nor will its use, all things being equal, materially alter the risk profile presented by a consultant, and therefore the premium implications will be minimal.

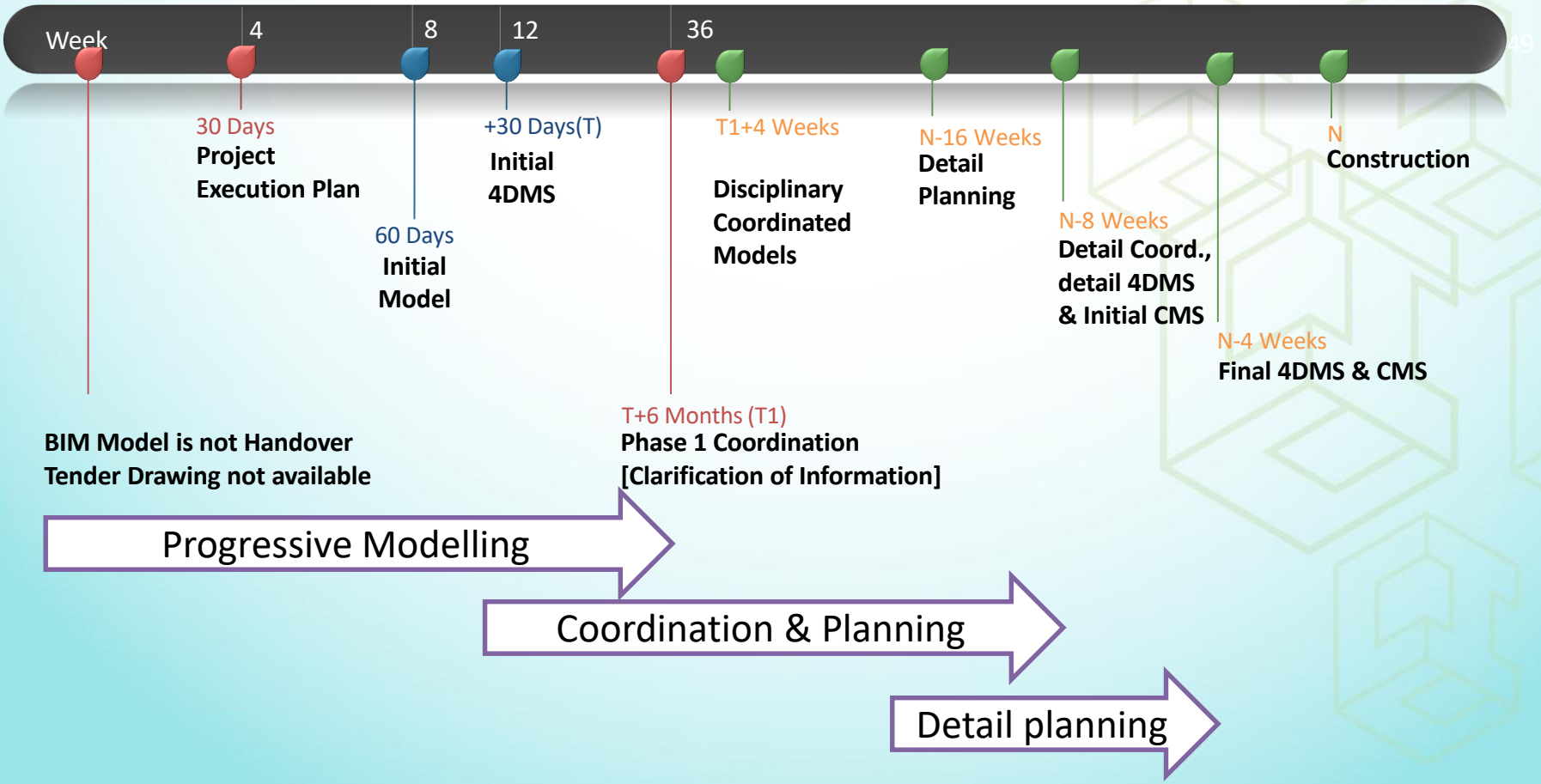
You should, therefore, have little difficulty in obtaining assurance from your broker that this activity will fall within the range of activities contemplated by our PI insurers.

It should also be stressed that this report **does not consider the Level 3 BIM environment**, which raises very different liability issues which will need further consideration. By way of explanation, by level 2 BIM we broadly mean that a "federated model" is being used, albeit in a managed 3D environment and perhaps with 4D construction sequencing and /or 5D cost information. Level 2 BIM requires each participant to develop their own model(s), which are then shared with the project model, with appropriate audit trails in place. It is the robustness of these audit trails and change control systems that gives insurers comfort.

It should be noted that simply because two or more parties are working together, this does not mean that this extends into Level 3 BIM territory, provided that the resultant models are still "federated".

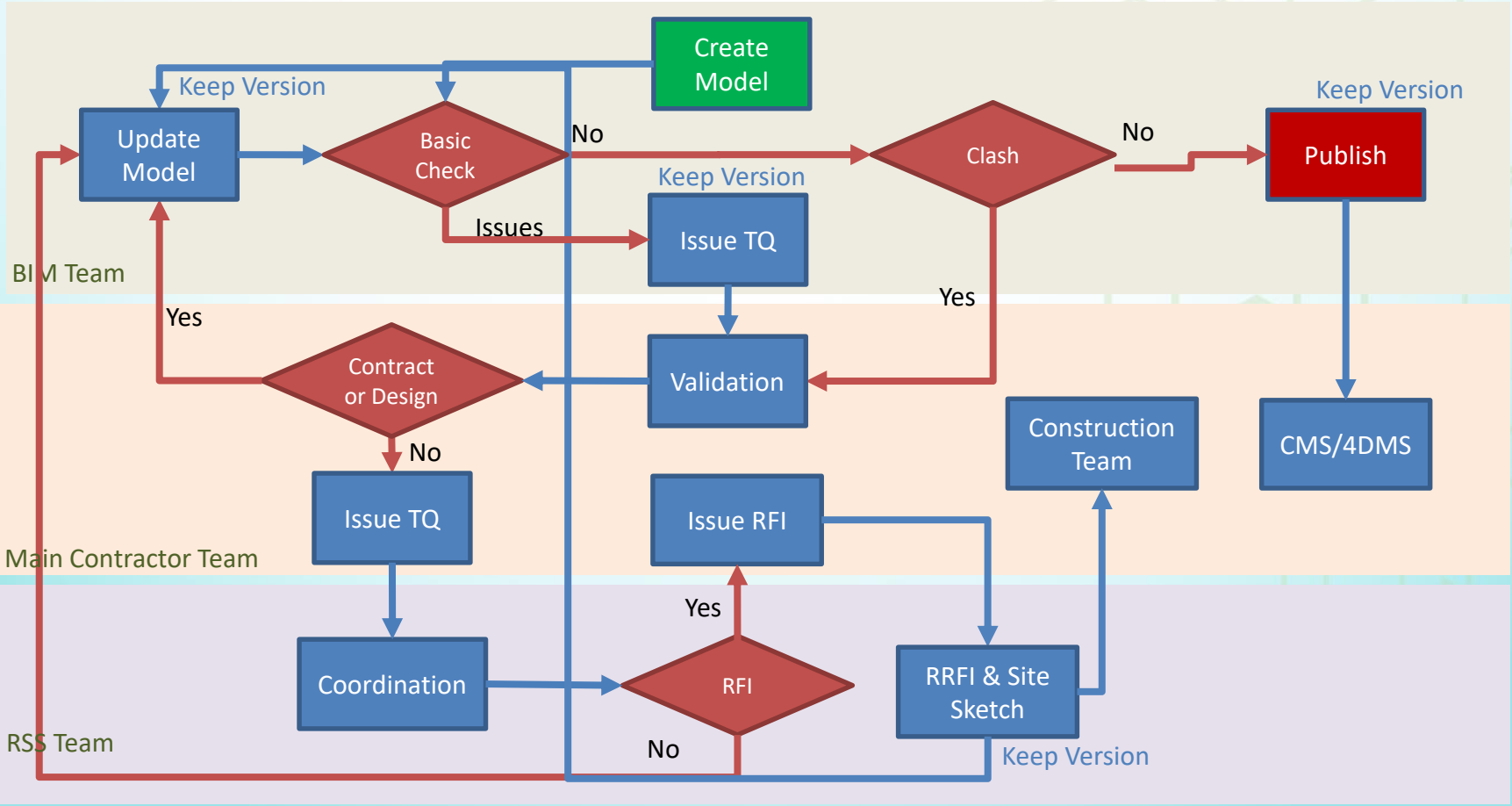
E. BIM Model Checking Procedures and Revision/Change Management

1 Criteria of validating design for various project stages



1 Criteria of validating design for various project stages

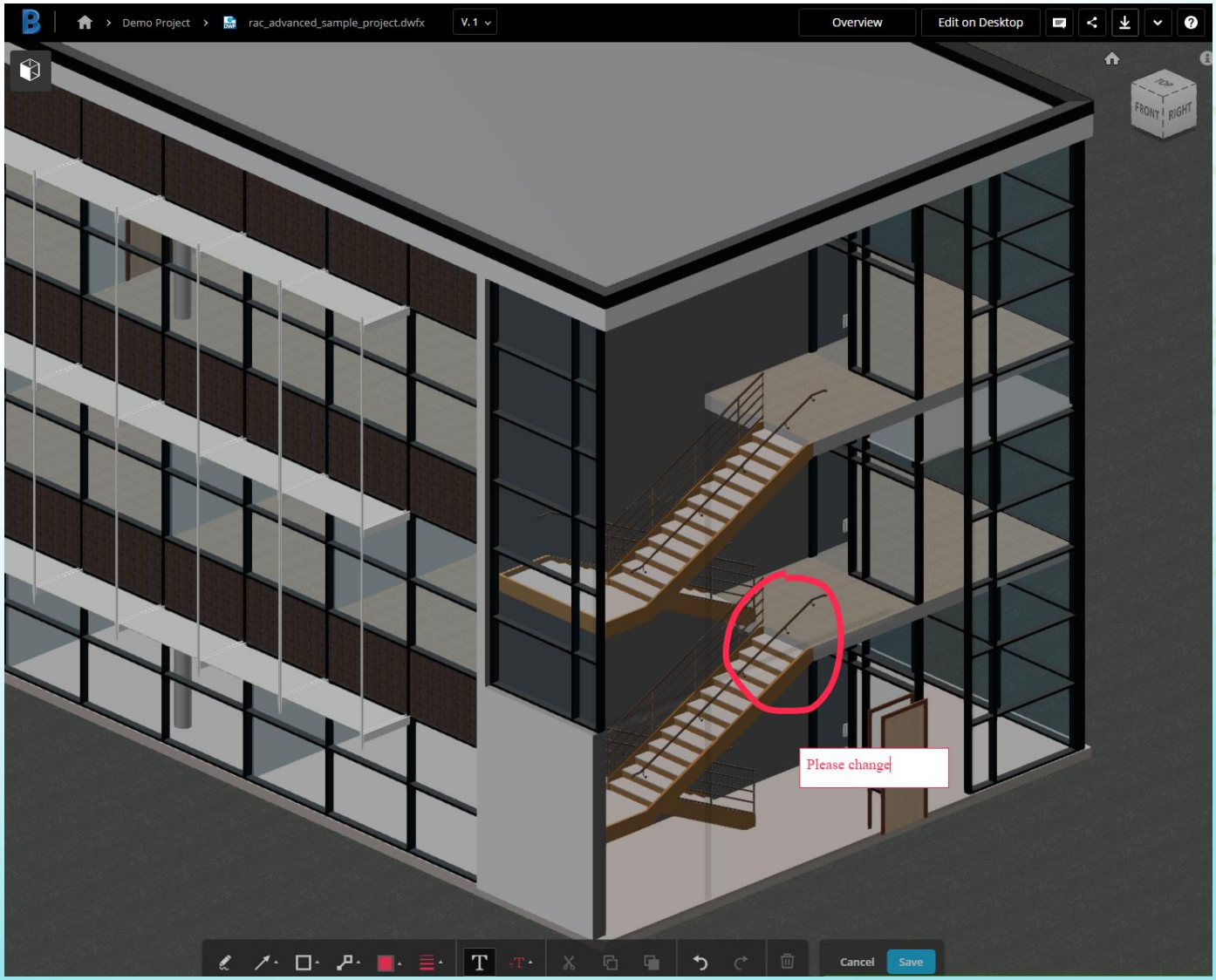
- Coordination Process in Construction Stage



2 Formulation of BIM model checking procedures for various design submissions

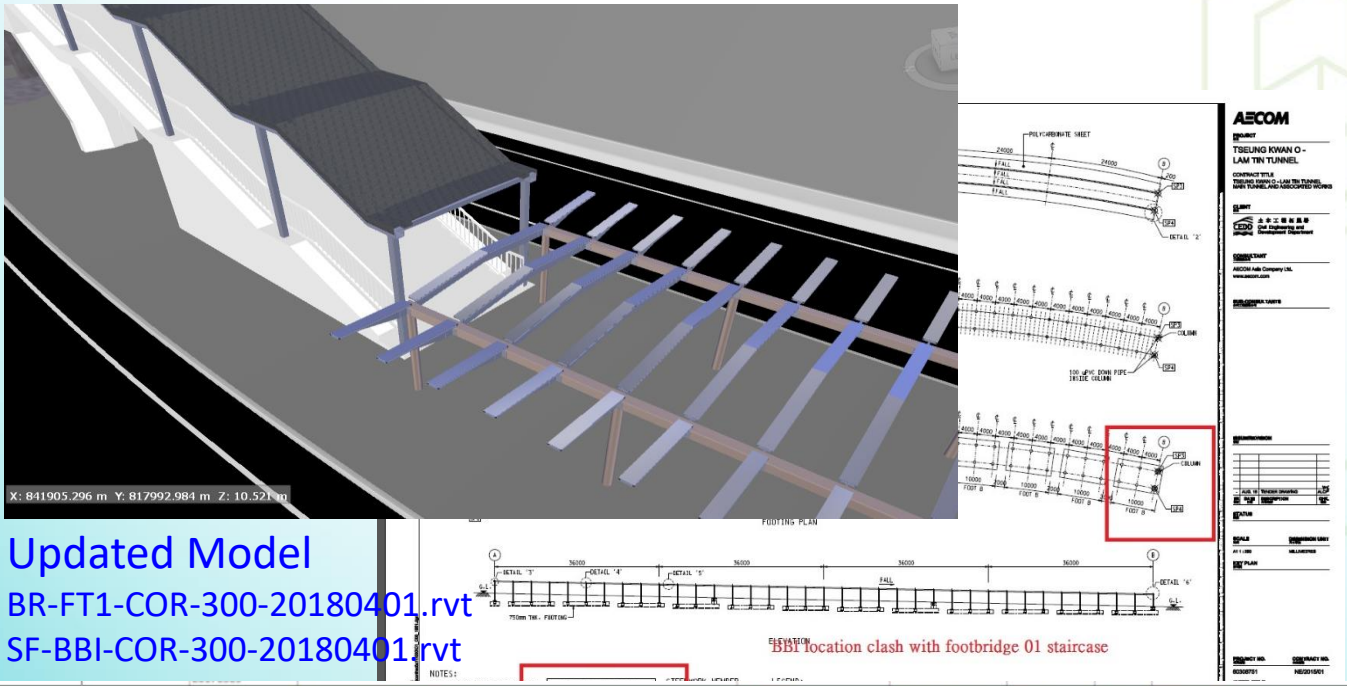
	Visual Inspection	Software Aided	Others
Design Standard	N/A	Design Constraints	Revision Mgt
Modelling Standard	Yes	N/A	Random Checks
CAD Standard	Yes	N/A	Version Mgt
Interference check	Yes	Clash Detection	Revision Mgt
Geometry Accuracy	Overlaid	Sections and Annotation	Point Cloud Overlaid
Information Completeness	Yes	Schedules	Onsite Inspection

3 Methods of digital redlining of BIM projects



4 Revision and change management

Site Sketch for TQ122



Updated Model

BR-FT1-COR-300-20180401.rvt

SF-BBI-COR-300-20180401.rvt

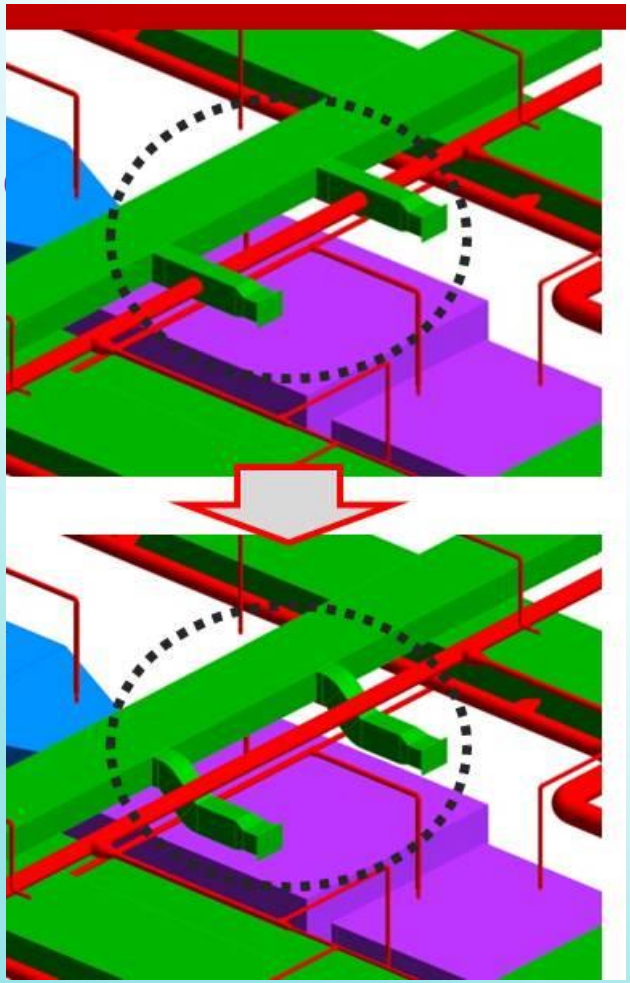
120		20170301, 20170509	Conflict of length of FT-01 section 3	Footbridge	RRFI-00266-R00	Spatial	Open	Model updating
121	Y	20170301, 20170509	Conflict of FT-01 deck width of section 3	Footbridge	RRFI-00266-R00		Closed	
122	Y	20161221, 20170509	Clash of FT-01 staircase and BBI	BBI	RRFI-00266-R00		Closed	
123	Y	2016122, 20170331, 20170509	Missing setting out line of BBI	BBI	RRFI-00267-R00		Closed	

Tracking Sheet

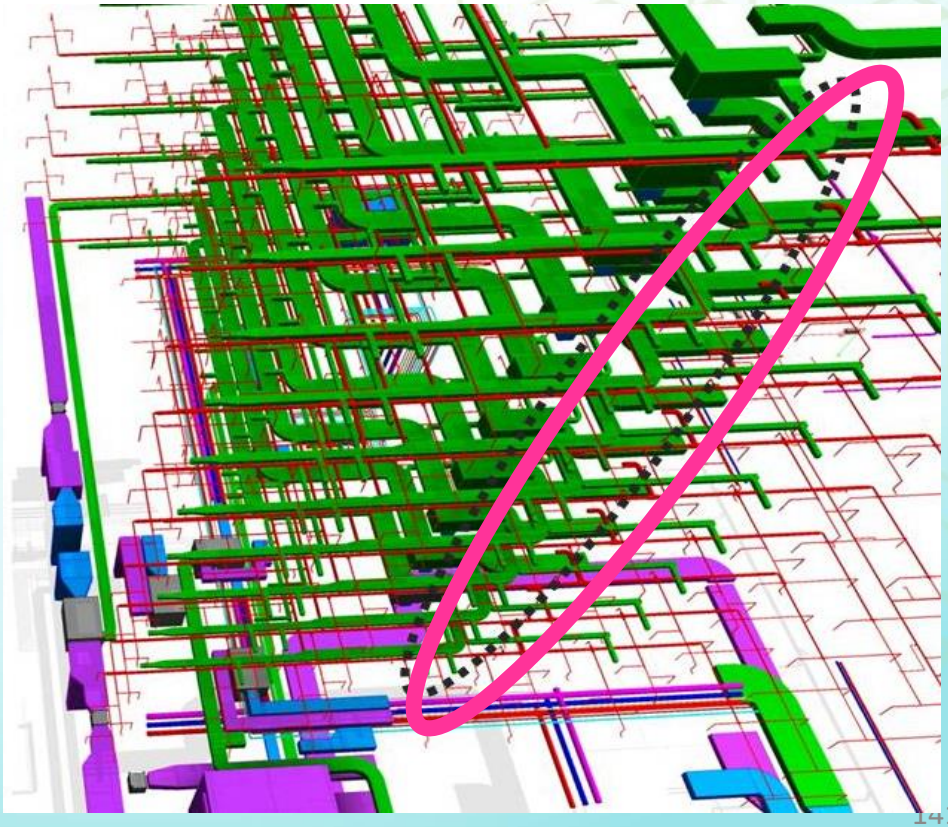
5 Method of detecting problems in a BIM project

Clash Detection

Building Services, False ceiling, Structural Elements

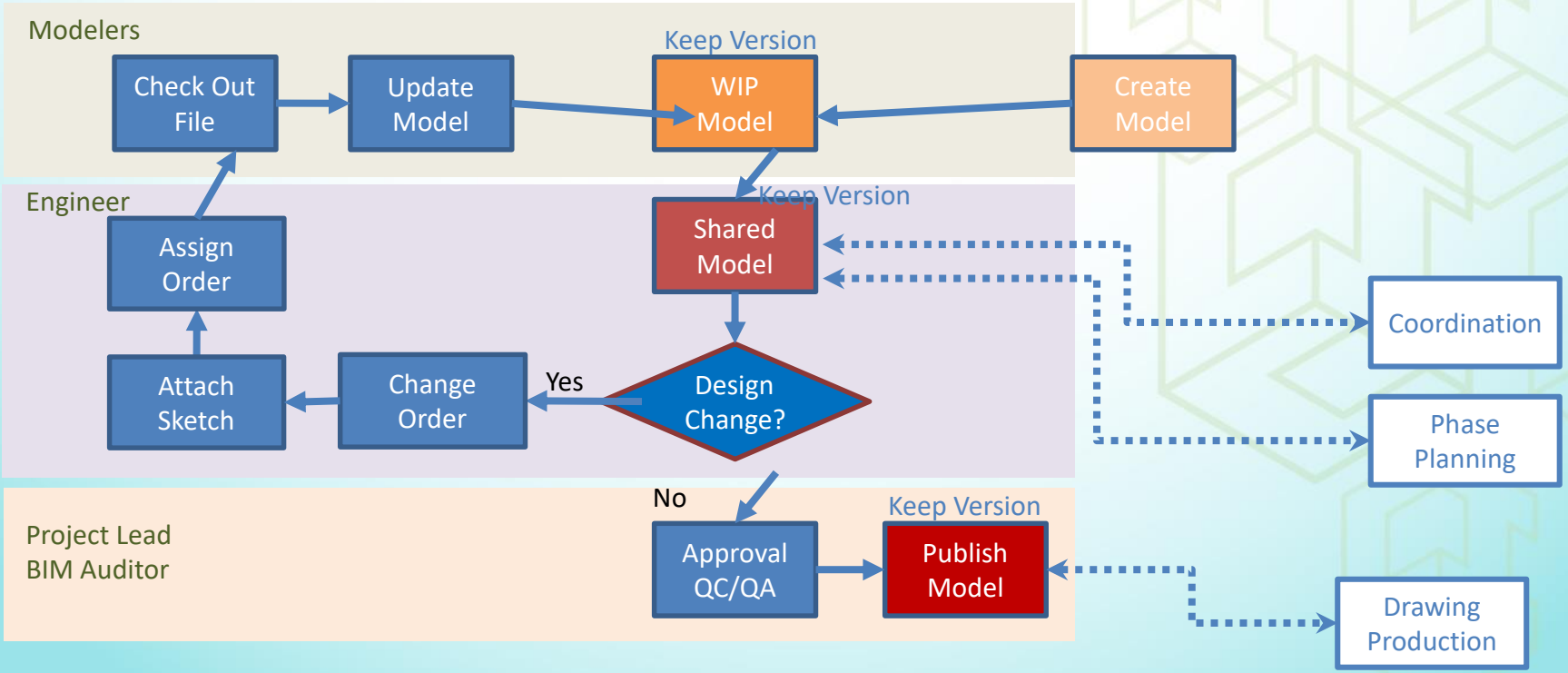


- Check clashes before build
- Minimize number of variations & avoid delay



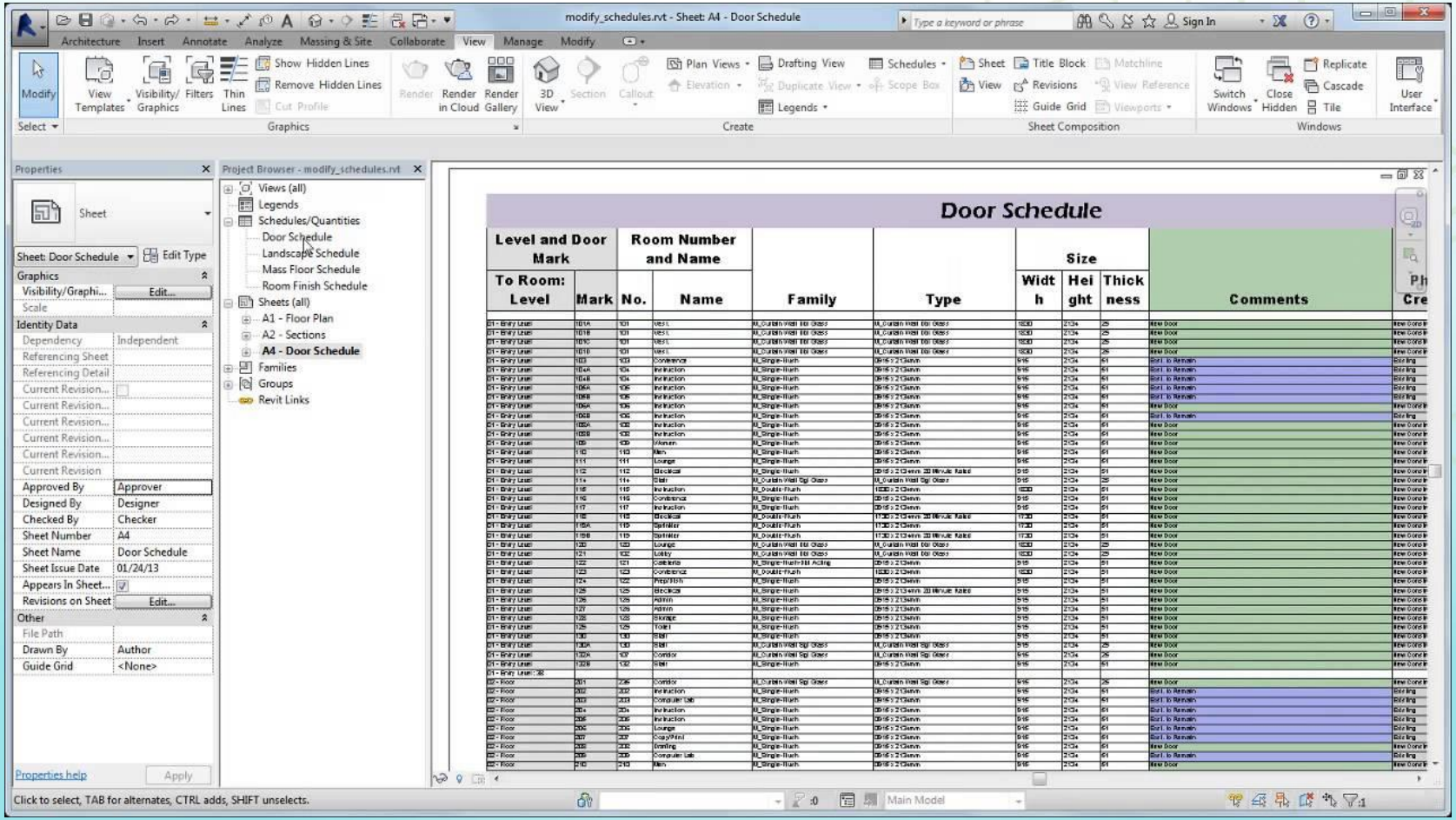
Source: http://www.designbimstudio.com

6 Going through a sample revision/change management cycle



7 Quality assurance/quality control in BIM projects

- Geometry (Modelling) cannot fully ensure BIM quality
- Check from Information side - scheduling



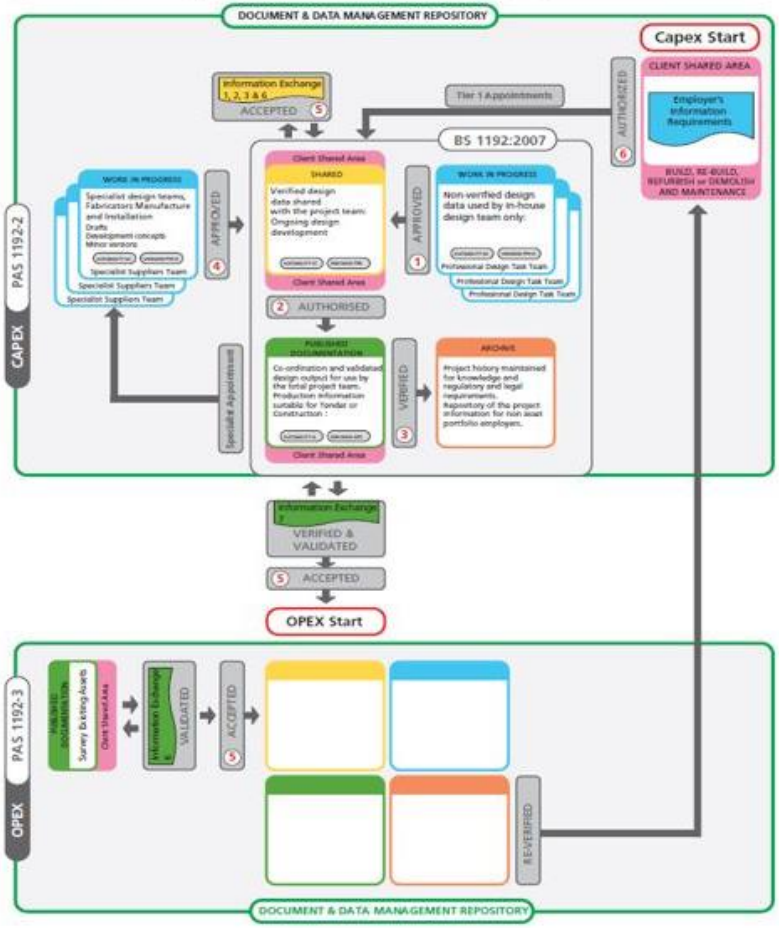
F. Coordination of Multi-Disciplinary BIM Projects

1 BIM model as a multi-disciplinary integrated database

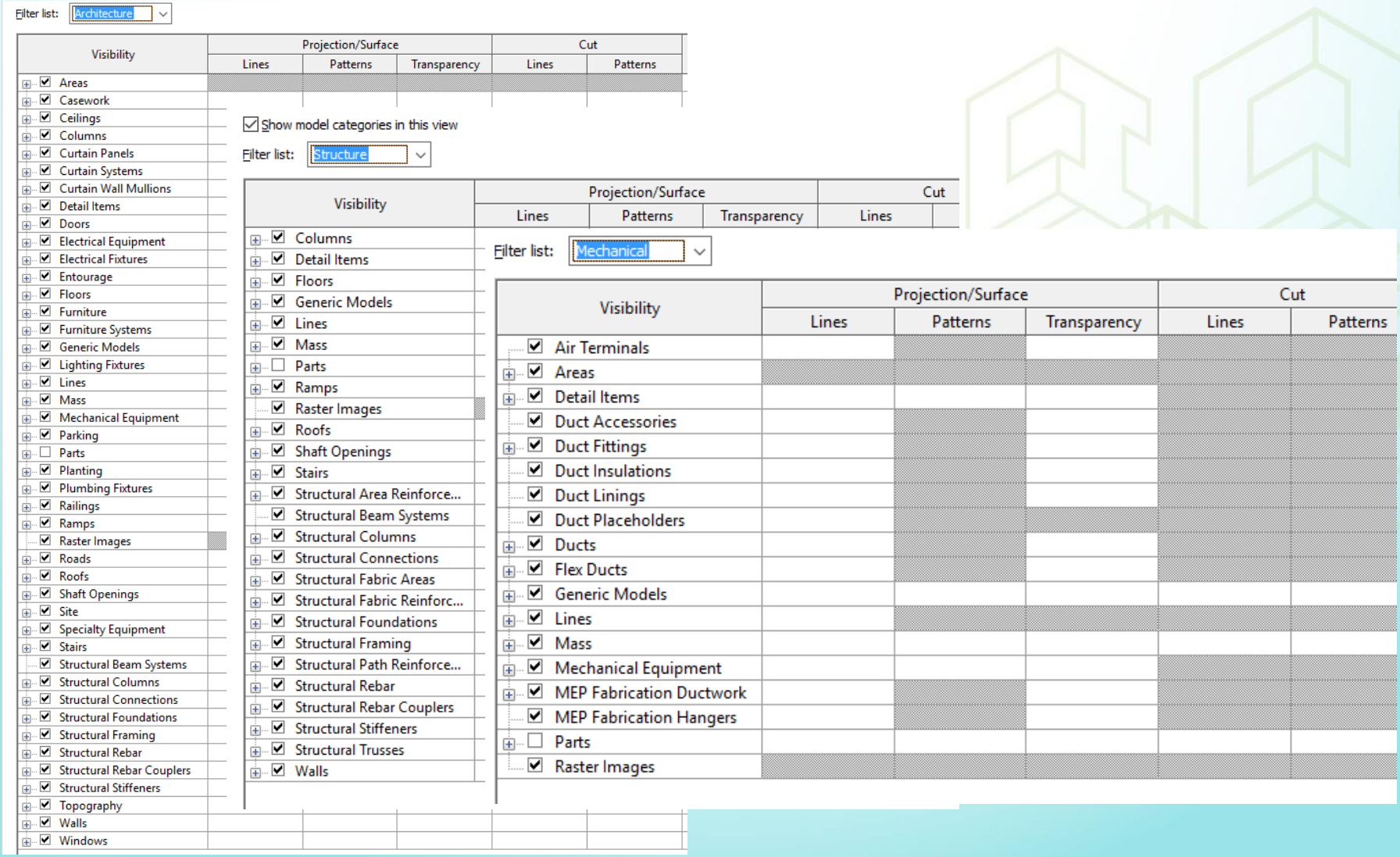
Common
Data
Environment

- File Management Methodology
  - PAS 1192
  - Tracking, Sharing of Working and release data
- 4 Key Stage
  - WIP
  - Share
  - Publish
  - Archive
- Replicate and Exchange to Next stage

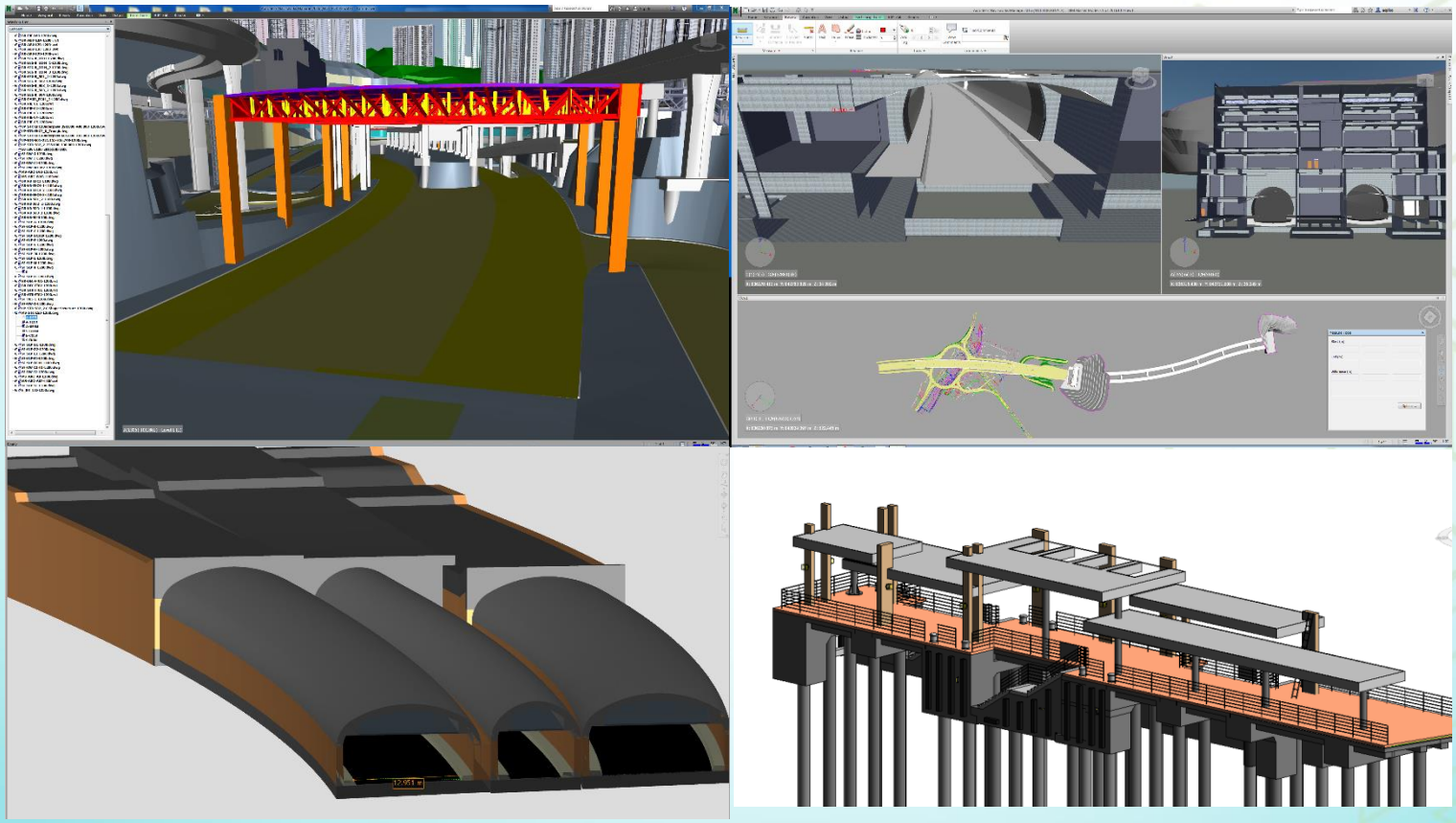
Figure 15 – Extending the common data environment (CDE)



1 BIM model as a multi-disciplinary integrated database



2 Integration of BIM contents from various professional disciplines

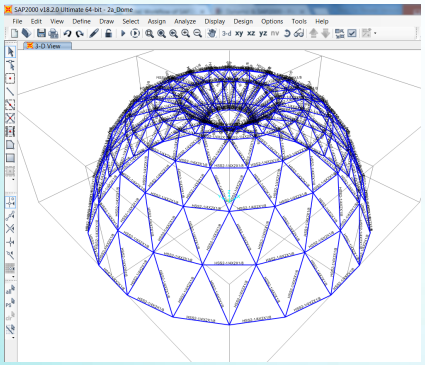


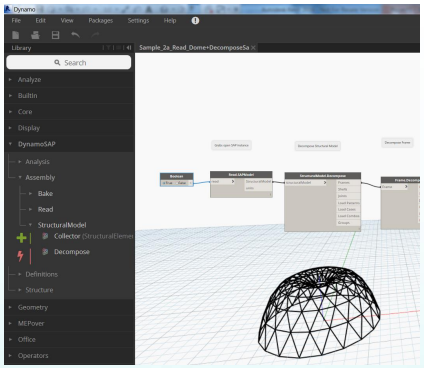
Modelling Methodology : Structural Models

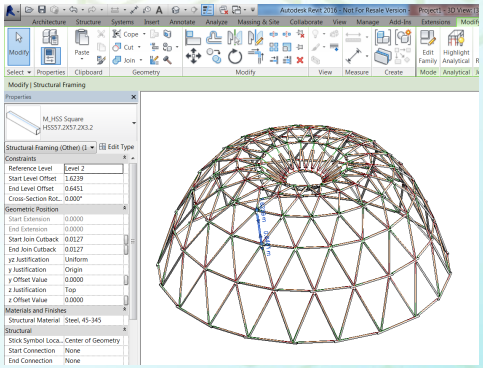
ID	Terminology	Autodesk	Format	Bentley	Format	Exchange Format
1	Beam, Column, Slab…	RVT: Structural Framing	DWG	ABD: Structural Element	DGN	XML
2	Pile, Pile Cap..	RVT: Structural Foundation	DWG	ABD: Structural Element	DGN	XML
3	Bridge Piers	RVT: Generic model	DWG	ABD: Generic model	DGN	N/A
4	Bridge Segments	C3D: Corridor	DWG	OBM : Deck	DGN	N/A
5	Tunnel Lining	C3D: Corridor	DWG	ORD: Corridor	DGN	N/A
6	Retaining Wall	C3D: Corridor	DWG	ORD: Corridor	DGN	N/A

Integrate Structural Analysis

SAP2000 → Dynamo → Revit

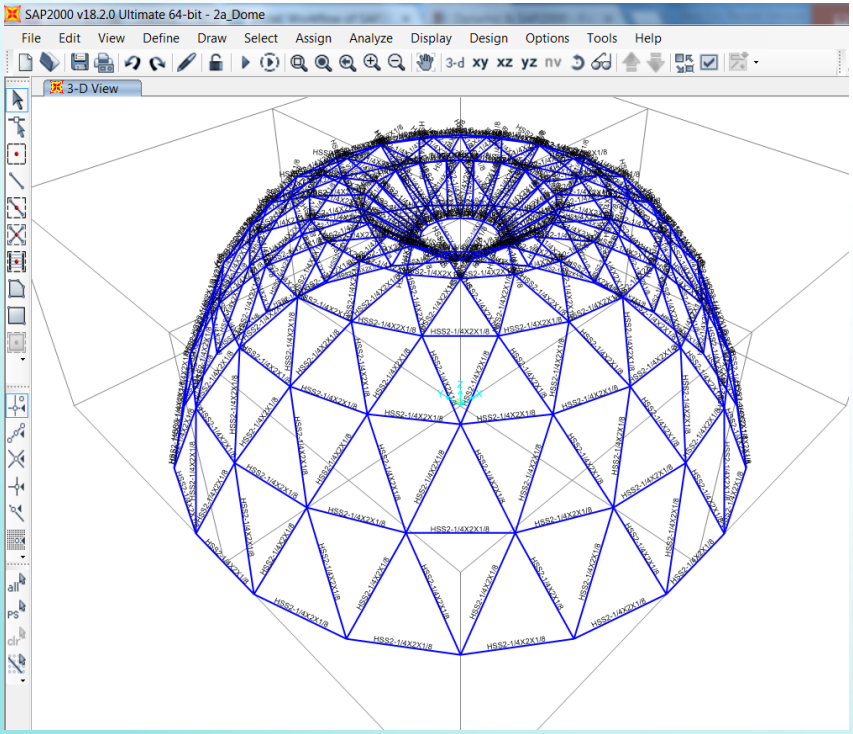




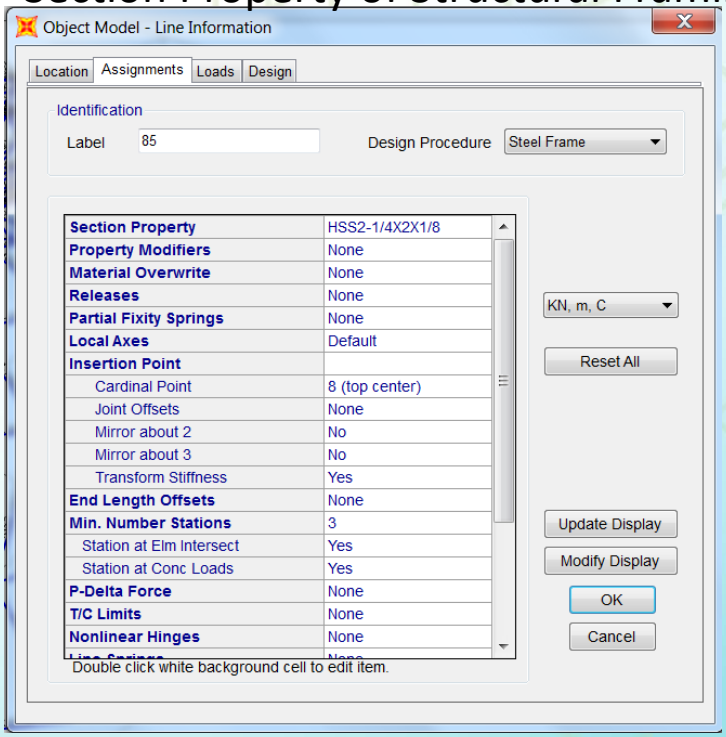


SAP2000

Model in SAP2000

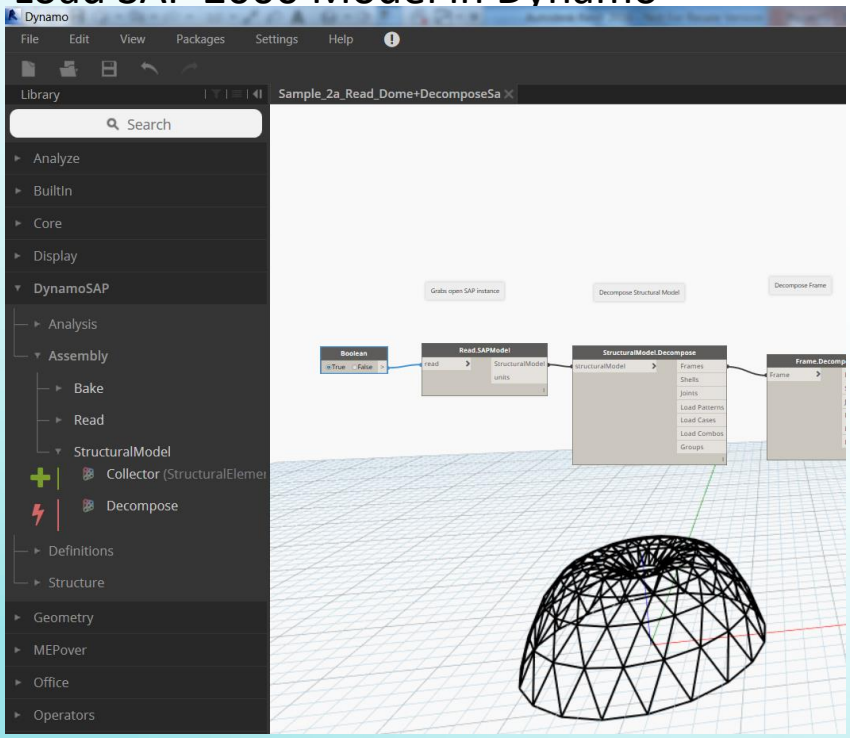


Section Property of Structural Framing

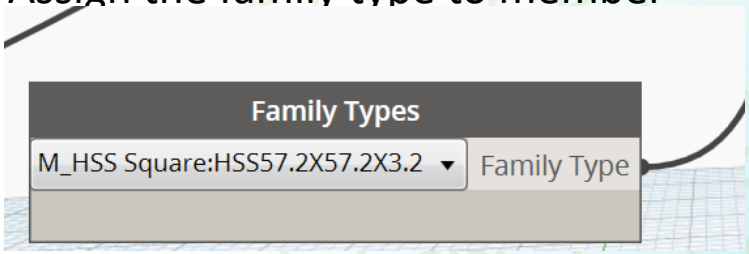


Dynamo

Load SAP 2000 Model in Dynamo

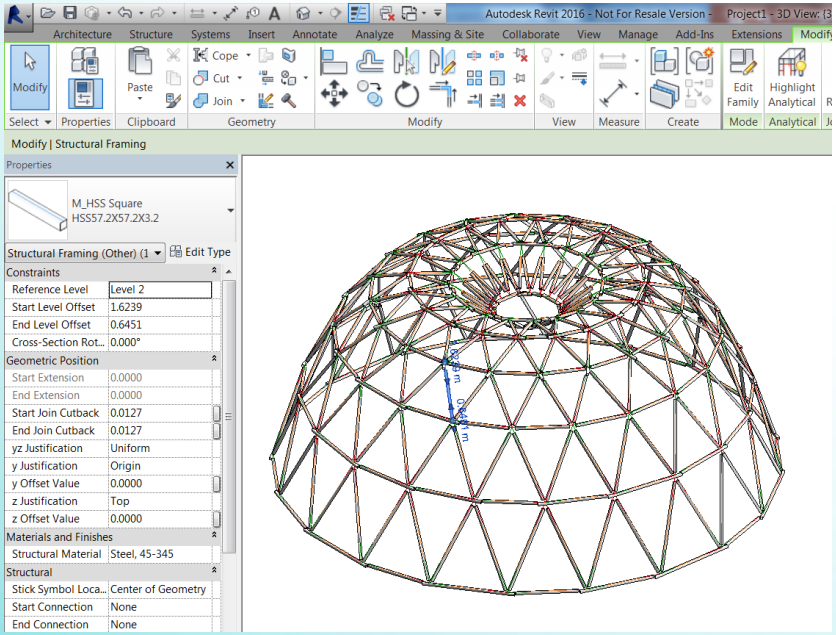


Assign the family type to member

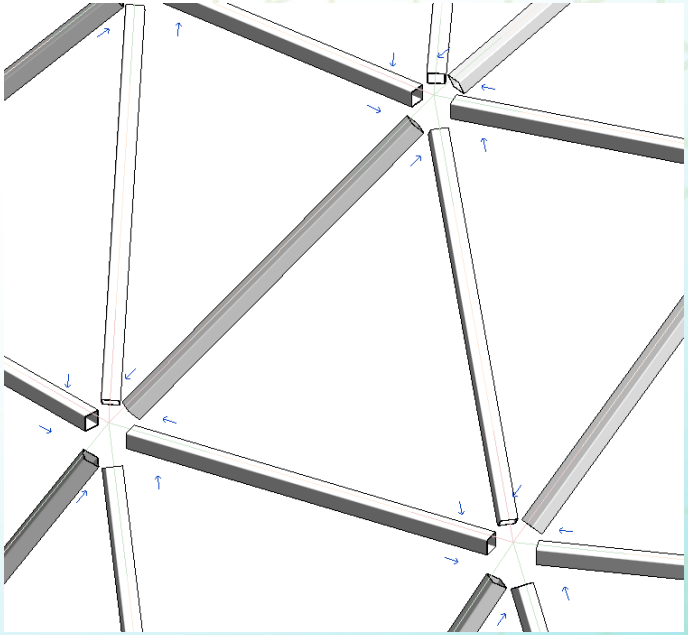


Revit

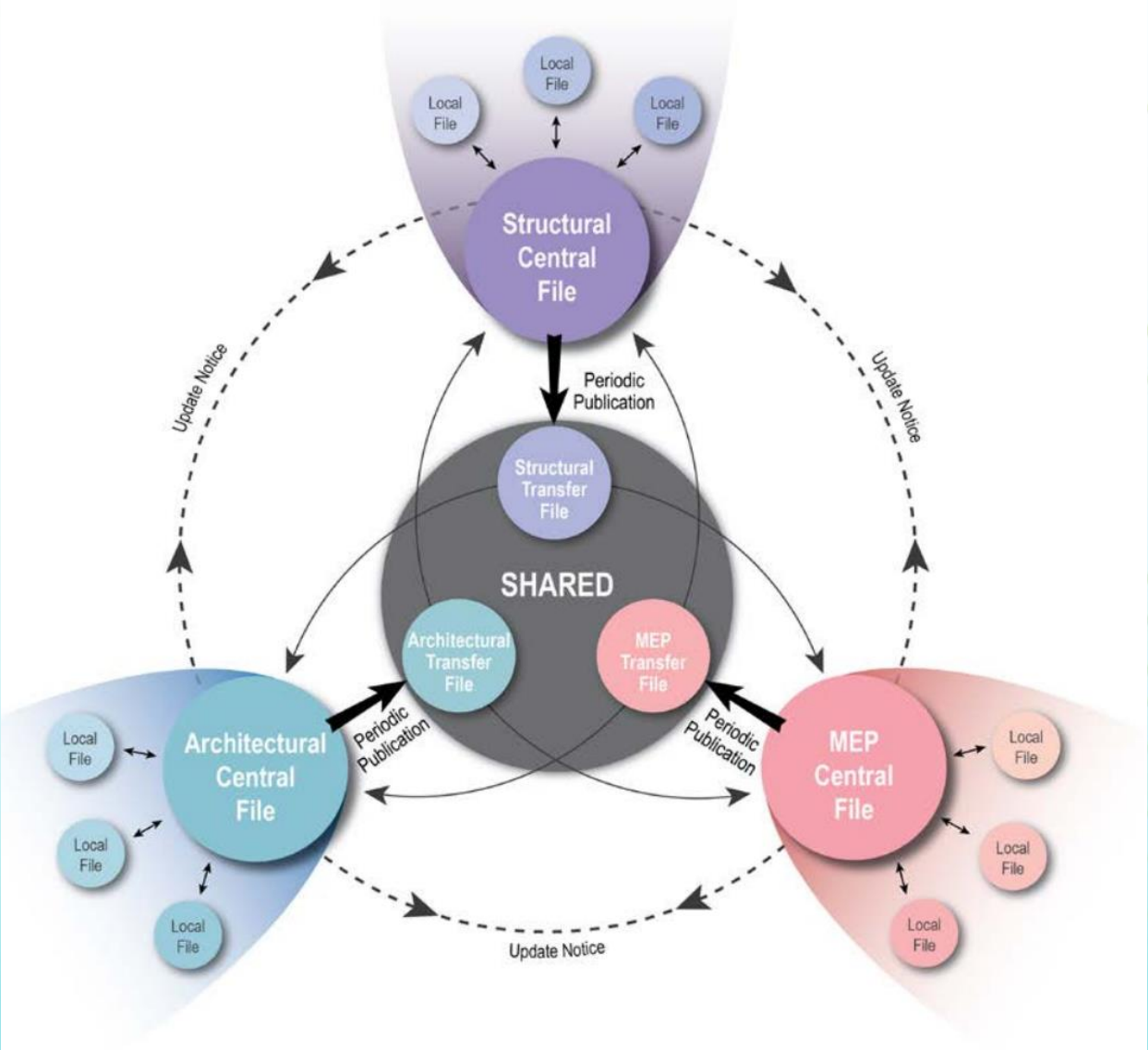
Regenerate Framing Model by Dynamo



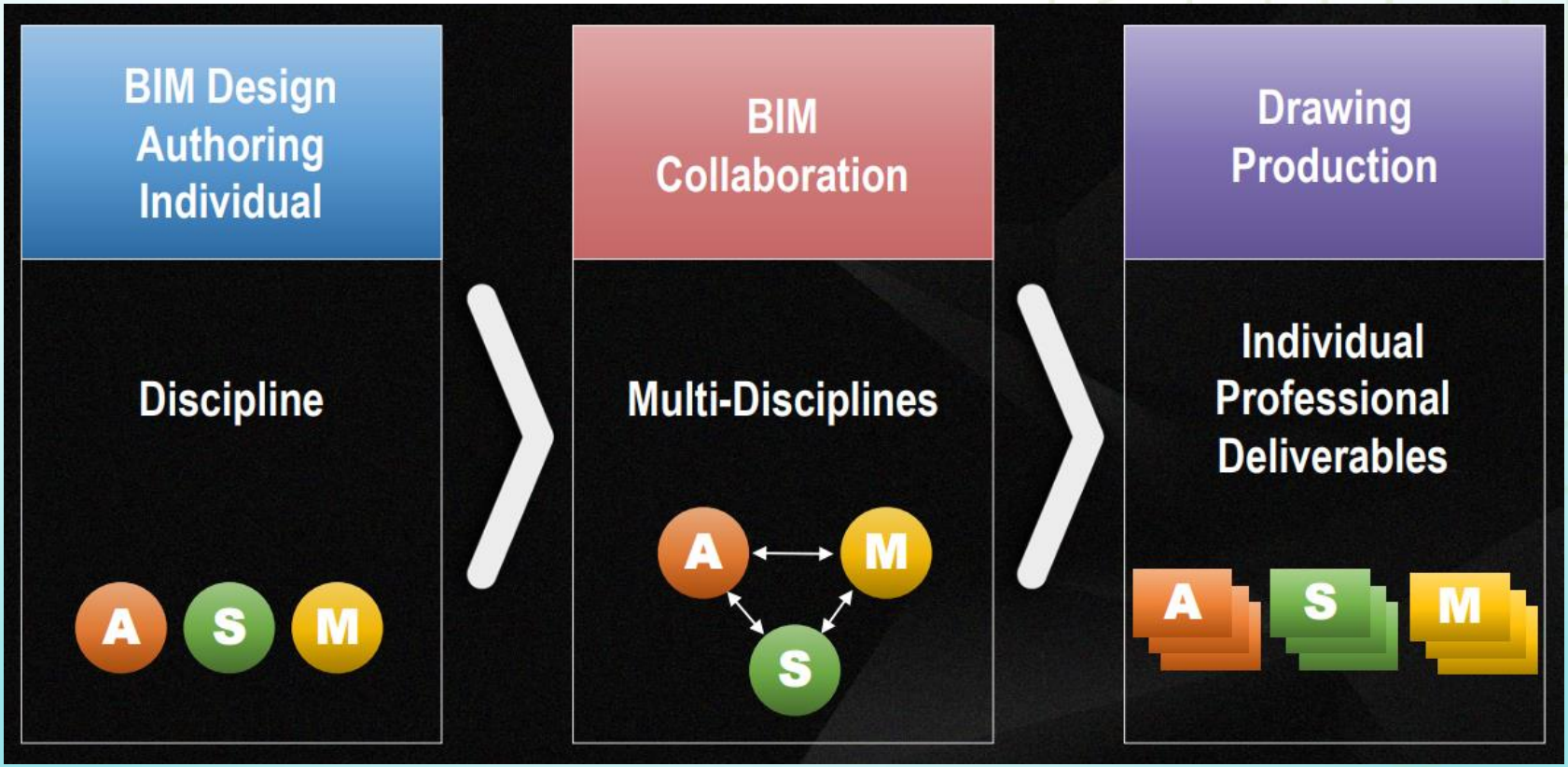
Adjust Further Structural Connection Detail



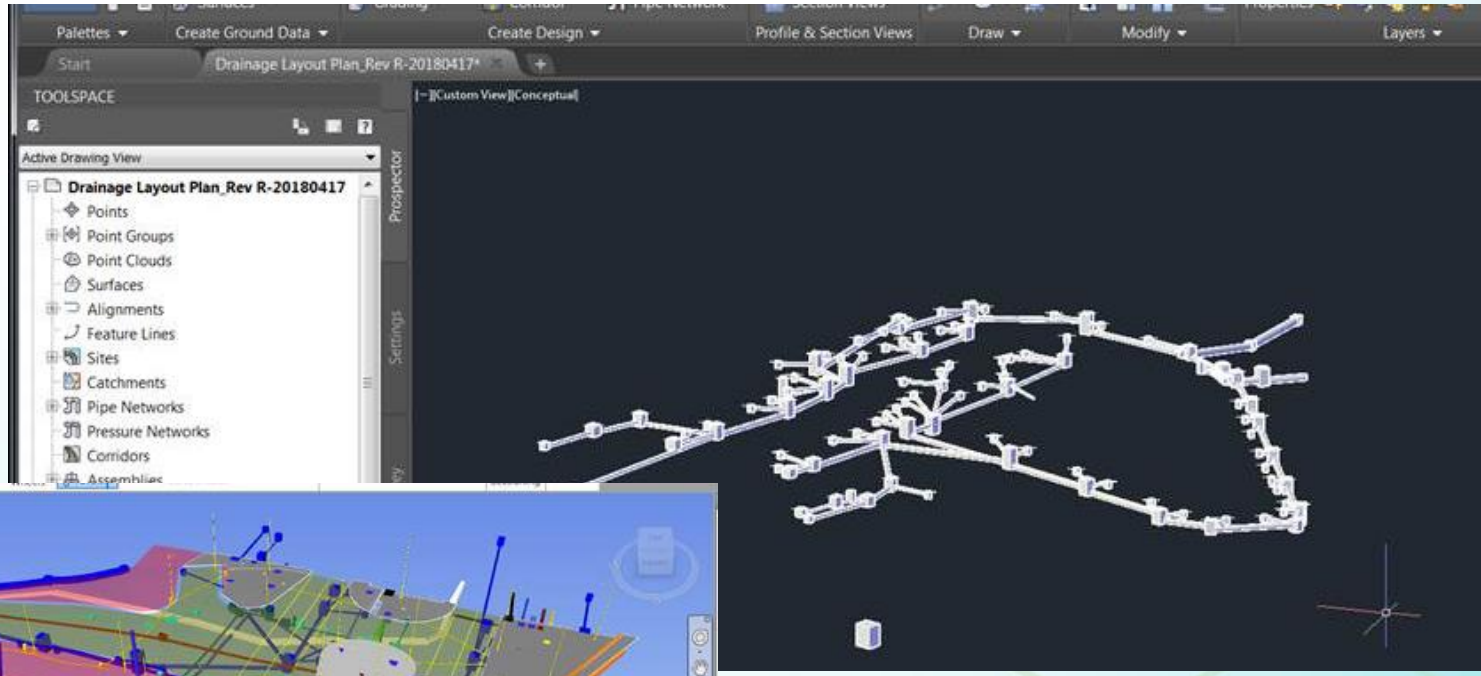
3 Methods and procedures of BIM data exchange

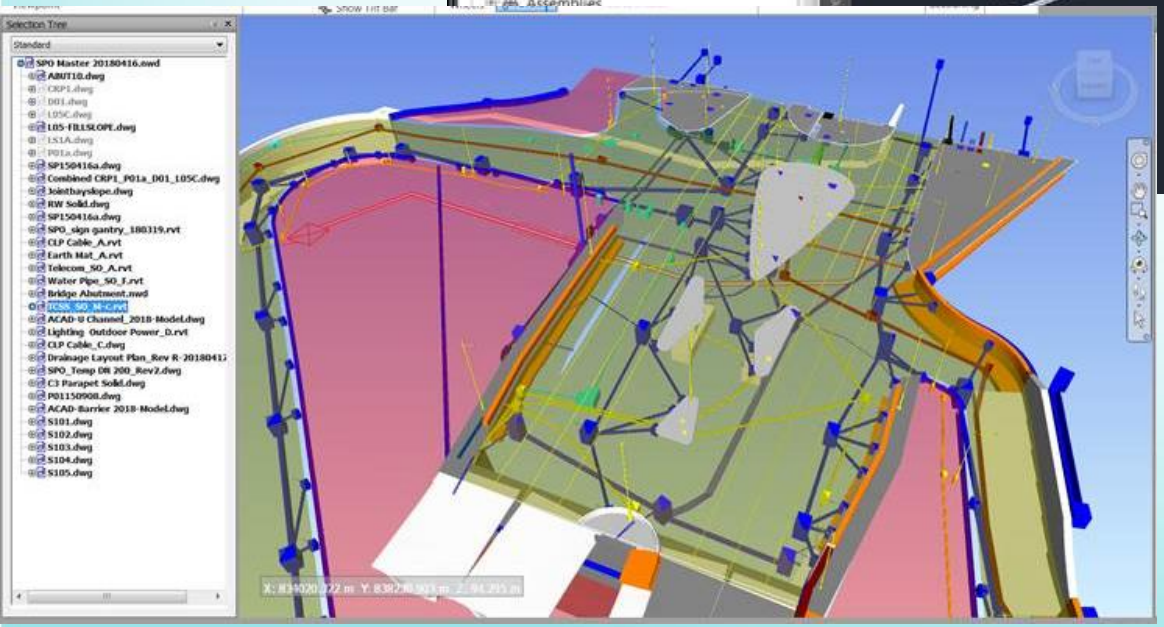


4 Understanding of cross-disciplinary model collaboration, office standards compliance check, dataset validation, clash analysis and detection



5 Collaboration and interface between civil and building BIM projects



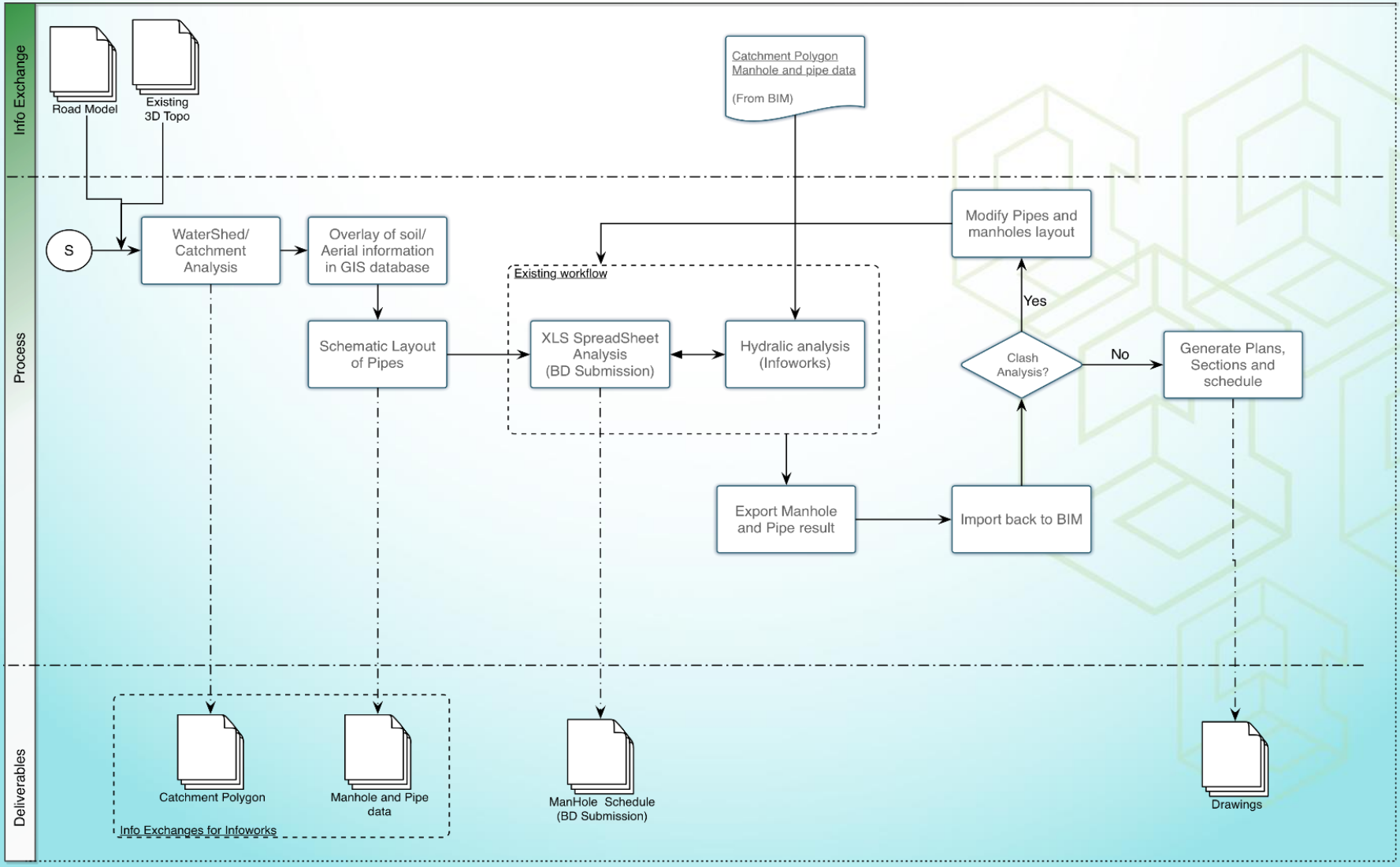


Modelling Methodology : Underground Utilities

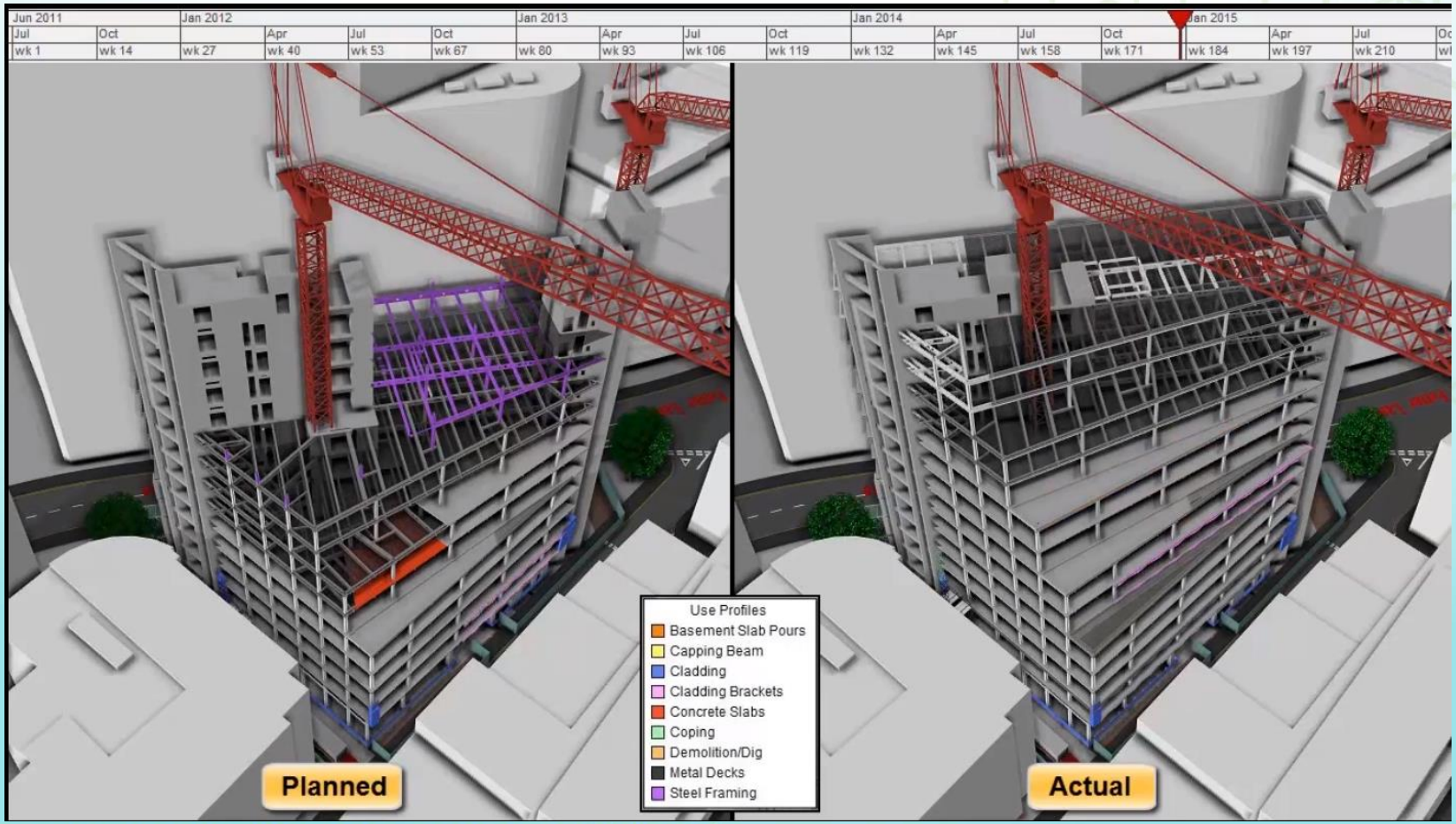
ID	Terminology	Autodesk	Format	Bentley	Format	Exchange Format
1	Storm Drain/PVC/DI Pipes	C3D: Pipe Network	DWG	SSU: Pipes	DGN	XML
2	Pressure Pipe	C3D: Pressure pipe	DWG	SSU: Pipes	DGN	XML
3	Manholes	C3D: Structures	DWG	SSU: Cells	DGN	N/A
4	Valve, Bend, Fittings	C3D: Fittings	DWG	SSU: Cells	DGN	N/A

- Utilities could be modelled in C3D/SSU or Revit/AECOSim
- Key Consideration
  - Interfaces with Terrain
  - Storm drainage analysis

Strom Drain Analysis



6 Introduction of 4D BIM for construction simulation and 5D BIM for visualization of the progress of construction activities and its related costs over time



THANK YOU