ARUP

CORENET X Leadership Forum 2

People / Process / Technology

Er. Sam Kilkenny-Brown, Associate of Arup Singapore

27 November 2023

ARUP

Our firm

For over 75 years, Arup has been recognised for its vision, talent and tenacity.

Dedicated to sustainable development, the firm is a collective of 16,000 designers, advisors and experts working across 140 countries. Founded to be both humane and excellent, we collaborate with our clients and partners using imagination, technology and rigour to shape a better world.

Arup worldwide

v1

Arup worldwide

ARUP

89 offices

33 countries

£1.9bn* turnover

75 yrs of profitable trading debt free

17,000+ people

*as at Mar 2023 *21/2022 financial year*

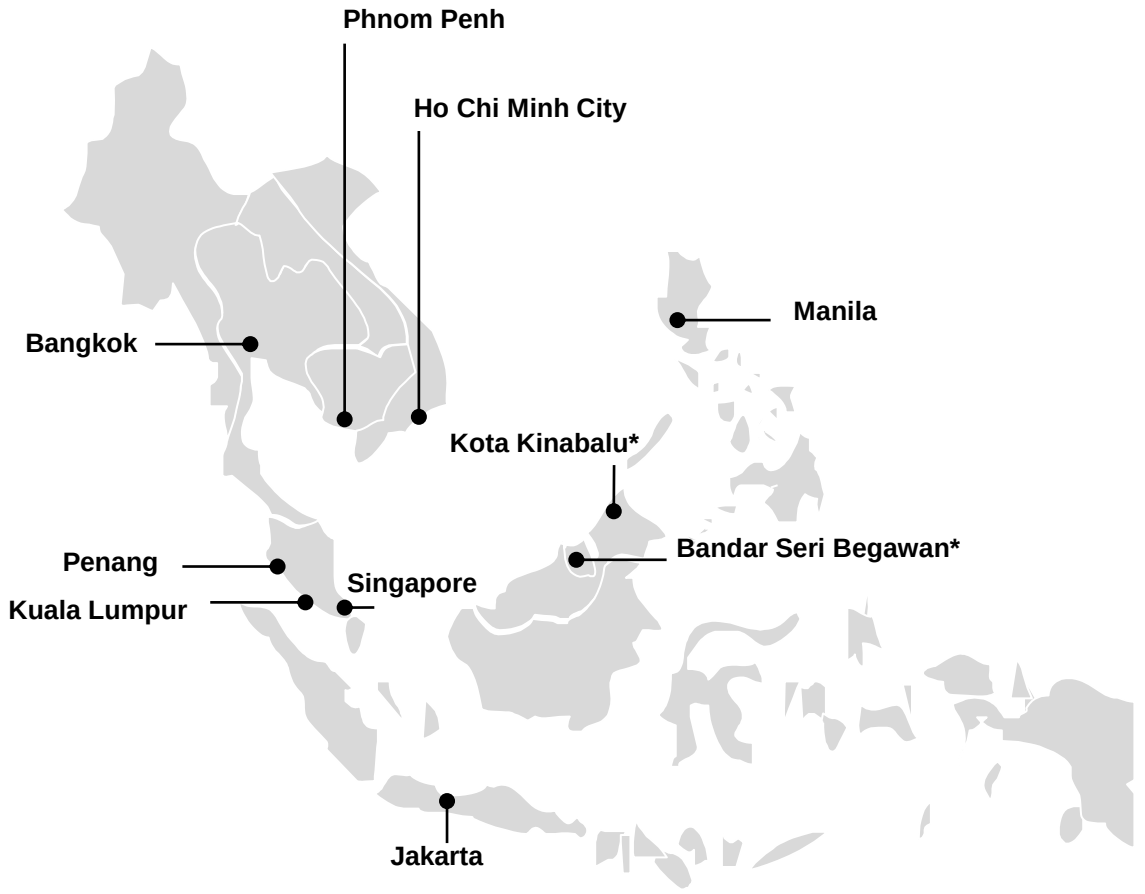
Arup in Southeast Asia

50+ years of city shaping history

1,000+ employees

10 offices

Arup has been in Southeast Asia for over 50 years and has longstanding offices in Jakarta, Kuala Lumpur, Manila and Singapore.



Arup in Singapore

We have been shaping this young, dynamic nation since 1968.
Our global and local expertise in tackling urban challenges unique to Singapore has made us the designers, engineers, planners and strategic advisors of choice for many local and international clients.

±450

Staff members
based in Singapore

ARUP

Digital

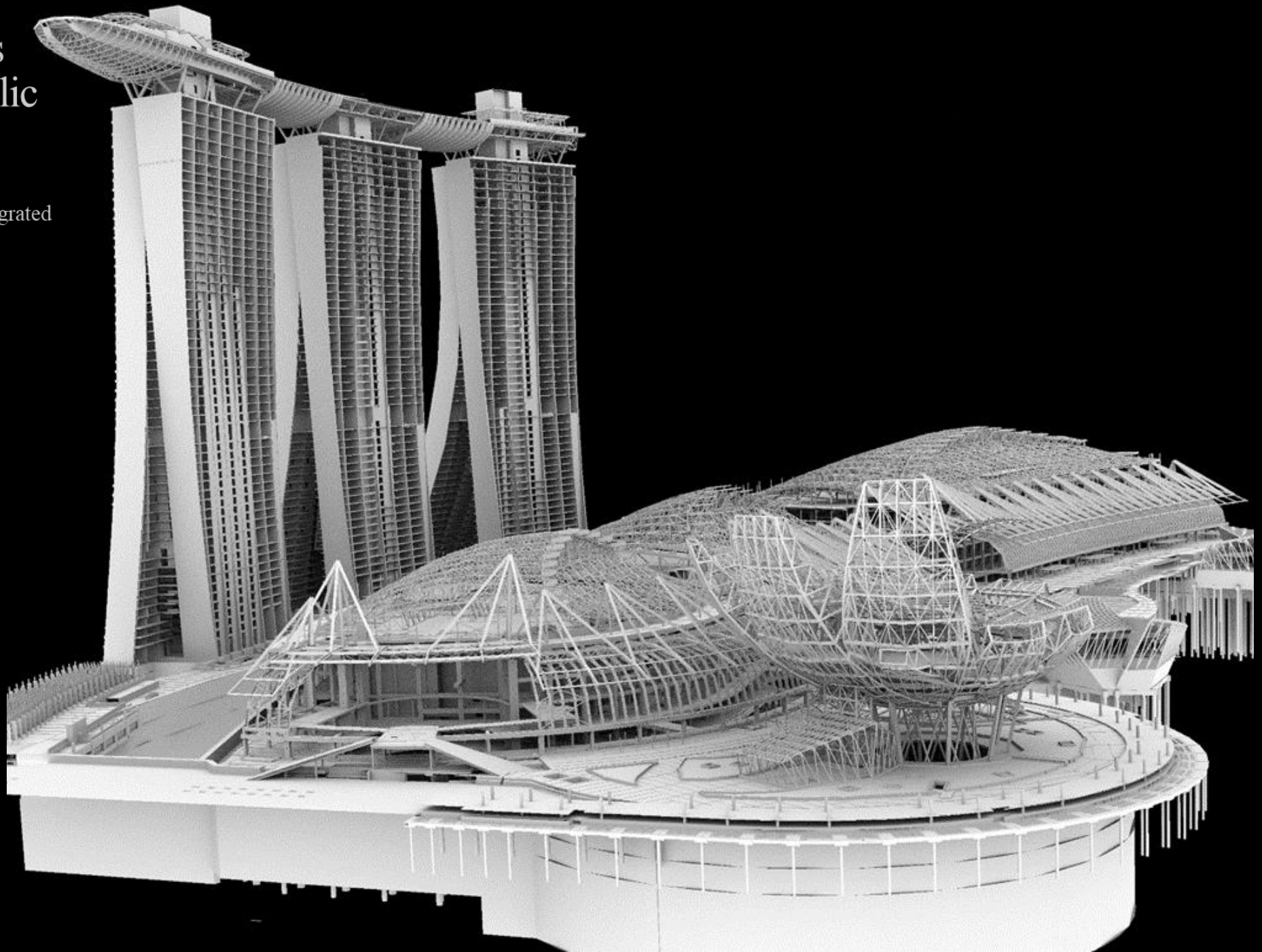
Digital runs through everything we do. We're engineers and analysts, planners and designers, strategists and digital specialists – determined to enhance the world around us. Our work combines analytical innovation, digital creativity, emerging technology, with the multidisciplinary breadth of Arup.

The world's longest public cantilever

Marina Bay Sands Integrated Resort , Singapore

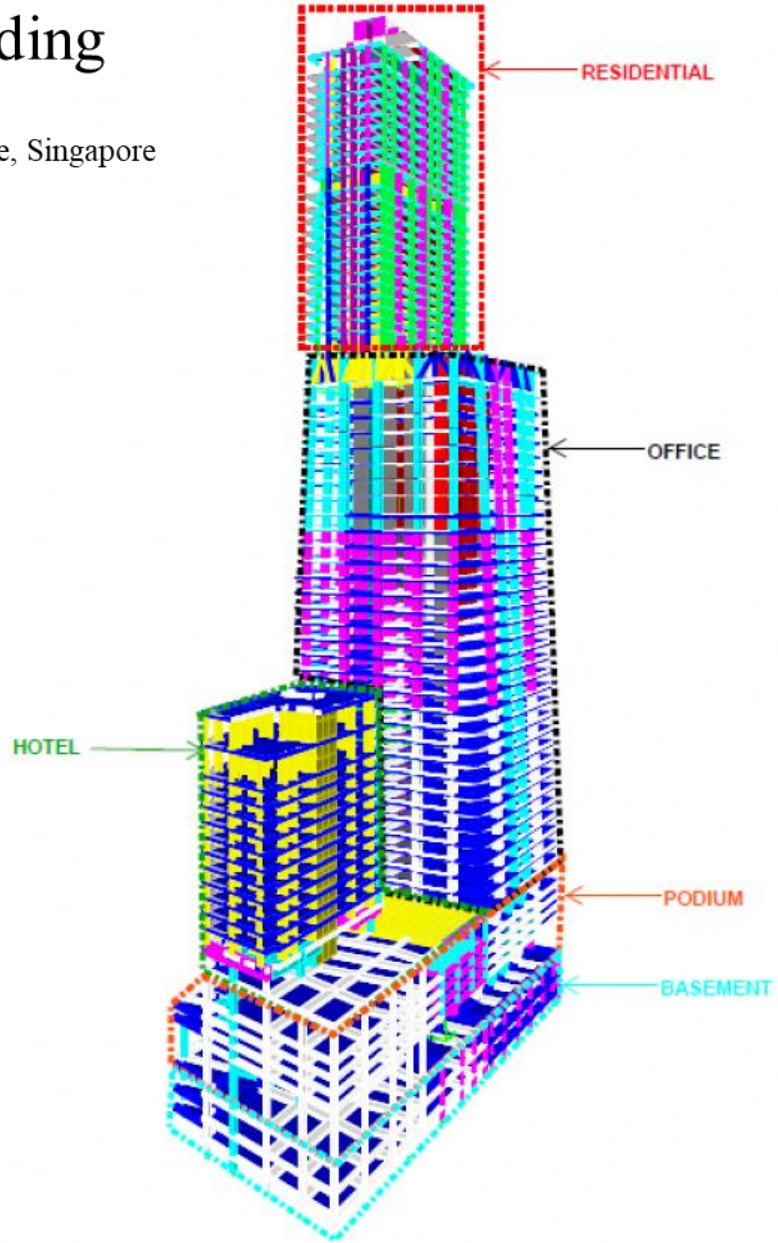
The world's longest public cantilever

Marina Bay Sands Integrated Resort , Singapore



Singapore's tallest building

Tanjong Pagar Centre, Singapore



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CORENET X - People

Our CORENET X team

Singapore

Country Leader
Tan Yoong Heng

Business Group Leader
See Lin Ming

Business Group Leader
Ching Lau

Building Structures
Mak Swee Chiang

Building Services
Scott Munro

Architecture
Jeremy Aloysius

Ronna Faller
(Architecture)

Khin Maw Maw
(BIM/Implementation Leader)

Thet Htar Zaw
(BIM)

Cheng Hong Yong
Engineer (MEP)

Subash Kathiresan
(C&S Civil)

Yar Ming Chong
Engineer (MEP)

Sam Kilkenny-Brown
Engineer (C&S)

Fire
Ruth Wong

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People

Leadership commitment

External CORENET X and RABW Training

Understanding and internalizing the new regulatory process (RABW) under CORENET X

Name	Role	Courses Attended
Subash Kathiresan	Engineer (Civil)	Introduction to Regulatory Approval Process via CORENET X
Veronica Wee	Engineer (MEP)	Introduction to Regulatory Approval Process via CORENET X
Hwee Kian Phua	Engineer (MEP)	Introduction to Regulatory Approval Process via CORENET X
Virgilio N. Quinones	BIM Technician (C&S)	Introduction to Regulatory Approval Process via CORENET X
Valentino Bermudez	BIM Technician (MEP)	Introduction to Regulatory Approval Process via CORENET X
Khin Maw Maw	BIM Manager (MEP)	CORENET X RABW Train-the-Trainer Course
Hong Keng Yap	BIM Manager (C&S)	CORENET X RABW Train-the-Trainer Course
Ronna Faller	BIM Specialist (Arch)	CORENET X RABW Train-the-Trainer Course

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People

Training Internal programme

Arup's hands on internal BIM training team

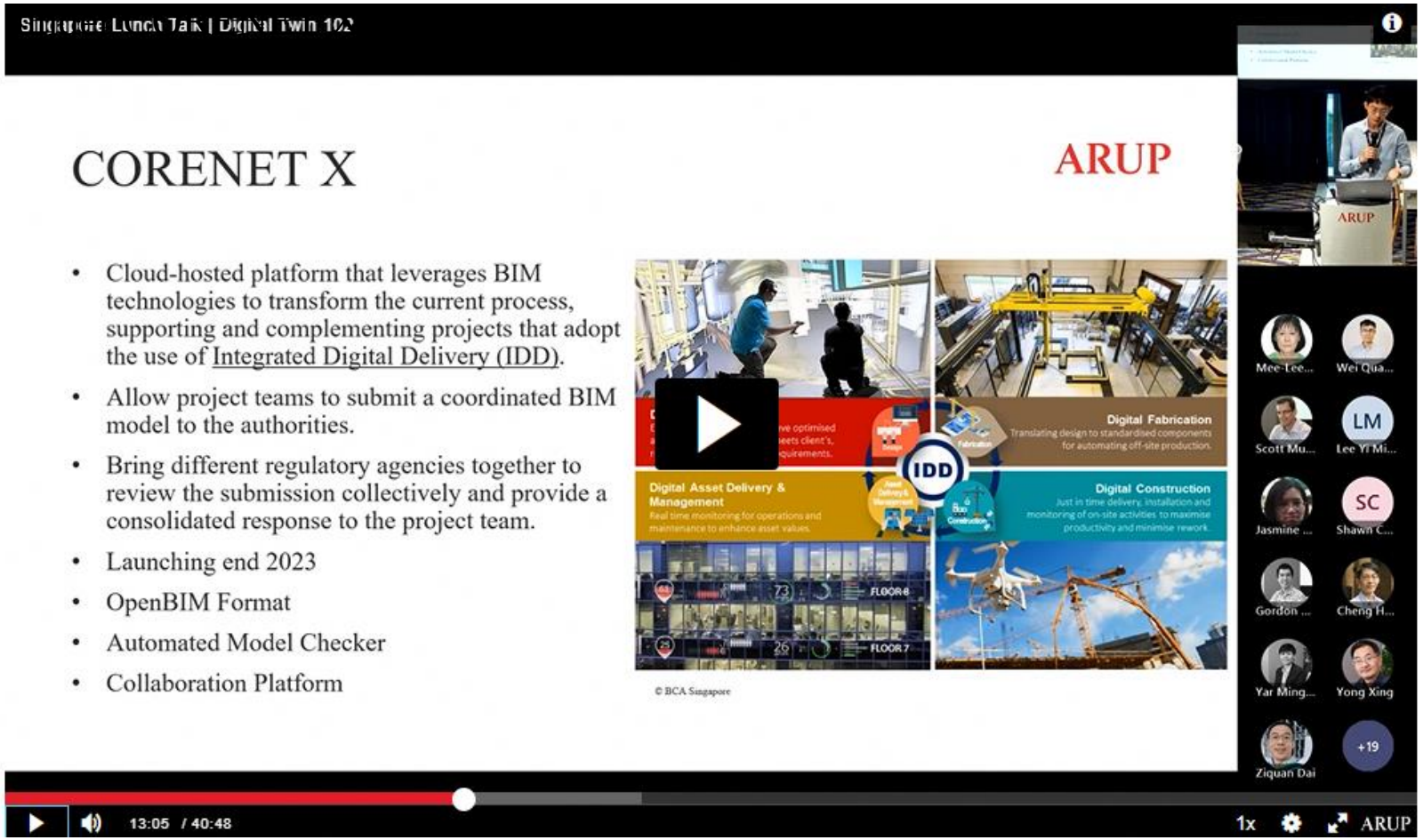
Understanding and internalizing the new regulatory process (RABW) under CORENET X

Name	Role	Role description
Khin Maw Maw	BIM Manager	Overall Responsibility for CORENET X Implementation
Thet Htar Zaw	BIM Manager (C&S)	Internal compliance Coordinator
Hong Keng Yap	BIM Manager (C&S)	BIM Hands-on Trainer
Valentino Bermudez	BIM Coordinator (MEP)	BIM Hands-on Trainer
Ronna Faller	BIM Specialist (Arch)	BIM Hands-on Trainer

People

Office Awareness Sharing Sessions

Understanding and internalizing the new regulatory process (RABW)



Cheng Hong Yong
Engineer (MEP)

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CORENET X – Technology & Process

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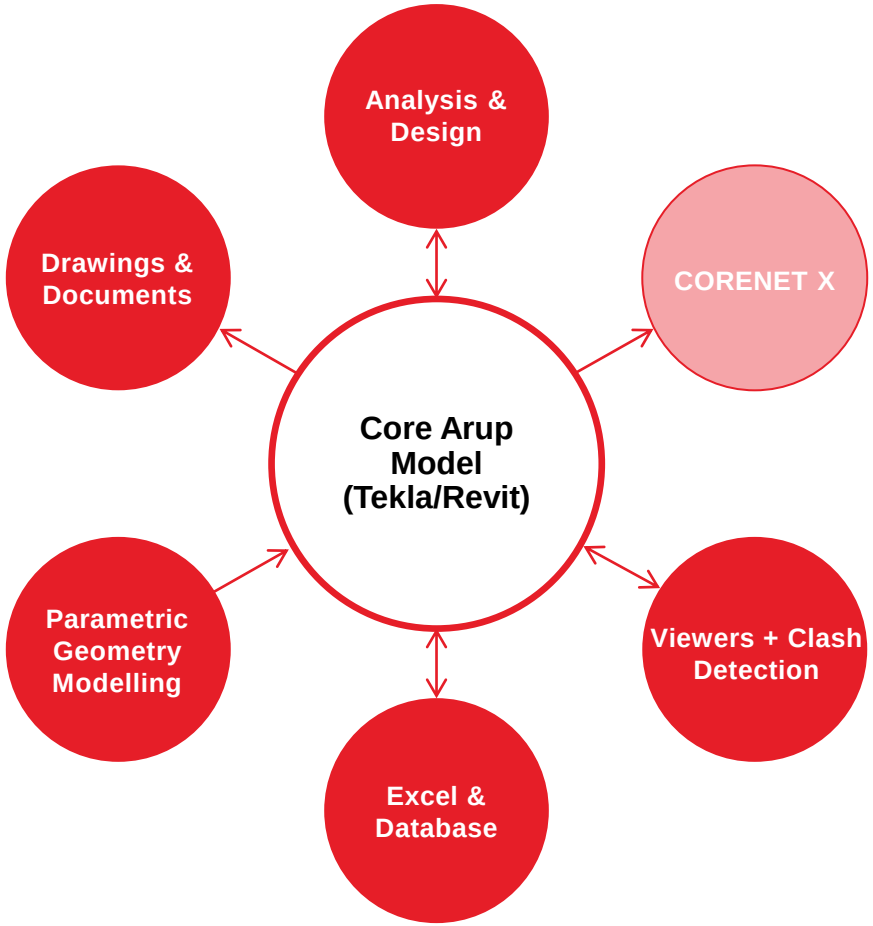
Technology & Process

Growing BIM and IFC-SG capability

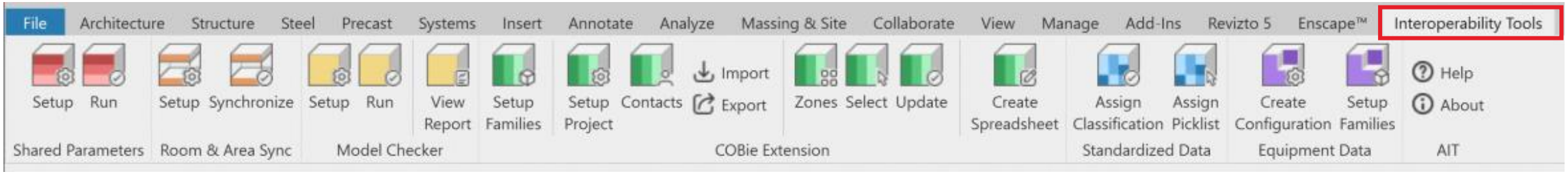
1. Check what is required for IFC-SG vs. what we have
2. Updating the Arup Core Model Template with IFC-SG parameters
3. IFC-SG Export Config file mapping



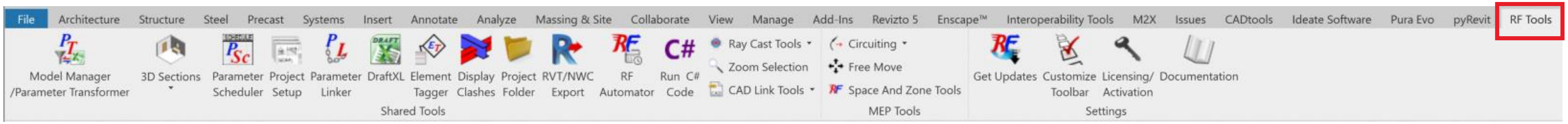
Technology & Process

Internal BIM templates to enhance productivity

Interoperability Tools for updating Template, Add Parameters, Validate and Populate IFC-SG Parameter,



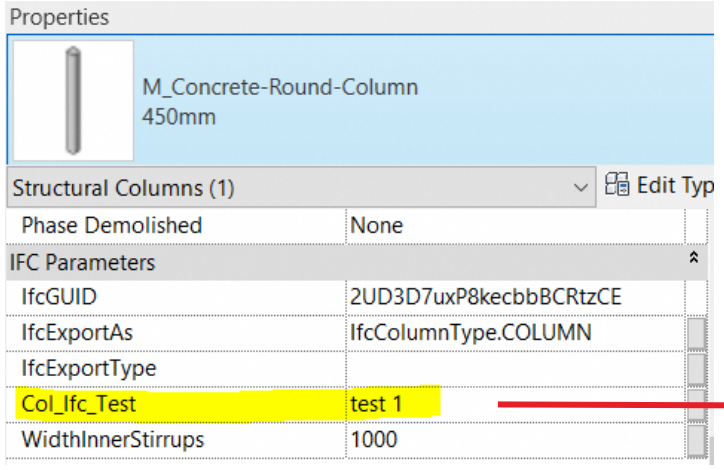
CADtools and RF Tools Design Data Transfer



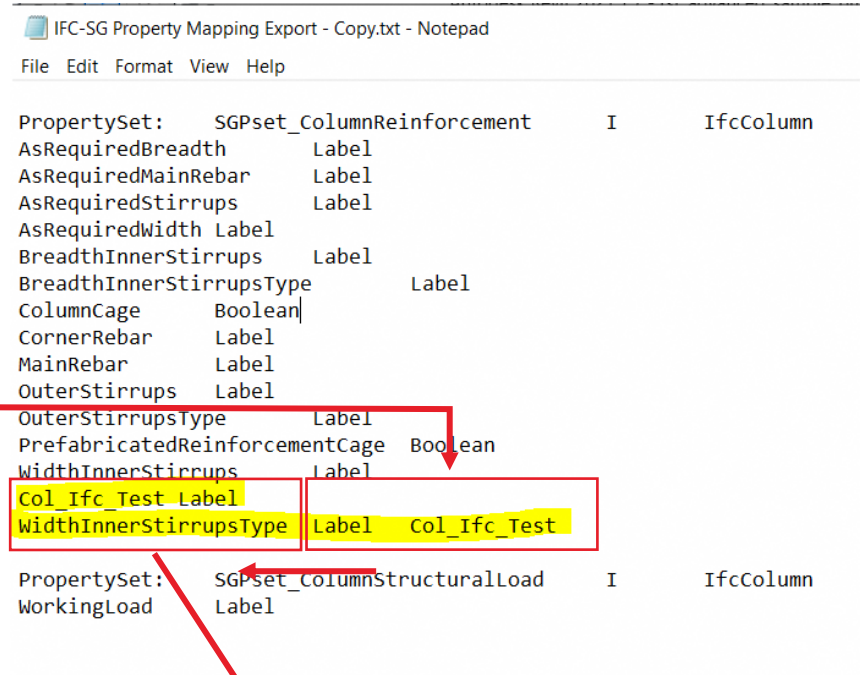
Technology & Process

Property Mapping of IFC-SG Config file

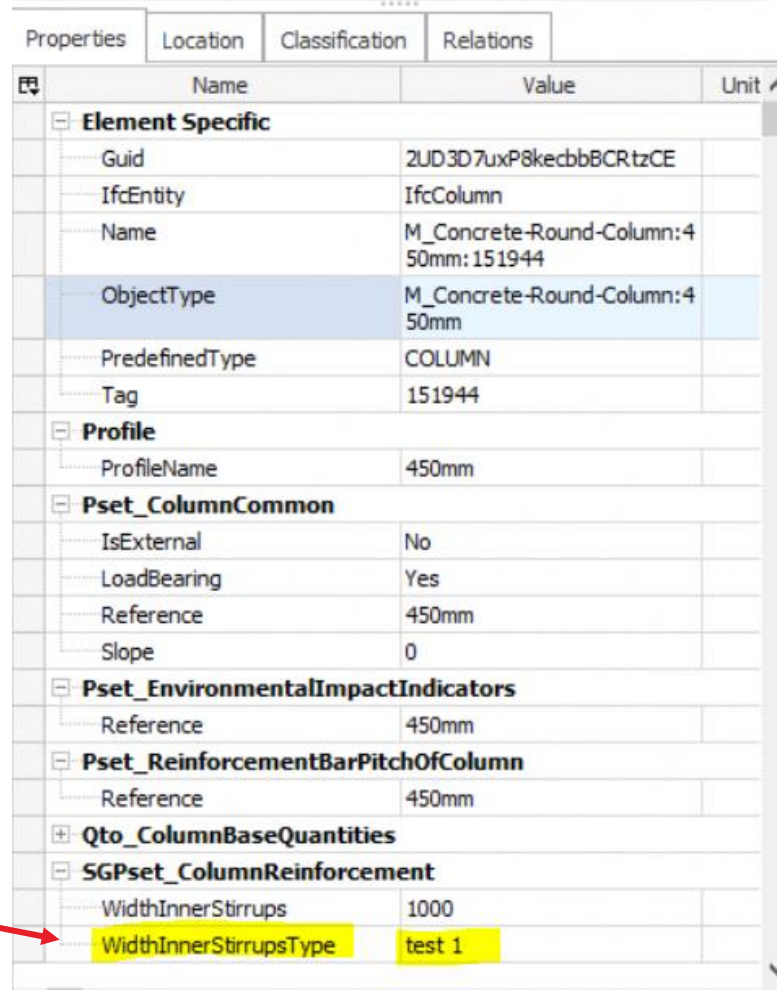
Revit (base data)



Config File for Mapping



IFC_SG (Output)



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Technology & Process

Reviewing of internal process/SOP

Arup Rebar Schedule

Structural Framing Schedule (Cast In-situ)

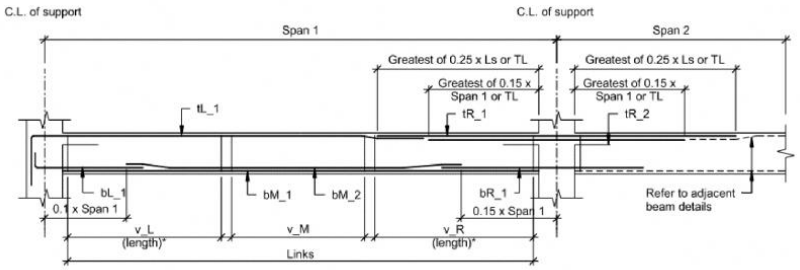
Beam Mark	Type	Detail Type	Top Reinforcement						Bottom Reinforcement						side_1	side_2	side Bar	Shear Reinforcement			V_2	V_3	Remarks
			tL_1	tL_2	tM_1	tM_2	tR_1	tR_2	bL_1	bL_2	bM_1	bM_2	bR_1	bR_2				v_L	v_M	v_R			
02B001	800x600	L_End (R)	6H32		6H32		6H32		6H32		6H32		6H32					2H13-150	2H13-200	2H13-150			
02B002	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B003	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B004	900x1000	Intermediate			10H32		10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B005	900x1000	R_End (S)					10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B006	800x600	L_End (S)	6H32				6H32		6H32		6H32		6H32					2H13-150	2H13-200	2H13-150			
02B007	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B008	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B009	800x600	R_End (R)			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B010	800x600	L_End (R)	6H32		6H32		6H32		6H32		6H32		6H32					2H13-150	2H13-200	2H13-150			
02B011	900x1000	Intermediate			10H32		10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B012	900x1000	R_End (S)					10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B013	800x600	L_End (S)	6H32				6H32		6H32		6H32		6H32					2H13-150	2H13-200	2H13-150			
02B014	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B015	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B016	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B017	800x600	Intermediate			6H32		6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B018	800x600	R_End (S)					6H32				6H32		6H32					2H13-150	2H13-200	2H13-150			
02B019	900x1000	L_End (S)	10H32				10H32		10H32		10H32		10H32					3H13-150	3H13-200	3H13-150			
02B020	900x1000	Intermediate			10H32		10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B021	900x1000	Intermediate			10H32		10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B022	900x1000	R_End (R)			10H32		10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B023	600x400	Single (SS)			4H25+4H25				4H25+4H25		4H25+4H25		4H25+4H25					2H13-150	2H13-200	2H13-150			
02B024	600x400	Single (SS)			4H25+4H25				4H25+4H25		4H25+4H25		4H25+4H25					2H13-150	2H13-200	2H13-150			
02B025	600x400	Single (SS)			4H25+4H25				4H25+4H25		4H25+4H25		4H25+4H25					2H13-150	2H13-200	2H13-150			
02B026	800x1000	L_End (R)	10H32		10H32		10H32		10H32		10H32		10H32					3H13-150	3H13-200	3H13-150			
02B027	800x1000	Intermediate			10H32		10H32				10H32		10H32					3H13-150	3H13-200	3H13-150			
02B028	800x1000	R_End (R)			10H32		10H32				10H32		10H32					3H13-200	3H13-200	3H13-200			
02B029	800x1000	L_End (R)	10H32		10H32		10H32		10H32		10H32		10H32					3H13-150	3H13-200	3H13-150			

Existing Data (but naming doesn't match)

IFC-SG Property	List
BeamSpanType	• Single • End • Interior • Cantilever

+ Additional Data (Arup does not have in BIM)

IFC-SG Property	List
ReinforcementLength	• Fully reinforced • Unreinforced • Any numerical value [up to 1 decimal place]



Left End Span - Simply Supported End {L_End (S)}

Scale 1:10

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Technology & Process

Participation and experiences in CORENET X sandbox

JTC TRENDSPACE

- Understand/learn preparation of submission models for CORENET X
- Testing CORENET X

Photo Credit to jtc Breaking New Ground

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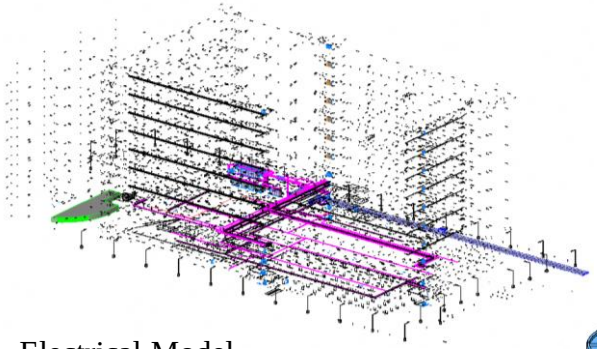
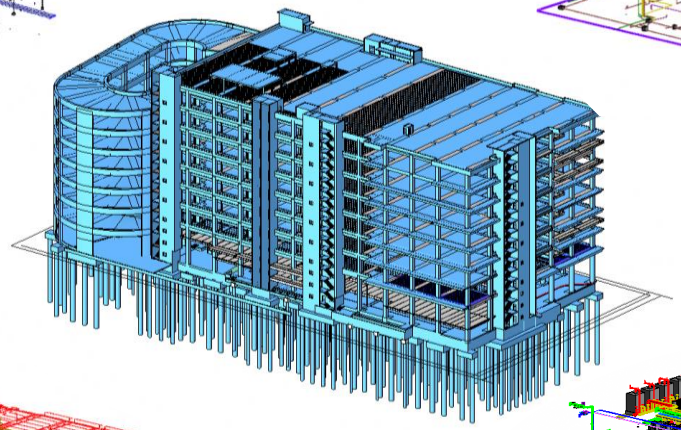
Technology & Process

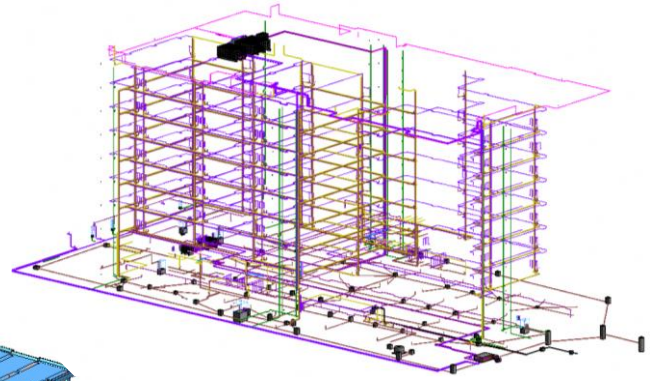
Participation and experiences in CORENET X sandbox



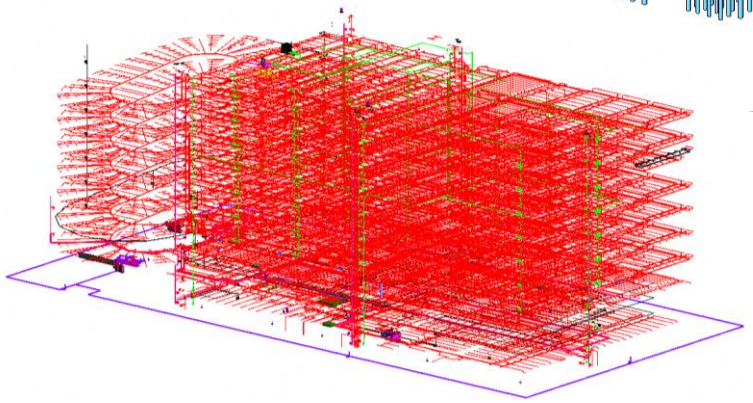
Electrical Model

Structural Model

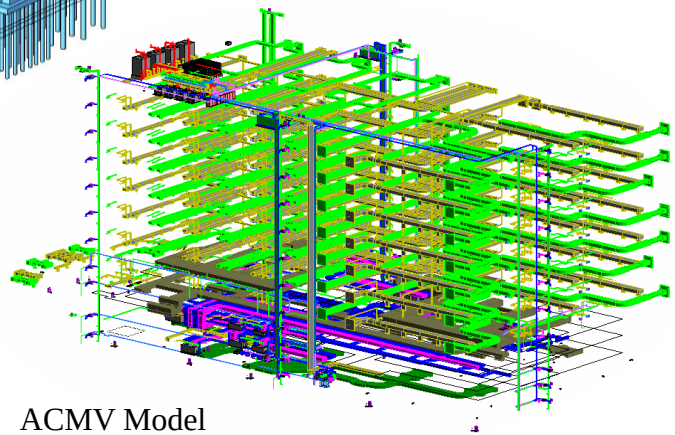




Plumbing Model



Fire Protection Model



ACMV Model

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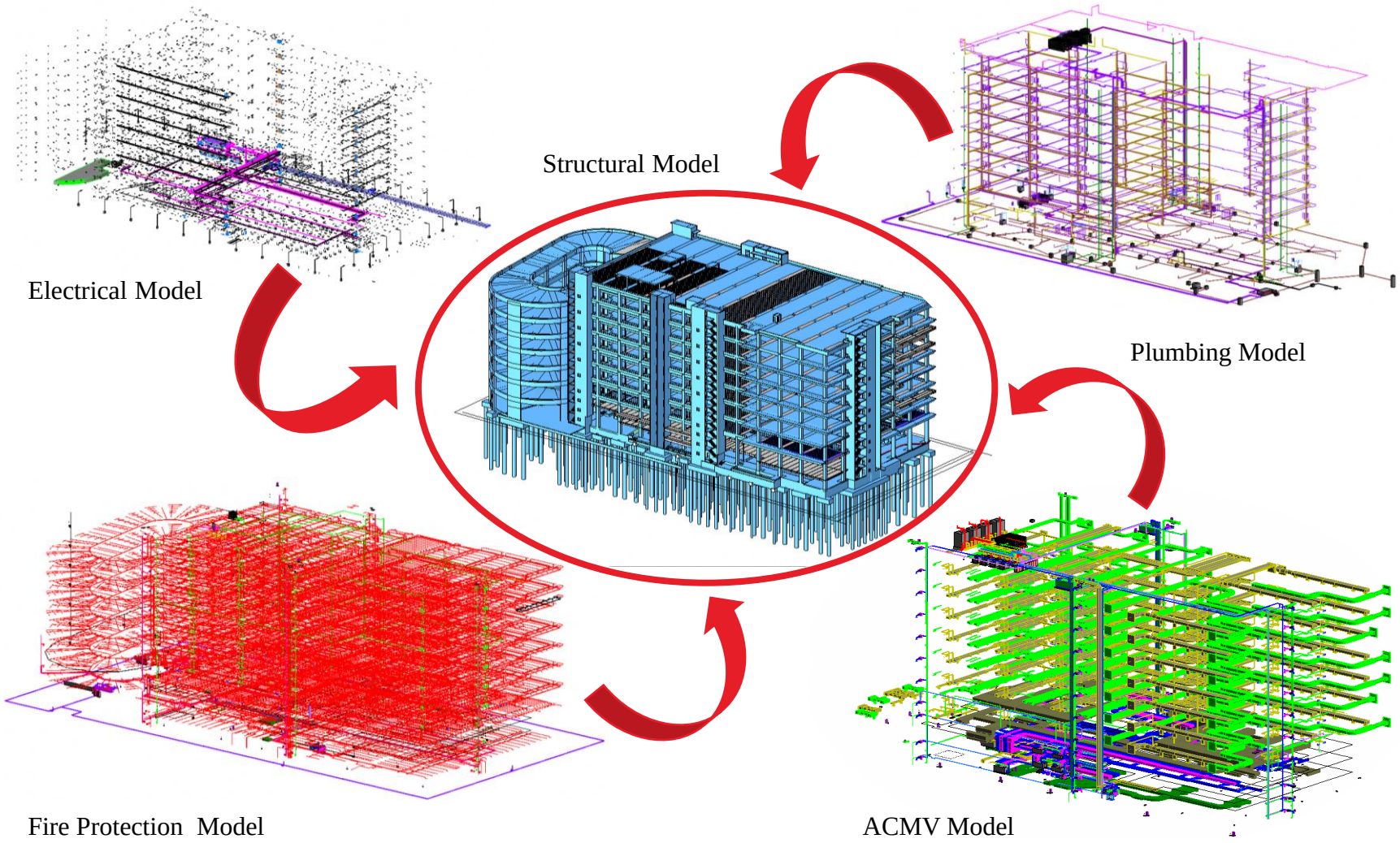
Technology & Process

Participation and experiences in CORENET X sandbox



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Implementation Strategy For CORENET X

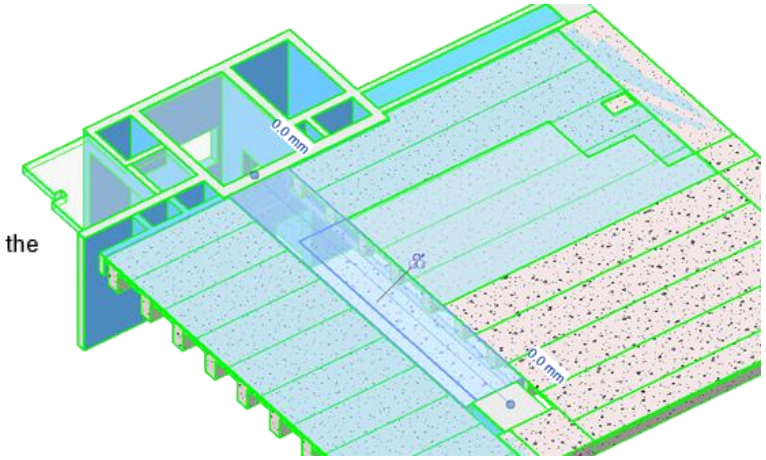
Populate IFC Classes and Validation Parameter

Revit & Regulatory Requirement

<Agency>
Singapore Civil Defence Force (SCDF)

<Regulatory Guidebook>
Fire Code

<Regulatory Requirement>
b. have the appropriate fire resistance to comply with the requirements of Cl.3.3; and



<IFC_Structural Framing Schedule>

A	B	C	D	E
Family and Type	IfcExportAs	IfcObjectType	Combustible	IsExternal
Precast - Inverted Tee: 900 x 2400	IfcBeamType		☐	☐
Precast - Inverted Tee: 900 x 2400	IfcBeamType		☐	☑
Precast - Inverted Tee: 800/900 x 2400	IfcBeamType		☐	☐
Precast - Inverted Tee: 800/900 x 2400	IfcBeamType		☐	☑
Precast - Inverted Tee: 800 x 2400	IfcBeamType		☐	☐
Precast - Inverted Tee: 800 x 2400	IfcBeamType		☐	☑

IFC-SG Data for Checking

Beam

Summary	Location	Material	Clashes	Pset_BeamC...	Pset_Environ...	SGPset_Beam

Property	Value
Model	JTCFH_STR_Beam
Prefix	
Name	Precast - Inverted Tee:900 x 2400:390769
Phase	For Info
Type	900 x 2400
Type Name	Precast - Inverted Tee:900 x 2400
Description	
Material Name	Concrete - Precast Concrete - 35 MPa
Layer	S-BEAM
Is External	False
Load Bearing	True
Fire Rating	
IFC Element	IfcBeam
Predefined Type	BEAM
Tag	390769
GUID	1ZtoqPuBTB4hEWx16DEBnZ

Beam

Summary	Location	Material	Clashes	Pset_BeamC...	SGPset_Beam

Property	Value
Combustible	False
IsExternal	False

Implementation Strategy For CORENET X

Populate IFC Classes and Validation Parameter

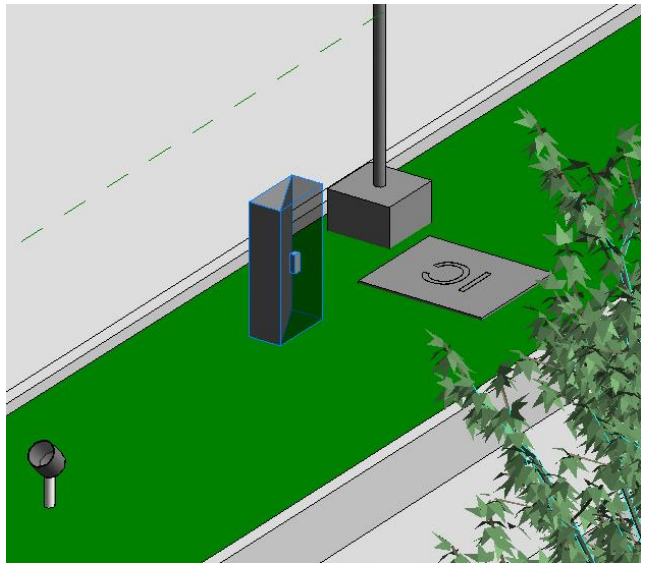
Revit & Regulatory Requirement

<Agency>
National Parks Board (NParks)

<Regulatory Guidebook>
Guidelines on Greenery Provision and Tree Conservation for Developments

<Regulatory Requirement>
Green buffers and peripheral planting verges should be free from any encroachment, except for allowable minor ancillary structures and landscaping structures as listed in the following table.

1. Allowable structures within the tree planting strips:
    - Flag poles
    - Lamp posts
    - Guard house/Sentry post
    - Bin point (Bin Centre is not allowed)
    - OG Boxes
    - Water bulk meter
    - Fire hydrant
    - Entrance gate/post
    - Metering Compartment
    - Development permanent signage
    - Garden furniture
    - Trellis
    - Water features
2. Other object not listed is deemed as encroachment.



<Electrical Equipment Schedule>

A	B	C
Family and Type	IfcExportAs	IfcObjectType
ArupSG_OG: OG - Overground Box	IfcJunctionBoxType.POWER	

IFC-SG Data for Checking

Junction Box

Summary	Location	Material	Clashes	Pset_Environm...

Property	Value
Model	JTCFH_ELL
Prefix	
Name	ArupSG_OG:DB-Lx-xx:3784511
Phase	Tender
Type	ArupSG_OG:OG - Overground Box
Type Name	ArupSG_OG:OG - Overground Box
Description	
Material Name	Arup-Electrical Equipment
Layer	E-ELEC-EQPM
IFC Element	IfcJunctionBox
Predefined Type	POWER
Tag	3784511
GUID	2no7hbmZL1XgVRjpnXO7nv

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Implementation Strategy For CORENET X

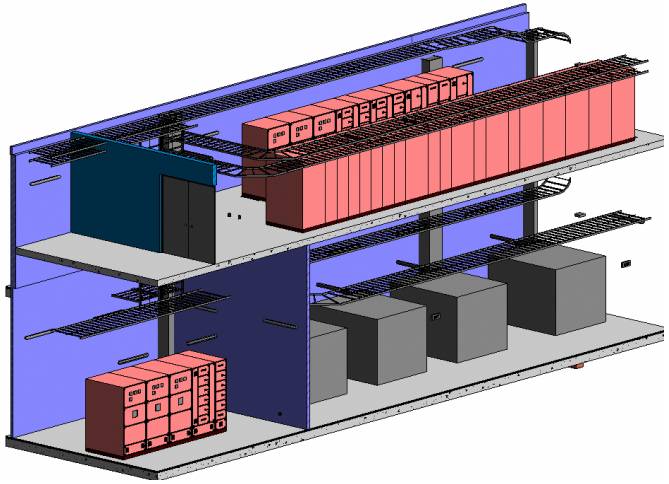
Populate IFC Classes and Validation Parameter

Revit & Regulatory Requirement

<Agency>
Public Utilities Board (PUB)

<Regulatory Guidebook>
Code of Practice on Sewerage and Sanitary Works
2ndEdition –January 2019

<Regulatory Requirement>
(a) WT/Transformer: Sanitary pipes shall not be placed above potable water storage tank, electrical transformer/switchgear
(c) In all non-residential buildings (e.g. commercial buildings, shopping malls, hotel, hospital, etc), the sanitary pipes shall be located such that:
i. no pipes from WC shall be located at the ceiling of a commercial unit.



IFC-SG Data for Checking

Name	Value	Unit
Element Specific		
IfcEntity	IfcElectricDistributionBoard	
Name	DBS_Panel_9000x1000x2100:DBS_Panel_9000x1000x2100:2298190	
PredefinedType	SWITCHBOARD	
Pset_ElectricDistributionBoardTypeCommon		
Reference	DBS_Panel_9000x1000x2100	
Pset_EnvironmentalImpactIndicators		
Reference	DBS_Panel_9000x1000x2100	

<Electrical Equipment Schedule>

A	B	C
Family and Type	IfcExportAs	IfcObjectType
ArupSG _DB: DB - Distribution Board	IfcElectricDistributionBoardType.DISTRIBUTIONBOARD	
ArupSG _DP: ArupSG _DP	IfcElectricDistributionBoardType.DISTRIBUTIONBOARD	
DBS_Panel_9000x1000x2100: DBS_Panel_9000x1000x2100	IfcElectricDistributionBoardType.SWITCHBOARD	
MV_Panel_13000x1450x2100: MV_Panel_13000x1450x2100	IfcElectricDistributionBoardType.SWITCHBOARD	
AUS-EE-Transformer.0001: Standard	IfcElectricDistributionBoardType.USERDEFINED	ELECTRICALTRANSFORMER
HT_Panel_4500x1500x2100: HT_Panel_4500x1500x2100	IfcElectricDistributionBoardType.USERDEFINED	SWITCHGEAR
AUS-EE-Transformer.0001: Standard	IfcTransformer	

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